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Role of the Retinal Vascular Endothelial Cell in Ocular Disease

Arpita S. Bharadwaj[1,*], **Binoy Appukuttan**[1,*], **Phillip A. Wilmarth**[2], **Yuzhen Pan**[1], **Andrew J. Stempel**[1], **Timothy J. Chipps**[1], **Eric E. Benedetti**[1], **David O. Zamora**[1], **Dongseok Choi**[3], **Larry L. David**[2], and **Justine R. Smith**[1,4]

[1]Casey Eye Institute, Oregon Health & Science University

[2]Department of Biochemistry and Molecular Biology, Oregon Health & Science University

[3]Department of Public Health and Preventive Medicine, Oregon Health & Science University

[4]Department of Cell & Developmental Biology, Oregon Health & Science University

Abstract

Retinal endothelial cells line the arborizing microvasculature that supplies and drains the neural retina. The anatomical and physiological characteristics of these endothelial cells are consistent with nutritional requirements and protection of a tissue critical to vision. On the one hand, the endothelium must ensure the supply of oxygen and other nutrients to the metabolically active retina, and allow access to circulating cells that maintain the vasculature or survey the retina for the presence of potential pathogens. On the other hand, the endothelium contributes to the blood-retinal barrier that protects the retina by excluding circulating molecular toxins, microorganisms, and pro-inflammatory leukocytes. Features required to fulfill these functions may also predispose to disease processes, such as retinal vascular leakage and neovascularization, and trafficking of microbes and inflammatory cells. Thus, the retinal endothelial cell is a key participant in retinal ischemic vasculopathies that include diabetic retinopathy and retinopathy of prematurity, and retinal inflammation or infection, as occurs in posterior uveitis. Using gene expression and proteomic profiling, it has been possible to explore the molecular phenotype of the human retinal endothelial cell and contribute to understanding of the pathogenesis of these diseases. In addition to providing support for the involvement of well-characterized endothelial molecules, profiling has the power to identify new players in retinal pathologies. Findings may have implications for the design of new biological therapies. Additional progress in this field is anticipated as other technologies, including epigenetic profiling methods, whole transcriptome shotgun sequencing, and metabolomics, are used to study the human retinal endothelial cell.

Keywords

retina; endothelial cell; molecular profiling; posterior uveitis; autoimmune uveitis; infectious uveitis; diabetic retinopathy; retinopathy of prematurity

Corresponding Author: Justine R. Smith, Address: Casey Eye Institute, 3375 SW Terwilliger Blvd, Portland, OR 97239, United States, Telephone: 1-503-494-5023, Facsimile: 1-503-494-6875, smithjus@ohsu.edu.
*Drs. Bharadwaj and Appukuttan contributed equally to this manuscript and share first authorship.

1. Introduction

Diseases involving the retinal vasculature, including 2 ischemic vasculopathies (i.e., diabetic retinopathy and retinopathy of prematurity) and various posterior forms of uveitis, are important causes of blindness in both industrialized countries and developing nations. Diabetic retinopathy affects approximately one-third of all persons who suffer from diabetes mellitus (Kempen et al., 2004b), a disease that is expected to affect 300 million people worldwide by 2025 (King et al., 1998). Retinopathy of prematurity accounts for up to one-third of childhood blindness, particularly in countries with intermediate infant mortality rates (Gilbert et al., 1997). Uveitis is a relatively uncommon disease, but due to an often substantial impact on vision at a relatively earlier age, its socioeconomic impact is roughly equivalent to that of diabetic retinopathy (Suttorp-Schulten and Rothova, 1996).

Retinal microvessels are complex structures, to which multiple cell populations contribute. Microvascular dysfunction is associated with retinal ischemia and neovascularization in diabetic retinopathy and retinopathy of prematurity, and leukocyte or microbial trafficking and potentiation of retinal inflammation in posterior uveitis. In this review, we focus on the critical participation of the retinal vascular endothelial cell in these pathological processes and highlight elements of the endothelial molecular phenotype that may predispose the retina to involvement in the stated diseases. We introduce our subject with a discussion of relevant anatomy and physiology, as well as descriptions of the model systems that are used to study the basic disease mechanisms.

2. Clinical significance of the retinal vascular diseases

2.1 Posterior uveitis

Inflammations that involve the intraocular tissues are termed uveitis. This large group of diseases is classified anatomically into anterior uveitis (primarily involving the anterior chamber), intermediate uveitis (primarily involving the vitreous), posterior uveitis (primarily involving the retina or choroid), and panuveitis (involving the anterior chamber, vitreous, and retina or choroid) (Bloch-Michel and Nussenblatt, 1987). Up to 10% of blindness in Western nations has been attributed to uveitis (Nussenblatt, 1990; Suttorp-Schulten and Rothova, 1996). In developing countries, the figure may be as high as 25% (London et al., 2010). Although 3 United States population-based studies report different patterns of age-stratified incidence, all show that more cases of uveitis begin during the working years than at any other period in life (Darrell et al., 1962; Gritz and Wong, 2004; Suhler et al., 2008). As a result, uveitis exacts an annual cost on society equivalent to that of diabetic retinopathy (Suttorp-Schulten and Rothova, 1996). In particular, approximately 50% of individuals with uveitis affecting the posterior segment of the eye suffer vision loss (Rothova et al., 1996).

Posterior uveitis is actually a diverse group of diseases with varied etiologies, including both autoimmune and infectious entities (Rodriguez et al., 1996; Suhler et al., 2008). Autoimmune uveitis may occur as part of a systemic inflammatory disease or be confined to the eye. Isolated autoimmune uveitis may take the form of a specific ocular syndrome or, if characteristic clinical features are not present, is often termed “idiopathic.” Large case series of posterior uveitis from the United States (Rodriguez et al., 1996) and Germany (Jakob et al., 2009) found that approximately 22% and 6% of cases were associated with systemic diseases and approximately 15% and 25% of cases were due to specific ocular syndromes, in the respective countries. In these same series, roughly 50% and 41% of cases were caused by infections. In developing nations, the percentage of cases caused by infections is even higher than in industrialized countries (London et al., 2010). Systemic inflammatory diseases identified in the 2 series included sarcoidosis, Behcet’s disease, and multiple sclerosis. Ocular syndromes identified in the 2 series included birdshot retinochoroidopathy

and a number of other conditions characterized by multiple inflammatory lesions in the retina and/or choroid, commonly grouped as the “white dot syndromes” (Quillen et al., 2004). Although bacterial, viral and fungal infections were observed, by far the most common infectious cause of posterior uveitis found in the United States and Germany was ocular toxoplasmosis—infection of the retina with the parasite *Toxoplasma gondii*—accounting for one quarter of total cases of posterior uveitis in both studies. Clinical aspects of ocular toxoplasmosis have been extensively described by Holland (Holland, 2003, 2004).

Management of uveitis depends on etiology. Since the 1950s, systemic corticosteroids have been used as first-line treatment for patients with non-infectious posterior uveitis (Gordon, 1956). High-dose corticosteroid therapy is frequently effective, but the multitude of metabolic side effects (Stanbury and Graham, 1998) necessitates the use of corticosteroid-sparing agents for the long-term treatment most patients require. Immunosuppressive drugs, including antimetabolites, T-cell inhibitors, and alkylating agents, are the most frequently used corticosteroid-sparing agents (Jabs et al., 2000). Unfortunately, half of patients with inflammatory eye disease who are treated with corticosteroid-sparing agents will eventually stop treatment, primarily due to lack of efficacy or adverse effects (Baker et al., 2006). This is an incentive for clinicians to consider recently developed biologic agents or locally delivered corticosteroids for patients with posterior uveitis.

A biologic is defined as “a therapy based on a contemporary understanding of the disease biology and usually produced by molecular (recombinant DNA or monoclonal) technology” (James T. Rosenbaum, American Academy of Ophthalmology Annual Meeting, Uveitis Subspecialty Day, 2005). Multiple publications describe the effectiveness of biologic agents in patients with recalcitrant posterior uveitis, including drugs directed against lymphocyte markers, tumor necrosis factor alpha, and interleukin-2 (Servat et al., 2012). On the other hand, a number of these agents have been associated with serious systemic toxicities, including potentially fatal infections and progressive multifocal leukoencephalopathy. Locally administered corticosteroid therapy can avoid the complications of systemically administered drugs. Local administration methods include periocular injection (Ferrante et al., 2004), intravitreal injection (Kok et al., 2005) and, for extended delivery, implantation of sustained release devices (Jaffe et al., 2006; Lowder et al., 2011). However, long-term delivery of corticosteroids to the eye has its own hazards, including the potential to cause visually significant cataract and elevated intraocular pressure requiring medical or surgical interventions (Kempen et al., 2011; Pavesio et al., 2010).

Antimicrobial therapy is the primary treatment for infectious posterior uveitis, but a good outcome with presently available agents is not guaranteed. For ocular toxoplasmosis in particular, the literature lacks strong evidence for effectiveness of treatment for the acute infection and none of the available drugs have proved capable of eradicating encysted parasites from the human retina (Stanford et al., 2003). The rate of clinical recurrence is estimated at 1 episode per 5 years (Holland et al., 2008). In addition, toxicity and teratogenicity are important concerns for the standard antimicrobial treatments (Rothova, 1993).

2.2 Retinal ischemic vasculopathies

Diabetic retinopathy is an ischemic retinal vasculopathy that affects individuals who suffer from diabetes mellitus. Retinopathy is routinely classified by clinical severity (Cheung et al., 2010) as non-proliferative—or background—or proliferative. Both forms involve microvascular lesions, but proliferative disease is distinguished by the presence of retinal neovascularization. Clinically significant macular edema may complicate either form. Diabetic retinopathy is the most common cause of blindness in young adults in Western countries (Congdon et al., 2003), and prevalence is expected to increase in developing

countries (Cheung et al., 2010). Statistics from the United States estimate that approximately one-third of diabetic patients have eye involvement and one-third of these people have vision-threatening retinopathy (i.e., preproliferative or proliferative retinopathy and/or macular edema) (Kempen et al., 2004a).

Retinopathy of prematurity is an ischemic retinal vasculopathy that occurs as a complication of premature birth. Retinal vascularization is incomplete prior to term, and therefore the premature infant is born with retinas that are only partially vascularized. The disease is staged according to vascular abnormalities that occur at the junction of vascularized and avascularized retina (International Committee for the Classification of Retinopathy of Prematurity, 2005). Retinopathy of prematurity causes up to 20% of childhood blindness in countries with relatively high incomes and low infant mortality rates (i.e., less than 10 per 1000 live births) (Wheatley et al., 2002). However, rates as high as 33% have been recorded in middle-income countries with intermediate infant mortality rates (i.e., 10–60 per 1000 live births) (Gilbert et al., 1997). Less common retinal ischemic vasculopathies include: retinal vein occlusion, as may complicate glaucoma or systemic hypertension; sickle cell retinopathy, which usually occurs in persons of African descent; and radiation retinopathy, which may follow radiotherapy for ocular tumors.

For more than 20 years, the mainstay of treatment for retinal ischemic vasculopathy has been the destruction of retina, including retinal pigment epithelium, by cryotherapy or photocoagulation (Diabetic Retinopathy Study Research Group, 1981; Cryotherapy for Retinopathy of Prematurity Cooperative Group, 1990; Early Treatment For Retinopathy Of Prematurity Cooperative, 2003). While this therapy is effective, it may contribute to structural complications, particularly if used to treat retinopathy of prematurity (Hovakimyan and Cunningham, 2002; McLoone et al., 2006). Reductions in visual field, color vision, and contrast sensitivity are also well documented in treated diabetic patients (Fong et al., 2007). These disadvantages have provided incentives for investigators to develop biological medical approaches to retinal ischemic vasculopathy.

Following recognition of the key role that VEGF plays in disease pathogenesis (Cheung et al., 2010; Sapieha et al., 2010) and the success of VEGF antibody blockade in treating neovascular age-related macular degeneration (Coleman et al., 2008), the potential effectiveness of targeting VEGF in diabetic retinopathy and retinopathy of prematurity has been explored. Clinical trials and case series indicate the approach might be of benefit (Cheung et al., 2010; Micieli et al., 2009). However, there is potential for toxicity to retinal neurons and glia, for which VEGF is a trophic factor (van Wijngaarden et al., 2005). Even more concerning are reports of thromboembolism and extraocular hemorrhage related to the effects of VEGF on non-ocular vascular beds following the exit of locally delivered anti-VEGF antibody from the eye (Gillies and Wong, 2007; Ueta et al., 2009).

3. Anatomical and physiological considerations

3.1 Anatomy of the retinal microvasculature

The microvasculature that supplies and drains the inner retina is well described in the classic anatomical text, *Gray's Anatomy* (Standring, 2008). The central retinal artery derives from the ophthalmic branch of the internal carotid artery, entering the optic nerve within the orbit approximately 12 mm behind the globe and subsequently coursing through the lamina cribrosa to access the retina. On the inner surface of the retina, superior and inferior branches immediately give rise to temporal and nasal arcades, which supply the 4 quadrants of the retina. Corresponding retinal veins drain these quadrants and meet at the optic nerve head as the central retinal vein, which drains into the cavernous sinus both directly and via the superior ophthalmic vein. The other intraocular circulations of the iris and choroid also

derive from the ophthalmic artery, but via ciliary arteries, which branch off the main trunk within the orbit subsequent to the central retinal artery.

Applying scanning electron microscopy to methacrylic methyl ester-injection/corrosion ocular vascular casts of 80 human eyes has allowed detailed observations of the 3-dimensional architecture of the retinal vascular network (Zhang, 1994). The retinal arteries and veins lie in the nerve fiber and ganglion cell layers. Arteriolar branches give rise to capillary networks, which exist in trilaminar form at the posterior pole. The layers include: radial peripapillary capillaries in the inner nerve fiber layer, mostly in a “long chain” pattern; an inner capillary plexus in the nerve fiber and ganglion cell layers; and a deep capillary plexus in the inner plexiform layer and inner nuclear layer. These layers reduce to 2 at the equator and only 1 in the macula and far retinal periphery. The capillary networks communicate via vertical “vascular bridges.” The macula contains a ring of terminal capillaries surrounding a central zone 450 to 500 μm in diameter, which appears avascular. Vessels are also absent within 1 disc area of the ora serrata where another terminal anastomosis exists. There are differences between the anatomy of the human retinal microvasculature and that of other species (Zhang, 1994). A new microperfusion fixation and immunostaining technique for processing retinal whole mounts, which are subsequently imaged by confocal microscopy, results in impressive resolution and has permitted novel observations relating to the human retinal microvasculature (Yu et al., 2010a; Yu et al., 2010b). Most notably, in almost 1 in 5 normal human eyes, retinal capillaries are seen to cross the fovea. This observation “may require a change in the concept of a completely avascular fovea and may be relevant to many macular diseases” (Yu et al., 2010b).

3.2 Embryology of the retinal microvasculature

The development of the human retinal circulation in utero remains a subject of much discussion, as exemplified in recent reviews by Fruttiger (Fruttiger, 2007) and Gariano (Gariano, 2010). Studies using human fetal whole mounts and immunohistochemistry for endothelial precursor markers suggest that in the human (Chan-Ling et al., 2004; Hasegawa et al., 2008; Hughes et al., 2000; McLeod et al., 2006), as opposed to other species such as the mouse (Fruttiger, 2002), retinal blood vessel formation begins at the level of the inner capillary plexus and in the region of the optic nerve head. Growth is centripetal by a process of vasculogenesis, which involves the development of rudimentary channels from differentiation of vascular endothelial precursor cells within the tissue. This is followed by expansion of the inner capillary plexus and the appearance of the deep capillary plexus and peripapillary radial plexus, as well as the foveal region and temporal raphe. These latter events occur by the process of angiogenesis, which refers to sprouting from existing endothelial buds. The avascularity of the fovea remains an enigma, but recent findings by the Provis laboratory are potentially highly relevant. These investigators find relatively high expression of potent anti-angiogenic regulator, pigment epithelium-derived factor, and repellent axonal guidance factors (which are likely to also affect endothelial cells) in the macula (Kozulin et al., 2009b). These factors have been localized to the ganglion cell layer in separate studies using macaque retinas (Kozulin et al., 2010; Kozulin et al., 2009a). Another group (Gariano, 2010) presents indirect evidence of a role for lutein and other macular pigments in foveal avascularity.

3.3 Physiology of the retinal circulation

There is disagreement in published literature regarding the presence of autonomic innervation of the retinal vessels within the eye of humans and other species (Collin, 1966; Hogan and Feeney, 1963; Lanigan et al., 1990; Menage et al., 1994). Whether such innervation is present or absent, it is well accepted that blood flow within the retinal circulation relies heavily on autoregulation. Recently the subject was reviewed

comprehensively in this journal (Pournaras et al., 2008). Simplistically presented, perfusion pressure and metabolic reactions act to influence the tone of retinal arterioles and capillaries, to regulate retinal blood flow. Although not specifically studied, retinal endothelial cells are likely to assist mural myocytes and pericytes in sensing and transducing mechanical forces. The retinal endothelium is coated with a glycocalyx (Lawrenson et al., 2000), which has been shown to function as a mechanical sensor and transducer in extra-ocular endothelia (Tarbell and Ebong, 2008). Retinal vascular endothelium also has the ability to detect chemical perturbations, including hypoxia and hypercapnia, and the metabolite, lactose (Pournaras et al., 2008). The endothelium communicates a need for retinal vasodilation or vasoconstriction, by production of molecular mediators that include nitric oxide, arachidonic acid metabolites, and endothelin-1 (Pournaras et al., 2008).

3.4 Microanatomy of the retinal endothelial cell

As a general rule, endothelial cells have flattened cytoplasm (except in the area where the nucleus bulges), abundant mitochondria and ribosomes, and pinocytotic vesicles that are more prominent in arterial forms (Rhodin, 1967, 1968). Distinguishing features of endothelial cells of the retinal circulation in particular are a lack of fenestrations and the presence of specialized “zonula occludens” intercellular junctions, which form stable and extremely tight unions with neighboring cells (Hogan et al., 1971). These characteristics contribute in large part to the blood-retinal barrier, which in health excludes circulating solutes from the retina (Cunha-Vaz, 1979). In contrast, choroidal endothelial cells have fenestrations with bridging diaphragms (Hogan et al., 1971). Within the retina, endothelial form varies markedly with vessel order. Studies of the retinal vasculature in human and porcine eyes reveal elongation of arteriolar endothelial cells that is most marked at the start of the tree in comparison to the more polygonal shape of venular cells (Yu et al., 2010b; Yu et al., 1997). This difference may relate to changes in blood flow and resulting local shear stress along the vascular tree, and is reflected in a differential abundance and structure of F-actin microfilaments—or stress fibers—in different retinal endothelial subpopulations. Interestingly, however, these differences do not apply in the macular region, suggesting “special features of macular hemodynamics” (Yu et al., 2010a).

3.5 Microenvironment of the retinal endothelial cell

Although the focus of our research and this review is the retinal endothelial cell, the cell does not function in isolation. On the contrary, interactions with vascular mural cells, neurons, and glial cells are critical for normal retinal endothelial cell functioning, and also contribute to the development of retinal vascular diseases. The intimate relationship between retinal endothelial cells and pericytes was recognized in the 1970s (Matsusaka, 1975), with pericytes embedded within the endothelial basement membrane seen to be making formal adhesive junctions with the endothelial cells. In this position, pericytes regulate multiple aspects of retinal endothelial behavior, including survival and proliferation (Benjamin et al., 1998; Darland et al., 2003). Loss of pericytes adversely impacts retinal endothelial cell function early in the development of diabetic retinopathy, as reviewed (Motiejunaite and Kazlauskas, 2008). Other work has drawn attention to the close relationships between retinal vessels, and astrocytes and Müller cells, as well as retinal neurons (Yu et al., 2010b). The functional importance of the interactions of retinal endothelial cells with these neighboring cells is well exemplified by the essential role of astrocytes in endothelial cell guidance in vascular patterning during retinal development (Dorrell and Friedlander, 2006) and the ability of retinal ganglion cells, reacting to local levels of the metabolite succinate by production of VEGF, to control retinal angiogenesis in health and disease (Sapieha et al., 2008).

3.6 Angiogenesis in the retina

Retinal angiogenesis is part of normal vascular development and a key component of retinal neovascularization in ischemic vasculopathy. In both situations, retinal hypoxia stimulates the synthesis of endothelial growth factors by various retinal cells. Vascular endothelial growth factor (VEGF) was the first angiogenic factor identified in retinal ischemic vasculopathy (Aiello et al., 1994) and almost simultaneously in retinal vascular development (Stone et al., 1995), and while other hypoxia-induced and hypoxia-independent factors have since been identified, it is clear that VEGF—or VEGFA—plays a critical role in normal and pathological angiogenesis (Cheung et al., 2010; Sapieha et al., 2010).

Angiogenesis involves specialization of endothelial cells into “tip cells” and “stalk cells” (Ferrara, 2004; Gerhardt, 2008). The migrating tip cells extend filipodia in association with astrocyte processes. Behind each tip cell, stalk cells proliferate to grow the endothelial sprout that initiates vessel formation. VEGF acts via at least 2 receptors, VEGFR-1 and VEGFR-2, to direct endothelial tip cell migration and stalk cell proliferation. Remarkable work from the Gerhardt group (Jakobsson et al., 2010), using computational modeling and in vitro and in vivo genetic mosaic sprouting assays, shows that endothelial cells compete to become tip cells and that competition is controlled by the balance of VEGFR-1 and VEGFR-2 between a cell and its neighbors. Lower relative VEGFR-1 increases, and lower VEGFR-2 decreases, the likelihood of being a tip cell, as signaled through the Notch system by variation in the level of delta-like ligand 4. Recently, 2 publications have separately implicated retinal microglia in endothelial tip cell anastomosis, which promotes the arborization of vascular networks (Fantin et al., 2010; Rymo et al., 2011). Interestingly, this effect appears to be independent of VEGF.

4. Molecular Phenotype of the Retinal Endothelial Cell

4.1 Molecular heterogeneity of vascular endothelial cells

Vascular endothelial cell heterogeneity refers to the variations in structure and function that differentiate endothelial cell subtypes across the body (Aird, 2006). Of particular interest in translational medical research are the molecular distinctions between these populations, as differences provide insights into disease pathogenesis and are potential targets for specific therapies. Profiling of the vascular endothelium by gene expression microarray, in particular, confirms the existence of heterogeneity between endothelial cells from different tissues, for large vessel versus microvascular endothelial cells, and for arterial versus venous endothelial cells (Chi et al., 2003b). Our research has been directed at defining the unique molecular phenotype of the human retinal endothelial cells, by transcriptomic and proteomic profiling. When we commenced this work, earlier studies on the responses of human retinal versus umbilical vein endothelial cells, and bovine retinal versus brain endothelial cells, to highly concentrated glucose had already suggested specific molecular features of the retinal endothelial cell that might have implications for retinal ischemic vasculopathy in diabetes mellitus (Grammas and Riden, 2003; Rymaszewski et al., 1992). Other pertinent studies have showed differential expression of angiogenic proteins and receptors by bovine retinal and choroidal endothelial cells in response to hypoxia (Brylla et al., 2003), and differential impact of nerve growth factor on the angiogenic properties of human retinal and choroidal endothelial cells (Steinle and Granger, 2003).

4.2 Isolation and culture of human ocular vascular endothelial cells

We have investigated the profile of the retinal endothelial cell at transcript and protein levels, with the goal of increasing understanding of this cell’s involvement in retinal vascular pathology. Since our interest is human disease, we have preferred to study retinal endothelial cells from human eyes, as opposed to eyes of experimental animals. Although

the molecular phenotypes of vascular endothelial cells from humans and other species have not been systematically compared, groups working in various areas of vascular endothelial cell pathobiology have observed differences that are likely to impact disease mechanisms (Autar et al., 2011; Choo et al., 1997; Kalsi et al., 1999; Pan et al., 1998; Smolenski et al., 2006). Gene expression may vary considerably between individuals. To address this concern, we took retinal endothelial cells and the comparison cell population from the same human eyes. We selected the choroidal endothelial cell as the control cell for several reasons. Like the retinal endothelial cell, it is microvascular. Since the choroid lies immediately adjacent to the retina, these cells' microenvironments are as similar as possible, and the choroidal and retinal circulations derive from the same artery. Importantly, the choroidal vasculature is not primarily involved ischemic retinal vasculopathy or the most common forms of posterior uveitis, as reported in large clinical series (Jakob et al., 2009; Rodriguez et al., 1996).

Human cadaver globes provide the source of primary ocular endothelial cells. In our experience, optimal yields are obtained if donors are younger than 50 at the time of death, have no history of vascular disease, and have been deceased for less than 24 hours at the start of the isolation procedure. We use paired globes to prepare each endothelial cell isolate. Following careful dissection of retina and choroid from the globe, and manual removal of the retinal pigment epithelium and pigmented choroidal cells from the choroid, the tissues are digested with graded solutions of type II collagenase (beginning as high as 3 mg/ml) and dispase (beginning as high as 0.3 mg/ml). Concentrations depend on the density of the tissue, which is affected by factors including donor age, presence of vascular disease, and time since death. Digestion of the tissue is facilitated by initial trituration, centrifugation to separate cells and debris after enzymatic treatment, and final passage through a 40-μm filter.

Primary ocular endothelial cell isolates are cultured in MCDB-131 medium with endothelial growth factors (EGM-2 SingleQuots supplement, omitting gentamicin, hydrocortisone, and serum; Lonza Clonetics, St. Louis, MO) and up to 10% fetal bovine serum (with pH strictly maintained at 7.2) until approximately 1 million endothelial cells are present, which may take more than a week for retinal endothelial cells. At this point, Dynabeads (Invitrogen Dynal AS, Oslo, Norway), pre-coated with murine anti-human CD31 antibody (BD Biosciences Pharmingen, San Diego, CA), are used to purify the endothelial cells. Separations may be repeated multiple times to ensure maximum yield. Several rounds of magnetic bead purification and subsequent culture may be needed to obtain endothelial cultures that are no less than 99% pure. Choroidal cultures, in particular, are initially heavily contaminated with stromal cells, which must be removed. While flow cytometric sorting is another potential approach to purification, in our hands this results in lower numbers of cells and inferior purity of the cultures.

4.3 Transcriptome of the human retinal endothelial cell

We initiated studies of the molecular phenotype of the human retinal vascular endothelial cell with gene expression profiling, using oligonucleotide arrays that included probes designed to detect 8746 well-characterized human transcripts (Smith et al., 2007). Retinal and control choroidal samples from 6 human donors were studied and replicates were included for majority. In addition to non-stimulated cells, cells exposed to *Toxoplasma gondii* and lipopolysaccharide—a commonly utilized inflammatory stimulus that is capable of inducing posterior uveitis in rodents (Ruiz-Moreno et al., 1992)—were also studied. Statistical assessment included normalization procedures developed for oligonucleotide expression arrays (Irizarry et al., 2003; Li and Wong, 2001; Tusher et al., 2001), significance analysis of microarrays (SAM) with the false-discovery rate set at 5% (Tusher et al., 2001), and gene ontology annotation using the United States National Institutes of Health Database for Annotation, Visualization and Integrated Discovery (DAVID).

One notable observation from this work was the demonstration that although gene expression differed between samples from different donors, and between stimulated and non-stimulated cells from the same donor, the most obvious difference in gene expression was between retinal and choroidal endothelial cells. This finding was clear evidence of the existence of vascular endothelial diversity even within the eye, and of a unique molecular phenotype of the retinal endothelial cell. By SAM, 779 transcripts (8.9%) were differentially expressed by retinal endothelial cells compared to choroidal endothelial cells, including 330 transcripts (3.8%) that were relatively highly expressed. Another important finding came from the gene ontology annotation, which showed that retinal endothelial cells expressed relatively high levels of transcripts involved in the immune response, including cell adhesion molecules, cytokines, chemokines, receptors, and enzymes involved in synthesizing inflammatory proteins. This finding was consistent with the known role of retinal blood vessels in leukocyte trafficking and regulation of inflammation in uveitis. Retinal endothelial cells also expressed relatively high levels of certain transcripts involved in response to stress, cell proliferation and adhesion, suggesting the possibility of a unique reaction to ischemia and specific regulation of neovascularization.

In considering the results of this work, we speculated that differential gene expression reflected differences in the interactions of transcription factors and respective *cis*-regulatory motifs(s) in human retinal and control choroidal endothelial cells. Taking an *in silico* approach, we used TRANSFAC Professional v11.4 (BIOBASE, Wolfenbuettel, Germany) and CisModule (Zhou and Wong, 2004) to identify cis-regulatory motifs in promoter sequences of genes that were differentially expressed by the 2 endothelial subpopulations (Choi et al., 2008). Motifs corresponding to 5 transcription factors were significantly more abundant in genes that were relatively highly expressed in retinal endothelial cells (i.e., glucocorticoid receptor, GCCR; high mobility group AT-hook 1, HMGA1; heat shock transcription factor 1, HSF1; p53, vitamin D receptor, VDR). As discussed in our publication (Choi et al., 2008), there is ample evidence that all 5 transcription factors regulate cellular processes involved in the growth of new vessels, including cell proliferation and migration and endothelial monolayer integrity, as well as effects on apoptotic pathways.

These same transcription factors have also been implicated in inflammatory disease. GCCR levels drop in the retina in endotoxin-induced uveitis, an effect which is reversed by exogenous corticosteroid, suggesting an immunomodulatory function (Zhao et al., 2011). Calcitriol (1,25-dihydroxyvitamin D_3), which acts via VDR, can prevent or limit experimental autoimmune uveoretinitis by preventing Th17 responses in particular (Tang et al., 2009). Although not studied in relation to uveitis, HMGA1 and HSF1 have both been implicated in systemic inflammatory responses. Inhibition of HMGA1 binding to the promoters of inducible nitric oxide synthase and P-selectin increases survival and reduces lung and liver inflammation in murine endotoxemia (Baron et al., 2010; Grant et al., 2009). Genetic HSF1 deficiency promotes inflammation in a murine model of inflammatory bowel disease, a systemic disease that is associated with uveitis (Tanaka et al., 2007). p53 is a master tumor suppressor transcription factor, but also acts to reciprocally down-regulate activity of NF-κb, which is a central transcription factor in inflammation (Gudkov et al., 2011).

Our gene expression microarray study reinforced an important consideration for designing similar experiments (Smith et al., 2007). Global gene expression patterns of retinal endothelial cell isolates were examined graphically by multi-dimensional scaling (MDS). The MDS plot simplifies a data set such that differences between samples can be viewed as 2- or 3-dimensional distances; points representing samples with similar gene expression are clustered, and those representing divergent profiles are far apart. From the MDS plot presented in Figure 1A, it is obvious that retinal endothelial cells from different donors have

distinct gene expression profiles. We separately examined the expression levels of E-selectin, intercellular adhesion molecule (ICAM)-1, vascular cell adhesion molecule (VCAM)-1, CD44, and CX_3CL1, and found that different retinal endothelial cell isolates expressed different levels of these adhesion molecules (Figure 1B). Research is often based on cells derived from a single human donor, but these data show the importance of studying multiple donors when investigating the molecular profile of an endothelial cell population.

Recently an independent group published a transcriptomic profiling study, also comparing cultured primary human retinal and choroidal endothelial cells (Browning et al., 2012), but having some methodological differences from our study. Gene expression of ocular endothelial cells, isolated from retina, choroid, and iris of 3 human donors, was profiled using oligonucleotide arrays. Human umbilical vein endothelial cells from 3 additional donors were also studied. A similar percentage of transcripts differed significantly between the retinal and choroidal endothelial cells in both this study (i.e., 8.4%) and our study (i.e., 8.9%). RNA was extracted when endothelial cells were 80% confluent and therefore actively proliferating, which has obvious relevance to angiogenesis. Differential expression of genes related to cell cycle, DNA replication, cell morphology, cell-to-cell interactions, cell movement, and gene expression were highlighted. Interestingly, transcriptomes of iris and choroidal endothelial cells differed less than 1%; although the authors did not speculate on this reason for this finding, it might reflect the shared uveal location of the respective vascular beds. As expected, differences were noted in the transcriptomes of retinal and umbilical vein endothelial cells, leading the authors to conclude that the latter “are probably not a suitable surrogate for the study of ocular … disorders”.

4.4 Proteome of the human retinal endothelial cell

After we identified significant differences in the transcriptome of human vascular endothelial cells of retinal versus choroidal origin, the logical next step was to compare the proteomes of these 2 endothelial cell subsets. We combined 2-dimensional difference gel electrophoresis (2D-DIGE) and tandem mass spectrometry to do this. Cultured retinal and choroidal endothelial cells from 5 human donors were separately lysed by treatment with 40 mM Tris-2% SDS buffer extraction, followed by sonication. The samples were then acetone-precipitated and labeled with Cy5 or Cy3 dyes. Isoelectrofocusing of the pooled protein samples was done with pH 4–7 gradient strips and a Protean IEF Cell (Bio-Rad Laboratories, Hercules, CA). Second-dimension separation employed 12% SDS-polyacrylamide gels. Gels were scanned using the DIGE-enabled Typhoon 9400 imager (GE Healthcare, Piscataway, NJ). Fluorescence intensities were analyzed by Phoretix 2D Evolution v2005 (Nonlinear Dynamics, Durham, NC). Log_2 signal intensities were normalized across the gels by matching medians to remove dye biases. Proteins that were differentially abundant in at least 4 of 5 donors were identified by SAM with the FDR set at 5%, as also employed in our gene expression microarray study.

Of 2514 protein spots detected on 2D-DIGE, 123 spots qualified for analysis; 20 spots were more abundant in retinal endothelial cell samples and 11 were more abundant in choroidal endothelial cell samples. These 31 protein spots were excised from gels and digested with trypsin. Peptides were separated by reverse-phase chromatography, and 17 proteins (including 11 more abundant in retina cells and 6 more abundant in choroid cells) were identified by tandem mass spectrometry with a LTQ linear ion trap (Thermo Finnigan, San Jose, CA). Eleven proteins more abundant in retinal endothelial cells included proteins implicated in inflammation (i.e., calreticulin, peroxiredoxin-4, protein disulfide isomerase, serpinB9, coactosin-like protein, vimentin, cathepsin B, annexin A3) and angiogenesis (i.e., calreticulin, peroxiredoxin-4, protein disulfide isomerase, vimentin, cathepsin B, annexin A3).

The data indicated that differences existed in the protein composition of human retinal and choroidal vascular endothelium. However, only a small number of differentially expressed proteins were identified. Several obstacles limit the yield by this method (Corthals et al., 2000; Santoni et al., 2000). Proteins with extreme isoelectric points or molecular weights go undetected in a single gel. Low abundance proteins may be missed due to the limited range of available stains. Membrane proteins are poorly solubilized in the aqueous buffers required for iso-electric separation and thus are also largely undetected; this is a particular concern for our investigation of the retinal endothelial proteome because cell surface proteins are an important aspect of an endothelial cell's signature. We recently turned to shotgun proteomics to establish a comprehensive list of retinal endothelial proteins.

Shotgun proteomics—"the direct and rapid analysis of the entire protein complement within a complex protein mixture" (Wu and MacCoss, 2002)—combines a gel-free approach to protein separation termed multidimensional protein identification technology (MudPIT) with tandem mass spectrometry (MS/MS) and sophisticated software for rapid spectrum matching. In MudPIT, digested protein is separated by 2-dimensional liquid chromatography (2D-LC) and fed directly into the mass spectrometer (Link et al., 1999). Various methods exist for measuring relative protein abundance in 2D-LC-MS/MS. The most straightforward method is spectral counting. Within a complex sample, higher abundance proteins produce more peptides, and consequently, a larger number of mass spectra. The number of mass spectra assigned to a protein is directly related to abundance in the sample (Liu et al., 2004).

We conducted a pilot study to evaluate the value of MudPIT in profiling the human retinal endothelial cell. Following standard isolation from 1 donor, retinal endothelial cells were lysed by sonication. Whole protein extracts were solubilized in 8M urea, reduced/alkylated, and digested with trypsin following dilution of urea to a 2M concentration. The digest was analyzed by 2D-LC-MS/MS, using the LTQ linear ion trap. This yielded approximately 400,000 MS/MS spectra. The data set was analyzed by Sequest software v27 rev12 (Thermo Finnigan) to identity peptides, and the numbers of spectra matching individual proteins were tabulated using the program, Scaffold (Proteome Software, Portland, OR). Only high (i.e., greater than 0.99) confidence proteins that could be identified by 2 or more unique peptides were included, resulting in the identification of 2457 proteins (Table 1). This result illustrates the superiority of the shotgun approach for protein identification in human retinal endothelial cells. A study comparing the retinal and choroidal endothelial proteomes of multiple donors by this method is ongoing in our laboratory.

4.5 Immortalization of human retinal endothelial cells

While the human retinal endothelial cell is the ideal cell for investigating its role in retinal vascular diseases, only limited numbers of cells can be isolated from paired human globes. In our hands, the maximum number is approximately 12 million cells, which is insufficient for follow-up studies of interesting molecules identified by molecular profiling. For this reason, we investigated the possibility of obtaining large numbers of retinal endothelial cells, without compromising the cell phenotype, by immortalizing the cells using LXSN16E6E7 (generously provided by Denise A. Galloway, PhD, Fred Hutchinson Cancer Institute, Seattle, WA). This murine amphotropic retroviral construct encodes the E6 and E7 oncogenes of human papilloma virus 16 and a gene conferring G418 antibiotic resistance (Halbert et al., 1991).

Actively proliferating retinal endothelial cells were exposed for 24 hours to LXSN16E6E7 harvested from PA317 packaging cells, with 5 mg/ml hexadimethrine bromide in some cases, and subsequently cultured in the presence of G418 antibiotic for a minimum of 4 days. Attempted immortalization of retinal endothelial cells from 11 donors was successful in 4 (36%), defined on the basis of growth to greater than 6 passages with 1:3 or greater split

at passage. Reasons for failure included low growth rate and overgrowth of non-endothelial cells. Phenotype of the endothelial cells was retained following immortalization, as demonstrated by cobblestone morphology, expression of CD31 and von Willebrand factor (VWF), and capillary-like tube formation on Matrigel (BD Biosciences Discovery Labware, Franklin Lakes, NJ) (Figure 2). Although the success rate of this procedure, per our definition, was less than 50%, when successful, the procedure provided substantial numbers of endothelial cells for use in multiple studies. Human choroidal endothelial cells may be similarly immortalized.

4.6 Supervillin: a retinal endothelial protein identified by molecular profiling

Molecular profiling has the potential to identify many novel proteins with potential relevance to retinal vascular diseases. We illustrate this by presenting work on supervillin, which was detected with relatively high expression in retinal endothelial cells by transcriptomic profiling (Smith et al., 2007). Although originally described in 1997 (Pestonjamasp et al., 1997), at the time of writing, there are only 21 research publications that relate to supervillin. The presence and role(s) of supervillin in endothelium have never been investigated.

Supervillin is a 205 kDa member of the gelsolin superfamily of actin-binding proteins (Silacci et al., 2004). A muscle-specific isoform, termed archvillin, is a closely related 250 KDa protein (Oh et al., 2003). Supervillin contains 6 gelsolin-related repeating units, plus an actin-binding domain/nuclear localization signal (Archer et al., 2004). This protein is expressed in human and mouse, and the structure is well conserved across species (Oh et al., 2003; Pope et al., 1998). Expression is widespread, but varies considerably between tissues; supervillin is expressed at very low levels in neural tissue (Pope et al., 1998). As well as actin, supervillin binds myosin and filamin (Chen et al., 2003), and has been implicated in cytoarchitecture at the plasma membrane and within the nucleus (Pestonjamasp et al., 1997; Wulfkuhle et al., 1999). Supervillin promotes disassembly of cell-substrate focal adhesions, inhibits cell spreading, and promotes invadopodial function (Crowley et al., 2009; Liu et al., 2011; Takizawa et al., 2007; Takizawa et al., 2006). In addition, studies in HeLa cells indicate that supervillin promotes cell motility (Fang et al., 2010). Although the gelsolin family proteins control actin organization, various members have other unrelated functions in cell processes, from controlling apoptosis to regulating phagocytosis (Silacci et al., 2004). Nonetheless, a role for supervillin in endothelial cell function has not yet been investigated, although CapG, another gelsolin family protein, is known to promote endothelial cell motility (Pellieux et al., 2003).

We independently confirmed expression of supervillin in primary human retinal endothelial cells by RT-PCR and western blot of total RNA and protein lysate, respectively, for 5 of 6 donors (Fig. 3A and 3B). One donor either did not produce supervillin or expressed it at a level undetectable by western blot. Reports of supervillin involvement in cell motility suggested a potential role in retinal vessel formation, which we studied using the immortalized human retinal endothelial cells. We observed upregulation of supervillin when endothelial cells were stimulated with human VEGF for up to 24 hours (Fig. 3C). We used the CyQuant NF Cell Proliferation Assay (Life Technologies, Molecular Probes, Eugene, OR), in which cellular DNA is tagged for quantification by fluorescent microplate reader, to examine supervillin's involvement in cell proliferation, which is a key component of vessel growth. In separate experiments using endothelial isolates derived from 2 human donors, supervillin-targeted siRNA knockdown resulted in significantly less proliferation than non-targeted siRNA (Fig. 3D). In both experiments and shown for 1 donor (Fig. 3E), western blot of protein extracts from siRNA-treated endothelial cells confirmed knockdown by the targeted siRNA by 48 hours after transfection. These findings, taken with our previous observation of high relative expression of supervillin by human retinal endothelial cells,

suggest the hypothesis that supervillin may specifically regulate growth of retinal blood vessels and make it an excellent candidate for further study in relation to the pathogenesis of neovascularization in the retinal ischemic vasculopathies.

5. Autoimmune posterior uveitis

5.1 In vivo models

Experimental autoimmune uveoretinitis (EAU) is the standard in vivo model of human autoimmune uveitis. The model was first described in the 1960s as “experimental allergic uveitis” in guinea pigs immunized with homologous retina emulsified in complete Freund’s adjuvant (Wacker and Lipton, 1965). Work conducted mainly at the National Eye Institute in the 1980s (e.g. (Caspi et al., 1988; Gery et al., 1986)) led to the development of models in genetically susceptible inbred mice and rats, and today these species are almost invariably used for studies of EAU. Inflammation is induced by a variety of different protocols, but frequently common is the use of bovine interphotoreceptor retinoid binding protein as the uveitogenic antigen. While uveitis affects both anterior and posterior segments of the eye in mouse EAU, the inflammation is based posteriorly and therefore this is appropriately viewed as a model of autoimmune posterior uveitis. Inflamed eyes demonstrate findings that include retinal vasculitis, retinitis and serous retinal detachments, subretinal neovascularization, choroiditis and vitritis (Caspi et al., 1988). Late in the course of the inflammation, retinal neovascular membranes develop (Chen et al., 2012).

The ocular leukocytic infiltrate is heterogeneous in EAU, including lymphocyte subsets, macrophages and neutrophils; resident cells, such as perivascular macrophages, microglia and retinal pigment epithelium also participate in the inflammation (Kerr et al., 2008). Different subpopulations of CD4+ helper T cell may initiate EAU, including Th1 cells and Th17 cells (Luger and Caspi, 2008; Nussenblatt, 1991). Th1 cells differentiate from naïve CD4+ T cells when interleukin (IL)-12 activates STAT-4 and T-bet, and their signature cytokine is interferon-gamma (IFN-γ). Th17 cells differentiate under the control of RORγt and are characterized by synthesis of IL-17—or IL-17A—as well as other inflammatory cytokines (i.e., IL-17F, IL-6, IL-21, IL-22 and tumor necrosis factor [TNF]-α). A relatively small, but persistent, subset of helper T cells produce IL-17 and IFN-γ, and have been designated Th17/Th1 cells (Shi et al., 2008). A landmark study from the Caspi group (Luger et al., 2008) shows that the effector response in EAU—Th1 or Th17—depends on the mode and the environment of antigen presentation. Once EAU is initiated, macrophages play a major role in the ensuing retinal damage, as convincingly demonstrated by the Dick laboratory (Copland et al., 2007).

To uncover pathogenic mechanisms, the effect of relevant manipulations of the immune system on the severity of EAU is determined. Traditionally, severity of EAU is measured by standard histopathology on tissue sections, usually scoring both cellular infiltration and structural damage to the retina (Dick et al., 1994). More recently, dissection of retinal whole mounts has been combined with intravital or immunohistochemical staining of retinal cells and molecules, which is often imaged by confocal microscopy (Xu et al., 2003a). Various imaging systems provide a means for studying disease severity in vivo. Until recently, fundus imaging in the mouse was not commonly performed due to limited availability and cost of equipment. Five years ago, topical endoscopic imaging (TEFI) was first described. This simple, inexpensive system involves applanation to the mouse cornea of a human tele-otoscope, which is attached to a digital single-lens reflex camera and illuminated with a xenon lamp (Paques et al., 2007). Several groups have used TEFI successfully to image the posterior eye EAU (Copland et al., 2008; Xu et al., 2008), and a severity grading has been developed that describes disease according to retinal infiltrates, optic disc inflammation, retinal vasculitis and structural damage (Xu et al., 2008). TEFI may be adapted for

fluorescein angiographic imaging of retinal vessels. Optical coherence tomography has been applied to imaging retinal microstructure in mice with EAU (Oh et al., 2011). Scanning laser confocal microscopy allows imaging of individual leukocyte interactions with the retinal vessel wall following administration of appropriate intravital dyes (Parnaby-Price et al., 1998a; Xu et al., 2002).

5.2 In vitro models

While most studies of retinal endothelial involvement in autoimmune posterior uveitis have been conducted with animal models, some standard immunological methods are readily adapted for the investigation of retinal endothelial properties during inflammation. Simple experiments for evaluation of leukocyte-retinal endothelial cell interactions and retinal endothelial responses to inflammatory molecules may be conducted using confluent cultured cells. Various flow chambers may be used to simulate blood flow across cell monolayers. The Boyden chamber, which is divided into upper and lower chambers by a filter (Boyden, 1962), may be used to study retinal endothelial transmigration of leukocytes when the filter is coated with basement membrane substitute and seeded with endothelial cells.

The Woodruff-Stamper binding assay is helpful to address the concern of phenotypic drift by cultured endothelial cells. Originally this assay was developed to examine the interaction between lymphocytes and the endothelium of high endothelial venules in peripheral lymph nodes (Stamper and Woodruff, 1977). In that setting, a suspension of lymphocytes is overlaid onto cryostat-cut sections of unfixed lymph node, with agitation designed to simulate blood flow. The assay has been modified by replacing lymph node with retina, for observation of leukocyte binding to retinal vascular endothelium (Hill et al., 1997). As well as demonstrating the affinity of a particular vessel for any given cell population, this assay makes it possible to study molecules that potentially mediate an interaction, using specific blocking antibodies.

5.3 Role of retinal endothelium in autoimmune posterior uveitis

Early work on EAU in the Lewis rat suggested important roles for the retinal endothelium in the development of autoimmune posterior uveitis. Immunohistochemical examination of eyes enucleated at the onset of EAU revealed expression of activation markers, class II antigen and fibronectin, on retinal endothelium, which stressed “the importance of the local vasculature in the development of the immune response” (Fujikawa et al., 1987a). By electron microscopy, endothelial cells in retinal venules showed morphologic changes coinciding with maximum tissue inflammation (McMenamin et al., 1992). The changes, which were described as “high endothelial venule-ness”, included increased numbers of cytoplasmic organelles, and increased thickness and irregularity, with deep intercellular clefts that contained lymphocytes and monocytes. These findings implied an essential participation of the retinal endothelium in leukocyte trafficking into the retina in posterior uveitis.

5.4 Leukocyte trafficking across retinal endothelium

Experiments applying scanning laser ophthalmoscopy and confocal microscopy to rat EAU have demonstrated that leukocytes migrate into the posterior segment of the eye via the retinal microvasculature (Parnaby-Price et al., 1998b). T cells also traffic across these vessels in small numbers to conduct immune surveillance of this region (Xu et al., 2003b). The experimental findings in EAU are supported by clinical observations in patients suffering from autoimmune posterior uveitis, who show frequent involvement of the retinal vessels (Sanders and Graham, 1988). One notable difference between human uveitis and EAU is that patients with different forms of posterior uveitis may have involvement of retinal arteries and/or retinal veins, whereas in EAU, leukocyte migration occurs primarily at

the level of the post-capillary venule (Xu et al., 2003a). A series of intravital and postmortem observations made in mouse EAU indicate that trafficking of leukocytes across the retinal endothelium requires 3 sets of conditions: up-regulation of adhesive proteins by the endothelium; priming of circulating leukocytes; and conducive hydrodynamic force within the retinal vasculature (Xu et al., 2003a; Xu et al., 2004a).

Leukocytes cross the endothelium by moving either between (paracellular) or through (transcellular) endothelial cells (Engelhardt and Wolburg, 2004). Transcellular migration is considered the rule for organs with extremely tight endothelial junctions, such as the brain (Garrido-Urbani et al., 2008). During transcellular migration, lymphocytic projections or 'podosomes' extend into endothelial 'podoprints', ultimately creating a transcellular pore (Carman et al., 2007). Electron microscopic studies show that in retina, where endothelial cells are connected by very tight junctions, leukocytes move transcellularly (Greenwood et al., 1994; McMenamin et al., 1992). However, a thorough immunohistochemical examination of retinal whole mounts from mice with EAU (Xu et al., 2005) reveals that leukocyte adhesion to and transmigration across the endothelium triggers disruption and loss of the junctional protein, occludin-1, and astrocyte disensheathment of the affected vessel. The changes occur only in retinal venules and spare other vessels despite close anatomical proximity. In light of these observations, one cannot discount the possibility of paracellular movement of leukocytes through the retinal endothelium in posterior uveitis.

Regardless of the route of transmigration, circulating leukocytes access any tissue as a result of complex molecular interactions with the local vascular endothelium. Chemokines control leukocyte movement through the endothelium, and adhesion molecules tether leukocytes to the endothelium (Ley et al., 2007). Although different leukocyte populations interact similarly with the vascular endothelium, the relative importance of specific adhesion molecules and chemokines appears to vary between the subsets. This is an area of active research in relation to both uveitis and extra-ocular inflammatory diseases.

5.4.1 Adhesion molecules—While the field of leukocyte extravasation continues to progress at fast pace, the literature contains excellent reviews that summarize the molecular events involved in leukocyte migration in general (Chavakis et al., 2009; Ley et al., 2007; Nourshargh et al., 2010) and across the retinal endothelium (Crane and Liversidge, 2008). Families of adhesion molecules that have been studied in relation to posterior uveitis in particular, include the selectins and members of the immunoglobulin superfamily. Selectins on endothelial cells (i.e., P-selectin; CD62P, E-selectin; CD62E) and leukocytes (i.e., L-selectin; CD62L) tether leukocytes to the endothelium via carbohydrate ligands (e.g., P-selectin glycoprotein ligand (PSGL)-1; CD162). This binding readily dissociates, and leukocytes begin to roll along the endothelial surface at low velocity. Chemokines on the endothelial surface activate integrins, resulting in arrest and firm adhesion of leukocytes. Well-described adhesive interactions occur between leukocyte function associated antigen-1 (LFA-1; CD11a/CD18) and very late antigen 4 (VLA-4; CD49d/CD29) on leukocytes, and ICAM-1 (CD54) and VCAM-1 (CD106) on endothelial cells, respectively. Gene expression profiling shows that human retinal endothelial cells constitutively express relatively high levels of ICAM-1, VCAM-1 and E-selectin (Smith et al., 2007), which might predispose the retina to inflammation if leukocyte activation status and shear stress were conducive.

Increased expression of P- and E-selectin on retinal venules is observed in tissue whole-mounts one day prior to leukocyte extravasation in mouse EAU (Xu et al., 2003a). Using the same model, but with adoptive transfer of CD4+ T cells polarized in vitro, a role for these selectins in EAU was confirmed (Xu et al., 2004b). Exposure to antibody directed against P-selectin glycoprotein ligand 1 inhibited rolling and infiltration of Th1-polarized, but not Th2-polarized, cells. Endotoxin-induced uveitis is a rodent model that is widely employed to

study anterior uveitis, but retinal involvement is also reported (Ruiz-Moreno et al., 1992). Consistent with the observations made in EAU, in rats injected systemically with lipopolysaccharide, cellular infiltration of the posterior segment was reduced by treatment with the antibodies directed against E- and P-selectin (Suzuma et al., 1998a). Participation of CD44 in posterior uveitis is also described. T cells and endothelium express this transmembrane glycoprotein, which binds L-selectin and E-selectin, and may bind itself via a hyaluronan bridge (Bonder et al., 2006; Dimitroff et al., 2001a; Dimitroff et al., 2001b). Retinal venules demonstrate increased CD44 expression during initiation of EAU in mice (Xu et al., 2004b). The importance of this finding was revealed with the adoptive transfer model (Xu et al., 2004b). Anti-CD44 antibody inhibited rolling and infiltration of CD4+ T cells, and the effect was most apparent for Th1-polarized cells.

Paralleling the changes in expression of E- and P-selectin during mouse EAU, ICAM-1 is detected early and on retinal venules, where leukocytes extravasate (Xu et al., 2003a). In contrast, VCAM-1 is expressed after the onset of leukocyte extravasation and occurs mainly in the retinal arterioles. The timing of ICAM-1 versus VCAM-1 expression is consistent with in vitro observations from an independent laboratory working in the rat (Greenwood et al., 1995). Migration of rat CD4+ T cells across a non-activated retinal endothelial monolayer in vitro was blocked by anti-ICAM-1, but not anti-VCAM-1, antibody. Yet, after endothelial activation by IL-1β, anti-VCAM-1 antibody inhibited migration. Several groups have demonstrated the inhibitory effect of targeting the ICAM-1/LFA-1 interaction in murine EAU (Uchio et al., 1994; Whitcup et al., 1993; Xu et al., 2003a). One study showed that this blockade targeted Th1-polarized cells in preference to Th2-polarized cells (Xu et al., 2004b). We observed that anti-ICAM-1 antibody did not inhibit rat experimental melanin-induced uveitis, a T cell-mediated inflammation affecting primarily the anterior uvea (Smith et al., 2000). In other words, ICAM-1 appears to play a more important role in posterior uveitis. A peptide inhibitor of VLA-4, termed α4-api, has been used to ameliorate mouse EAU, implicating VCAM-1/VLA-4 interactions in leukocyte extravasation (Martin et al., 2005).

Translational research using human cells or tissues supports a role for adhesion molecules in the development of autoimmune posterior uveitis. By immunohistochemistry, E-selectin and ICAM-1 were detected on retinal endothelium of cadaver eyes with no history of disease (Duguid et al., 1992). In an independent report, ICAM-1 was detected on endothelial cells in the posterior segment of eyes from 6 patients with uveitis, but not 7 normal eyes (Whitcup et al., 1992). Another paper described expression of E-selectin, ICAM-1, VCAM-1, and CD44 to be significantly increased in an eye with acute sympathetic ophthalmia, in comparison to an eye in the late, fibrotic stage and several normal eyes (Kuppner et al., 1993). Elevated serum levels of soluble adhesion molecules (i.e., P-selectin, E-selectin and ICAM-1) have been measured in patients with different forms of posterior uveitis, including primary retinal vasculitis, Behcet's disease, sarcoidosis and idiopathic disease (Arocker-Mettinger et al., 1992; Aydintug et al., 1995; Haznedaroglu et al., 2000; Lee et al., 2007a; Sari et al., 2005; Zaman et al., 1994). Serum levels of ICAM-1 and VCAM-1 drop in patients with Behcet's disease after immunosuppressive treatment (Verity et al., 1998). In one functional study, antibodies directed against the LFA-1 subunit, CD18, or VLA-4 subunit, CD29, significantly inhibited binding of peripheral blood lymphocytes to retinal endothelium in a modified Woodruff-Stamper assay (Hill et al., 1997). In other work, anti-ICAM-1 antibody reduced adhesion of human CD4+ T cells to a human retinal endothelial cell line by up to 50% (Liversidge et al., 1990).

Gene expression profiling in our laboratory using oligonucleotide arrays has showed that expression of E-selectin, ICAM-1, and VCAM-1 increases significantly in retinal endothelial cells after a 4-hour incubation with the general inflammatory stimulus,

lipopolysaccharide (Smith et al., 2007). To follow-up on this result, we used real-time quantitative RT-PCR to investigate the effect of several pro-inflammatory cytokines on the retinal endothelial cell expression of adhesion molecules implicated in posterior uveitis: tumor necrosis factor (TNF)-α, which is a master cytokine, and interferon (IFN)-γ and interleukin (IL)-17, which are prototype Th1 and Th17 cytokines, respectively (Figure 4). In comparison to unstimulated cells, immortalized human retinal endothelial cells treated for 4 hours with TNF-α showed a significant increase in the expression of ICAM-1, VCAM-1, and E-selectin. A similarly timed exposure to IFN-γ significantly up-regulated ICAM-1 expression and trended to increased VCAM-1 expression ($p = 0.055$), while exposure to IL-17 significantly up-regulated E-selectin expression. We also examined the expression of P-selectin and CD44 and found that none of the selected cytokines significantly altered transcript levels in human retinal endothelial cells, with the exception of IL-17, which induced a modest increase in P-selectin expression.

5.4.2 Chemokines—Chemokines are a large family of low molecular weight cytokines with multiple chemoattractant activities. These functions include directing chemokine receptor-bearing leukocytes along a concentration gradient towards a site of inflammation, which may involve crossing an endothelium (Rot and von Andrian, 2004). Endothelial cells synthesize an array of chemokines that are expressed on the luminal surface in association with glycosaminoglycans or atypical chemokine receptors; additionally, they trancystose chemokine produced by neighboring non-endothelial cells and similarly express the cytokines (Middleton et al., 2002; Ulvmar et al., 2011). Chemokines also contribute to leukocyte migration by interacting with G protein-coupled chemokine receptors on the endothelial cell surface, activating integrins, and promoting firm adhesion between leukocytes and endothelium, as discussed above. We have reported that human retinal endothelial cells constitutively express relatively high levels of multiple chemokines, including CCL2, CXCL1, CXCL2, CXCL3, CXCL6, CXCL8, CXCL10, CXCL11, and CX3CL1 (Smith et al., 2007). This spectrum of chemokines sets up the endothelium to attract a spectrum of leukocytes, including T cells, B cells, NK cells, monocytes, dendritic cells, and neutrophils. Experiments conducted in mouse EAU indicate the participation of retinal endothelial cell chemokines, including CCL2, CCL3, and CXCL10. Applying immunohistochemistry to ocular cross-sections from mice in the early phase of EAU, one group demonstrated expression of CXCL10 on retinal endothelium (Keino et al., 2003), and a second group independently reported expression of CCL3 and CCL2 on retinal endothelium (Crane et al., 2001). Treatment with anti-CCL3 antibody significantly reduced the inflammatory and structural EAU scores, and leukocytes demonstrated faster velocity, lower rolling efficiency, and less tissue infiltration, in comparison to mice treated with irrelevant antibody (Crane et al., 2001). CCL5 has been detected in inflamed eyes, but in association with T cells, not vascular endothelium (Crane et al., 2001), and consistent with this, CCR5-knock-out mice and mice treated with anti-CCR5 antibody exhibit alterations in T cell emigration into the eye. (Crane et al., 2006; Takeuchi et al., 2005).

Several published studies using cultured human retinal endothelial cells implicate multiple endothelial chemokines in the development of retinal inflammation, covering a broad range of leukocyte specificities and including CCL2, CCL3, and CXCL10. In one report, stimulation of human retinal endothelial cells with the combination of master cytokines, TNF-α and IL-1β, increased levels of all tested chemokines (i.e., CCL2, CCL3, CCL4, CCL5, CXCL1, CXCL5, and CXCL8), according to ELISA (Crane et al., 2000). Another publication focused on CX3CL1—also known as fractalkine—which is a unique protein that functions as an adhesion molecule in its membrane-anchored form and a chemokine when cleaved (Silverman et al., 2003). Immunostaining of human ocular tissue confirmed constitutive expression of CX3CL1 on retinal endothelium. Per ELICA, cultured human retinal endothelial cells up-regulated the chemokine on exposure to TNF-α, IFN-γ, and

CD40 ligand, but not IL-13 or IL-17, and down-regulated it in response to IL-4. Involvement of this chemokine in uveitis may depend on species, since mice without functional CX3CR1 develop EAU of equivalent severity to that observed in wild-type animals (Kezic and McMenamin, 2010). In our microarray profiling study, stimulating human retinal endothelial cells with lipopolysaccharide increased gene transcripts of CCL2, CCL8, CCL20, CXCL1, CXCL2, CXCL6, CXCL18, CXCL10, and CX3CL1 (Smith et al., 2007). We were interested to know the effects of TNF-α, IFN-γ, and IL-17 on expression of CXCL10 or CCL20, which specifically attract Th1 or Th17 cells, respectively (Sallusto et al., 1998; Singh et al., 2008), and approached this with real-time quantitative RT-PCR. When immortalized human retinal endothelial cells were stimulated for 4 hours with TNF-α, levels of both CXCL10 and CCL20 transcript increased significantly. As expected, the Th1 cytokine, IFN-γ, significantly increased expression of CXCL10 alone, but surprisingly, stimulation with IL-17 did not impact expression of CCL20 significantly (Figure 5).

5.5 Effects of retinal endothelium on the inflammatory response

In posterior uveitis, retinal endothelial cells respond to a variety of molecular signals, but they also produce molecules that may influence the course of the inflammation, including certain membrane-bound proteins, enzymes and cytokines. Cytokines have long been recognized as important molecular mediators of uveitis (Wakefield and Lloyd, 1992). Interleukin-1β and TNF-α are master cytokines with multiple pro-inflammatory activities that are clearly involved in autoimmune posterior uveitis and its animal model. Patients with posterior uveitis may exhibit elevated intraocular levels of TNF-α and IL-β (Ahn et al., 2006; Franks et al., 1992; Kuiper et al., 2011), and polymorphisms in the genes encoding these cytokines predispose to Behcet's disease, which commonly manifests as posterior uveitis (Du et al., 2009). Therapies that inhibit the activity of TNF-α have become standard in the management of recalcitrant uveitis involving the posterior segment of the eye (Sfikakis, 2010), and there is recent interest in targeting IL-β for treatment of the disease (Gul et al., 2012). Consistent with the human experience, intravitreal injection of TNF-α or IL-β in rabbits induces retinal perivascular inflammation and breakdown of the blood-retinal barrier (Luna et al., 1997). Both TNF-α and IL-β are expressed at significantly elevated levels in eyes of mice with active EAU (Hashida et al., 2005), and severity of the inflammation is significantly reduced by intervention that lowers the levels of these cytokines (Kitamei et al., 2006).

Human retinal endothelial cells produce TNF-α and IL-β, as well as IL-6, which may be secreted in response to the 2 master cytokines (Smith et al., 2007; Tezel et al., 2001). IL-6 is a pleiotropic cytokine that induces the differentiation and/or activation of various leukocyte subsets (Kishimoto et al., 1995). In our microarray study, human retinal endothelial cells constitutively expressed relatively high levels of IL-6 transcript, and increased this expression almost 20-fold following a brief exposure to lipopolysaccharide (Smith et al., 2007). Expression of pro-inflammatory cytokines by these cells appears to be modulated, since lipopolysaccharide also induced up-regulation of suppressor of cytokine signaling (SOCS)1 (Smith et al., 2007), which down-regulates pro-inflammatory cytokine signaling (Krebs and Hilton, 2001). SOCS1 is highly induced in the retina at the onset of peak of inflammation (Takase et al., 2005), and SOCS1 transgenic rats or mice develop relatively mild EAU by clinical and standard histopathological assessment, with reduced expansion and retinal immigration of CD4+ T cells producing IFN-γ or IL-17 (Yu et al., 2011).

Human retinal endothelial cells also are capable of immunomodulation through the production of IFN-β when the innate immune toll-like receptor 3 is activated, as might occur in retinal vasculitis (Lee et al., 2007b). Following the pioneering work by Koetter and Zierhut, it has become clear that Type I IFNs, including IFN-α and IFN-β, may be highly effective anti-inflammatory agents in various forms of severe uveitis, particularly that due to

Behcet's disease (Becker et al., 2005; Bodaghi et al., 2007; Deuter et al., 2010). Elevated levels of Type 1 interferons have been detected in the serum of patients with different forms of retinal vasculitis (Kotter et al., 2005; Lee et al., 2007b). Studies in rodents suggest these cytokines effect inhibition of uveitis though the reduced production of pro-inflammatory cytokines by cell populations that include CD4+ T cells (Okada et al., 1998a; Okada et al., 1998b; Sun et al., 2011).

Enzymes synthesized by retinal endothelial cells include members of the matrix metalloproteinase (MMP) family (Smith et al., 2007). These zinc-dependent endopeptidases have multiple activities in health and disease, the most studied of which is degradation of various components of the extracellular matrix (McCawley and Matrisian, 2001). As one example, leukocytes use MMPs to enable them to transmigrate the endothelial basement membrane and access target tissue during inflammation. The activity of MMPs is regulated by a family of promiscuous tissue inhibitor of metalloproteinases (TIMPs) that also are synthesized by endothelial cells (Smith et al., 2007).

Early evidence that MMPs were involved in the development of posterior uveitis came from an interventional study in rat EAU with BB-1101, which is a broad-spectrum MMP inhibitor (Wallace et al., 1999). Incidence and clinical severity of inflammation were significantly reduced, and retina was protected per histological examination. Subsequent work revealed similar anti-inflammatory activity of a selective MMP-2/MMP-9 small peptide inhibitor in mouse EAU (El-Shabrawi et al., 2004). High levels of MMP-2 and MMP-9 have been measured in ocular fluids taken from patients with different forms of uveitis (El-Shabrawi et al., 2000), and both MMPs have been detected in human and bovine retinal endothelial cells by RT-PCR (Behzadian et al., 2001; Li et al., 2010). Studies using bovine cells show MMP-2 and MMP-9 probably contribute to breakdown of the blood-retinal barrier in posterior uveitis; purified MMP-2 or MMP-9 increases the permeability of simulated bovine retinal endothelium in a transwell system and effects degradation of junctional occludin (Behzadian et al., 2001; Giebel et al., 2005). Work from our group (Smith et al., 2007) and others (Li et al., 2010) with human retinal endothelial cells suggests roles for additional MMPs and TIMPs in posterior uveitis, including MMP-3, MMP-10, MMP-12, MMP-14, and TIMP1, but additional investigation is required before conclusions can be drawn.

From multiple studies conducted in rodent EAU, backed by research using diseased human eyes, an important role for oxidative stress in posterior uveitis has been recognized (Nguyen and Rao, 2011; Rao, 1990). A key player is nitric oxide, which is produced from arginine and oxygen through the action of inducible nitric oxide synthase (NOS2) or constitutively expressed neuronal (NOS1) and endothelial (NOS3) forms (Lowenstein et al., 1994). Although NOS is not essential for EAU to be manifest, inhibition of the enzyme reduces inflammation in and protects the structure of the retina (Liversidge et al., 2002; Silver et al., 1999; Thillaye-Goldenberg et al., 2000). Immunohistochemistry was used to show NOS2 expression in the retina of eyes from 8 patients with sympathetic ophthalmia, which is a form of uveitis that follows sensitization to retinal antigens (Parikh et al., 2008). Ahead of leukocyte infiltration in rodent EAU, photoreceptors demonstrate NOS2 activity (Rajendram et al., 2007), and subsequently, infiltrating macrophages and resident microglia are major producers (Broderick et al., 2002; Zhang et al., 1999). Retinal endothelium may be a supplementary source of NOS in posterior uveitis. Our shotgun proteomic profiling confirms human retinal endothelial cell expression of NOS3, as well as eNOS interacting protein, which regulates enzymatic activity. Research conducted with bovine cells shows that endothelial cells express NOS2 when stimulated with TNF-α and/or IFN-γ (Chakravarthy et al., 1995). Other enzymes provide protection against oxidative stress, such as superoxide dismutase (SOD), which converts superoxide to hydrogen peroxide, and is up-regulated early in mouse EAU (Saraswathy and Rao, 2009). Our gene expression array profiling

detected high levels of SOD2 in human retinal endothelial cells, with significant increase following stimulation with lipopolysaccharide (Smith et al., 2007).

Vascular endothelium, including that in retina, does not constitutively express Class II antigen and thus cannot be considered a professional antigen-presenting cell. However, expression of Class II antigen by Lewis rat retinal endothelial cells is induced during EAU and in culture, leading to speculation of a potential capacity to present antigen to T cells non-professionally (Fujikawa et al., 1987b; Fujikawa et al., 1989). While it is unclear what might occur in vivo, subconfluent rat retinal endothelial cells support retinal antigen-induced T cell proliferation that is potentiated by IFN-γ (Wang et al., 1995). Retinal endothelium also may impact the activation of the infiltrating monocytes that are responsible for much of the damage to local tissue during posterior uveitis. Involvement of CD200 and receptor, CD200R, in this process has been thoroughly investigated in the Dick laboratory (Dick et al., 2003). CD200 is a member of the immunoglobulin superfamily that is expressed on vascular endothelium and neurons within human and rodent retina (Dick et al., 2001). CD200R is expressed on cells of myeloid derivation. Agonist CD200R antibody inhibited IFN-γ-induced production of nitric oxide and IL-6 by mouse bone marrow-derived macrophages (Copland et al., 2007). Consistent with this observation, retinas of CD200 gene-deficient mice exhibited relatively high NOS2 activity early in EAU, and experienced earlier onset and greater severity of inflammation, with prominent apoptosis of ganglion cells and photoreceptors (Broderick et al., 2002). Parallel studies in rats with EAU treated with anti-CD200R antibody yielded similar results (Banerjee and Dick, 2004).

6. Infectious posterior uveitis

6.1 Interaction of the retinal endothelium with infectious pathogens

As highlighted in several editorials and dedicated issues of *Thrombosis and Haemostasis* (Herwald, 2007; Schnittler and Preissner, 2009; Schnittler and Preissner, 2005), it is only recently that the critical involvement of the vascular endothelium in limiting the access of infectious pathogens to body sites, and the mechanisms by which disease microbes target the endothelium, have been recognized. Mechanisms involve invading or transmigrating host endothelial cells, as well as impacting host cell machinery that may support or inhibit replication of the microbe, or modulate the immune response. Some pathogens utilize a leukocyte taxi to move across an endothelial barrier; this mechanism is considered particularly important in infections of the central nervous system (CNS) because of the presence of the blood-brain barrier. Most endogenous ocular infections that present as posterior uveitis are acquired following systemic infection, and therefore require that the retinal endothelium be breached by the responsible micro-organism. The most common infectious posterior uveitis is caused by *Toxoplasma gondii*.

6.2 Ocular toxoplasmosis

T. gondii is an obligate intracellular protozoan parasite with an “apical complex,” placing it in phylum Apicomplexan (Black and Boothroyd, 2000). The complex, which defines the anterior end of the parasite, contains specialized secretory granules known as micronemes and rhoptries that are critical for host cell invasion. *T. gondii* exists in 3 forms: (1) an oocyst, which is produced by sexual reproduction and, after maturation, contains a small number of highly infectious sporozoites; (2) a tachyzoite, the form that characterizes an active infection; and (3) a tissue cyst, which contains multiple relatively dormant bradyzoites (Dubey et al., 1998). Although sexual reproduction takes place only in the intestine of the feline primary host, all other mammals and birds may act as secondary hosts for *T. gondii*. Most humans are infected following oral ingestion of cysts in pork and lamb, or oocysts released into the environment in the feces of infected cats (Montoya and

Liesenfeld, 2004). In a minority of cases, tachyzoites cross the placenta from a newly infected pregnant woman to her unborn child.

After ingestion by a human host and conversion to the tachyzoite form within the intestinal epithelium, *T. gondii* disseminates throughout the body primarily via the blood stream and lymphatics (Roberts and McLeod, 1999). Tachyzoites proliferate to high numbers within cells of target organs, and lyse cells on egress (Black and Boothroyd, 2000). Although the parasite infects all nucleated cells, in the human host, the infection persists in retina, brain, and muscle. The reasons for the CNS localization of *T. gondii* are poorly understood, but it is hypothesized that either: (1) the mechanisms responsible for immune privilege promote persistence of the parasite; or (2) tachyzoite entry into the CNS is facilitated (Montoya and Remington, 1997). Certainly immunomodulatory cytokines expressed in the retina promote tachyzoite proliferation (Nagineni et al., 2002). Studies from our group have explored the interaction between *T. gondii* and the human retinal endothelial cells.

It seems very possible that retinal endothelium is exposed to free *T. gondii* tachyzoites following infection, since circulating tachyzoites have been detected in the blood of immunocompetent patients (Silveira et al., 2011). We have addressed the possibility that tachyzoites might exhibit specific tropism for retinal endothelial cells by comparing infection in different subtypes of endothelial cells, including retinal endothelial cells, in simple infectivity assays (Smith et al., 2004). Intracellular growth of RH strain *T. gondii* tachyzoites was measured by uptake of ^{3}H-uracil in cell cultures, since parasites, but not mammalian endothelial cells, incorporate uracil directly through pyrimidine salvage. Results of these studies showed that tachyzoites proliferated more rapidly within human retinal endothelial cells than aortic, human umbilical, and dermal endothelial cells. New work from our group suggests that, in addition to the possibility of entering the retina by infecting endothelial cells, *T. gondii* tachyzoites may also gain access to the tissue by a different interaction with the retinal vascular endothelium. Using the Boyden chamber assay, we have demonstrated that tachyzoites are capable of transmigrating simulated human retinal endothelium, without significant disruption of the endothelium (Furtado et al., 2012).

Infection or transmigration are initiated by molecular attachment of the *T. gondii* tachyzoite to the host cell. Tachyzoites bind vascular endothelium in intact human retina under flow conditions (Chipps et al., 2006), and the binding-invasion step occurs relatively quickly for human retinal endothelial cells (Zamora et al., 2008). Sulfated proteoglycans have been implicated as host receptors on non-endothelial cells (Carruthers et al., 2000; Monteiro et al., 1998; Ortega-Barria and Boothroyd, 1999). In this respect, results of our gene expression microarray study might be relevant, showing that human retinal endothelial cells express relatively high levels of multiple sulfotransferases. These include carbohydrate sulfotransferases 1, 2, 11, and 12, N-deacetylase/N-sulfotransferases 1 and 2, sulfotransferase 1B1, and tyrosylprotein sulfotransferase 1 (Smith et al., 2007). High levels of these enzymes may confer high retinal endothelial surface expression of sulfated proteoglycans, which would promote tachyzoite adhesion. Other potential host receptors for *T. gondii* tachyzoites that are expressed at high levels by human retinal endothelial cells, per our transcriptomic profiling study, include integrin αv and ICAM-1. Tachyzoites bind laminin (Furtado et al., 1992), as does endothelial integrin αv when complexed with integrin β3 (Kramer et al., 1990); a laminin bridge is used by the tachyzoites to attach to human fibroblasts (Furtado et al., 1992). Our work using the Boyden chamber assay reveals that ICAM-1, but not VCAM-1, blockade significantly inhibits *T. gondii* tachyzoite migration across simulated human retinal vascular endothelium (Furtado et al., 2012). This is consistent with work conducted previously in the Sibley laboratory, showing ICAM-1 binds tachyzoite micronemal protein, MIC2, and facilitates migration across simulated human intestinal epithelium (Barragan et al., 2005).

Infection of retinal endothelial cells with *T. gondii* results in expression of various molecules that participate in the immune response. We used gene expression microarray profiling to study the response of human retinal endothelial cells to infection with *T. gondii* tachyzoites. The 62 transcripts that were up-regulated 4 hours following exposure included ICAM-1 and VCAM-1. These cell adhesion molecules are used by lymphocytes, dendritic cells, monocytes, and innate immune cells that are expected to react to a retinal infection. It is possible that this up-regulation also promotes migration of infected leukocytes across retinal endothelium; these cells have been shown to traffic tachyzoites across the blood-brain barrier (Courret et al., 2006; Lambert et al., 2006). Also upregulated were CCL2, CXCL2, and CCL8, which could attract a wide variety of innate and adaptive immune cells to a site of infection. Finally, we noted up-regulation of IL-6, which has the ability to proliferate and activate T cells and differentiate B cells. Retinal endothelial cells might also regulate the reactive inflammation in ocular toxoplasmosis, since the nuclear factor of kappa light polypeptide gene enhancer in B-cells inhibitor, alpha (IKBA), was also found to be up-regulated. Results from an independent group's investigation of the response of rat retinal endothelial cells to infection are very consistent with our own observations (Knight et al., 2005). At 2 hours post-infection, these cells up-regulate chemokines, CCL2, CCL4, CCL5, CXCL1, and CX3CL1, and adhesion molecule, ICAM-1.

6.3 Endogenous endophthalmitis

Our observations of *T. gondii* tachyzoite interactions with the retinal endothelium leads to questions about how other systematically contracted infectious agents might move into the retina. Endogenous bacterial endophthalmitis is an uncommon, but eye-threatening infection characterized by diffuse intraocular inflammation that is acquired via the retinal circulation (Jackson et al., 2003). *Listeria monocytogenes* is one of the most common Gram-positive organisms recovered from eyes with endogenous bacterial endophthalmitis, and *Escherichia coli is* a common Gram-negative pathogen in this disease (Jackson et al., 2003). Endogenous endophthalmitis may also result from fungal infection, most commonly with the yeast *Candida albicans* (Chhablani, 2011). Although the route of bacterial or fungal migration from the bloodstream to the retina has not been studied, interactions between *L. monocytogenes*, *E. coli*, and *C. albicans* with non-ocular endothelial subpopulations have been investigated.

L. monocytogenes crosses the blood-brain barrier to cause meningitis. Infectivity studies in human brain vascular endothelial cells show bacterial invasion, intracellular replication, and spread to adjacent cells, leaving the endothelium intact (Greiffenberg et al., 1998). At least 2 bacterial proteins mediate host cell surface recognition, invasion, or both: internalin A, recognizing host epithelial (E)-cadherin; and internalin B, recognizing hepatocyte growth factor receptor, Met (Bonazzi et al., 2009). However, the studies implicating E-cadherin have been conducted in non-endothelial cell populations (Bonazzi et al., 2009), and whether Met-internalin B interactions account for brain tropism is undetermined. One group (Greiffenberg et al., 1998) observed no difference in invasion of human brain endothelial cells when internalin A was deleted from *L. monocytogenes*, but significantly reduced invasion when internalin B was deleted. On the other hand, an independent group (Wilson and Drevets, 1998) observed no difference in binding or invasion of these cells by internalin A-deleted, internalin B-deleted and doubled deleted *L. monocytogenes* mutants. While the non-observation of a protein in a proteomics experiment does not discount its presence on a cell in vivo, our pilot MudPIT analysis of cultured human retinal endothelial cells did not identify either E-cadherin or Met in these cells.

Similar to our finding of *T. gondii* tachyzoite trophism for human retinal endothelial cells, human vascular endothelial invasion by *E. coli* is specific to brain endothelial cells and is not observed for other endothelial subpopulations, including umbilical vein and aortic

endothelial cells (Kim, 2000). *E. coli t*rafficking is a complicated process involving multiple host-bacterial interactions (Kim, 2003). Some identified bacterial-human brain endothelial ligands that specifically mediate binding and invasion include OmpA with gp96 homolog (Prasadarao et al., 2003), IbeA with vimentin (Zou et al., 2006), and cytotoxic necotizing factor 1 with 67 kDa laminin receptor (Kim et al., 2005a). According to our shotgun proteomics analysis, human retinal endothelial cells express each of these ligands. Although tested in human umbilical vein cells, an interesting twist on this observation is that FadA adhesion of *Fusobacterium nucleatum*, which is an oral commensal, binds vascular endothelial (VE)-cadherin (Fardini et al., 2011). As expected for an endothelial junctional protein, we find VE-cadherin in human retinal endothelial cells, although not differentially expressed. Binding translocates VE-cadherin from junctional complexes, and this is associated with increased permeability of the endothelium and increased transmigration of *E. coli* as evaluated by transwell migration assay. In other words, *F. nucleatum*, which could readily be introduced into the blood stream during tooth brushing, may enable *E. coli* passage across endothelium.

In a flow chamber, using immortalized microvascular endothelial monolayers to simulate the vascular wall, different forms of *C. albicans* bind readily when shear stress is matched to that in capillaries and postcapillary venules (Grubb et al., 2009). Using a transwell system populated with human brain endothelial cells on collagen, transendothelial migration occurs without loss of monolayer integrity, and by transmission electron microscopy, it is possible to observe the fungus in intracellular vacuoles without disruption to the cell (Jong et al., 2001). Studies of human umbilical vein cells indicate that endothelial N (neural)-cadherin may coordinate endocytosis of *C. albicans* (Phan et al., 2005). By affinity purification, with subsequent protein sequencing and confirmatory immunblotting and immunostaining, neuronal (N)-cadherin was identified as a *C. albicans* hyphal binding protein. However, when blockade by siRNA almost completely silenced N-cadherin, endocytosis was only reduced by approximately 30%, suggesting the involvement of other ligands. Indirect evidence suggests the possible involvement of αv integrin in fungal adhesion. Human umbilical vein endothelial αvβ3 binds vitronectin when presented in clustered form (Zanetti et al., 1994), and *C. albicans* germ tubes bind vitronectin (Santoni et al., 2001). Thus it is possible that clusters of vitronectin on the fungus provide a molecular connection to the vascular endothelium. These observations of a role for αv integrin and N-cadherin in *C.* albicans-endothelial binding are particularly interesting in light of the relatively high levels of expression of these 2 molecules by human retinal endothelial cells, per our gene expression microarray analysis (Smith et al., 2007).

6.4 Viral infections of the retina

A number of systemically acquired viruses infect the human retina, and these presumably reach this tissue via the hematogenous route. On the other hand, studies of viral infection of the retinal vascular endothelium are scant. Cytomegalovirus (CMV) is a herpesvirus that infects most persons across the globe, and causes clinically significant retinal infections in the context of immune compromise. CMV retinitis develops in 20% to 25% of untreated persons infected with human immunodeficiency virus (Holland, 1992), and the condition continues to be a common infection in patients with acquired immune deficiency syndrome (AIDS) despite the introduction of highly active anti-retroviral therapy (Jabs, 2011). In the context of AIDS, CMV has a wide cellular tropism, with generalized organ involvement. On the other hand, in a healthy individual, the virus infects a limited number of cells to establish latency, and endothelial cells are one such cell (Jarvis and Nelson, 2007). The virus demonstrates differential infectivity of different endothelial subpopulations (Jarvis and Nelson, 2007), but although CMV is known to infect human retinal endothelial cells (Rao et al., 1998), there have been no studies that have specifically addressed susceptibility of

retinal endothelial cells to infection. Following initial contact with heparin sulfate proteoglycans, interactions with epidermal growth factor receptor (EGFR) (Chan et al., 2009), platelet-derived growth factor receptor (Soroceanu et al., 2008), and various integrins (Feire et al., 2004) mediate virus entry into the cell. Our shotgun proteomics study shows that human retinal endothelial cells express EGFR and multiple integrins.

7. Retinal ischemic vasculopathies

7.1 In vivo models

The classic model of retinal ischemic vasculopathy was developed by in the early 1990s (Smith et al., 1994). In summary, when newborn mouse pups are placed in a hyperoxic environment (i.e., 75% oxygen) from postnatal day (P)7 through P12, and returned to atmospheric air at P12, all the pups develop retinal neovascularization. This peaks at P17 through P21, with subsequent regression of the new vessels and neovascular tufts and development of normal vascular morphology by P24. With the development of standardized methods of quantifying retinal neovascularization and the availability of genetically modified mice, the model of oxygen-induced retinopathy (OIR) has become routine in the investigation of processes of retinal neovascularization and neovascularization in general (Aguilar et al., 2008). Variants of the model in different species have distinct advantages and disadvantages. Having a larger eye than the mouse, the rat is suited for therapeutic experiments that involve intraocular injection (Hartnett, 2010; Penn et al., 1993). However, the method of inducing retinopathy is relatively labor-intensive, requiring alternating high and low oxygen levels every 12 to 24 hours for 7 to 14 days after birth, followed by room air for up to 7 days. Kittens and dog pups have eyes sized closer to those of humans, but these species are expensive to maintain and practically difficult to study (Kremer et al., 1987; McLeod et al., 1998). Retinal detachment, which may be observed in advanced retinal ischemic vasculopathy is a clinically-relevant feature of the canine model. A zebrafish model of hypoxia-induced retinopathy has been developed, which allows for rapid screening of orally administered antiangiogenic agents (Cao et al., 2008).

Standard methods for retinal neovascularization measurement in murine OIR are: (1) fluorescein-dextran angiography to determine the extent of retinal neovascularization by fluorescence microscopy on flat mounted retinas; (2) lectin staining of retinal vasculature to demarcate neovascular tufts on flat mounted retinas; and (3) staining and counting of neovascular endothelial nuclei in whole eye cross sections to determine the number of endothelial cells that have penetrated the vitreal side of the internal limiting membrane (Connor et al., 2009). Digital imaging and analysis software allow the investigator to rapidly and accurately quantify vaso-obliteration, neovascularization, and regression of new vessels in the retina (Connor et al., 2009; Stahl et al., 2009).

Identification of molecules involved in the development of retinal ischemic vasculopathy has provided the basis for other animal models. Given that VEGF is a key stimulus for retinal neovascularization, it is not surprising that intravitreal injections of VEGF or other methods to increase intraocular VEGF have been used in various species to mimic the neovascular phase of the disease in particular (Lebherz et al., 2005; Ohno-Matsui et al., 2002; Rakoczy et al., 2003; Shen et al., 2006; Tolentino et al., 1996). Another example, that also highlights the value of an unbiased profiling approach, is the rat carbonic anhydrase (CA)-1 retinal vascular permeability model. When a proteomics screen of vitreous samples from patients with diabetes mellitus identified elevated CA-1 in the presence of retinopathy, investigators developed a rat model in which intraocular injection of CA-1 resulted in increased retinal vascular permeability and intraretinal edema (Gao et al., 2007).

Although widely used to study ischemic retinal neovascularization, OIR most closely represents retinopathy of prematurity. Additional animal models have been developed to specifically investigate other forms of retinal ischemic vasculopathy. The streptozotocin rat model of diabetic retinopathy is typically induced in rats by intravenous or intraperitoneal injection of streptozotocin (50 – 100 mg/kg body weight) (Papachristodoulou et al., 1976; Sosula et al., 1972). Multiple spontaneous rodent and primate models of human diabetic retinopathy are also reported (e.g. (Johnson et al., 2005; Kim et al., 2005b; Shinohara et al., 2000; Sima et al., 1985)). Although the proliferative stage of diabetic retinopathy is typically not observed, these models are very useful for studying background pathology in the retinal vasculature, including changes in capillary form and capillary leakage. Diabetic dog and cat models offer the advantage of a larger eye and may exhibit retinal changes that mimic the human condition better than rodent models, but are less easily supported (Gardiner et al., 1994; Linsenmeier et al., 1998). Recently, the Kimba transgenic mouse that overexpresses VEGF within photoreceptors was crossed with the Akita mice with hyperglycemic background (Rakoczy et al., 2010). The resulting “Akimba mouse” exhibits severe retinal pathology, including retinal edema and neovascularization. Retinal vein occlusion may be recapitulated in mice or rats by argon laser photocoagulation of retinal veins after intravenous administration of the photolabile dye, rose bengal (Zhang et al., 2007; Zhang et al., 2008). In the central retinal vein occlusion model, the retina becomes ischemic and edematous within minutes, while occlusion of a branch retinal vein results in less severe disease. Laser-induced retinal vessel occlusion has been performed in rabbits, pigs, and nonhuman primates (Ameri et al., 2008; Mendrinos et al., 2011; Virdi and Hayreh, 1982).

7.2 In vitro models

Assays using cultured retinal endothelial cells or retinal tissue have been instrumental for the dissection of the molecular mechanisms of retinal ischemic vasculopathy. Integrity of the retinal endothelial component of the blood-retinal barrier may be readily studied in a transwell system. Confluent endothelial cells are cultured on the filter barrier to establish tight junctions, and subsequently the rate of diffusion of a tagged high molecular weight compound (e.g., rhodamine-isothiocynate labeled 70-kDa dextran) between chambers is measured (Harhaj et al., 2006).

Capillary-like tubule formation is commonly employed to study retinal endothelial cell participation in the formation of blood vessels. This assay has been developed and modified across many laboratories and over many years, using different endothelial cell subpopulations, including human retinal endothelial cells ((Bishop et al., 1999; Crabtree and Subramanian, 2007; Donovan et al., 2001; Kanzawa et al., 1993; Lawley and Kubota, 1989; Sanz et al., 2002) and Figure 2). Endothelial cells are grown on an extracellular matrix substitute (e.g., Matrigel; BD Biosciences, Franklin Lakes, NJ), which may be supplemented with growth factors or various non-endothelial cell populations. Proliferation and migration of the endothelial cells results in formation of capillary-like tube structures over a period of 24 hours, and these may be quantified using digital images and computer software, for length of tubes and number of branch points. Secondary sprouting may also be measured after the original tubules collapse (Castellon et al., 2002). To recognize the impact of the microenvironment on endothelial cell behavior, and the potential for dedifferentiation of endothelial cells in culture, other groups have described technically challenging assays, in which outgrowth of vessels from retinal explants is measured (Im et al., 2005; Knott et al., 1999)

Blood vessel growth requires several activities from the endothelial cell, which may be interrogated separately in different assays. These include endothelial cell proliferation, endothelial cell migration, and degradation of the local basement membrane. To quantify proliferation simply, cells are counted using a hemocytometer with trypan blue stain, either

manually or using an automated system such as Countess (Life Technologies, Carlsbad, CA). There are several commercially available indirect methods, such as the CyQuant NF Cell Proliferation Assay (Life Technologies, Molecular Probes), which measures DNA content, and the XTT Cell Proliferation Assay (ATCC, Manassas, VA), which measures cell metabolism. One of the most common endothelial cell migration assays uses the transwell system (Alessandri et al., 1983). Endothelial cells are plated on the upper surface of the filter, and medium in the lower chamber is supplemented with an angiogenic or anti-angiogenic agent under investigation. After incubation, migrated endothelial cells are identified by Wright's stain, and counted. To examine degradative activity of endothelial cells, one straightforward assay involves seeding cells below confluence on glass cover slips that are pre-coated with fluorescein isothiocyanate-gelatin (Bowden et al., 2001). At the end of the assay, areas of matrix degradation associated with each cell are measured under epifluorescence.

7.3 Role of the retinal endothelium in retinal ischemic vasculopathy

Different types of retinal ischemic vasculopathy are initiated in different pathological settings, but common angiogenic factors are released in response to ischemia, which leads to breakdown of the blood-retinal barrier and/or retinal neovascularization. Over a decade ago, the hypothesis of "hyperglycemia-induced overproduction of superoxide by the mitochondrial electron-transport chain" was first proposed to connect the different pathogenic mechanisms of diabetic vasculopathy including: overactivity of the polyol pathway; high levels of advanced glycation end-products; protein kinase C family activation; and increased hexosamine pathway flux (Brownlee, 2001). Today this theory still holds (Stitt, 2010), although additional interacting mechanisms have been identified (Cheung et al., 2010). Endothelial dysfunction is accompanied by loss of pericytes (Motiejunaite and Kazlauskas, 2008) and basement membrane thickening (Roy et al., 2010), and retinal ischemia ensues. As recently reviewed (Sapieha et al., 2010), within the retina of a premature infant, which lacks normal autoregulation and antioxidants, high levels of oxygen lead to oxidative stress, initiating nitrative stress and lipid peroxidation of cell membranes, and suppress production of growth factors. These events are particularly toxic to endothelial cells. Retinal vascular development ceases, and there is microvascular degeneration, with resultant retinal ischemia.

7.4 Molecular mediators of retinal ischemic vasculopathy

As previously stressed (see section 3.6), VEGF is the key regulator of normal angiogenesis, as well as pathogenic mechanisms involved in retinal ischemic vasculopathy. However, multiple factors have been implicated in the development of, or protection against, this group of diseases. Even an extensive review cannot do justice to the considerable body of literature on the subject. Included in this section is a limited discussion of research relating to VEGF, the angiopoietin-Tie system, and the insulin-like growth factor system, with focus on the participation of the retinal endothelial cell in retinal ischemic vasculopathy.

7.4.1 Vascular endothelial growth factor—More than 2000 reports have been published on subjects relating to VEGF and the retina to date. In all forms of retinal ischemic vasculopathy, leakage from the vasculature and neovascularization occur in large part as the consequence of elevated VEGF levels in the face of hypoxia. Various biological therapies that inhibit these processes act by impeding the action of this potent endothelial growth factor. Per one recent comprehensive review (Otrock et al., 2007), the VEGF family of secreted glycoproteins includes VEGF -A, -B, -C, -D, -E, -F, and placental growth factor. Unqualified VEGF, which has been the primary focus of research and development in relation to retinal ischemic vasculopathy, refers to VEGF-A. The gene encoding VEGF yields alternatively spliced products that are translated into angiogenic isoforms of different

lengths, designated by the length of the amino acid chain (i.e., $VEGF_{121}$, $VEGF_{145}$, $VEGF_{165}$, $VEGF_{183}$, $VEGF_{189}$, and $VEGF_{206}$). Of its multiple isoforms, $VEGF_{165}$ is considered the most relevant to retinal ischemic pathology (Ishida et al., 2003a). Differential splicing also generates anti-angiogenic VEGF isoforms, which are identified by 'b' following the amino acid number (i.e., $VEGF_{121b}$, $VEGF_{165b}$, and $VEGF_{189b}$)(Qiu et al., 2009). Vascular endothelial growth factor may be synthesized by multiple populations within human retina, including endothelial cells, pericytes, neurons, and the retinal pigment epithelium (Adamis et al., 1993; Boulton et al., 1998; Lutty et al., 1996; Vidro et al., 2008).

There are at least 5 transmembrane tyrosine kinase receptors for VEGF family members (i.e., VEGFR-1 (Flt-1), VEGFR-2 (KDR), VEGFR-3 (Flt-4), neuropilin (NP)-1, and NP-2) (Otrock et al., 2007). Vascular endothelial growth factor binds VEGFR-1 and -2, and NP-1 and -2; VEGFR-2 activation is primarily responsible for signaling the pro-angiogenic activities of this glycoprotein, but VEGFR-1 binding may influence cell migration (Kanno et al., 2000; Otrock et al., 2007). Immunohistochemical observations of human eyes from 18 cadavers without history of diabetes mellitus and 27 cadavers with such history indicated constitutive expression of VEGFR-1, but not VEGFR-2, in health, and up-regulation of VEGF-R1 and new expression of VEGFR-2 in diabetes for the majority (Witmer et al., 2002).

Consistent with this observation, cultured proliferating human retinal endothelial cells express both VEGFR-1 and -2 (Stewart et al., 2011). Hypoxia induces VEGF receptor expression by retinal endothelial cells. The endothelium of retinal vessels in mouse pups immunostains for VEGFR-2, and when OIR is induced, the number of immunoreactive vessels in avascular areas is significantly increased in comparison to room air-exposed control mice (Suzuma et al., 1998b). Studies from independent groups using bovine retinal endothelial cells show up-regulation of transcript encoding VEFGR-2 (Takagi et al., 1996), or VEGFR-1 and -2 (Brylla et al., 2003) when cells are exposed to hypoxia. The Rhesus macaque retinochoroidal cell line, RF/6A, consistently expresses VEGFR-2 constitutively, and this expression is increased on exposure to low oxygen tension (Ottino et al., 2004).

Hypoxia inducible factor (HIF) is a transcription factor that binds a hypoxia-response element (HRE) within the promoter of the VEGF gene when cellular oxygen is low (Forsythe et al., 1996; Levy et al., 1995). The HIF heterodimer consists of oxygen-sensitive and -insensitive HIF-α and HIF-β subunits. Different HIF-α subunits give rise to different HIFs, although most research to date has focused on HIF-1. In normal oxygen tension, HIF-α is targeted for degradation via proline hydroxylation and von Hippel-Lindau protein-chaperoned ubiquitination; oxygen starvation permits dimerization of HIF-α and HIF-β subunits to generate active HIF (Ivan et al., 2001; Jaakkola et al., 2001). Although HIF is arguably the most important transcriptional regulator of VEGF expression, a microarray gene expression analysis suggests that more than 2% of all genes in human endothelial cells are regulated by HIF-1 (Manalo et al., 2005).

The importance of HIF-1 in the development of retinal ischemic vasculopathy is clear from work with animal models. In OIR, retinal HIF-1α and HIF-2α become markedly elevated within hours of return from hyperoxia to room air in neurons and glial cells, respectively (Mowat et al., 2010; Ozaki et al., 1999). Elegant studies that investigated the association between acute intensive insulin therapy and diabetic retinopathy in the streptozotocin rat, showed such therapy produced breakdown of the blood-retinal barrier, as a consequence of increased VEGF expression, via HIF-1α (Poulaki et al., 2002). Various interventions targeting HIF, including knockout of the relevant VEGF promoter binding site, and administration of digoxin or the small chemical inhibitor, YC-1, stabilize the blood-retinal

barrier and/or reduce neovascularization in mouse OIR (DeNiro et al., 2010; Vinores et al., 2006; Yoshida et al., 2010).

While studies using in vivo models have focused on non-endothelial sources of HIF, in vitro research using tissues and cells support a role for retinal endothelial cell HIF in retinal ischemic vasculopathy. Immunostaining showed the presence of HIF-1α in pre-retinal fibrovascular membranes obtained at vitrectomy from 12 patients with proliferative diabetic retinopathy, and this was more obvious in predominantly vascular in comparison to predominantly fibrotic specimens (Lim et al., 2010). Human retinal endothelial cells are capable of producing both HIF-1α and HIF-2α when exposed to hypoxia (DeNiro et al., 2009), and electrophoretic mobility shift assays demonstrate HIF-1 binding to VEGF promoter sequences following hypoxic exposure in bovine retinal endothelial cells (Miyamoto et al., 2002). Under normoxia and hypoxia, YC-1 inhibits proliferation and migration of human retinal endothelial cell, and reduces formation of capillary-like tubules by these cells (DeNiro et al., 2009). The same inhibitor reduces outgrowth of vessels from mouse retinal explants cultured under hypoxic conditions (DeNiro et al., 2009).

Transcription enhancer activator domain family member 4 (TEAD4)—also referred to as transcriptional enhancer factor (TEF)-3 or related transcriptional enhancer factor (RTEF)-1—is a member of the TEA DNA binding family. Interaction of this transcription factor with VEGF was originally described in relation to bovine aortic endothelial cells. In these cells, binding of TEAD4 to a sequence of Sp1 response elements remote from HRE in the VEGF promoter increases the expression of VEGF under hypoxic conditions (Shie et al., 2004). Subsequent publications from the same group have showed a role for TEAD4 in the transcriptional regulation of HIF-1α and VEGF-B in extra-ocular endothelial cell populations (Jin et al., 2011; Xu et al., 2011). One of us (BA) has investigated the expression of TEAD4 in cells that include human retinal endothelial cells, and in mouse OIR and laser-induced central retinal artery occlusion in the *Rhesus macaque* (Appukuttan et al., 2007; Appukuttan et al., 2012).

Analysis of cultured primary human retinal endothelial cells reveals that TEAD4 message is alternatively spliced to produce multiple isoforms, as well as the full-length $TEAD4_{1305}$, and that certain isoforms are produced only under hypoxic stress. There are differences in the ability of each isoform to regulate the VEGF promoter, and although the majority of the isoforms activate the promoter, $TEAD4_{216}$ is unique in repressing gene expression whether cells are exposed to normal or low oxygen tension. Different isoforms are detected within the developing mouse retina, and expression similarly varies between mice with OIR and room air-exposed pups. Levels of TEAD4 are also responsive to oxygen tension; 24 hours after occlusion of the central retinal artery, TEAD4 is up-regulated in the Rhesus retina (Appukuttan et al., 2012).

7.4.2 Angiopoietin-Tie system—Recently summarized in relation to diabetic retinopathy (Hammes et al., 2011), the angiopoietin(Ang)-Tie system is essential for development of a normal retinal vasculature and for maintenance of a mature vasculature. On the other hand, perturbations in the system contribute to retinal vascular pathology in a complex manner that depends in part on temporal and environmental factors. Ang1 activates the endothelial cell receptor tyrosine kinase, Tie2. Ang2 also binds Tie2, but with lower affinity and less potency, and may act as an agonist or an antagonist of Tie2 (Maisonpierre et al., 1997; Yuan et al., 2009). As was applied to humans by our shotgun proteomic profiling of human retinal endothelial cells, Tie2 and Ang2, but not Ang1, are expressed by endothelial cells. Retinal pericytes are one source of Ang1 (Wakui et al., 2006). Pericytes also express Tie2 and collaborate with endothelial cells in effecting the vascular changes that are mediated by the Ang-Tie system (Pfister et al., 2008). Ang2 has been implicated in

human retinal ischemic vasculopathy. In one study, immunostaining co-localized Ang2 with Tie2 and an endothelial cell marker (i.e., von Willebrand factor) in approximately half of 38 fibrovascular membranes removed from eyes with advanced retinopathy of prematurity (Umeda et al., 2003). Another study showed vitreous levels of Ang2 were significantly elevated in eyes of 30 patients with active proliferative diabetic retinopathy, when compared with levels in eyes of 11 patients with inactive proliferative disease and 18 persons who did not have diabetes mellitus (Watanabe et al., 2005).

Many investigators have addressed the role(s) of the Ang-Tie system in ischemic retinal vasculopathy in in vivo models and in vitro systems. Several studies involving mice OIR show that Ang2 expression increases in the retina during this model, with the level peaking at P17 when retinal neovascularization is active, while Ang1 expression does not vary (Das et al., 2003; Hackett et al., 2000; Oh et al., 1999). In adult rats exposed briefly to hypoxia, up-regulation in the retina of Ang2 protein is also detected (Sivakumar et al., 2008). Despite a difference in kinetics, 2 reports agree that expression of Ang2 message and protein rises in the retina of streptozotocin-injected diabetic rats, but not non-diabetic control rats, while Ang1 levels are not affected (Ohashi et al., 2004; Rangasamy et al., 2011).

Systemic treatment of mouse OIR with a Tie2 antagonist (i.e., muTEK delta Fc) significantly reduces the formation of neovascular capillary fronds in the retina (Das et al., 2003). In the same model, heterozygous or homozygous Ang2 gene-deletion results in less or no retinal neovascularization by histopathological examination at P17, despite a rudimentary retinal vasculature that would be expected to confer marked ischemia (Feng et al., 2009; Hackett et al., 2002). As anticipated from this result, retinal neovascularization is decreased when Ang2 is overexpressed in the retina from P12 to P17 by inducible transgene; however, if Ang2 is overexpressed from P20, when neovascularization begins to regress, this regression is accelerated (Oshima et al., 2005). The findings are consistent with Ang2 having either vasoproliferative or vasoregressive activity depending on the presence in ischemic retina or absence, respectively, of VEGF (Hammes et al., 2011). In mice that transgenically overexpress Ang1 within the retina between P12 and P17, OIR-related neovascularization is reduced (Nambu et al., 2004), although if expression is activated on P20, retinal new vessels regress at normal speed (Nambu et al., 2005). In adult streptozotocin-injected rats, intravitreal injection of Ang1 reduces retinal vascular leakage, while intravitreal injection of Ang2 increases leakage, as demonstrated by extravasation of Evans blue-tagged albumin (Joussen et al., 2002; Rangasamy et al., 2011). Following intravitreal injection of VEGF, retinal Ang1 transgenic mice demonstrate reduced retinal vascular leakage of [^{3}H]-mannitol in comparison to wild-type controls (Nambu et al., 2004).

Research with cultured retinal endothelial cells provides additional insights into the involvement of the Ang-Tie system in retinal ischemic vasculopathy. VEGF stimulates the expression of Ang2, but not Ang1, in cultured bovine retinal endothelial cells (Oh et al., 1999). Hypoxia also induces Ang2 expression in these cells, although by a non-VEGF-directed mechanism since the effect is not neutralized with anti-VEGF antibody. Human retinal endothelial cells cultured in highly concentrated glucose, at a level similar to that in the blood in untreated diabetic mellitus, up-regulate Ang2 expression (Rangasamy et al., 2011). Endogenous Ang2 causes increased permeability of simulated human retinal endothelium in a transwell system (Rangasamy et al., 2011). Coincident with increased permeability, gaps form between endothelial cells, and VE-cadherin staining is lost as the junctional protein is phosphorylated. Studies using porcine retinal endothelial cells and the transwell system show that Ang2 effects on vascular permeability are potentiated by VEGF (Peters et al., 2007). Cultured bovine retinal endothelial cells produce elevated levels of MMP-9 when treated with Ang1 or Ang2 (Das et al., 2003), consistent with the well established role of the MMPs in angiogenesis (Stetler-Stevenson, 1999).

7.4.3 Insulin-like growth factor system—Since insulin-like growth factor (IGF)-1 was first sequenced over 30 years ago (Rinderknecht and Humbel, 1978), a complex IGF system involving ligands, receptors, and binding proteins has been recognized (Firth and Baxter, 2002; Martin and Baxter, 2011). In relation to retinal ischemic vasculopathy, most work in this area has focused on IGF-1. Insulin-like growth factor-1 is produced within the eye and also synthesized extraocularly, primarily by the liver. Thus and although there is debate about the relative importance of the 2 sources, IGF-1 may achieve effects by autocrine, paracrine, and endocrine routes. Soluble IGF-1 binds with highest affinity to cell surface receptor, IGF-1R, to signal activity. The bioavailability of IGF-1 is impacted by the insulin receptors and insulin-like growth factor binding proteins (IGFBPs), which may sequester IGF-1 or concentrate the growth factor near its receptor. Six high affinity IGBPs have been described to date, and intraocular activities independent of IGF-1 are described (Chang et al., 2007; Kielczewski et al., 2011; Lofqvist et al., 2007).

Examination of rodent eyes indicates that IGF-1 may be produced by many retinal cells including photoreceptors and other neuronal populations, glial cells and retinal vascular endothelium (Lofqvist et al., 2009; Sivakumar et al., 2008). Immunostaining of cultured primary human retinal endothelial cells reveals presence of IGF-1, IGF-1R, and IGFBP1 through IGFBP5 (Spoerri et al., 1998), and we detected IGFBP6 transcript in human retinal endothelium in our expression profiling study (Smith et al., 2007). Early work on the involvement of the IGF-1 family in retinal ischemic vasculopathy was nicely summarized in a review from the Grant laboratory (Shaw and Grant, 2004), which has made major contributions on the subject.

Several groups have investigated the expression of IGF-1 and related proteins in human ocular material taken from patients with diabetic retinopathy. Changes in the level of IGF-1 and increase in IGF-1R expression are supportive of a role for the growth factor in retinal ischemic vasculopathy, and apparent contradictions between results of different studies may reflect patient factors such as duration of disease and level of ischemia, as well as methodological differences. Application of immunoassays to vitreous of multiple groups of patients with proliferative diabetic retinopathy—and other forms of retinal ischemia—versus patients without retinal ischemic vasculopathy showed significantly increased concentration of IGF-1 in ischemic eyes (Burgos et al., 2000; Meyer-Schwickerath et al., 1993; Spranger et al., 2000). Epiretinal fibrovascular membranes removed from 5 patients with proliferative diabetic retinopathy at vitrectomy strongly bound radioactive IGF-1, and this was inhibited by addition of non-radioactive IGF-1 to the assay, suggesting expression of IGF-1R in retinal neovascular tissue (Ulbig et al., 1995). By colloidal gold quantitative immunocytochemistry, retinal endothelial cells isolated from eyes of 3 deceased persons with a history of non-proliferative diabetic retinopathy showed significantly reduced levels of IGF-1 in comparison to isolates from 3 donors with no past history of diabetes mellitus (Spoerri et al., 1998). This was associated with increased expression of IGF-1R, and IGFBP1, 2, 3, and 5, and reduced expression of IGFBP4. In a separate study, retina from 6 cadavers with a history of diabetes mellitus under 15 years duration contained significantly less IGF-1 transcript and significantly higher IGF-1R than 6 non-diabetic donors (Gerhardinger et al., 2001).

Despite some differences in results, multiple animal studies have similarly supported an important role for IGF-1 in ischemic retinal vasculopathy. Intravitreal injection of human recombinant IGF-1 in pigs induces retinal microvasculopathy with vascular tortuosity and formation of microaneurysms, accompanied by retinal vascular leakage, as might be seen in non-proliferative diabetic retinopathy (Danis and Bingaman, 1997) Intravitreal injection of IGF-1 in mice induces a breakdown of the blood-retinal barrier, as measured by significant extravasation of [^{3}H]-mannitol into the retina versus kidney and lung (Derevjanik et al.,

2002). Mice that transgenically express IGF-1 from retinal neurons develop features of background diabetic retinopathy, including intraretinal microvascular abnormalities, as well as retinal neovascularization, in adulthood (Ruberte et al., 2004). They also experience increased retinal vascular permeability when studied with radioactive and fluorescent trackers, which correlates with altered expression of zonula occludens (ZO)-1 and claudin-1 junctional proteins (Haurigot et al., 2009).

The landmark study from the L.E. Smith group demonstrated that in mouse OIR, an IGF-1R peptide antagonist, JB3, significantly reduced peak retinal neovascularization, in comparison to a control peptide (Smith et al., 1999). Subsequent collaboration between Smith and Hellstrom, involving experimental studies with IGF-1 gene deficient mice and clinical observations made in premature infants, led to an important hypothesis of retinopathy of prematurity (Hellstrom et al., 2001). After premature birth and in the absence of sufficient IGF-1, retinal vascular development initially ceases. Hypoxia results, and VEGF increases to a commiserate degree, which if sufficiently high when the IGF-1 level recovers, promotes neovascularization. Insulin-like growth factor-1 has been measured both at increased and decreased levels in streptozotocin-injected diabetic rats in comparison to non-diabetic controls (Gerhardinger et al., 2001; Lowe et al., 1995; Poulaki et al., 2004). However, systemically administered anti-IGF-1R antibody reduced VEGF levels, and decreased retinal vascular leakage and leukostasis—an early hallmark of diabetic retinopathy discussed in Section 7.5—in these animals(Poulaki et al., 2004).

It is clear that IGF-1 plays an important role in retinal endothelial cell survival. Transcriptomic profiling by both our group (Smith et al., 2007) and another team (Browning et al., 2012) demonstrates relatively high expression of IGF-1R on human retinal endothelial cells. Conditions of highly concentrated glucose and serum starvation induce apoptosis of human retinal endothelial cells, but this effect is partially abrogated when cells are cultured with IGF-1 (Wilson et al., 2001). Mitogen-activated protein kinase signaling is used by VEGF to induce endothelial cell proliferation; following treatment with the IGF-1R peptide antagonist, JB3, bovine retinal endothelial cells do not maximally activate MAP kinase activation in response to VEGF (Smith et al., 1999). Similarly, a minimal level of IGF-1, in conjunction with VEGF, is required to activate the Akt pathway, which is important for cell survival (Hellstrom et al., 2001). Experiments in cultured cells suggest that endothelial cells may be induced to produce IGF-1 when exposed to disease-relevant stimuli. Exposure to low oxygen tension increases IGF-1 production by endothelial cells isolated from bovine or human retina ((Eter et al., 2002) and Table 3).

The ability of IGF-1 to promote retinal endothelial cell proliferation has been observed for several species, including the human (Browning et al., 2012; Castellon et al., 2002; Devi et al., 2011). Retinal endothelial cells may be particularly responsive to IGF-1. When the response of proliferating human retinal and choroidal endothelial cells is compared, both cell populations show dose-related growth in the presence of VEGF, but retinal endothelial cells alone grow on exposure to IGF-1 (Browning et al., 2012). Further, bovine retinal endothelial cells proliferate at a higher rate than bovine aortic endothelial cells, when treated with IGF-1 (King et al., 1985). Insulin growth factor-1 is able to induce migration of human retinal endothelial cells through a transwell filter (Grant et al., 1987), and promotes formation of capillary-like tubes and secondary sprouting on basement membrane substitute (Castellon et al., 2002). In experiments using a rat retinal endothelial cell line, IGF-1 reduces transelectrical resistance of retinal endothelial monolayers in transwells, and this change is associated with a fall in the level of VE-cadherin (Devi et al., 2011).

7.5 Endothelial cell death and survival in retinal ischemic vasculopathy

A role for inflammatory mediators is increasingly recognized in the retinal ischemic vasculopathies. Observations of leukocytes accumulating within the retinal vasculature and transmigrating retinal vessels have focused most research in this area on the adhesion molecules expressed by the retinal vascular endothelium (Noda et al., 2012). Groundbreaking work has established a model in which retinal hyperoxia induces increased ICAM-1 expression on retinal endothelial cells (Ishida et al., 2003b). In turn, this promotes the accumulation of leukocytes within the retinal vasculature, triggering retinal endothelial apoptosis. Vascular remodeling or vaso-obliteration follows when this occurs in the context of development or disease, respectively. Histopathological examination of human globes from diabetic patients reveals an increased expression of ICAM-1 on the retinal endothelium (McLeod et al., 1995). Other work has shown the ability of rodent retinal endothelial cells to up-regulate ICAM-1 in vivo following streptozotocin-induced hyperglycemia (Gustavsson et al., 2010) and in response to intravitreal injection of VEGF (Lu et al., 1999), which is abundantly present in ischemic retinal vasculopathy. Accordingly, anti-ICAM-1 antibody significantly limits retinal leukostasis and vascular leakage in rat streptozotocin-induced diabetes (Miyamoto et al., 1999). The finding of similar retinal vascular development after a course of OIR in ICAM-1-gene-deleted mice versus wild-type controls remains to be reconciled (Kociok et al., 2009).

Several other retinal endothelial adhesion molecules (i.e., VCAM-1 and E-selectin) have been investigated in relation to retinal leukostasis, albeit in fewer studies. Blockade of integrin α4, which with integrin β1 forms the VCAM-1 ligand, VLA-4, significantly reduces retinal vascular leakage (Iliaki et al., 2009). The authors were concerned that VCAM-1 was not up-regulated in streptozotocin-induced rat diabetes, and suggested that other endothelial ligands such as fibronectin or MadCAM-1 might be responsible for these effects. However, an independent group demonstrated significant upregulation of VCAM-1 on retinal vascular endothelium in the streptozotocin mouse model, using confocal immunofluorescence (Gustavsson et al., 2010). In bovine retinal endothelial cells, migration was promoted by serum from diabetic patients versus healthy controls, and this effect was blocked by specific antibody targeting VCAM-1 (Olson et al., 1997). In the same study, antiE-selectin antibody also reduced the migration potency of diabetic serum. E-selection was not increased on retinal endothelium in human diabetic eyes (McLeod et al., 1995), but the phenomenon of selectin shedding has been invoked to explain this apparent discrepancy (Noda et al., 2012). Our gene expression profiling data, showing high relative expression of ICAM-1, VCAM-1, and E-selectin by human retinal endothelial cells, points to a predisposition of the human retinal vasculature to leukocyte adhesion, which may increase its susceptibility to vasculopathy (Smith et al., 2007).

Leukostasis in retinal vessels results in retinal endothelial loss and breakdown of the blood-retinal barrier via the Fas/Fas ligand apoptosis pathway. As shown in studies conducted using the rat streptozotocin-induced model (Joussen et al., 2003), a diabetic state induces increased expression of Fas on retinal endothelium. In addition to augmented expression of FasL on leukocytes, this sets the stage for apoptotic programmed cell death. Indeed, TUNEL staining reveals retinal endothelial apoptosis in diabetic rats. Antibody directed against FasL prevents retinal endothelial cell loss and reduces retinal vascular permeability in this model. Increased numbers of pre-retinal endothelial nuclei with reduced TUNEL staining, indicative of increased retinal neovascularization and reduced apoptosis, are consistently observed in OIR in the gld C57BL/6 mouse (Barreiro et al., 2003; Davies et al., 2003). In this mouse, FasL has a Fas binding deficit in comparison to FasL in C57BL/6 wild-type mice

Other pathways that result in activation of caspases and consequent apoptosis of retinal endothelial cells are also described in relation to retinal ischemic vasculopathy. Oxidative stress is a known trigger of apoptosis, via release of cytochrome c from mitochondria. After alloxan injection, rats develop a streptozotocin-like diabetic syndrome and exhibit high levels of lipid peroxides and caspase-3 activity within the retina (Kowluru and Koppolu, 2002). On the other hand, a diet supplemented with anti-oxidants reduces the high lipid peroxide and caspase-3 levels. Changes in cultured bovine retinal endothelial cells exposed to highly concentrated glucose mimic those seen in the diabetic rat retina and are similarly reversed with various antioxidants (Kowluru and Koppolu, 2002). This result has been independently replicated in bovine and human retinal endothelial cells (El-Remessy et al., 2011; Mohr et al., 2002). There is controversy in the literature regarding the ability of hyperglycemia to directly activate apoptosis. Highly pure cultures of human retinal endothelial cells do not produce oxygen reactive species on exposure to high glucose concentration (Busik et al., 2008). However, they do so in response to pro-inflammatory cytokines, TNF-α and Il-1β, and other retinal cells, including Mueller cells and retinal pigment epithelial cells, secrete these cytokines when treated with highly concentrated glucose. When co-cultured with human Muller cells and exposed to high concentration glucose, caspase-3 is activated in human retinal endothelial cells. This finding is consistent with our observation of increased expression of caspase-3 when human retinal endothelial cells are stimulated with lipopolysaccharide, which is a general pro-inflammatory stimulus (Smith et al., 2007).

Work using a rat retinal endothelial cell line strongly suggests that caspase-independent (i.e., mediated by apoptosis-inducing factor) apoptosis may also occur in the context of retinal ischemic vasculopathy (Leal et al., 2009). When the endothelial cells were exposed to hydrogen peroxide, caspase-3 was activated. In contrast, exposure to highly concentrated glucose or the nitric oxide donor, NOC-18, induced changes in nuclear morphology and annexin V binding indicative of apoptosis, but did not activate caspase-3. Instead, translocation of apoptosis inducing factor from mitochondria to nucleus was observed.

The autophagy-lysosomal pathway is a survival strategy that allows a cell to degrade non-essential components and potentially survive exposure to multiple physiological and pathological stresses.(Kroemer et al., 2010) Intracellular vesicles, known as autophagosomes, engulf organelles and proteins, and chaperone them to lysosomes for immediate degradation. Hypoxic stress is one initiator of autophagy that has been studied quite extensively in tumor pathobiology (Schlie et al., 2011). Key mediators of hypoxia-induced autophagy, such as Beclin 1, BCL2/adenovirus E1B 19 kDa protein-interacting protein (BNIP)-3, microtubule-associated protein light chain (MAPLC)-3, and autophagy-related gene (ATG)5, have been identified in cancer cells (Bai et al., 2012; Can et al., 2011; Song et al., 2011; Wu et al., 2011). Both HIF-1α-dependent and -independent mechanisms have been recognized in tumor growth. We investigated the ability of human retinal endothelial cells to develop an autophagy response in the setting of oxygen starvation, since this is a key feature of human retinal ischemic vasculopathy.

To address whether human retinal endothelial cells undergo autophagy under hypoxic conditions, we performed a preliminary screen of genes involved in the lysosomal degradation process. Confluent cultures of immortalized human retinal endothelial cells were incubated in modified MCDB-131 medium with 2% FCS and endothelial growth factors, and exposed to 1% oxygen or room air for 48 hours. Subsequently, total RNA was isolated using the RNeasy Mini Kit (Qiagen, Valencia, CA). Response to hypoxia was determined by RT-PCR for $VEGF_{165}$. Primer sequences and expected product size appear in Table 2. Quantitative real-time RT-PCR was performed with the Chromo4 Thermocycler and iQ SYBR Green Supermix (both from Bio-Rad Laboratories, Hercules, CA). The RT^2

Profiler PCR Array System (SABiosciences, Qiagen, Frederick, MA) was used to profile the expression of 84 autophagy-associated genes in hypoxic versus normoxic human retinal endothelial cells. Total RNA was reverse transcribed using the RT^2 First Strand Kit (SA Biosciences, Qiagen), and the autophagy array plate was cycled on the Chromo4 Thermocycler, per the manufacturer's instructions. Data were analyzed using the RT^2 Profiler PCR Array Data Analysis software (SABiosciences, Qiagen).

Expression of $VEGF_{165}$ was significantly increased 6-fold for hypoxic human retinal endothelial cells in comparison to normoxic cells, confirming that the treated cells had experienced hypoxic stress (Figure 6). After normalization to 5 house-keeping genes (i.e., β-2-microglobulin, hypoxanthine phosphoribosyltransferase 1, ribosomal protein L13a, glyceraldehyde-3-phosphate dehydrogenase, and β-actin), analysis of data from quintuple PCR arrays found 21 genes significantly up-regulated and 11 genes significantly down-regulated in human retinal endothelial cells as a result of exposure to hypoxia (Table 3). However, just 4 genes (i.e., CXCR4, Cathepsin S, DNA-damage regulated autophagy modulator 1 and tumor necrosis factor) showed increases that were greater than 1.5-fold, and down-regulated transcripts included ATG3, ATG4A, ATG4C and ATG9B, which are involved in autophagic vacuole formation. While it would be appropriate to continue these studies by evaluating autophagy at the protein level, our findings imply that human retinal endothelial cells have quite limited capacity to activate autophagy, which may translate to a susceptibility to stress. In other words, and consistent with the observation of endothelial cell apoptosis in early diabetic retinopathy, human retinal endothelial cells may be particularly susceptible to the low oxygen tensions that occur in the retinal circulation in diabetes mellitus.

8. Future Directions

Further clarification of the molecular phenotype of the human retinal endothelial cell, particularly in the context of disease-relevant stimulations, will increase understanding of the pathogenesis of retinal vascular diseases. As molecular biological technologies, analysis software, and reference databases advance, novel information will continue to flow from this form of research. Profiling by multiple approaches has merit as this provides a more global overview of the molecular phenotype. Concordance in abundance identified by different molecular profiling methods increases confidence in the results. However, discordance may suggest new hypotheses with respect to the cell's biology. Several systems that have been used to interrogate the molecular phenotype of different extraocular endothelial cells would also provide interesting insights about the retinal endothelial cell. These include: genome-wide methylation profiling to elucidate epigenetic signature (Lagarkova et al., 2010); ligand-receptor screening, which is best approached by phage display (Pasqualini et al., 2010); and metabolomics to characterize the spectrum of small-molecule metabolites (Yuan et al., 2011).

Most relevant to our research is the relatively recent development of RNA-seq—also termed whole transcriptome shotgun sequencing—which is likely to replace gene expression microarray as the preferred form of transcriptome profiling within the next 5 years. While this technique has several applications, arguably the most exciting is the identification and quantitation of transcript isoforms related to alternative splicing or single nucleotide polymorphisms, in addition to known full-length transcripts (Ozsolak and Milos, 2011). The methodology has already been applied to an extraocular endothelial cell population, in a study that compared pulmonary microvascular endothelial cell gene expression in response to thrombin (Zhang et al., 2012). The authors observed significantly increased expression of 150 genes, but also up-regulation of 480 known transcript isoforms and 1,775 previously unknown isoforms, in treated versus control endothelial cells.

Of immediate future interest is the specific molecular profile of retinal endothelial cell subpopulations (i.e., arterial and venous retinal endothelial cells). Vascular endothelial molecular diversity differentiates arterial and venous locations outside the eye. In the largest endothelial profiling study to date, combined data for cells isolated from arteries or veins at multiple sites revealed 817 vein-specific genes and 59 artery-specific genes (Chi et al., 2003a). Evidence from clinical and experimental posterior uveitis indicates that such diversity also exists within the eye. The pattern of arterial versus venous involvement varies according to the specific etiology of the uveitis, a feature often used diagnostically (Sanders and Graham, 1988). Studies in mice with EAU, which is characterized by leukocyte immigration at the post-capillary venule, indicate that retinal arterioles and venules differ in terms of cell adhesion molecule expression at the onset of the disease (Xu et al., 2003a).

Arteries can be distinguished from veins on the basis of expression of ephrin-B2 and EphB4 respectively (Wang et al., 1998). This distinction is present at the fetal onset of angiogenesis, when these molecules are important in determining vascular cell fate(Harvey and Oliver, 2004), and persists into adult life (Shin et al., 2001). Capillaries also express ephrin-B2 and EphB4, establishing arterial versus venous identities within the microcirculation (Shin et al., 2001). We have used immunohistochemistry to show that human retinal vessels exist as subpopulations of ephrin-B2-positive endothelial cells, consistent with arterial phenotype, and ephrin-B2-negative endothelial cells, indicative of venous identity (Figure 7). Thus ephrin-B2 expression could be used as the basis for flow cytometric separation of freshly isolated human retinal endothelial cells prior to culture. Alternatively, laser capture microdissection could be used to isolate arterial and venous endothelium from intact human retina, following immunodetection of ephrin-B2, to provide material for transcriptomic, proteomic, and other analyses.

The ideal treatment for a retinal vascular disease would be a drug that inhibited a key pathogenic mechanism, but had no impact on physiological processes. While posterior uveitis and retinal ischemic vasculopathy involve multiple cell populations, the retinal endothelial cell is a central player. Thus, targeting the involvement of the retinal endothelial cell would be a logical therapeutic approach in these diseases. Inventive treatment strategies directed against the retinal endothelium have already been described in animal models. A multimerized endothelin enhancer upstream of the human Cdc6 promoter chimera effectively delivers an IGF-1R targeted ribozyme to proliferating endothelial cells in vitro (Luz-Madrigal et al., 2007). When injected intravitreally, the ribozyme reduces retinal neovascularization in mouse OIR and laser-induced retinopathy, without adversely affecting the normal retinal vasculature. A baculoviral construct with GFP reporter expression controlled by VEGF-R1 promoter shows expression limited to the retinal endothelium when injected intravitreally in rats (Shaw et al., 2006). This system has not been used to deliver therapeutic proteins to the endothelium, but could readily be adapted for that purpose. The molecular composition of the human retinal endothelial cell in conditions relevant to health and disease provides a strong basis for the development of effective biologic therapies for posterior uveitis and retinal ischemic vasculopathy.

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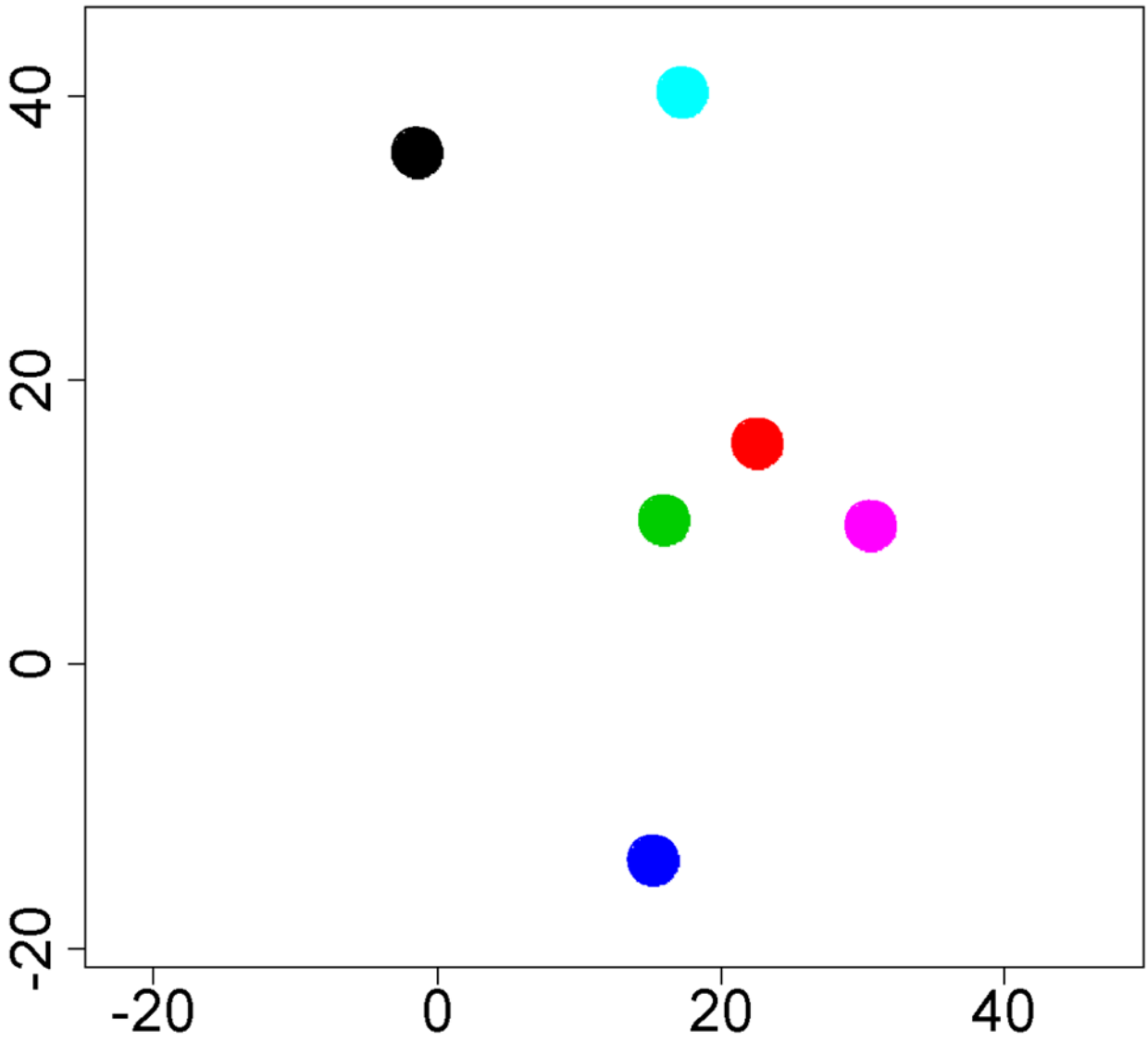

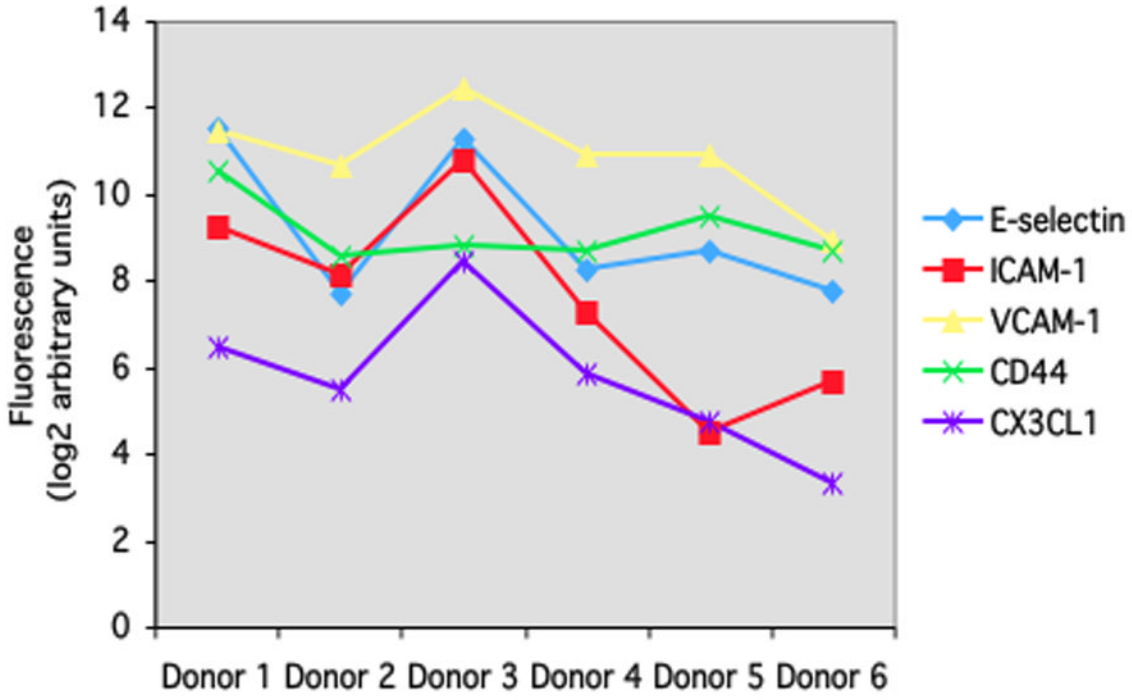

Figure 1.

(A) Multi-dimensional scaling plot shows global gene expression by retinal endothelial cells from 6 human donors. Circles designate individual donors. (B) Relative gene expression of selected adhesion molecules in retinal endothelial cells from the same human donors. Normalized fluorescence intensity, which reflects hybridization to the relevant array probes, was averaged for each donor and expressed in log2 scale. Generated using previously published data (Smith et al., 2007).

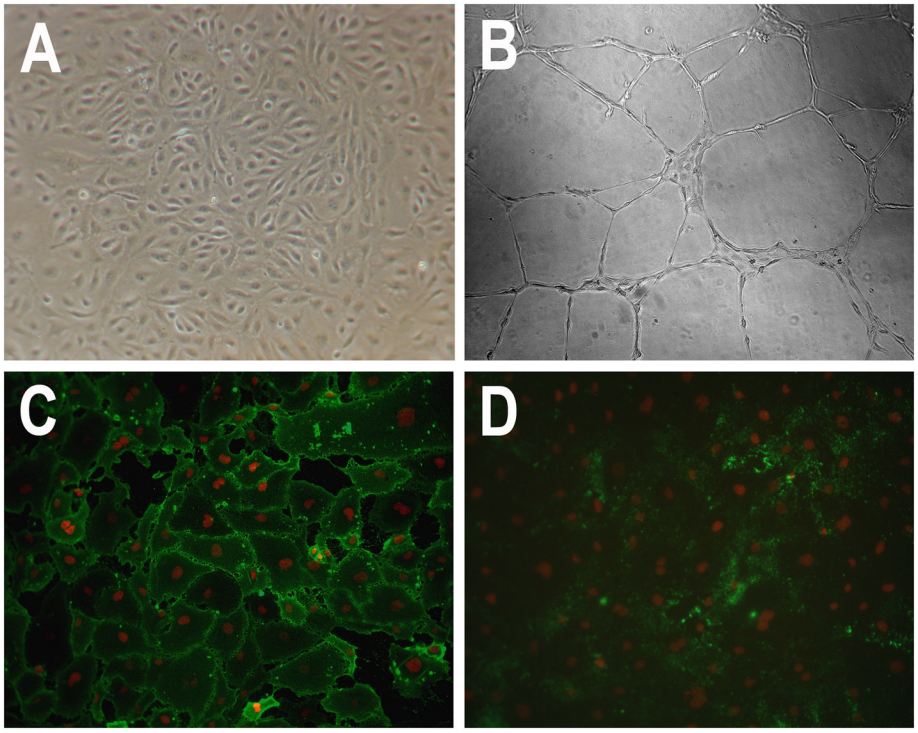

Figure 2.

Photomicrographs of human retinal endothelial cells immortalized by transduction with LXSN16E6E7. Cell retain an endothelial phenotype as indicated by: (A) Cobblestone morphology. Original magnification: 200X; (B) Capillary-like tube formation after 24-hour incubation in 5% CO_2 and at 37 °C on Matrigel (BD Biosciences Discovery Labware, Bedford, MA). Original Magnification: 100X. (C–D) Expression of (C) CD31, as detected by mouse monoclonal anti-human CD31 antibody (concentration: 10 μg/ml; clone: JC70A: isotype IgG1κ; BD Pharmingen Biosciences, San Diego, CA) and Alexa Fluor 488-conjugated goat anti-mouse IgG antibody (concentration: 5 μg/ml; Life Technologies, Molecular Probes, Eugene, OR) and (D) VWF, as detected by Alexa Fluor 488-conjugated rabbit polyclonal anti-human VWF antibody (concentration: 16 μg/ml; fraction: IgG; DAKO, Glostrup, Denmark) and Alexa Fluor 488-conjugated anti-rabbit IgG antibody (concentration: 5 μg/ml; Life Technologies, Molecular Probes). Propidium iodide nuclear counterstain (Life Technologies, Molecular Probes). Original magnification: 400X. Paired cell cultures stained with antibody directed against an irrelevant antigen showed no positive staining.

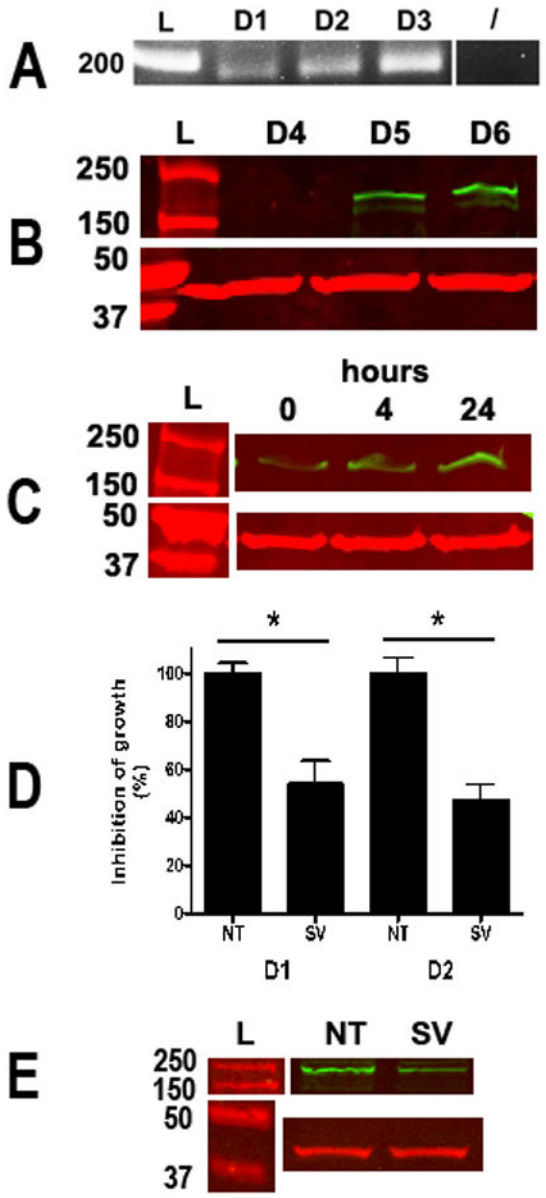

Figure 3.

Gel images of supervillin (A) RT-PCR product (165 bp) and (B) protein (205 kDa, β-actin at 42 kDa) from primary retinal endothelial cells of 6 human donors (D1–D6). L = ladder./ = no cDNA. (C) Gel image of supervillin protein in human retinal endothelial cells stimulated with VEGF (20 ng/ml, Millipore, Temecula, CA) for 0, 4 and 24 hours. (D) Graph showing proliferation of immortalized retinal endothelial cells from 2 human donors initially plated at 3000 cells/wells in a 96-well plate, 96 hours after transfection with supervillin (SV) or non-targeted (NT) siRNA using Targefect-siRNA transfection kit (Targeting Systems, El Cajon, CA). SV siRNA: sense = 5′-GGCGGUCCCUCAUCAAGAAGC-3′, anti-sense = 5′-UUCUUGAUGAGGGACCGCCCU-3′ (designed using siDirect (Naito et al., 2004)). NT siRNA: sense = 5′-CGCCGACGUUUAACGGAAGCC-3′, anti-sense = 5′-CUUCCGUUAAACGUCGGCGCA-3′. n = 4–8 wells/condition. D = donor. * = $p \leq 0.003$. (E) Gel image of supervillin protein in the siRNA-treated human retinal endothelial cells

that were used in the proliferation experiment shown in (D – donor 1), 48 hours following transfection.

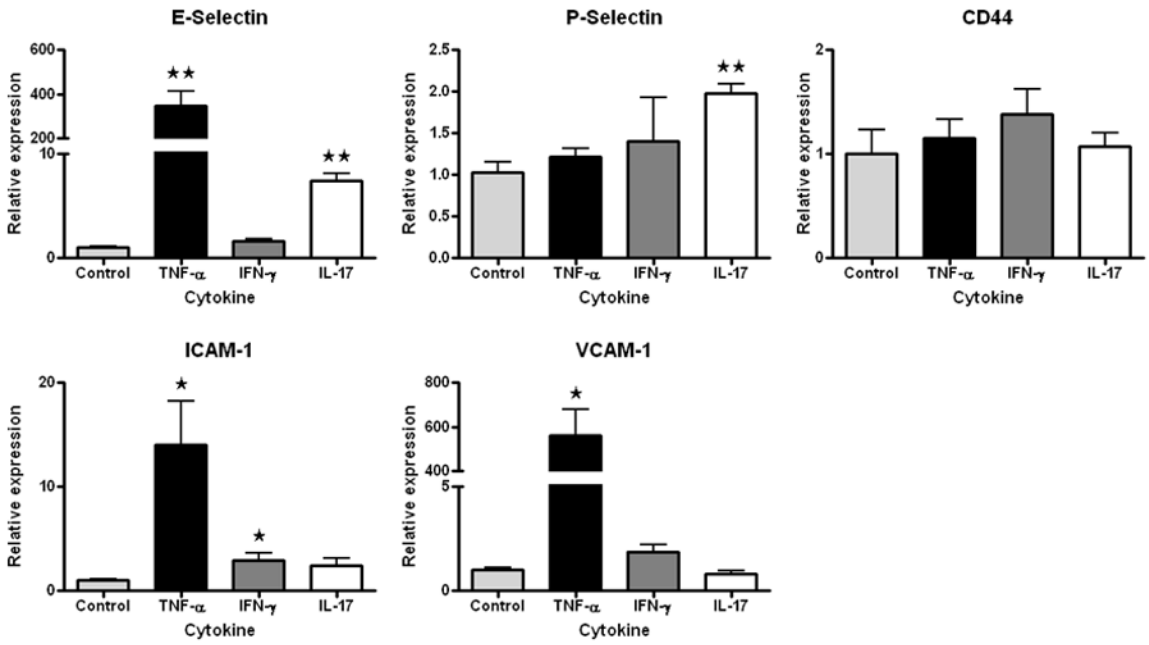

Figure 4.

Graphs showing relative expression of E-selectin, P-selectin, ICAM-1, VCAM-1, and CD44 transcript by immortalized human retinal endothelial cells following exposure to one of the following conditions: medium alone; TNF-α (10ng/ml, R&D Systems, Minneapolis, MN); IFN-γ (20ng/ml, R&D Systems); and IL-17 (100ng/ml, R&D Systems). Endothelial cells were cultured to confluence in modified MCDB-131 medium (Sigma-Aldrich, St. Louis, MO) with 2.5% FBS (Hyclone, Logan, UT) and endothelial growth factors (EGM-2 SingleQuots supplement (Clonetics-Lonza, St. Louis, MO), omitting gentamicin, hydrocortisone and serum, at 1:4 dilution), and subsequently incubated with or without cytokine for 4 hours. Total RNA was isolated using the RNeasy Mini Kit (Qiagen, Valencia, CA), and cDNA was synthesized using the iScript cDNA Synthesis Kit (Bio-Rad Laboratories, Hercules, CA). Relative expression of gene products, normalized to GAPDH, was determined by using the Chromo4 Thermocycler and iQ SYBR Green Supermix (both from Bio-Rad Laboratories). Data were analyzed using Chromo4 Opticon Monitor 3 software. Primer sequences appear in Table 2. In all graphs, bars represent mean and error bars represent standard error of mean (n = 3 wells; * = $p<0.05$, ** = $p<0.01$, two-tailed Student's t-test).

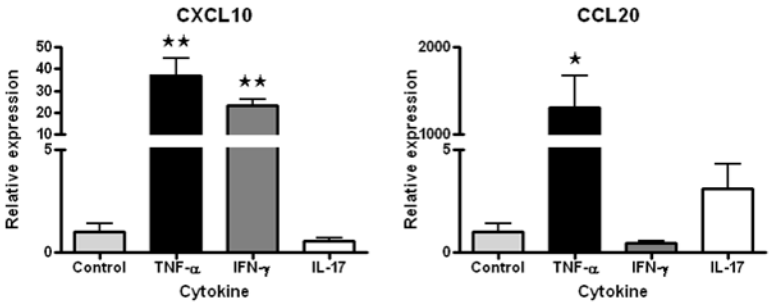

Figure 5.

Graphs showing relative expression of CXCL10 and CCL20 transcript by immortalized human retinal endothelial cells following exposure to one of the following conditions: medium alone; TNF-α (10ng/ml); IFN-γ (20ng/ml); and IL-17 (100ng/ml). Experimental conditions and real-time quantitative RT-PCR are described in the Figure 4 legend. Primer sequences appear in Table 2. In both graphs, bars represent mean and error bars represent standard error of mean (n = 3 wells; * = $p<0.05$, ** = $p<0.01$, two-tailed Student's t-test).

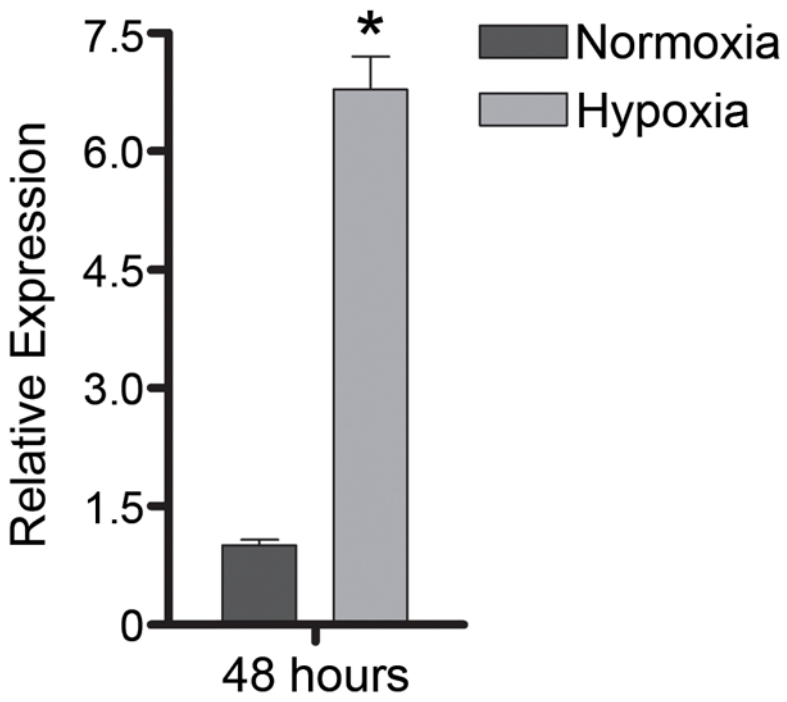

Figure 6.

Graphs showing increased relative expression of $VEGF_{165}$ transcript by immortalized human retinal endothelial cells following a 48-hour exposure to hypoxia. Endothelial cells were cultured to confluence in modified MCDB-131 medium (Sigma-Aldrich, St. Louis, MO) with 2% FBS (Hyclone, Logan, UT) and endothelial growth factors (EGM-2 SingleQuots supplement (Clonetics-Lonza, St. Louis, MO), omitting gentamicin, hydrocortisone and serum), and subsequently incubated for 48 hours in 1% or room air level oxygen. Total RNA was isolated using the RNeasy Mini Kit (Qiagen, Valencia, CA), and cDNA was synthesized using the iScript cDNA Synthesis Kit (Bio-Rad Laboratories, Hercules, CA). Relative expression of gene products, normalized to GAPDH, was determined by using the Chromo4 Thermocycler and iQ SYBR Green Supermix (both from Bio-Rad Laboratories). Data were analyzed using Chromo4 Opticon Monitor 3 software. Primer sequences appear in Table 2. Bars represent mean and error bars represent standard error of mean (n = 3 reactions; * = $p < 0.001$, two-tailed Student's t-test).

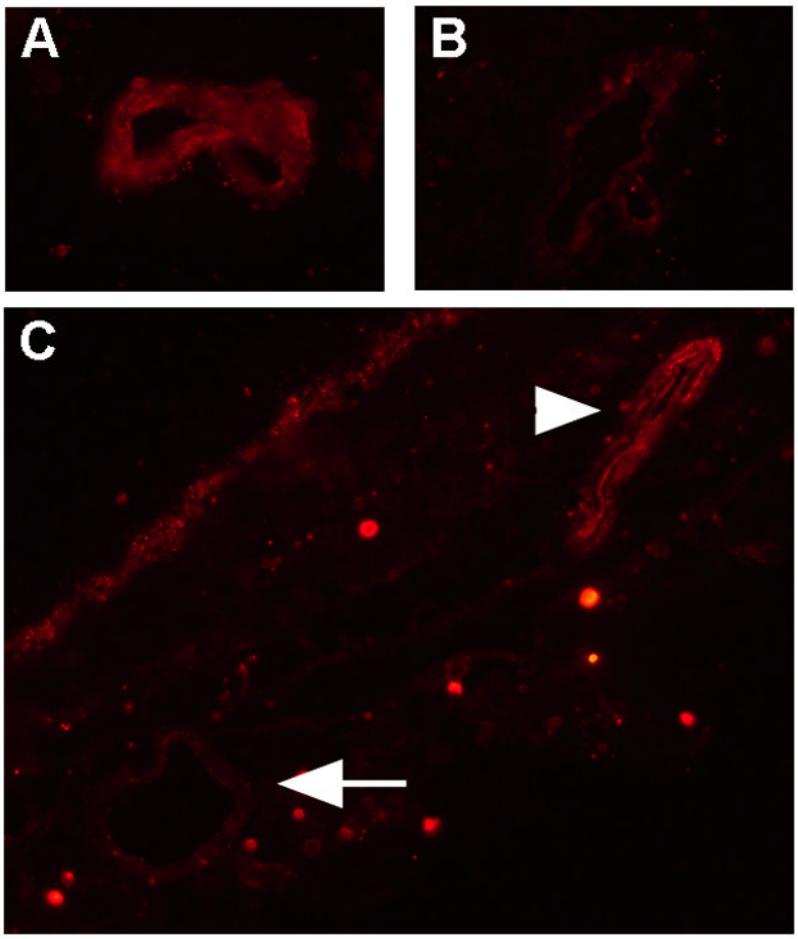

Figure 7.
Photomicrographs of fresh frozen retinal sections from the same human donor immunostained with rabbit anti-human ephrin-B2 polyclonal antibody (1:50 dilution; Santa Cruz Biotechnology, Santa Cruz, CA) diluted 1:50 or rabbit IgG similarly diluted as negative control. Specific staining was identified by Alexa Fluor 594-labelled secondary antibody (1:400 dilution; Invitrogen). (A) Retinal vascular channel expressing ephrin-B2; (B) Absence of positive staining in negative control. Original Magnification: 400X; (C) Ephrin-B2-positive arterial channel (arrowhead) adjacent to ephrin-B2-negative venous channel (arrow).

Table 1

Human retinal endothelial proteins identified by 2 or more peptides using multidimensional protein identification technology. Protein descriptions and accessions are from a human Sprot database search. If proteins could not be distinguished on the basis of observed peptides, more than one accession will be listed. Molecular weight is calculated and given in Da. Total SpC is the total spectral count and proteins are ranked in decreasing order of Total SpC. Sequence-reversed decoy protein matches are denoted by REVERSED.

Protein Description	Accession Number	Molecular Weight	Total SpC
Vimentin	P08670|VIME_HUMAN	53,635	1955
Myosin-9 (Myosin heavy chain 9) (Myosin heavy chain, nonmuscle IIa) (Nonmuscle myosin heavy chain IIa) (NMMHC II-a) (NMMHC-IIA) (Cellular myosin heavy chain, type A) (Nonmuscle myosin heavy chain-A) (NMMHC-A)	P35579|MYH9_HUMAN	226,520	1386
Actin, cytoplasmic 1 (Beta-actin)	P60709|ACTB_HUMAN, P63261|ACTG_HUMAN	41,720	1239
Filamin-B (FLN-B) (Beta-filamin) (Actin-binding-like protein) (Thyroid autoantigen) (Truncated actin-binding protein) (Truncated ABP) (ABP-280 homolog) (ABP-278) (Filamin 3) (Filamin homolog 1) (Fh1)	O75369|FLNB_HUMAN	278,172	711
Filamin-A (Alpha-filamin) (Filamin-1) (Endothelial actin-binding protein) (Actin-binding protein 280) (ABP-280) (Nonmuscle filamin)	P21333|FLNA_HUMAN	280,711	678
Tubulin beta chain (Tubulin beta-5 chain)	P07437|TBB5_HUMAN	49,653	629
Annexin A2 (Annexin II) (Lipocortin II) (Calpactin I heavy chain) (Chromobindin-8) (p36) (Protein I) (Placental anticoagulant protein IV) (PAP-IV)	P07355|ANXA2_HUMAN	38,588	585
Alpha-enolase (EC 4.2.1.11) (2-phospho-D-glycerate hydro-lyase) (Non-neural enolase) (NNE) (Enolase 1) (Phosphopyruvate hydratase) (C-myc promoter-binding protein) (MBP-1) (MPB-1) (Plasminogen-binding protein)	P06733|ENOA_HUMAN	47,152	567
Glyceraldehyde-3-phosphate dehydrogenase (EC 1.2.1.12) (GAPDH)	P04406|G3P_HUMAN	36,035	521
Pyruvate kinase isozymes M1/M2 (EC 2.7.1.40) (Pyruvate kinase muscle isozyme) (Pyruvate kinase 2/3) (Cytosolic thyroid hormone-binding protein) (CTHBP) (THBP1)	P14618|KPYM_HUMAN	57,920	512
Basement membrane-specific heparan sulfate proteoglycan core protein precursor (HSPG) (Perlecan) (PLC)	P98160|PGBM_HUMAN	468,788	485
Plectin-1 (PLTN) (PCN) (Hemidesmosomal protein 1) (HD1) (Plectin-11)	Q15149|PLEC1_HUMAN	531,708	477
Heat shock protein HSP 90-beta (HSP 84) (HSP 90)	P08238|HS90B_HUMAN	83,249	456
Heat shock cognate 71 kDa protein (Heat shock 70 kDa protein 8)	P11142|HSP7C_HUMAN	70,882	430
Neuroblast differentiation-associated protein AHNAK (Desmoyokin) (Fragments)	Q09666|AHNK_HUMAN	312,479	395
78 kDa glucose-regulated protein precursor (GRP 78) (Heat shock 70 kDa protein 5) (Immunoglobulin heavy chain-binding protein) (BiP) (Endoplasmic reticulum lumenal Ca(2+)-binding protein grp78)	P11021|GRP78_HUMAN	72,317	392
Talin-1	Q9Y490|TLN1_HUMAN	269,747	346
Peptidyl-prolyl cis-trans isomerase A (EC 5.2.1.8) (PPIase A) (Rotamase A) (Cyclophilin A) (Cyclosporin A-binding protein)	P62937|PPIA_HUMAN	17,995	343

Prog Retin Eye Res. Author manuscript; available in PMC 2014 January 01.

Protein Description	Accession Number	Molecular Weight	Total SpC
Alpha-actinin-4 (Non-muscle alpha-actinin 4) (F-actin cross-linking protein)	O43707|ACTN4_HUMAN	104,839	331
Tubulin alpha-6 chain (Alpha-tubulin 6)	Q9BQE3|TBA6_HUMAN	49,877	321
Tubulin beta-6 chain	Q9BUF5|TBB6_HUMAN	49,839	319
Elongation factor 2 (EF-2)	P13639|EF2_HUMAN	95,322	316
Elongation factor 1-alpha 1 (EF-1-alpha-1) (Elongation factor 1 A-1) (eEF1A-1) (Elongation factor Tu) (EF-Tu) (Leukocyte receptor cluster member 7)	P68104|EF1A1_HUMAN	50,123	315
Lamin-A/C (70 kDa lamin) (Renal carcinoma antigen NY-REN-32)	P02545|LMNA_HUMAN	74,123	301
Moesin (Membrane-organizing extension spike protein)	P26038|MOES_HUMAN	67,804	297
Endoplasmin precursor (Heat shock protein 90 kDa beta member 1) (94 kDa glucose-regulated protein) (GRP94) (gp96 homolog) (Tumor rejection antigen 1)	P14625|ENPL_HUMAN	92,454	278
Galectin-1 (Lectin galactoside-binding soluble 1) (Beta-galactoside-binding lectin L-14-I) (Lactose-binding lectin 1) (S-Lac lectin 1) (Galaptin) (14 kDa lectin) (HPL) (HBL) (Putative MAPK-activating protein MP12)	P09382|LEG1_HUMAN	14,698	271
von Willebrand factor precursor (vWF) [Contains: von Willebrand antigen 2 (von Willebrand antigen II)]	P04275|VWF_HUMAN	309,268	270
Spectrin alpha chain, brain (Spectrin, non-erythroid alpha chain) (Alpha-II spectrin) (Fodrin alpha chain)	Q13813|SPTA2_HUMAN	284,525	269
Protein disulfide-isomerase precursor (EC 5.3.4.1) (PDI) (Prolyl 4-hydroxylase subunit beta) (Cellular thyroid hormone-binding protein) (p55)	P07237|PDIA1_HUMAN	57,100	262
Protein disulfide-isomerase A3 precursor (EC 5.3.4.1) (Disulfide isomerase ER-60) (ERp60) (58 kDa microsomal protein) (p58) (ERp57) (58 kDa glucose-regulated protein)	P30101|PDIA3_HUMAN	56,767	260
Cofilin-1 (Cofilin, non-muscle isoform) (18 kDa phosphoprotein) (p18)	P23528|COF1_HUMAN	18,485	246
Fibronectin precursor (FN) (Cold-insoluble globulin) (CIG)	P02751|FINC_HUMAN	262,581	243
Tropomyosin alpha-4 chain (Tropomyosin-4) (TM30p1)	P67936|TPM4_HUMAN	28,504	241
Histone H4	P62805|H4_HUMAN	11,350	241
Spectrin beta chain, brain 1 (Spectrin, non-erythroid beta chain 1) (Beta-II spectrin) (Fodrin beta chain)	Q01082|SPTB2_HUMAN	274,595	235
Annexin A1 (Annexin I) (Lipocortin I) (Calpactin II) (Chromobindin-9) (p35) (Phospholipase A2 inhibitory protein)	P04083|ANXA1_HUMAN	38,698	232
Clathrin heavy chain 1 (CLH-17)	Q00610|CLH1_HUMAN	191,601	223
60 kDa heat shock protein, mitochondrial precursor (Hsp60) (60 kDa chaperonin) (CPN60) (Heat shock protein 60) (HSP-60) (Mitochondrial matrix protein P1) (P60 lymphocyte protein) (HuCHA60)	P10809|CH60_HUMAN	61,038	223
Profilin-1 (Profilin I)	P07737|PROF1_HUMAN	15,036	220
Heat shock protein HSP 90-alpha (HSP 86) (Renal carcinoma antigen NY-REN-38)	P07900|HS90A_HUMAN	84,645	216

Protein Description	Accession Number	Molecular Weight	Total SpC
Transitional endoplasmic reticulum ATPase (TER ATPase) (15S Mg(2+)-ATPase p97 subunit) (Valosin-containing protein) (VCP)	P55072|TERA_HUMAN	89,307	209
Fructose-bisphosphate aldolase A (EC 4.1.2.13) (Muscle-type aldolase) (Lung cancer antigen NY-LU-1)	P04075|ALDOA_HUMAN	39,403	209
Vinculin (Metavinculin)	P18206|VINC_HUMAN	123,783	204
Dynein heavy chain, cytosolic (DYHC) (Cytoplasmic dynein heavy chain 1) (DHC1) (Dynein heavy chain 1, cytoplasmic 1)	Q14204|DYHC_HUMAN	532,388	201
Phosphoglycerate kinase 1 (EC 2.7.2.3) (Primer recognition protein 2) (PRP 2) (Cell migration-inducing gene 10 protein)	P00558|PGK1_HUMAN	44,597	201
Triosephosphate isomerase (EC 5.3.1.1) (TIM) (Triose-phosphate isomerase)	P60174|TPIS_HUMAN	26,651	190
Alpha-actinin-1 (Alpha-actinin cytoskeletal isoform) (Non-muscle alpha-actinin-1) (F-actin cross-linking protein)	P12814|ACTN1_HUMAN	103,043	183
Calreticulin precursor (CRP55) (Calregulin) (HACBP) (ERp60) (grp60)	P27797|CALR_HUMAN	48,125	182
Thrombospondin-1 precursor	P07996|TSP1_HUMAN	129,364	181
Nestin	P48681|NEST_HUMAN	176,687	178
WD repeat protein 1 (Actin-interacting protein 1) (AIP1) (NORI-1)	O75083|WDR1_HUMAN	66,175	169
Nucleolin (Protein C23)	P19338|NUCL_HUMAN	76,598	162
Myosin light polypeptide 6 (Smooth muscle and nonmuscle myosin light chain alkali 6) (Myosin light chain alkali 3) (Myosin light chain 3) (MLC-3) (LC17)	P60660|MYL6_HUMAN	16,912	159
Heterogeneous nuclear ribonucleoprotein U (hnRNP U) (Scaffold attachment factor A) (SAF-A) (p120) (pp120)	Q00839|HNRPU_HUMAN	90,496	158
Fascin (Singed-like protein) (55 kDa actin-bundling protein) (p55)	Q16658|FSCN1_HUMAN	54,512	158
TRYPSIN PRECURSOR.	CONT|sp|P00761|TRYP_PI G	24,391	157
Heterogeneous nuclear ribonucleoproteins A2/B1 (hnRNP A2/hnRNP B1)	P22626|ROA2_HUMAN	37,412	152
Ribosome-binding protein 1 (Ribosome receptor protein) (180 kDa ribosome receptor homolog) (ES/130-related protein)	Q9P2E9|RRBP1_HUMAN	152,453	147
Heterogeneous nuclear ribonucleoprotein K (hnRNP K) (Transformation up-regulated nuclear protein) (TUNP)	P61978|HNRPK_HUMAN	50,961	143
Eukaryotic initiation factor 4A-I (EC 3.6.1.-) (ATP-dependent RNA helicase eIF4A-1) (eIF4A-I) (eIF-4A-I)	P60842|IF4A1_HUMAN	46,137	143
Ras GTPase-activating-like protein IQGAP1 (p195)	P46940|IQGA1_HUMAN	189,241	139
Thioredoxin domain-containing protein 5 precursor (Thioredoxin-like protein p46) (Endoplasmic reticulum protein ERp46)	Q8NBS9|TXND5_HUMAN	47,611	138

Protein Description	Accession Number	Molecular Weight	Total SpC
Serpin H1 precursor (Collagen-binding protein) (Colligin) (47 kDa heat shock protein) (Rheumatoid arthritis-related antigen RA-A47) (Arsenic-transactivated protein 3) (AsTP3) (Proliferation-inducing gene 14 protein)	P50454|SERPH_HUMAN	46,424	138
Transgelin-2 (SM22-alpha homolog)	P37802|TAGL2_HUMAN	22,374	138
Tubulin alpha-ubiquitous chain (Alpha-tubulin ubiquitous) (Tubulin K-alpha-1)	P68363|TBAK_HUMAN	50,134	138
ATP synthase subunit beta, mitochondrial precursor (EC 3.6.3.14)	P06576|ATPB_HUMAN	56,543	134
Heterogeneous nuclear ribonucleoprotein A1 (Helix-destabilizing protein) (Single-strand RNA-binding protein) (hnRNP core protein A1)	P09651|ROA1_HUMAN	38,828	131
ATP synthase subunit alpha, mitochondrial precursor (EC 3.6.3.14)	P25705|ATPA_HUMAN	59,734	128
Fatty acid synthase (EC 2.3.1.85) [Includes: [Acyl-carrier-protein] S-acetyltransferase (EC 2.3.1.38); [Acyl-carrier-protein] S-malonyltransferase (EC 2.3.1.39); 3-oxoacyl-[acyl-carrier-protein] synthase (EC 2.3.1.41); 3-oxoacyl-[acyl-carrier-protein] reductase (EC 1.1.1.100); 3-hydroxypalmitoyl-[acyl-carrier-protein] dehydratase (EC 4.2.1.61); Enoyl-[acyl-carrier-protein] reductase (EC 1.3.1.10); Oleoyl-[acyl-carrier-protein] hydrolase (EC 3.1.2.14)]	P49327|FAS_HUMAN	273,382	124
Major vault protein (MVP) (Lung resistance-related protein)	Q14764|MVP_HUMAN	99,308	124
60S ribosomal protein L3 (HIV-1 TAR RNA-binding protein B) (TARBP-B)	P39023|RL3_HUMAN	46,092	124
Histone H2A type 1-B	P04908|H2A1B_HUMAN, P28001|H2A1E_HUMAN, Q7L7L0|H2A3_HUMAN, Q93077|H2A1C_HUMAN	14,118	121
Platelet endothelial cell adhesion molecule precursor (PECAM-1) (EndoCAM) (GPIIA') (CD31 antigen)	P16284|PECA1_HUMAN	82,518	118
Protein disulfide-isomerase A4 precursor (EC 5.3.4.1) (Protein ERp-72) (ERp72)	P13667|PDIA4_HUMAN	72,916	118
Chloride intracellular channel protein 1 (Nuclear chloride ion channel 27) (NCC27) (Chloride channel ABP) (Regulatory nuclear chloride ion channel protein) (hRNCC)	O00299|CLIC1_HUMAN	26,905	117
Annexin A5 (Annexin V) (Lipocortin V) (Endonexin II) (Calphobindin I) (CBP-I) (Placental anticoagulant protein I) (PAP-I) (PP4) (Thromboplastin inhibitor) (Vascular anticoagulant-alpha) (VAC-alpha) (Anchorin CII)	P08758|ANXA5_HUMAN	35,921	116
Cytosol aminopeptidase (EC 3.4.11.1) (Leucine aminopeptidase) (LAP) (Leucyl aminopeptidase) (Leucine aminopeptidase 3) (Proline aminopeptidase) (EC 3.4.11.5) (Prolyl aminopeptidase) (Peptidase S)	P28838|AMPL_HUMAN	56,150	115
Peroxiredoxin-1 (EC 1.11.1.15) (Thioredoxin peroxidase 2) (Thioredoxin-dependent peroxide reductase 2) (Proliferation-associated gene protein) (PAG) (Natural killer cell-enhancing factor A) (NKEF-A)	Q06830|PRDX1_HUMAN	22,093	114
Heat-shock protein beta-1 (HspB1) (Heat shock 27 kDa protein) (HSP 27) (Stress-responsive protein 27) (SRP27) (Estrogen-regulated 24 kDa protein) (28 kDa heat shock protein)	P04792|HSPB1_HUMAN	22,765	112
ATP-citrate synthase (EC 2.3.3.8) (ATP-citrate (pro-S-)-lyase) (Citrate cleavage enzyme)	P53396|ACLY_HUMAN	120,825	111
Cytoskeleton-associated protein 4 (63 kDa membrane protein) (p63)	Q07065|CKAP4_HUMAN	66,004	111
Staphylococcal nuclease domain-containing protein 1 (p100 co-activator) (100 kDa coactivator) (EBNA2 coactivator p100) (Tudor domain-containing protein 11)	Q7KZF4|SND1_HUMAN	101,981	110

Protein Description	Accession Number	Molecular Weight	Total SpC
Protein-glutamine gamma-glutamyltransferase 2 (EC 2.3.2.13) (Tissue transglutaminase) (TGase C) (TGC) (TG(C)) (Transglutaminase-2) (TGase-H)	P21980|TGM2_HUMAN	77,311	110
SERUM ALBUMIN PRECURSOR.	CONT|sp|P02769|ALBU_BO VIN	69,253	110
60S ribosomal protein L4 (L1)	P36578|RL4_HUMAN	47,681	109
Malate dehydrogenase, mitochondrial precursor (EC 1.1.1.37)	P40926|MDHM_HUMAN	35,514	108
Transketolase (EC 2.2.1.1) (TK)	P29401|TKT_HUMAN	67,861	107
Heterogeneous nuclear ribonucleoprotein M (hnRNP M)	P52272|HNRPM_HUMAN	77,499	106
40S ribosomal protein S3a	P61247|RS3A_HUMAN	29,927	106
PDZ and LIM domain protein 1 (Elfin) (LIM domain protein CLP-36) (C-terminal LIM domain protein 1)	O00151|PDLI1_HUMAN	36,053	106
Rab GDP dissociation inhibitor beta (Rab GDI beta) (Guanosine diphosphate dissociation inhibitor 2) (GDI-2)	P50395|GDIB_HUMAN	50,648	104
Heterogeneous nuclear ribonucleoprotein H (hnRNP H)	P31943|HNRH1_HUMAN	49,212	104
Actin, alpha skeletal muscle (Alpha-actin-1)	P68133|ACTS_HUMAN	42,034	103
Protein disulfide-isomerase A6 precursor (EC 5.3.4.1) (Protein disulfide isomerase P5) (Thioredoxin domain-containing protein 7)	Q15084|PDIA6_HUMAN	48,104	102
6-phosphofructokinase type C (EC 2.7.1.11) (Phosphofructokinase 1) (Phosphohexokinase) (Phosphofructo-1-kinase isozyme C) (PFK-C) (6-phosphofructokinase, platelet type)	Q01813|K6PP_HUMAN	85,579	101
Bifunctional aminoacyl-tRNA synthetase [Includes: Glutamyl-tRNA synthetase (EC 6.1.1.17) (Glutamate--tRNA ligase); Prolyl-tRNA synthetase (EC 6.1.1.15) (Proline--tRNA ligase)]	P07814|SYEP_HUMAN	163,011	101
150 kDa oxygen-regulated protein precursor (Orp150) (Hypoxia up-regulated 1)	Q9Y4L1|OXRP_HUMAN	111,319	101
Polyadenylate-binding protein 1 (Poly(A)-binding protein 1) (PABP 1)	P11940|PABP1_HUMAN	70,653	101
14-3-3 protein epsilon (14-3-3E)	P62258|1433E_HUMAN	29,157	101
Stress-induced-phosphoprotein 1 (STI1) (Hsc70/Hsp90-organizing protein) (Hop) (Transformation-sensitive protein IEF SSP 3521) (NY-REN-11 antigen)	P31948|STIP1_HUMAN	62,624	98
Stress-70 protein, mitochondrial precursor (75 kDa glucose-regulated protein) (GRP 75) (Peptide-binding protein 74) (PBP74) (Mortalin) (MOT)	P38646|GRP75_HUMAN	73,663	98
ATP-dependent DNA helicase 2 subunit 1 (ATP-dependent DNA helicase II 70 kDa subunit) (Lupus Ku autoantigen protein p70) (Ku70) (70 kDa subunit of Ku antigen) (Thyroid-lupus autoantigen) (TLAA) (CTC box-binding factor 75 kDa subunit) (CTCBF) (CTC75) (DNA-repair protein XRCC6)	P12956|KU70_HUMAN	69,828	98
14-3-3 protein zeta/delta (Protein kinase C inhibitor protein 1) (KCIP-1)	P63104|1433Z_HUMAN	27,728	98
Microtubule-associated protein 4 (MAP 4)	P27816|MAP4_HUMAN	121,003	97
Cell surface glycoprotein MUC18 precursor (Melanoma-associated antigen MUC18) (Melanoma cell adhesion molecule) (Melanoma-associated antigen A32) (S-endo 1 endothelial-associated antigen) (Cell surface glycoprotein P1H12) (CD146 antigen)	P43121|MUC18_HUMAN	71,589	97

Protein Description	Accession Number	Molecular Weight	Total SpC
Heterogeneous nuclear ribonucleoprotein Q (hnRNP Q) (hnRNP-Q) (Synaptotagmin-binding, cytoplasmic RNA-interacting protein) (Glycine- and tyrosine-rich RNA-binding protein) (GRY-RBP) (NS1-associated protein 1)	O60506|HNRPQ_HUMAN	69,586	96
Neutral alpha-glucosidase AB precursor (EC 3.2.1.84) (Glucosidase II subunit alpha)	Q14697|GANAB_HUMAN	106,858	92
Glucose-6-phosphate isomerase (EC 5.3.1.9) (GPI) (Phosphoglucose isomerase) (PGI) (Phosphohexose isomerase) (PHI) (Neuroleukin) (NLK) (Sperm antigen 36) (SA-36)	P06744|G6PI_HUMAN	63,131	92
Ubiquitin-activating enzyme E1 (A1S9 protein)	P22314|UBE1_HUMAN	117,832	91
DNA-dependent protein kinase catalytic subunit (EC 2.7.11.1) (DNA-PK catalytic subunit) (DNA-PKcs) (DNPK1) (p460)	P78527|PRKDC_HUMAN	469,078	90
Catenin alpha-1 (Cadherin-associated protein) (Alpha E-catenin) (NY-REN-13 antigen)	P35221|CTNA1_HUMAN	100,055	90
6-phosphogluconate dehydrogenase, decarboxylating (EC 1.1.1.44)	P52209|6PGD_HUMAN	53,124	90
Heterogeneous nuclear ribonucleoproteins C1/C2 (hnRNP C1/hnRNP C2)	P07910|HNRPC_HUMAN	33,653	90
Plastin-3 (T-plastin)	P13797|PLST_HUMAN	70,421	89
Peptidyl-prolyl cis-trans isomerase B precursor (EC 5.2.1.8) (PPIase) (Rotamase) (Cyclophilin B) (S-cyclophilin) (SCYLP) (CYP-S1)	P23284|PPIB_HUMAN	22,725	89
Interleukin enhancer-binding factor 3 (Nuclear factor of activated T-cells 90 kDa) (NF-AT-90) (Double-stranded RNA-binding protein 76) (DRBP76) (Translational control protein 80) (TCP80) (Nuclear factor associated with dsRNA) (NFAR) (M-phase phosphoprotein 4) (MPP4)	Q12906|ILF3_HUMAN	95,321	88
T-complex protein 1 subunit beta (TCP-1-beta) (CCT-beta)	P78371|TCPB_HUMAN	57,472	87
HLA class I histocompatibility antigen, A-2 alpha chain precursor (MHC class I antigen A*2)	P01892|1A02_HUMAN	40,903	87
Microtubule-associated protein 1B (MAP 1B) [Contains: MAP1 light chain LC1]	P46821|MAP1B_HUMAN	270,602	86
Heat shock 70 kDa protein 1 (HSP70.1) (HSP70-1/HSP70-2)	P08107|HSP71_HUMAN	70,022	85
Polymerase I and transcript release factor (PTRF protein)	Q6NZI2|PTRF_HUMAN	43,459	85
40S ribosomal protein S3	P23396|RS3_HUMAN	26,671	85
40S ribosomal protein S4, X isoform (Single copy abundant mRNA protein) (SCR10)	P62701|RS4X_HUMAN	29,581	85
Heterogeneous nuclear ribonucleoprotein D0 (hnRNP D0) (AU-rich element RNA-binding protein 1)	Q14103|HNRPD_HUMAN	38,417	85
T-complex protein 1 subunit epsilon (TCP-1-epsilon) (CCT-epsilon)	P48643|TCPE_HUMAN	59,654	84
Fatty acid-binding protein, epidermal (E-FABP) (Psoriasis-associated fatty acid-binding protein homolog) (PA-FABP)	Q01469|FABPE_HUMAN	15,146	83
Nucleophosmin (NPM) (Nucleolar phosphoprotein B23) (Numatrin) (Nucleolar protein NO38)	P06748|NPM_HUMAN	32,557	83
Nucleoside diphosphate kinase B (EC 2.7.4.6) (NDK B) (NDP kinase B) (nm23-H2) (C-myc purine-binding transcription factor PUF)	P22392|NDKB_HUMAN	17,280	82
Tryptophanyl-tRNA synthetase, cytoplasmic (EC 6.1.1.2) (Tryptophan--tRNA ligase) (TrpRS) (IFP53) (hWRS)	P23381|SYWC_HUMAN	53,150	81

Protein Description	Accession Number	Molecular Weight	Total SpC
Dihydropyrimidinase-related protein 2 (DRP-2) (Collapsin response mediator protein 2) (CRMP-2) (N2A3)	Q16555|DPYL2_HUMAN	62,276	81
EH domain-containing protein 2	Q9NZN4|EHD2_HUMAN	61,145	80
Vigilin (High density lipoprotein-binding protein) (HDL-binding protein)	Q00341|VIGLN_HUMAN	141,424	80
T-complex protein 1 subunit delta (TCP-1-delta) (CCT-delta) (Stimulator of TAR RNA-binding)	P50991|TCPD_HUMAN	57,908	80
Adenylyl cyclase-associated protein 1 (CAP 1)	Q01518|CAP1_HUMAN	51,838	80
L-lactate dehydrogenase B chain (EC 1.1.1.27) (LDH-B) (LDH heart subunit) (LDH-H) (Renal carcinoma antigen NY-REN-46)	P07195|LDHB_HUMAN	36,621	80
40S ribosomal protein S6 (Phosphoprotein NP33)	P62753|RS6_HUMAN	28,664	80
60S ribosomal protein L10 (QM protein) (Tumor suppressor QM) (Laminin receptor homolog)	P27635|RL10_HUMAN	24,560	79
Phosphoglycerate mutase 1 (EC 5.4.2.1) (EC 5.4.2.4) (EC 3.1.3.13) (Phosphoglycerate mutase isozyme B) (PGAM-B) (BPG-dependent PGAM 1)	P18669|PGAM1_HUMAN	28,787	78
60S ribosomal protein L8	P62917|RL8_HUMAN	28,007	78
Dihydropyrimidinase-related protein 3 (DRP-3) (Unc-33-like phosphoprotein) (ULIP protein) (Collapsin response mediator protein 4) (CRMP-4)	Q14195|DPYL3_HUMAN	61,946	78
Filamin-C (Gamma-filamin) (Filamin-2) (Protein FLNc) (Actin-binding-like protein) (ABP-L) (ABP-280-like protein)	Q14315|FLNC_HUMAN	290,934	76
Actin-like protein 3 (Actin-related protein 3)	P61158|ARP3_HUMAN	47,354	76
60S ribosomal protein L5	P46777|RL5_HUMAN	34,346	76
ATP-dependent RNA helicase A (EC 3.6.1.-) (Nuclear DNA helicase II) (NDH II) (DEAH box protein 9)	Q08211|DHX9_HUMAN	140,944	75
Eukaryotic translation initiation factor 5A-1 (eIF-5A-1) (eIF-5A1) (Eukaryotic initiation factor 5A isoform 1) (eIF-5A) (eIF-4D) (Rev-binding factor)	P63241|IF5A1_HUMAN	16,815	75
Thioredoxin reductase 1, cytoplasmic precursor (EC 1.8.1.9) (TR) (TR1)	Q16881|TRXR1_HUMAN	54,689	74
Glutathione S-transferase P (EC 2.5.1.18) (GST class-pi) (GSTP1-1)	P09211|GSTP1_HUMAN	23,339	74
Myosin regulatory light chain 2, nonsarcomeric (Myosin RLC)	P19105|MLRM_HUMAN	19,777	74
ATP-dependent DNA helicase 2 subunit 2 (EC 3.6.1.-) (ATP-dependent DNA helicase II 80 kDa subunit) (Lupus Ku autoantigen protein p86) (Ku86) (Ku80) (86 kDa subunit of Ku antigen) (Thyroid-lupus autoantigen) (TLAA) (CTC box-binding factor 85 kDa subunit) (CTCBF) (CTC85) (Nuclear factor IV) (DNA-repair protein XRCC5)	P13010|KU86_HUMAN	82,689	73
L-lactate dehydrogenase A chain (EC 1.1.1.27) (LDH-A) (LDH muscle subunit) (LDH-M) (Proliferation-inducing gene 19 protein) (Renal carcinoma antigen NY-REN-59)	P00338|LDHA_HUMAN	36,671	73
T-complex protein 1 subunit alpha (TCP-1-alpha) (CCT-alpha)	P17987|TCPA_HUMAN	60,327	72
Heterogeneous nuclear ribonucleoprotein A3 (hnRNP A3)	P51991|ROA3_HUMAN	39,577	72

Protein Description	Accession Number	Molecular Weight	Total SpC
Ribonuclease inhibitor (Ribonuclease/angiogenin inhibitor 1) (RAI) (Placental ribonuclease inhibitor) (RNase inhibitor) (RI)	P13489|RINI_HUMAN	49,956	72
Chloride intracellular channel protein 4 (Intracellular chloride ion channel protein p64H1)	Q9Y696|CLIC4_HUMAN	28,756	72
Elongation factor 1-gamma (EF-1-gamma) (eEF-1B gamma)	P26641|EF1G_HUMAN	50,101	72
GTP-binding nuclear protein Ran (GTPase Ran) (Ras-like protein TC4) (Androgen receptor-associated protein 24)	P62826|RAN_HUMAN	24,405	72
T-complex protein 1 subunit theta (TCP-1-theta) (CCT-theta) (Renal carcinoma antigen NY-REN-15)	P50990|TCPQ_HUMAN	59,603	71
Guanine nucleotide-binding protein subunit beta 2-like 1 (Guanine nucleotide-binding protein subunit beta-like protein 12.3) (Receptor of activated protein kinase C 1) (RACK1) (Receptor for activated C kinase)	P63244|GBLP_HUMAN	35,059	71
40S ribosomal protein S2 (S4) (LLRep3 protein)	P15880|RS2_HUMAN	31,307	71
Heat shock 70 kDa protein 4 (Heat shock 70-related protein APG-2) (HSP70RY)	P34932|HSP74_HUMAN	94,283	70
40S ribosomal protein S8	P62241|RS8_HUMAN	24,188	70
Coronin-1C (Coronin-3) (hCRNN4)	Q9ULV4|COR1C_HUMAN	53,232	69
Non-POU domain-containing octamer-binding protein (NonO protein) (54 kDa nuclear RNA-and DNA-binding protein) (p54(nrb)) (p54nrb) (55 kDa nuclear protein) (NMT55) (DNA-binding p52/p100 complex, 52 kDa subunit)	Q15233|NONO_HUMAN	54,214	69
Proliferation-associated protein 2G4 (Cell cycle protein p38-2G4 homolog) (hG4-1) (ErbB3-binding protein 1)	Q9UQ80|PA2G4_HUMAN	43,769	68
Actin-like protein 2 (Actin-related protein 2)	P61160|ARP2_HUMAN	44,744	68
10 kDa heat shock protein, mitochondrial (Hsp10) (10 kDa chaperonin) (CPN10) (Early-pregnancy factor) (EPF)	P61604|CH10_HUMAN	10,914	67
Keratin, type II cytoskeletal 1 (Cytokeratin-1) (CK-1) (Keratin-1) (K1) (67 kDa cytokeratin) (Hair alpha protein)	P04264|K2C1_HUMAN	66,001	66
Interferon-induced GTP-binding protein Mx1 (Interferon-regulated resistance GTP-binding protein MxA) (Interferon-induced protein p78) (IFI-78K)	P20591|MX1_HUMAN	75,519	66
Dolichyl-diphosphooligosaccharide--protein glycosyltransferase 67 kDa subunit precursor (EC 2.4.1.119) (Ribophorin I) (RPN-I)	P04843|RIB1_HUMAN	68,553	65
Voltage-dependent anion-selective channel protein 2 (VDAC-2) (hVDAC2) (Outer mitochondrial membrane protein porin 2)	P45880|VDAC2_HUMAN	38,076	65
Myoferlin (Fer-1-like protein 3)	Q9NZM1|MYOF_HUMAN	234,698	64
Laminin subunit beta-1 precursor (Laminin B1 chain)	P07942|LAMB1_HUMAN	198,045	64
Coatomer subunit alpha (Alpha-coat protein) (Alpha-COP) (HEPCOP) (HEP-COP) [Contains: Xenin (Xenopsin-related peptide); Proxenin]	P53621|COPA_HUMAN	138,317	64
Spliceosome RNA helicase BAT1 (EC 3.6.1.-) (DEAD box protein UAP56) (56 kDa U2AF65-associated protein) (ATP-dependent RNA helicase p47) (HLA-B-associated transcript-1)	Q13838|UAP56_HUMAN	48,974	64

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Trifunctional enzyme subunit alpha, mitochondrial precursor (TP-alpha) (78 kDa gastrin-binding protein) [Includes: Long-chain enoyl-CoA hydratase (EC 4.2.1.17); Long chain 3-hydroxyacyl-CoA dehydrogenase (EC 1.1.1.211)]	P40939|ECHA_HUMAN	82,984	63
EH domain-containing protein 1 (Testilin) (hPAST1)	Q9H4M9|EHD1_HUMAN	60,611	63
Poly(rC)-binding protein 1 (Alpha-CP1) (hnRNP-E1) (Nucleic acid-binding protein SUB2.3)	Q15365|PCBP1_HUMAN	37,480	63
Zyxin (Zyxin-2)	Q15942|ZYX_HUMAN	61,258	63
Nucleosome assembly protein 1-like 1 (NAP-1-related protein) (hNRP)	P55209|NP1L1_HUMAN	45,357	63
Histone H1.4 (Histone H1b)	P10412|H14_HUMAN, P16402|H13_HUMAN	21,849	63
Calnexin precursor (Major histocompatibility complex class I antigen-binding protein p88) (p90) (IP90)	P27824|CALX_HUMAN	67,552	63
Tubulin beta-2C chain (Tubulin beta-2 chain)	P68371|TBB2C_HUMAN	49,813	63
Tight junction protein ZO-2 (Zonula occludens 2 protein) (Zona occludens 2 protein) (Tight junction protein 2)	Q9UDY2|ZO2_HUMAN	133,957	62
60S acidic ribosomal protein P0 (L10E)	P05388|RLA0_HUMAN	34,256	62
Programmed cell death 6-interacting protein (PDCD6-interacting protein) (ALG-2-interacting protein 1) (Hp95)	Q8WUM4|PDC6I_HUMAN	96,007	61
60S acidic ribosomal protein P2 (Renal carcinoma antigen NY-REN-44)	P05387|RLA2_HUMAN	11,648	61
Kinesin heavy chain (Ubiquitous kinesin heavy chain) (UKHC)	P33176|KINH_HUMAN	109,668	60
A-kinase anchor protein 12 (A-kinase anchor protein 250 kDa) (AKAP 250) (Myasthenia gravis autoantigen gravin)	Q02952|AKA12_HUMAN	191,414	60
Splicing factor, proline- and glutamine-rich (Polypyrimidine tract-binding protein-associated-splicing factor) (PTB-associated-splicing factor) (PSF) (DNA-binding p52/p100 complex, 100 kDa subunit) (100 kDa DNA-pairing protein) (hPOMp100)	P23246|SFPQ_HUMAN	76,132	60
Keratin, type II cytoskeletal 7 (Cytokeratin-7) (CK-7) (Keratin-7) (K7) (Sarcolectin)	P08729|K2C7_HUMAN	51,401	60
5′-nucleotidase precursor (EC 3.1.3.5) (Ecto-5′-nucleotidase) (5′-NT) (CD73 antigen)	P21589|5NTD_HUMAN	63,351	60
Cytosolic nonspecific dipeptidase (Glutamate carboxypeptidase-like protein 1) (CNDP dipeptidase 2)	Q96KP4|CNDP2_HUMAN	52,862	59
EH domain-containing protein 4 (Hepatocellular carcinoma-associated protein 10/11)	Q9H223|EHD4_HUMAN	61,160	59
Microtubule-actin cross-linking factor 1, isoform 4	Q96PK2|MACF4_HUMAN	670,132	59
40S ribosomal protein S7	P62081|RS7_HUMAN	22,110	58
High mobility group protein B1 (High mobility group protein 1) (HMG-1)	P09429|HMGB1_HUMAN	24,877	58
Inosine-5′-monophosphate dehydrogenase 2 (EC 1.1.1.205) (IMP dehydrogenase 2) (IMPDH-II) (IMPD 2)	P12268|IMDH2_HUMAN	55,788	57
T-complex protein 1 subunit zeta (TCP-1-zeta) (CCT-zeta) (CCT-zeta-1) (Tcp20) (HTR3) (Acute morphine dependence-related protein 2)	P40227|TCPZ_HUMAN	58,007	57

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C-1-tetrahydrofolate synthase, cytoplasmic (C1-THF synthase) [Includes: Methylenetetrahydrofolate dehydrogenase (EC 1.5.1.5); Methenyltetrahydrofolate cyclohydrolase (EC 3.5.4.9); Formyltetrahydrofolate synthetase (EC 6.3.4.3)]	P11586|C1TC_HUMAN	101,544	56
Far upstream element-binding protein 2 (FUSE-binding protein 2) (KH type-splicing regulatory protein) (KSRP) (p75)	Q92945|FUBP2_HUMAN	72,691	56
Transcription intermediary factor 1-beta (TIF1-beta) (Tripartite motif-containing protein 28) (Nuclear corepressor KAP-1) (KRAB-associated protein 1) (KAP-1) (KRAB-interacting protein 1) (KRIP-1) (RING finger protein 96)	Q13263|TIF1B_HUMAN	88,531	56
Dysferlin (Dystrophy-associated fer-1-like protein) (Fer-1-like protein 1)	O75923|DYSF_HUMAN	237,284	55
Rho GDP-dissociation inhibitor 2 (Rho GDI 2) (Rho-GDI beta) (Ly-GDI)	P52566|GDIS_HUMAN	22,970	55
60S ribosomal protein L6 (TAX-responsive enhancer element-binding protein 107) (TAXREB107) (Neoplasm-related protein C140)	Q02878|RL6_HUMAN	32,711	55
Heterogeneous nuclear ribonucleoprotein L (hnRNP L)	P14866|HNRPL_HUMAN	60,169	54
Cathepsin B precursor (EC 3.4.22.1) (Cathepsin B1) (APP secretase) (APPS) [Contains: Cathepsin B light chain; Cathepsin B heavy chain]	P07858|CATB_HUMAN	37,803	54
RING finger protein 213	Q63HN8|RN213_HUMAN	373,963	54
Peroxiredoxin-6 (EC 1.11.1.15) (Antioxidant protein 2) (1-Cys peroxiredoxin) (1-Cys PRX) (Acidic calcium-independent phospholipase A2) (EC 3.1.1.-) (aiPLA2) (Non-selenium glutathione peroxidase) (EC 1.11.1.7) (NSGPx) (24 kDa protein) (Liver 2D page spot 40) (Red blood cells page spot 12)	P30041|PRDX6_HUMAN	25,018	54
Protein CYR61 precursor (Cysteine-rich, angiogenic inducer, 61) (Insulin-like growth factor-binding protein 10) (Protein GIG1)	O00622|CYR61_HUMAN	42,008	54
Annexin A6 (Annexin VI) (Lipocortin VI) (P68) (P70) (Protein III) (Chromobindin-20) (67 kDa calelectrin) (Calphobindin-II) (CPB-II)	P08133|ANXA6_HUMAN	75,860	53
T-complex protein 1 subunit eta (TCP-1-eta) (CCT-eta) (HIV-1 Nef-interacting protein)	Q99832|TCPH_HUMAN	59,350	53
Probable ATP-dependent RNA helicase DDX17 (EC 3.6.1.-) (DEAD box protein 17) (RNA-dependent helicase p72) (DEAD box protein p72)	Q92841|DDX17_HUMAN	72,355	53
A-kinase anchor protein 2 (Protein kinase A-anchoring protein 2) (PRKA2) (AKAP-2) (AKAP-KL)	Q9Y2D5|AKAP2_HUMAN	96,084	53
Transaldolase (EC 2.2.1.2)	P37837|TALDO_HUMAN	37,524	53
Proteasome subunit alpha type 1 (EC 3.4.25.1) (Proteasome component C2) (Macropain subunit C2) (Multicatalytic endopeptidase complex subunit C2) (Proteasome nu chain) (30 kDa prosomal protein) (PROS-30)	P25786|PSA1_HUMAN	29,538	53
Nuclease sensitive element-binding protein 1 (Y-box-binding protein 1) (Y-box transcription factor) (YB-1) (CCAAT-binding transcription factor I subunit A) (CBF-A) (Enhancer factor I subunit A) (EFI-A) (DNA-binding protein B) (DBPB)	P67809|YBOX1_HUMAN	35,906	53
60S ribosomal protein L17 (L23)	P18621|RL17_HUMAN	21,379	53
26S protease regulatory subunit S10B (Proteasome 26S subunit ATPase 6) (Proteasome subunit p42)	P62333|PRS10_HUMAN	44,157	52
60S ribosomal protein L7a (Surfeit locus protein 3) (PLA-X polypeptide)	P62424|RL7A_HUMAN	29,978	52

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Procollagen-lysine,2-oxoglutarate 5-dioxygenase 1 precursor (EC 1.14.11.4) (Lysyl hydroxylase 1) (LH1)	Q02809|PLOD1_HUMAN	83,535	52
40S ribosomal protein S18 (Ke-3) (Ke3)	P62269|RS18_HUMAN	17,701	52
T-complex protein 1 subunit gamma (TCP-1-gamma) (CCT-gamma) (hTRiC5)	P49368|TCPG_HUMAN	60,517	51
PDZ and LIM domain protein 5 (Enigma homolog) (Enigma-like PDZ and LIM domains protein)	Q96HC4|PDLI5_HUMAN	63,953	51
BTB/POZ domain-containing protein KCTD12 (Pfetin) (Predominantly fetal expressed T1 domain)	Q96CX2|KCD12_HUMAN	35,684	51
Laminin subunit gamma-1 precursor (Laminin B2 chain)	P11047|LAMC1_HUMAN	177,587	50
Hexokinase-1 (EC 2.7.1.1) (Hexokinase type I) (HK I) (Brain form hexokinase)	P19367|HXK1_HUMAN	102,470	50
Catenin delta-1 (p120 catenin) (p120(ctn)) (Cadherin-associated Src substrate) (CAS) (p120(cas))	O60716|CTND1_HUMAN	108,154	50
26S protease regulatory subunit 4 (P26s4) (Proteasome 26S subunit ATPase 1)	P62191|PRS4_HUMAN	49,168	50
40S ribosomal protein S17	P08708|RS17_HUMAN	15,533	50
Translationally-controlled tumor protein (TCTP) (p23) (Histamine-releasing factor) (HRF) (Fortilin)	P13693|TCTP_HUMAN	19,578	50
60S ribosomal protein L7	P18124|RL7_HUMAN	29,210	50
Reticulocalbin-1 precursor	Q15293|RCN1_HUMAN	38,873	50
Far upstream element-binding protein 1 (FUSE-binding protein 1) (FBP) (DNA helicase V) (HDH V)	Q96AE4|FUBP1_HUMAN	67,543	49
Glucose-6-phosphate 1-dehydrogenase (EC 1.1.1.49) (G6PD)	P11413|G6PD_HUMAN	59,240	49
40S ribosomal protein SA (p40) (34/67 kDa laminin receptor) (Colon carcinoma laminin-binding protein) (NEM/1CHD4) (Multidrug resistance-associated protein MGr1-Ag)	P08865|RSSA_HUMAN	32,836	49
26S protease regulatory subunit 8 (Proteasome 26S subunit ATPase 5) (Proteasome subunit p45) (p45/SUG) (Thyroid hormone receptor-interacting protein 1) (TRIP1)	P62195|PRS8_HUMAN	45,609	49
Collagen alpha-1(IV) chain precursor (Arresten)	P02462|CO4A1_HUMAN	160,600	49
Protein FAM62A (Membrane-bound C2 domain-containing protein)	Q9BSJ8|FA62A_HUMAN	122,841	48
Proteasome subunit alpha type 6 (EC 3.4.25.1) (Proteasome iota chain) (Macropain iota chain) (Multicatalytic endopeptidase complex iota chain) (27 kDa prosomal protein) (PROS-27) (p27K)	P60900|PSA6_HUMAN	27,382	48
Heterogeneous nuclear ribonucleoprotein F (hnRNP F) (Nucleolin-like protein mcs94-1)	P52597|HNRPF_HUMAN	45,654	48
Heterogeneous nuclear ribonucleoprotein G (hnRNP G) (RNA-binding motif protein, X chromosome) (Glycoprotein p43)	P38159|HNRPG_HUMAN	42,316	48
60S ribosomal protein L23 (Ribosomal protein L17)	P62829|RL23_HUMAN	14,848	48
Serpin B6 (Placental thrombin inhibitor) (Cytoplasmic antiproteinase) (CAP) (Protease inhibitor 6) (PI-6)	P35237|SPB6_HUMAN	42,573	48
Thymosin beta-4 (T beta 4) (Fx) [Contains: Hematopoietic system regulatory peptide (Seraspenide)]	P62328|TYB4_HUMAN	5,035	48
Tubulin beta-3 chain (Tubulin beta-III) (Tubulin beta-4)	Q13509|TBB3_HUMAN	50,415	47

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Keratin, type I cytoskeletal 18 (Cytokeratin-18) (CK-18) (Keratin-18) (K18)	P05783|K1C18_HUMAN	48,041	47
Septin-2 (Protein NEDD5)	Q15019|SEPT2_HUMAN	41,470	47
Collagen alpha-1(XVIII) chain precursor [Contains: Endostatin]	P39060|COIA1_HUMAN	178,142	47
Transforming protein RhoA precursor (H12)	P61586|RHOA_HUMAN	21,750	47
Thymosin beta-10	P63313|TYB10_HUMAN	5,008	47
Ubiquitin carboxyl-terminal hydrolase isozyme L1 (EC 3.4.19.12) (EC 6.-.-.-) (UCH-L1) (Ubiquitin thioesterase L1) (Neuron cytoplasmic protein 9.5) (PGP 9.5) (PGP9.5)	P09936|UCHL1_HUMAN	24,806	46
Guanine nucleotide-binding protein G(i), alpha-2 subunit (Adenylate cyclase-inhibiting G alpha protein)	P04899|GNAI2_HUMAN	40,434	46
Hsp90 co-chaperone Cdc37 (Hsp90 chaperone protein kinase-targeting subunit) (p50Cdc37)	Q16543|CDC37_HUMAN	44,450	46
Protein DJ-1 (Oncogene DJ1) (Parkinson disease protein 7)	Q99497|PARK7_HUMAN	19,873	46
Aspartate aminotransferase, mitochondrial precursor (EC 2.6.1.1) (Transaminase A) (Glutamate oxaloacetate transaminase 2)	P00505|AATM_HUMAN	47,459	46
60S ribosomal protein L12	P30050|RL12_HUMAN	17,801	46
Histone H2B type 1-K (H2B K) (HIRA-interacting protein 1)	O60814|H2B1K_HUMAN, P57053|H2BFS_HUMAN, P58876|H2B1D_HUMAN, P62807|H2B1C_HUMAN, Q5QNW6|H2B2F_HUMAN, Q93079|H2B1H_HUMAN, Q99877|H2B1N_HUMAN, Q99879|H2B1M_HUMAN, Q99880|H2B1L_HUMAN	13,873	46
CAD protein [Includes: Glutamine-dependent carbamoyl-phosphate synthase (EC 6.3.5.5); Aspartate carbamoyltransferase (EC 2.1.3.2); Dihydroorotase (EC 3.5.2.3)]	P27708|PYR1_HUMAN	242,965	45
Integrin beta-1 precursor (Fibronectin receptor subunit beta) (Integrin VLA-4 subunit beta) (CD29 antigen)	P05556|ITB1_HUMAN	88,447	45
Peroxisomal multifunctional enzyme type 2 (MFE-2) (D-bifunctional protein) (DBP) (17-beta-hydroxysteroid dehydrogenase 4) (17-beta-HSD 4) (D-3-hydroxyacyl-CoA dehydratase) (EC 4.2.1.107) (3-alpha,7-alpha,12-alpha-trihydroxy-5-beta-cholest-24-enoyl-CoA hydratase) (3-hydroxyacyl-CoA dehydrogenase) (EC 1.1.1.35)	P51659|DHB4_HUMAN	79,670	45
Importin beta-1 subunit (Karyopherin beta-1 subunit) (Nuclear factor P97) (Importin 90)	Q14974|IMB1_HUMAN	97,153	45
Polypyrimidine tract-binding protein 1 (PTB) (Heterogeneous nuclear ribonucleoprotein I) (hnRNP I) (57 kDa RNA-binding protein PPTB-1)	P26599|PTBP1_HUMAN	57,205	45
ADP/ATP translocase 2 (Adenine nucleotide translocator 2) (ANT 2) (ADP,ATP carrier protein 2) (Solute carrier family 25 member 5) (ADP,ATP carrier protein, fibroblast isoform)	P05141|ADT2_HUMAN	32,879	45
40S ribosomal protein S14	P62263|RS14_HUMAN	16,255	45
Glucosidase 2 subunit beta precursor (Glucosidase II subunit beta) (Protein kinase C substrate, 60.1 kDa protein, heavy chain) (PKCSH) (80K-H protein)	P14314|GLU2B_HUMAN	59,408	45
Cysteine and glycine-rich protein 1 (Cysteine-rich protein 1) (CRP1) (CRP)	P21291|CSRP1_HUMAN	20,549	45

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Proactivator polypeptide precursor [Contains: Saposin A (Protein A); Saposin B-Val; Saposin B (Sphingolipid activator protein 1) (SAP-1) (Cerebroside sulfate activator) (CSAct) (Dispersin) (Sulfatide/GM1 activator); Saposin C (Co-beta-glucosidase) (A1 activator) (Glucosylceramidase activator) (Sphingolipid activator protein 2) (SAP-2); Saposin D (Protein C) (Component C)]	P07602|SAP_HUMAN	58,094	45
Tropomyosin alpha-3 chain (Tropomyosin-3) (Tropomyosin gamma) (hTM5)	P06753|TPM3_HUMAN	32,802	45
40S ribosomal protein S5	P46782|RS5_HUMAN	22,859	45
CD59 glycoprotein precursor (Membrane attack complex inhibition factor) (MACIF) (MAC-inhibitory protein) (MAC-IP) (Protectin) (MEM43 antigen) (Membrane inhibitor of reactive lysis) (MIRL) (20 kDa homologous restriction factor) (HRF-20) (HRF20) (1F5 antigen)	P13987|CD59_HUMAN	14,159	45
Rho-related GTP-binding protein RhoC precursor (H9)	P08134|RHOC_HUMAN	21,989	45
Sodium/potassium-transporting ATPase alpha-1 chain precursor (EC 3.6.3.9) (Sodium pump 1) (Na(+)/K(+) ATPase 1)	P05023|AT1A1_HUMAN	112,882	44
Elongation factor Tu, mitochondrial precursor (EF-Tu) (P43)	P49411|EFTU_HUMAN	49,524	44
GCN1-like protein 1 (HsGCN1)	Q92616|GCN1L_HUMAN	292,732	44
Rho GDP-dissociation inhibitor 1 (Rho GDI 1) (Rho-GDI alpha)	P52565|GDIR_HUMAN	23,190	44
Voltage-dependent anion-selective channel protein 1 (VDAC-1) (hVDAC1) (Outer mitochondrial membrane protein porin 1) (Plasmalemmal porin) (Porin 31HL) (Porin 31HM)	P21796|VDAC1_HUMAN	30,756	44
Phosphatidylethanolamine-binding protein 1 (PEBP-1) (Prostatic-binding protein) (HCNPpp) (Neuropolypeptide h3) (Raf kinase inhibitor protein) (RKIP) [Contains: Hippocampal cholinergic neurostimulating peptide (HCNP)]	P30086|PEBP1_HUMAN	21,039	44
14-3-3 protein beta/alpha (Protein kinase C inhibitor protein 1) (KCIP-1) (Protein 1054)	P31946|1433B_HUMAN	28,065	44
Coronin-1B (Coronin-2)	Q9BR76|COR1B_HUMAN	54,217	44
60S ribosomal protein L10a (CSA-19)	P62906|RL10A_HUMAN	24,814	44
40S ribosomal protein S10	P46783|RS10_HUMAN	18,880	44
HLA class I histocompatibility antigen, B-49 alpha chain precursor (MHC class I antigen B*49) (B-21)	P30487|1B49_HUMAN, P30488|1B50_HUMAN	40,563	44
Vasodilator-stimulated phosphoprotein (VASP)	P50552|VASP_HUMAN	39,811	43
Valyl-tRNA synthetase (EC 6.1.1.9) (Valine--tRNA ligase) (ValRS) (Protein G7a)	P26640|SYV_HUMAN	140,460	43
F-actin capping protein subunit beta (CapZ beta)	P47756|CAPZB_HUMAN	31,334	43
Actin-related protein 2/3 complex subunit 2 (ARP2/3 complex 34 kDa subunit) (p34-ARC)	O15144|ARPC2_HUMAN	34,316	43
Myosin-10 (Myosin heavy chain 10) (Myosin heavy chain, nonmuscle IIb) (Nonmuscle myosin heavy chain IIb) (NMMHC II-b) (NMMHC-IIB) (Cellular myosin heavy chain, type B) (Nonmuscle myosin heavy chain-B) (NMMHC-B)	P35580|MYH10_HUMAN	228,927	42
Lamin-B1	P20700|LMNB1_HUMAN	66,392	42

Protein Description	Accession Number	Molecular Weight	Total SpC
Serine/threonine-protein phosphatase 2A 65 kDa regulatory subunit A alpha isoform (PP2A, subunit A, PR65-alpha isoform) (PP2A, subunit A, R1-alpha isoform) (Medium tumor antigen-associated 61 kDa protein)	P30153|2AAA_HUMAN	65,207	42
Heat-shock protein 105 kDa (Heat shock 110 kDa protein) (Antigen NY-CO-25)	Q92598|HS105_HUMAN	96,848	42
Annexin A3 (Annexin III) (Lipocortin III) (Placental anticoagulant protein III) (PAP-III) (35-alpha calcimedin) (Inositol 1,2-cyclic phosphate 2-phosphohydrolase)	P12429| ANXA3_HU MAN	36,359	42
Prohibitin	P35232|PHB_HUMAN	29,787	42
Guanine nucleotide-binding protein G(I)/G(S)/G(T) subunit beta 1 (Transducin beta chain 1)	P62873|GBB1_HUMAN	37,360	42
Glycyl-tRNA synthetase (EC 6.1.1.14) (Glycine--tRNA ligase) (GlyRS)	P41250|SYG_HUMAN	83,124	42
Caldesmon (CDM)	Q05682|CALD1_HUMAN	93,233	42
26S protease regulatory subunit 6B (Proteasome 26S subunit ATPase 4) (MIP224) (MB67-interacting protein) (TAT-binding protein 7) (TBP-7)	P43686|PRS6B_HUMAN	47,350	42
40S ribosomal protein S11	P62280|RS11_HUMAN	18,413	42
Nicotinamide phosphoribosyltransferase (EC 2.4.2.12) (NAmPRTase) (Nampt) (Pre-B cell-enhancing factor) (Pre-B-cell colony-enhancing factor 1) (Visfatin)	P43490|NAMPT_HUMAN	55,505	42
Histone H2A type 1 (H2A.1)	P0C0S8|H2A1_HUMAN, P20671|H2A1D_HUMAN, Q16777|H2A2C_HUMAN, Q6FI13|H2A2A_HUMAN, Q96KK5|H2A1H_HUMAN, Q99878|H2A1J_HUMAN	14,074	42
Dynactin-1 (150 kDa dynein-associated polypeptide) (DP-150) (DAP-150) (p150-glued) (p135)	Q14203|DYNA_HUMAN	141,680	41
Myosin-Ic (Myosin I beta) (MMI-beta) (MMIb)	O00159|MYO1C_HUMAN	118,024	41
Coatomer subunit delta (Delta-coat protein) (Delta-COP) (Archain)	P48444|COPD_HUMAN	57,193	41
Calpain-2 catalytic subunit precursor (EC 3.4.22.53) (Calpain-2 large subunit) (Calcium-activated neutral proteinase 2) (CANP 2) (Calpain M-type) (M-calpain) (Millimolar-calpain) (Calpain large polypeptide L2)	P17655|CAN2_HUMAN	79,995	41
Adenosylhomocysteinase (EC 3.3.1.1) (S-adenosyl-L-homocysteine hydrolase) (AdoHcyase)	P23526|SAHH_HUMAN	47,699	41
Drebrin (Developmentally-regulated brain protein)	Q16643|DREB_HUMAN	71,407	41
Eukaryotic translation initiation factor 3 subunit 8 (eIF3 p110) (eIF3c)	Q99613|IF38_HUMAN	105,329	41
Coatomer subunit beta′ (Beta′-coat protein) (Beta′-COP) (p102)	P35606|COPB2_HUMAN	102,471	41
Proteasome subunit alpha type 7 (EC 3.4.25.1) (Proteasome subunit RC6-1) (Proteasome subunit XAPC7)	O14818|PSA7_HUMAN	27,869	41
40S ribosomal protein S12	P25398|RS12_HUMAN	14,508	41
60S ribosomal protein L38	P63173|RL38_HUMAN	8,201	41
Brain acid soluble protein 1 (BASP1 protein) (Neuronal axonal membrane protein NAP-22) (22 kDa neuronal tissue-enriched acidic protein)	P80723|BASP_HUMAN	22,675	41

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Histone H3.1 (H3/a) (H3/b) (H3/c) (H3/d) (H3/f) (H3/h) (H3/i) (H3/j) (H3/k) (H3/l)	P68431|H31_HUMAN, P84243|H33_HUMAN, Q71DI3|H32_HUMAN	15,387	41
HLA class I histocompatibility antigen, B-8 alpha chain precursor (MHC class I antigen B*8)	P30460|1B08_HUMAN	40,313	41
High mobility group protein B2 (High mobility group protein 2) (HMG-2)	P26583|HMGB2_HUMAN	24,017	40
Calponin-2 (Calponin H2, smooth muscle) (Neutral calponin)	Q99439|CNN2_HUMAN	33,680	40
40S ribosomal protein S13	P62277|RS13_HUMAN	17,205	40
Elongation factor 1-delta (EF-1-delta) (Antigen NY-CO-4)	P29692|EF1D_HUMAN	31,104	40
Coatomer subunit gamma (Gamma-coat protein) (Gamma-COP)	Q9Y678|COPG_HUMAN	97,701	39
Ras-interacting protein 1 (Rain)	Q5U651|RAIN_HUMAN	103,442	39
Histone H1.5 (Histone H1a)	P16401|H15_HUMAN	22,564	39
Early endosome antigen 1 (Endosome-associated protein p162) (Zinc finger FYVE domain-containing protein 2)	Q15075|EEA1_HUMAN	162,450	39
Trifunctional enzyme subunit beta, mitochondrial precursor (TP-beta) [Includes: 3-ketoacyl-CoA thiolase (EC 2.3.1.16) (Acetyl-CoA acyltransferase) (Beta-ketothiolase)]	P55084|ECHB_HUMAN	51,278	39
F-actin capping protein subunit alpha-1 (CapZ alpha-1)	P52907|CAZA1_HUMAN	32,905	39
Leucine-rich repeat-containing protein 59	Q96AG4|LRC59_HUMAN	34,913	39
Isocitrate dehydrogenase [NADP], mitochondrial precursor (EC 1.1.1.42) (Oxalosuccinate decarboxylase) (IDH) (NADP(+)-specific ICDH) (IDP) (ICD-M)	P48735|IDHP_HUMAN	50,892	39
Synaptic vesicle membrane protein VAT-1 homolog (EC 1.-.-.-)	Q99536|VAT1_HUMAN	41,902	39
Calumenin precursor (Crocalbin) (IEF SSP 9302)	O43852|CALU_HUMAN	37,090	39
Eukaryotic translation initiation factor 4 gamma 1 (eIF-4-gamma 1) (eIF-4G1) (eIF-4G 1) (p220)	Q04637|IF4G1_HUMAN	175,520	38
UPF0027 protein C22orf28	Q9Y3I0|CV028_HUMAN	55,192	38
Src substrate cortactin (Amplaxin) (Oncogene EMS1)	Q14247|SRC8_HUMAN	61,618	38
Acidic leucine-rich nuclear phosphoprotein 32 family member A (Potent heat-stable protein phosphatase 2A inhibitor I1PP2A) (Acidic nuclear phosphoprotein pp32) (Leucine-rich acidic nuclear protein) (Lanp) (Putative HLA-DR-associated protein I) (PHAPI) (Mapmodulin)	P39687|AN32A_HUMAN	28,568	38
Endoglin precursor (CD105 antigen)	P17813|EGLN_HUMAN	70,561	38
Hematopoietic lineage cell-specific protein (Hematopoietic cell-specific LYN substrate 1) (LckBP1) (p75)	P14317|HCLS1_HUMAN	53,979	38
Alpha-centractin (Centractin) (Centrosome-associated actin homolog) (Actin-RPV) (ARP1)	P61163|ACTZ_HUMAN	42,597	38
60S ribosomal protein L27a	P46776|RL27A_HUMAN	16,543	38
Catenin beta-1 (Beta-catenin)	P35222|CTNB1_HUMAN	85,479	38
60S ribosomal protein L22 (Epstein-Barr virus small RNA-associated protein) (EBER-associated protein) (EAP) (Heparin-binding protein HBp15)	P35268|RL22_HUMAN	14,769	38

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Small nuclear ribonucleoprotein Sm D2 (snRNP core protein D2) (Sm-D2)	P62316|SMD2_HUMAN	13,509	38
SAM domain and HD domain-containing protein 1 (Dendritic cell-derived IFNG-induced protein) (DCIP) (Monocyte protein 5) (MOP-5)	Q9Y3Z3|SAMH1_HUMAN	72,185	38
Beta crystallin B1	P53674|CRBB1_HUMAN	28,006	38
Elongation factor 1-beta (EF-1-beta)	P24534|EF1B_HUMAN	24,746	38
130 kDa leucine-rich protein (LRP 130) (GP130) (Leucine-rich PPR motif-containing protein)	P42704|LPPRC_HUMAN	145,190	37
Arginyl-tRNA synthetase, cytoplasmic (EC 6.1.1.19) (Arginine--tRNA ligase) (ArgRS)	P54136|SYRC_HUMAN	75,364	37
Heterogeneous nuclear ribonucleoprotein R (hnRNP R)	O43390|HNRPR_HUMAN	70,926	37
ATP-dependent RNA helicase DDX1 (EC 3.6.1.-) (DEAD box protein 1) (DEAD box protein retinoblastoma) (DBP-RB)	Q92499|DDX1_HUMAN	82,415	37
26S protease regulatory subunit 6A (Proteasome 26S subunit ATPase 3) (Tat-binding protein 1) (TBP-1) (Proteasome subunit P50)	P17980|PRS6A_HUMAN	49,187	37
Splicing factor 3B subunit 2 (Spliceosome-associated protein 145) (SAP 145) (SF3b150) (Pre-mRNA-splicing factor SF3b 145 kDa subunit)	Q13435|SF3B2_HUMAN	97,641	37
Eukaryotic translation initiation factor 2 subunit 1 (Eukaryotic translation initiation factor 2 subunit alpha) (eIF-2-alpha) (EIF-2alpha) (EIF-2A)	P05198|IF2A_HUMAN	36,095	37
Ras GTPase-activating protein-binding protein 1 (EC 3.6.1.-) (G3BP-1) (ATP-dependent DNA helicase VIII) (HDH-VIII) (GAP SH3 domain-binding protein 1)	Q13283|G3BP1_HUMAN	52,145	37
Tropomyosin-1 alpha chain (Alpha-tropomyosin)	P09493|TPM1_HUMAN	32,692	37
Transmembrane emp24 domain-containing protein 10 precursor (Transmembrane protein Tmp21) (21 kDa transmembrane-trafficking protein) (p24delta) (S31III125) (S31I125) (Tmp-21-I)	P49755|TMEDA_HUMAN	24,960	37
60S ribosomal protein L11 (CLL-associated antigen KW-12)	P62913|RL11_HUMAN	20,235	37
FK506-binding protein 1A (EC 5.2.1.8) (Peptidyl-prolyl cis-trans isomerase) (PPIase) (Rotamase) (12 kDa FKBP) (FKBP-12) (Immunophilin FKBP12)	P62942|FKB1A_HUMAN	11,933	37
Phosphoribosylformylglycinamidine synthase (EC 6.3.5.3) (FGAM synthase) (FGAMS) (Formylglycinamide ribotide amidotransferase) (FGARAT) (Formylglycinamide ribotide synthetase)	O15067|PUR4_HUMAN	144,646	36
Matrin-3	P43243|MATR3_HUMAN	94,609	36
Trifunctional purine biosynthetic protein adenosine-3 [Includes: Phosphoribosylamine--glycine ligase (EC 6.3.4.13) (GARS) (Glycinamide ribonucleotide synthetase) (Phosphoribosylglycinamide synthetase); Phosphoribosylformylglycinamidine cyclo-ligase (EC 6.3.3.1) (AIRS) (Phosphoribosyl-aminoimidazole synthetase) (AIR synthase); Phosphoribosylglycinamide formyltransferase (EC 2.1.2.2) (GART) (GAR transformylase) (5′-phosphoribosylglycinamide transformylase)]	P22102|PUR2_HUMAN	107,750	36
Very-long-chain specific acyl-CoA dehydrogenase, mitochondrial precursor (EC 1.3.99.-) (VLCAD)	P49748|ACADV_HUMAN	70,374	36
3-ketoacyl-CoA thiolase, mitochondrial (EC 2.3.1.16) (Beta-ketothiolase) (Acetyl-CoA acyltransferase) (Mitochondrial 3-oxoacyl-CoA thiolase) (T1)	P42765|THIM_HUMAN	41,906	36

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Eukaryotic translation initiation factor 3 subunit 10 (eIF-3 theta) (eIF3 p167) (eIF3 p180) (eIF3 p185) (eIF3a)	Q14152|IF3A_HUMAN	166,557	36
60S ribosomal protein L13 (Breast basic conserved protein 1)	P26373|RL13_HUMAN	24,244	36
Multimerin-2 precursor (EMILIN-3) (Elastin microfibril interface located protein 3) (Elastin microfibril interfacer 3) (EndoGlyx-1 p125/p140 subunit)	Q9H8L6|MMRN2_HUMAN	104,398	36
Integrin alpha-5 precursor (Fibronectin receptor subunit alpha) (Integrin alpha-F) (VLA-5) (CD49e antigen) [Contains: Integrin alpha-5 heavy chain; Integrin alpha-5 light chain]	P08648|ITA5_HUMAN	114,521	36
26S proteasome non-ATPase regulatory subunit 6 (26S proteasome regulatory subunit S10) (p42A) (Proteasome regulatory particle subunit p44S10) (Phosphonoformate immuno-associated protein 4) (Breast cancer-associated protein SGA-113M)	Q15008|PSMD6_HUMAN	45,515	36
Procollagen-lysine,2-oxoglutarate 5-dioxygenase 2 precursor (EC 1.14.11.4) (Lysyl hydroxylase 2) (LH2)	O00469|PLOD2_HUMAN	84,669	36
Lupus La protein (Sjoegren syndrome type B antigen) (SS-B) (La ribonucleoprotein) (La autoantigen)	P05455|LA_HUMAN	46,821	36
UMP-CMP kinase (EC 2.7.4.14) (Cytidylate kinase) (Deoxycytidylate kinase) (Cytidine monophosphate kinase) (Uridine monophosphate/cytidine monophosphate kinase) (UMP/CMP kinase) (UMP/CMPK) (Uridine monophosphate kinase)	P30085|KCY_HUMAN	22,205	36
60S ribosomal protein L26-like 1	Q9UNX3|RL26L_HUMAN	17,238	36
14-3-3 protein theta (14-3-3 protein tau) (14-3-3 protein T-cell) (HS1 protein)	P27348|1433T_HUMAN	27,747	36
Ras-related protein Ral-A precursor	P11233|RALA_HUMAN	23,549	36
Heterogeneous nuclear ribonucleoprotein U-like protein 2 (Scaffold-attachment factor A2) (SAF-A2)	Q1KMD3|HNRL2_HUMAN	85,087	35
ATP-dependent RNA helicase DDX3X (EC 3.6.1.-) (DEAD box protein 3, X-chromosomal) (Helicase-like protein 2) (HLP2) (DEAD box, X isoform)	O00571|DDX3X_HUMAN	73,228	35
Inorganic pyrophosphatase (EC 3.6.1.1) (Pyrophosphate phospho-hydrolase) (PPase)	Q15181|IPYR_HUMAN	32,643	35
Cullin-associated NEDD8-dissociated protein 1 (Cullin-associated and neddylation-dissociated protein 1) (p120 CAND1) (TBP-interacting protein TIP120A) (TBP-interacting protein of 120 kDa A)	Q86VP6|CAND1_HUMAN	136,363	35
Putative GTP-binding protein 9	Q9NTK5|GTPB9_HUMAN	44,727	35
60S ribosomal protein L13a (23 kDa highly basic protein)	P40429|RL13A_HUMAN	23,560	35
Sarcoplasmic/endoplasmic reticulum calcium ATPase 2 (EC 3.6.3.8) (Calcium pump 2) (SERCA2) (SR Ca(2+)-ATPase 2) (Calcium-transporting ATPase sarcoplasmic reticulum type, slow twitch skeletal muscle isoform) (Endoplasmic reticulum class 1/2 Ca(2+) ATPase)	P16615|AT2A2_HUMAN	114,741	34
Ubiquitin carboxyl-terminal hydrolase 5 (EC 3.1.2.15) (Ubiquitin thioesterase 5) (Ubiquitin-specific-processing protease 5) (Deubiquitinating enzyme 5) (Isopeptidase T)	P45974|UBP5_HUMAN	95,770	34
26S protease regulatory subunit 7 (Proteasome 26S subunit ATPase 2) (Protein MSS1)	P35998|PRS7_HUMAN	48,618	34
UDP-glucose:glycoprotein glucosyltransferase 1 precursor (EC 2.4.1.-) (UDP-glucose ceramide glucosyltransferase-like 1) (UDP--Glc:glycoprotein glucosyltransferase) (HUGT1)	Q9NYU2|UGGG1_HUMAN	174,965	34

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26S proteasome non-ATPase regulatory subunit 2 (26S proteasome regulatory subunit RPN1) (26S proteasome regulatory subunit S2) (26S proteasome subunit p97) (Tumor necrosis factor type 1 receptor-associated protein 2) (55.11 protein)	Q13200|PSMD2_HUMAN	100,184	34
UDP-glucose 6-dehydrogenase (EC 1.1.1.22) (UDP-Glc dehydrogenase) (UDP-GlcDH) (UDPGDH)	O60701|UGDH_HUMAN	55,007	34
Peroxiredoxin-2 (EC 1.11.1.15) (Thioredoxin peroxidase 1) (Thioredoxin-dependent peroxide reductase 1) (Thiol-specific antioxidant protein) (TSA) (PRP) (Natural killer cell-enhancing factor B) (NKEF-B)	P32119|PRDX2_HUMAN	21,874	34
Endoplasmic reticulum protein ERp29 precursor (ERp31) (ERp28)	P30040|ERP29_HUMAN	28,977	34
Asparaginyl-tRNA synthetase, cytoplasmic (EC 6.1.1.22) (Asparagine--tRNA ligase) (AsnRS)	O43776|SYNC_HUMAN	62,926	34
26S proteasome non-ATPase regulatory subunit 11 (26S proteasome regulatory subunit S9) (26S proteasome regulatory subunit p44.5)	O00231|PSD11_HUMAN	47,448	34
60S ribosomal protein L23a	P62750|RL23A_HUMAN	17,678	34
Ubiquitin thioesterase protein OTUB1 (EC 3.4.-.-) (Otubain-1) (OTU domain-containing ubiquitin aldehyde-binding protein 1) (Ubiquitin-specific-processing protease OTUB1) (Deubiquitinating enzyme OTUB1)	Q96FW1|OTUB1_HUMAN	31,267	34
Reticulon-4 (Neurite outgrowth inhibitor) (Nogo protein) (Foocen) (Neuroendocrine-specific protein) (NSP) (Neuroendocrine-specific protein C homolog) (RTN-x) (Reticulon-5)	Q9NQC3|RTN4_HUMAN	129,917	34
Plexin-D1 precursor	Q9Y4D7|PLXD1_HUMAN	212,078	33
116 kDa U5 small nuclear ribonucleoprotein component (U5 snRNP-specific protein, 116 kDa) (U5-116 kDa) (Elongation factor Tu GTP-binding domain protein 2) (hSNU114)	Q15029|U5S1_HUMAN	109,420	33
Golgi apparatus protein 1 precursor (Golgi sialoglycoprotein MG-160) (E-selectin ligand 1) (ESL-1) (Cysteine-rich fibroblast growth factor receptor) (CFR-1)	Q92896|GSLG1_HUMAN	134,577	33
Carbonyl reductase [NADPH] 1 (EC 1.1.1.184) (NADPH-dependent carbonyl reductase 1) (Prostaglandin-E(2) 9-reductase) (EC 1.1.1.189) (Prostaglandin 9-ketoreductase) (15-hydroxyprostaglandin dehydrogenase [NADP+]) (EC 1.1.1.197)	P16152|DHCA_HUMAN	30,357	33
Prohibitin-2 (B-cell receptor-associated protein BAP37) (Repressor of estrogen receptor activity) (D-prohibitin)	Q99623|PHB2_HUMAN	33,280	33
Cathepsin D precursor (EC 3.4.23.5) [Contains: Cathepsin D light chain; Cathepsin D heavy chain]	P07339|CATD_HUMAN	44,535	33
Glutamate dehydrogenase 1, mitochondrial precursor (EC 1.4.1.3) (GDH)	P00367|DHE3_HUMAN	61,382	33
Microtubule-associated protein RP/EB family member 1 (APC-binding protein EB1) (End-binding protein 1) (EB1)	Q15691|MARE1_HUMAN	29,982	33
Calpain-1 catalytic subunit (EC 3.4.22.52) (Calpain-1 large subunit) (Calcium-activated neutral proteinase 1) (CANP 1) (Calpain mu-type) (muCANP) (Micromolar-calpain)	P07384|CAN1_HUMAN	81,875	33
Septin-11	Q9NVA2|SEP11_HUMAN	49,381	33
Coatomer subunit beta (Beta-coat protein) (Beta-COP)	P53618|COPB_HUMAN	107,128	33

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Proteasome activator complex subunit 1 (Proteasome activator 28-alpha subunit) (PA28alpha) (PA28a) (Activator of multicatalytic protease subunit 1) (11S regulator complex subunit alpha) (REG-alpha) (Interferon gamma up-regulated I-5111 protein) (IGUP I-5111)	Q06323|PSME1_HUMAN	28,706	33
Splicing factor, arginine/serine-rich 1 (pre-mRNA-splicing factor SF2, P33 subunit) (Alternative-splicing factor 1) (ASF-1)	Q07955|SFRS1_HUMAN	27,727	33
60S ribosomal protein L32	P62910|RL32_HUMAN	15,842	33
60S ribosomal protein L21	P46778|RL21_HUMAN	18,547	33
40S ribosomal protein S19	P39019|RS19_HUMAN	16,043	33
Protein transport protein Sec23A (SEC23-related protein A)	Q15436|SC23A_HUMAN	86,145	32
AP-2 complex subunit alpha-1 (Adapter-related protein complex 2 alpha-1 subunit) (Alpha-adaptin A) (Adaptor protein complex AP-2 alpha-1 subunit) (Clathrin assembly protein complex 2 alpha-A large chain) (100 kDa coated vesicle protein A) (Plasma membrane adaptor HA2/AP2 adaptin alpha A subunit)	O95782|AP2A1_HUMAN	107,540	32
Eukaryotic translation initiation factor 3 subunit 9 (eIF-3 eta) (eIF3 p116) (eIF3 p110) (eIF3b) (Prt1 homolog) (hPrt1)	P55884|IF39_HUMAN	92,475	32
Signal transducer and activator of transcription 1-alpha/beta (Transcription factor ISGF-3 components p91/p84)	P42224|STAT1_HUMAN	87,319	32
40S ribosomal protein S9	P46781|RS9_HUMAN	22,575	32
Proteasome subunit alpha type 2 (EC 3.4.25.1) (Proteasome component C3) (Macropain subunit C3) (Multicatalytic endopeptidase complex subunit C3)	P25787|PSA2_HUMAN	25,881	32
Multifunctional protein ADE2 [Includes: Phosphoribosylaminoimidazole-succinocarboxamide synthase (EC 6.3.2.6) (SAICAR synthetase); Phosphoribosylaminoimidazole carboxylase (EC 4.1.1.21) (AIR carboxylase) (AIRC)]	P22234|PUR6_HUMAN	47,062	32
Malate dehydrogenase, cytoplasmic (EC 1.1.1.37) (Cytosolic malate dehydrogenase)	P40925|MDHC_HUMAN	36,409	32
Nuclear autoantigenic sperm protein (NASP)	P49321|NASP_HUMAN	85,218	31
Ran GTPase-activating protein 1	P46060|RGP1_HUMAN	63,525	31
Heterogeneous nuclear ribonucleoprotein H3 (hnRNP H3) (hnRNP 2H9)	P31942|HNRH3_HUMAN	36,910	31
Cysteine-rich protein 2 (CRP2) (Protein ESP1)	P52943|CRIP2_HUMAN	22,475	31
Serpin B9 (Cytoplasmic antiproteinase 3) (CAP-3) (CAP3) (Protease inhibitor 9)	P50453|SPB9_HUMAN	42,386	31
Agrin precursor	O00468|AGRIN_HUMAN	214,820	31
Thioredoxin-dependent peroxide reductase, mitochondrial precursor (EC 1.11.1.15) (Peroxiredoxin-3) (PRX III) (Antioxidant protein 1) (AOP-1) (Protein MER5 homolog) (HBC189)	P30048|PRDX3_HUMAN	27,675	31
Interferon-induced guanylate-binding protein 1 (GTP-binding protein 1) (Guanine nucleotide-binding protein 1) (GBP-1) (HuGBP-1)	P32455|GBP1_HUMAN	67,886	31
Mannose-6-phosphate receptor-binding protein 1 (Cargo selection protein TIP47) (47 kDa mannose 6-phosphate receptor-binding protein) (47 kDa MPR-binding protein) (Placental protein 17) (PP17)	O60664|M6PBP_HUMAN	47,028	30

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Splicing factor 3B subunit 1 (Spliceosome-associated protein 155) (SAP 155) (SF3b155) (Pre-mRNA-splicing factor SF3b 155 kDa subunit)	O75533|SF3B1_HUMAN	145,802	30
Probable transcription factor PML (Tripartite motif-containing protein 19) (RING finger protein 71)	P29590|PML_HUMAN	97,499	30
RuvB-like 2 (EC 3.6.1.-) (48 kDa TATA box-binding protein-interacting protein) (48 kDa TBP-interacting protein) (TIP49b) (Repressing pontin 52) (Reptin 52) (51 kDa erythrocyte cytosolic protein) (ECP-51) (TIP60-associated protein 54-beta) (TAP54-beta)	Q9Y230|RUVB2_HUMAN	51,140	30
Integrin-linked protein kinase (EC 2.7.11.1) (ILK-1) (ILK-2) (59 kDa serine/threonine-protein kinase) (p59ILK)	Q13418|ILK_HUMAN	51,402	30
Aconitate hydratase, mitochondrial precursor (EC 4.2.1.3) (Citrate hydro-lyase) (Aconitase)	Q99798|ACON_HUMAN	85,410	30
Tyrosyl-tRNA synthetase, cytoplasmic (EC 6.1.1.1) (Tyrosyl--tRNA ligase) (TyrRS)	P54577|SYYC_HUMAN	59,127	30
Glutaminyl-tRNA synthetase (EC 6.1.1.18) (Glutamine--tRNA ligase) (GlnRS)	P47897|SYQ_HUMAN	87,782	30
Eukaryotic translation initiation factor 5B (eIF-5B) (Translation initiation factor IF-2)	O60841|IF2P_HUMAN	138,786	30
26S proteasome non-ATPase regulatory subunit 3 (26S proteasome regulatory subunit S3) (Proteasome subunit p58)	O43242|PSMD3_HUMAN	60,962	30
Serine-threonine kinase receptor-associated protein (UNR-interacting protein) (WD-40 repeat protein PT-WD) (MAP activator with WD repeats)	Q9Y3F4|STRAP_HUMAN	38,421	30
1,4-alpha-glucan branching enzyme (EC 2.4.1.18) (Glycogen branching enzyme) (Brancher enzyme)	Q04446|GLGB_HUMAN	80,445	30
Aspartyl-tRNA synthetase, cytoplasmic (EC 6.1.1.12) (Aspartate--tRNA ligase) (AspRS) (Cell proliferation-inducing gene 40 protein)	P14868|SYDC_HUMAN	57,119	30
60S ribosomal protein L18	Q07020|RL18_HUMAN	21,617	30
40S ribosomal protein S16	P62249|RS16_HUMAN	16,428	30
40S ribosomal protein S25	P62851|RS25_HUMAN	13,725	30
60S ribosomal protein L14 (CAG-ISL 7)	P50914|RL14_HUMAN	23,272	30
Ubiquinol-cytochrome-c reductase complex core protein 1, mitochondrial precursor (EC 1.10.2.2) (Core I protein)	P31930|UQCR1_HUMAN	52,628	29
LIM and SH3 domain protein 1 (LASP-1) (MLN 50)	Q14847|LASP1_HUMAN	29,699	29
Regulator of nonsense transcripts 1 (EC 3.6.1.-) (ATP-dependent helicase RENT1) (Nonsense mRNA reducing factor 1) (NORF1) (Up-frameshift suppressor 1 homolog) (hUpf1)	Q92900|RENT1_HUMAN	124,329	29
Integrin alpha-2 precursor (Platelet membrane glycoprotein Ia) (GPIa) (Collagen receptor) (VLA-2 alpha chain) (CD49b antigen)	P17301|ITA2_HUMAN	129,280	29
DNA-(apurinic or apyrimidinic site) lyase (EC 4.2.99.18) (AP endonuclease 1) (APEX nuclease) (APEN) (REF-1 protein)	P27695|APEX1_HUMAN	35,538	29
14-3-3 protein eta (Protein AS1)	Q04917|1433F_HUMAN	28,202	29
Splicing factor 3B subunit 3 (Spliceosome-associated protein 130) (SAP 130) (SF3b130) (Pre-mRNA-splicing factor SF3b 130 kDa subunit) (STAF130)	Q15393|SF3B3_HUMAN	135,561	29

Protein Description	Accession Number	Molecular Weight	Total SpC
FK506-binding protein 4 (EC 5.2.1.8) (Peptidyl-prolyl cis-trans isomerase) (PPIase) (Rotamase) (p59 protein) (HSP-binding immunophilin) (HBI) (FKBP52 protein) (52 kDa FK506-binding protein) (FKBP59)	Q02790|FKBP4_HUMAN	51,788	29
Small nuclear ribonucleoprotein-associated proteins B and B′ (snRNP-B) (Sm protein B/B′) (Sm-B/Sm-B′) (SmB/SmB′)	P14678|RSMB_HUMAN, P63162|RSMN_HUMAN	24,593	29
Superoxide dismutase [Cu-Zn] (EC 1.15.1.1)	P00441|SODC_HUMAN	15,917	29
60S ribosomal protein L24 (Ribosomal protein L30)	P83731|RL24_HUMAN	17,762	29
Serine/threonine-protein phosphatase PP1-beta catalytic subunit (EC 3.1.3.16) (PP-1B)	P62140|PP1B_HUMAN	37,170	29
Beta-2-microglobulin precursor [Contains: Beta-2-microglobulin variant pI 5.3]	P61769|B2MG_HUMAN	13,697	29
CD44 antigen precursor (Phagocytic glycoprotein I) (PGP-1) (HUTCH-I) (Extracellular matrix receptor-III) (ECMR-III) (GP90 lymphocyte homing/adhesion receptor) (Hermes antigen) (Hyaluronate receptor) (Heparan sulfate proteoglycan) (Epican) (CDw44)	P16070|CD44_HUMAN	81,535	29
Nucleoprotein TPR	P12270|TPR_HUMAN	265,580	28
Dynactin subunit 2 (Dynactin complex 50 kDa subunit) (50 kDa dynein-associated polypeptide) (p50 dynamitin) (DCTN-50)	Q13561|DCTN2_HUMAN	44,214	28
Acetyl-CoA acetyltransferase, mitochondrial precursor (EC 2.3.1.9) (Acetoacetyl-CoA thiolase) (T2)	P24752|THIL_HUMAN	45,182	28
Nucleolar RNA helicase 2 (EC 3.6.1.-) (Nucleolar RNA helicase II) (Nucleolar RNA helicase Gu) (RH II/Gu) (Gu-alpha) (DEAD box protein 21)	Q9NR30|DDX21_HUMAN	87,328	28
Serine hydroxymethyltransferase, mitochondrial precursor (EC 2.1.2.1) (Serine methylase) (Glycine hydroxymethyltransferase) (SHMT)	P34897|GLYM_HUMAN	55,977	28
Threonyl-tRNA synthetase, cytoplasmic (EC 6.1.1.3) (Threonine--tRNA ligase) (ThrRS)	P26639|SYTC_HUMAN	83,420	28
Eukaryotic translation initiation factor 3 subunit 7 (eIF-3 zeta) (eIF3 p66) (eIF3d)	O15371|IF37_HUMAN	63,956	28
Protein-L-isoaspartate(D-aspartate) O-methyltransferase (EC 2.1.1.77) (Protein-beta-aspartate methyltransferase) (PIMT) (Protein L-isoaspartyl/D-aspartyl methyltransferase) (L-isoaspartyl protein carboxyl methyltransferase)	P22061|PIMT_HUMAN	24,633	28
ATP-binding cassette sub-family E member 1 (RNase L inhibitor) (Ribonuclease 4 inhibitor) (RNS4I) (2′-5′ oligoadenylate-binding protein) (HuHP68)	P61221|ABCE1_HUMAN	67,298	28
60S ribosomal protein L9	P32969|RL9_HUMAN	21,846	28
Core histone macro-H2A.1 (Histone macroH2A1) (mH2A1) (H2A.y) (H2A/y) (Medulloblastoma antigen MU-MB-50.205)	O75367|H2AY_HUMAN	39,601	28
26S proteasome non-ATPase regulatory subunit 1 (26S proteasome regulatory subunit RPN2) (26S proteasome regulatory subunit S1) (26S proteasome subunit p112)	Q99460|PSMD1_HUMAN	105,821	28
Peroxisomal 3,2-trans-enoyl-CoA isomerase (EC 5.3.3.8) (Dodecenoyl-CoA isomerase) (Delta(3),delta(2)-enoyl-CoA isomerase) (D3,D2-enoyl-CoA isomerase) (DBI-related protein 1) (DRS-1) (Hepatocellular carcinoma-associated antigen 88) (Renal carcinoma antigen NY-REN-1)	O75521|PECI_HUMAN	39,592	28
DNA damage-binding protein 1 (Damage-specific DNA-binding protein 1) (UV-damaged DNA-binding factor) (DDB p127 subunit) (DDBa) (UV-damaged DNA-binding protein 1) (UV-DDB 1)	Q16531|DDB1_HUMAN	126,952	28

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(Xeroderma pigmentosum group E-complementing protein) (XPCe) (XPE-binding factor) (XPE-BF) (X-associated protein 1) (XAP-1)			
Purine nucleoside phosphorylase (EC 2.4.2.1) (Inosine phosphorylase) (PNP)	P00491|PNPH_HUMAN	32,100	28
Thioredoxin (Trx) (ATL-derived factor) (ADF) (Surface-associated sulphydryl protein) (SASP)	P10599|THIO_HUMAN	11,719	28
Stabilin-1 precursor (Fasciclin, EGF-like, laminin-type EGF-like and link domain-containing scavenger receptor 1) (FEEL-1) (MS-1 antigen)	Q9NY15|STAB1_HUMAN	275,449	28
Putative RNA-binding protein 3 (RNA-binding motif protein 3) (RNPL)	P98179|RBM3_HUMAN	17,153	28
GTPase IMAP family member 4 (Immunity-associated protein 4) (Immunity-associated nucleotide 1 protein) (hIAN1)	Q9NUV9|GIMA4_HUMAN	37,517	28
Aldo-keto reductase family 1 member C3 (EC 1.-.-.-) (Trans-1,2-dihydrobenzene-1,2-diol dehydrogenase) (EC 1.3.1.20) (3-alpha-hydroxysteroid dehydrogenase type 2) (EC 1.1.1.213) (3-alpha-HSD type 2) (3-alpha-HSD type II, brain) (Prostaglandin F synthase) (EC 1.1.1.188) (PGFS) (Estradiol 17-beta-dehydrogenase) (EC 1.1.1.62) (17-beta-hydroxysteroid dehydrogenase type 5) (17-beta-HSD 5) (Chlordecone reductase homolog HAKRb) (HA1753) (Dihydrodiol dehydrogenase type I) (Dihydrodiol dehydrogenase 3) (DD3) (DD-3)	P42330|AK1C3_HUMAN	36,827	28
Stathmin (Phosphoprotein p19) (pp19) (Oncoprotein 18) (Op18) (Leukemia-associated phosphoprotein p18) (pp17) (Prosolin) (Metablastin) (Protein Pr22)	P16949|STMN1_HUMAN	17,285	28
Cystatin-B (Stefin-B) (Liver thiol proteinase inhibitor) (CPI-B)	P04080|CYTB_HUMAN	11,121	28
U5 small nuclear ribonucleoprotein 200 kDa helicase (EC 3.6.1.-) (U5 snRNP-specific 200 kDa protein) (U5-200KD) (Activating signal cointegrator 1 complex subunit 3-like 1) (BRR2 homolog)	O75643|U520_HUMAN	244,496	27
Ankycorbin (Ankyrin repeat and coiled-coil structure-containing protein) (Retinoic acid-induced protein 14) (Novel retinal pigment epithelial cell protein)	Q9P0K7|RAI14_HUMAN	110,025	27
Paxillin	P49023|PAXI_HUMAN	64,515	27
Nuclear migration protein nudC (Nuclear distribution protein C homolog)	Q9Y266|NUDC_HUMAN	38,226	27
Splicing factor 3 subunit 1 (Spliceosome-associated protein 114) (SAP 114) (SF3a120)	Q15459|SF3A1_HUMAN	88,868	27
60S ribosomal protein L18a	Q02543|RL18A_HUMAN	20,745	27
Sequestosome-1 (Phosphotyrosine-independent ligand for the Lck SH2 domain of 62 kDa) (Ubiquitin-binding protein p62) (EBI3-associated protein of 60 kDa) (p60) (EBIAP)	Q13501|SQSTM_HUMAN	47,669	27
Presequence protease, mitochondrial precursor (EC 3.4.24.-) (hPreP) (Pitrilysin metalloproteinase 1) (Metalloprotease 1) (hMP1)	Q5JRX3|PREP_HUMAN	117,439	27
Ca(2+)/calmodulin-dependent protein kinase phosphatase (EC 3.1.3.16) (CaM-kinase phosphatase) (CaMKPase) (Partner of PIX 2) (hFEM-2) (Protein phosphatase 1F)	P49593|PPM1F_HUMAN	49,812	27
Protein SET (Phosphatase 2A inhibitor I2PP2A) (I-2PP2A) (Template-activating factor I) (TAF-I) (HLA-DR-associated protein II) (PHAPII) (Inhibitor of granzyme A-activated DNase) (IGAAD)	Q01105|SET_HUMAN	33,471	27
Proteasome activator complex subunit 2 (Proteasome activator 28-subunit beta) (PA28beta) (PA28b) (Activator of multicatalytic protease subunit 2) (11S regulator complex subunit beta) (REG-beta)	Q9UL46|PSME2_HUMAN	27,344	27

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EGF-containing fibulin-like extracellular matrix protein 1 precursor (Fibulin-3) (FIBL-3) (Fibrillin-like protein) (Extracellular protein S1-5)	Q12805|FBLN3_HUMAN	54,621	27
Prostaglandin E synthase 3 (EC 5.3.99.3) (Cytosolic prostaglandin E2 synthase) (cPGES) (Telomerase-binding protein p23) (Hsp90 co-chaperone) (Progesterone receptor complex p23)	Q15185|TEBP_HUMAN	18,680	27
60S ribosomal protein L27	P61353|RL27_HUMAN	15,780	27
Cathepsin Z precursor (EC 3.4.22.-) (Cathepsin X) (Cathepsin P)	Q9UBR2|CATZ_HUMAN	33,850	27
Laminin subunit alpha-4 precursor	Q16363|LAMA4_HUMAN	202,512	26
Tubulointerstitial nephritis antigen-like precursor (Tubulointerstitial nephritis antigen-related protein) (TIN Ag-related protein) (TIN-Ag-RP) (Glucocorticoid-inducible protein 5) (Oxidized LDL-responsive gene 2 protein) (OLRG-2)	Q9GZM7|TINAL_HUMAN	52,369	26
Kinectin (Kinesin receptor) (CG-1 antigen)	Q86UP2|KTN1_HUMAN	156,258	26
Septin-7 (CDC10 protein homolog)	Q16181|SEPT7_HUMAN	50,662	26
Proliferating cell nuclear antigen (PCNA) (Cyclin)	P12004|PCNA_HUMAN	28,751	26
Eukaryotic translation initiation factor 3 subunit 2 (eIF-3 beta) (eIF3 p36) (eIF3i) (TGF-beta receptor-interacting protein 1) (TRIP-1)	Q13347|IF32_HUMAN	36,484	26
Serine/threonine-protein phosphatase PP1-alpha catalytic subunit (EC 3.1.3.16) (PP-1A)	P62136|PP1A_HUMAN	37,496	26
Ubiquitin-associated protein 2-like (Protein NICE-4)	Q14157|UBP2L_HUMAN	114,516	26
Electron transfer flavoprotein subunit alpha, mitochondrial precursor (Alpha-ETF)	P13804|ETFA_HUMAN	35,062	26
Dynamin-2 (EC 3.6.5.5)	P50570|DYN2_HUMAN	98,050	26
Heterogeneous nuclear ribonucleoprotein U-like protein 1 (Adenovirus early region 1B-associated protein 5) (E1B-55 kDa-associated protein 5) (E1B-AP5)	Q9BUJ2|HNRL1_HUMAN	95,722	26
Cytoplasmic dynein 1 intermediate chain 2 (Dynein intermediate chain 2, cytosolic) (DH IC-2) (Cytoplasmic dynein intermediate chain 2)	Q13409|DC1I2_HUMAN	71,438	26
AP-2 complex subunit beta-1 (Adapter-related protein complex 2 beta-1 subunit) (Beta-adaptin) (Plasma membrane adaptor HA2/AP2 adaptin beta subunit) (Clathrin assembly protein complex 2 beta large chain) (AP105B)	P63010|AP2B1_HUMAN	104,537	26
ELAV-like protein 1 (Hu-antigen R) (HuR)	Q15717|ELAV1_HUMAN	36,075	26
Methionyl-tRNA synthetase, cytoplasmic (EC 6.1.1.10) (Methionine--tRNA ligase) (MetRS)	P56192|SYMC_HUMAN	101,100	26
Fumarate hydratase, mitochondrial precursor (EC 4.2.1.2) (Fumarase)	P07954|FUMH_HUMAN	54,620	26
Phenylalanyl-tRNA synthetase beta chain (EC 6.1.1.20) (Phenylalanine--tRNA ligase beta chain) (PheRS)	Q9NSD9|SYFB_HUMAN	66,115	26
Catechol O-methyltransferase (EC 2.1.1.6)	P21964|COMT_HUMAN	30,020	26
Switch-associated protein 70 (SWAP-70)	Q9UH65|SWP70_HUMAN	68,981	26
Leucyl-tRNA synthetase, cytoplasmic (EC 6.1.1.4) (Leucine--tRNA ligase) (LeuRS)	Q9P2J5|SYLC_HUMAN	134,453	26

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Glutathione peroxidase 1 (EC 1.11.1.9) (GSHPx-1) (GPx-1) (Cellular glutathione peroxidase)	P07203|GPX1_HUMAN	21,882	26
Proteasome subunit beta type 1 precursor (EC 3.4.25.1) (Proteasome component C5) (Macropain subunit C5) (Multicatalytic endopeptidase complex subunit C5) (Proteasome gamma chain)	P20618|PSB1_HUMAN	26,473	26
ATP synthase D chain, mitochondrial (EC 3.6.3.14)	O75947|ATP5H_HUMAN	18,474	26
Twinfilin-2 (Twinfilin-1-like protein) (A6-related protein) (hA6RP) (Protein tyrosine kinase 9-like)	Q6IBS0|TWF2_HUMAN	39,531	26
Histone H2B type 1-J (H2B.r) (H2B/r) (H2B.1)	P06899|H2B1J_HUMAN, P23527|H2B1O_HUMAN, P33778|H2B1B_HUMAN, Q16778|H2B2E_HUMAN	13,887	26
Transcription factor BTF3 (RNA polymerase B transcription factor 3)	P20290|BTF3_HUMAN	22,150	26
Putative pre-mRNA-splicing factor ATP-dependent RNA helicase DHX15 (EC 3.6.1.-) (DEAH box protein 15) (ATP-dependent RNA helicase #46)	O43143|DHX15_HUMAN	90,917	26
Aminopeptidase N (EC 3.4.11.2) (hAPN) (Alanyl aminopeptidase) (Microsomal aminopeptidase) (Aminopeptidase M) (gp150) (Myeloid plasma membrane glycoprotein CD13) (CD13 antigen)	P15144|AMPN_HUMAN	109,496	25
Isocitrate dehydrogenase [NADP] cytoplasmic (EC 1.1.1.42) (Cytosolic NADP-isocitrate dehydrogenase) (Oxalosuccinate decarboxylase) (IDH) (NADP(+)-specific ICDH) (IDP)	O75874|IDHC_HUMAN	46,643	25
Gamma-interferon-inducible protein Ifi-16 (Interferon-inducible myeloid differentiation transcriptional activator) (IFI 16)	Q16666|IF16_HUMAN	88,240	25
G1 to S phase transition protein 1 homolog (GTP-binding protein GST1-HS)	P15170|GSPT1_HUMAN	55,739	25
Puromycin-sensitive aminopeptidase (EC 3.4.11.-) (PSA)	P55786|PSA_HUMAN	103,261	25
6-phosphofructokinase, liver type (EC 2.7.1.11) (Phosphofructokinase 1) (Phosphohexokinase) (Phosphofructo-1-kinase isozyme B) (PFK-B)	P17858|K6PL_HUMAN	85,001	25
Pre-mRNA-processing factor 19 (EC 6.3.2.-) (PRP19/PSO4 homolog) (hPso4) (Nuclear matrix protein 200) (Senescence evasion factor)	Q9UMS4|PRP19_HUMAN	55,163	25
Gelsolin precursor (Actin-depolymerizing factor) (ADF) (Brevin) (AGEL)	P06396|GELS_HUMAN	85,680	25
Transportin-1 (Importin beta-2) (Karyopherin beta-2) (M9 region interaction protein) (MIP)	Q92973|TNPO1_HUMAN	101,296	25
Adenylate kinase isoenzyme 2, mitochondrial (EC 2.7.4.3) (ATP-AMP transphosphorylase)	P54819|KAD2_HUMAN	26,461	25
Dynein light chain 1, cytoplasmic (Dynein light chain LC8-type 1) (8 kDa dynein light chain) (DLC8) (Protein inhibitor of neuronal nitric oxide synthase) (PIN)	P63167|DYL1_HUMAN	10,348	25
Protein phosphatase 2C isoform gamma (EC 3.1.3.16) (PP2C-gamma) (Protein phosphatase magnesium-dependent 1 gamma) (Protein phosphatase 1C)	O15355|PP2CG_HUMAN	59,254	25
Collagen alpha-2(IV) chain precursor	P08572|CO4A2_HUMAN	167,522	25
Destrin (Actin-depolymerizing factor) (ADF)	P60981|DEST_HUMAN	18,488	25
Ubiquitin carboxyl-terminal hydrolase 14 (EC 3.1.2.15) (Ubiquitin thioesterase 14) (Ubiquitin-specific-processing protease 14) (Deubiquitinating enzyme 14)	P54578|UBP14_HUMAN	56,052	25
Bifunctional 3′-phosphoadenosine 5′-phosphosulfate synthetase 2 (PAPS synthetase 2) (PAPSS 2) (Sulfurylase kinase 2) (SK2) (SK 2) [Includes: Sulfate adenylyltransferase (EC 2.7.7.4) (Sulfate adenylate transferase) (SAT) (ATP-sulfurylase); Adenylyl-sulfate kinase (EC 2.7.1.25)	O95340|PAPS2_HUMAN	69,484	25

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(Adenylylsulfate 3′-phosphotransferase) (APS kinase) (Adenosine-5′-phosphosulfate 3′-phosphotransferase) (3′-phosphoadenosine-5′-phosphosulfate synthetase)]			
40S ribosomal protein S20	P60866|RS20_HUMAN	13,355	25
Acidic leucine-rich nuclear phosphoprotein 32 family member B (PHAPI2 protein) (Silver-stainable protein SSP29) (Acidic protein rich in leucines)	Q92688|AN32B_HUMAN	28,771	25
Transgelin (Smooth muscle protein 22-alpha) (SM22-alpha) (WS3-10) (22 kDa actin-binding protein)	Q01995|TAGL_HUMAN	22,593	25
Actin-related protein 2/3 complex subunit 1B (ARP2/3 complex 41 kDa subunit) (p41-ARC)	O15143|ARC1B_HUMAN	40,932	24
Signal transducer and activator of transcription 3 (Acute-phase response factor)	P40763|STAT3_HUMAN	88,052	24
Hepatoma-derived growth factor (HDGF) (High-mobility group protein 1-like 2) (HMG-1L2)	P51858|HDGF_HUMAN	26,771	24
Succinate dehydrogenase [ubiquinone] flavoprotein subunit, mitochondrial precursor (EC 1.3.5.1) (Fp) (Flavoprotein subunit of complex II)	P31040|DHSA_HUMAN	72,674	24
Poly(rC)-binding protein 2 (Alpha-CP2) (hnRNP-E2)	Q15366|PCBP2_HUMAN	38,563	24
NAD(P)H dehydrogenase [quinone] 1 (EC 1.6.5.2) (Quinone reductase 1) (NAD(P)H:quinone oxidoreductase 1) (QR1) (DT-diaphorase) (DTD) (Azoreductase) (Phylloquinone reductase) (Menadione reductase)	P15559|NQO1_HUMAN	30,851	24
Protein flightless-1 homolog	Q13045|FLII_HUMAN	144,737	24
Filamin-binding LIM protein 1 (FBLP-1) (Mitogen-inducible 2-interacting protein) (MIG2-interacting protein) (Migfilin)	Q8WUP2|FBLI1_HUMAN	40,651	24
Zinc finger CCCH type antiviral protein 1 (Zinc finger CCCH domain-containing protein 2)	Q7Z2W4|ZCC2_HUMAN	101,428	24
Nascent polypeptide-associated complex subunit alpha (NAC-alpha) (Alpha-NAC) (Hom s 2.02)	Q13765|NACA_HUMAN	23,365	24
Glycogen phosphorylase, brain form (EC 2.4.1.1)	P11216|PYGB_HUMAN	96,680	24
14-3-3 protein gamma (Protein kinase C inhibitor protein 1) (KCIP-1)	P61981|1433G_HUMAN	28,285	24
40S ribosomal protein S28	P62857|RS28_HUMAN	7,823	24
40S ribosomal protein S15a	P62244|RS15A_HUMAN	14,822	24
60S ribosomal protein L19	P84098|RL19_HUMAN	23,449	24
SH3 domain-binding glutamic acid-rich-like protein 3 (SH3 domain-binding protein 1) (SH3BP-1)	Q9H299|SH3L3_HUMAN	10,420	24
Alpha crystallin A chain (Heat-shock protein beta-4) (HspB4) [Contains: Alpha crystallin A chain, short form]	P02489|CRYAA_HUMAN	19,892	24
Collagen alpha-1(XII) chain precursor	Q99715|COCA1_HUMAN	333,174	24
D-dopachrome decarboxylase (EC 4.1.1.84) (D-dopachrome tautomerase) (Phenylpyruvate tautomerase II)	P30046|DOPD_HUMAN	12,694	24
S-formylglutathione hydrolase (EC 3.1.2.12) (FGH) (Esterase D)	P10768|ESTD_HUMAN	31,446	23
HECT, UBA and WWE domain-containing protein 1 (EC 6.3.2.-) (E3 ubiquitin protein ligase URE-B1) (Mcl-1 ubiquitin ligase E3) (Mule) (ARF-binding protein 1) (ARF-BP1)	Q7Z6Z7|HUWE1_HUMAN	481,874	23

Prog Retin Eye Res. Author manuscript; available in PMC 2014 January 01.

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Poly [ADP-ribose] polymerase 1 (EC 2.4.2.30) (PARP-1) (ADPRT) (NAD(+) ADP-ribosyltransferase 1) (Poly[ADP-ribose] synthetase 1)	P09874|PARP1_HUMAN	113,070	23
2-oxoglutarate dehydrogenase E1 component, mitochondrial precursor (EC 1.2.4.2) (Alpha-ketoglutarate dehydrogenase)	Q02218|ODO1_HUMAN	113,459	23
Ras-related C3 botulinum toxin substrate 1 precursor (p21-Rac1) (Ras-like protein TC25) (Cell migration-inducing gene 5 protein)	P63000|RAC1_HUMAN	21,433	23
Adenylate kinase isoenzyme 1 (EC 2.7.4.3) (ATP-AMP transphosphorylase) (AK1) (Myokinase)	P00568|KAD1_HUMAN	21,617	23
Ras-related protein Rab-1B	Q9H0U4|RAB1B_HUMAN	22,154	23
FK506-binding protein 3 (EC 5.2.1.8) (Peptidyl-prolyl cis-trans isomerase) (PPIase) (Rotamase) (25 kDa FKBP) (FKBP-25) (Rapamycin-selective 25 kDa immunophilin)	Q00688|FKBP3_HUMAN	25,159	23
Nonspecific lipid-transfer protein (EC 2.3.1.176) (Propanoyl-CoA C-acyltransferase) (NSL-TP) (Sterol carrier protein 2) (SCP-2) (Sterol carrier protein X) (SCP-X) (SCP-chi) (SCPX)	P22307|NLTP_HUMAN	58,977	23
Regulator of chromosome condensation (Chromosome condensation protein 1) (Cell cycle regulatory protein)	P18754|RCC1_HUMAN	44,950	23
Ubiquinol-cytochrome-c reductase complex core protein 2, mitochondrial precursor (EC 1.10.2.2) (Core protein II) (Complex III subunit II)	P22695|UQCR2_HUMAN	48,425	23
Myosin-VI (Unconventional myosin VI)	Q9UM54|MYO6_HUMAN	149,679	23
Ran-specific GTPase-activating protein (Ran-binding protein 1) (RanBP1)	P43487|RANG_HUMAN	23,293	23
U1 small nuclear ribonucleoprotein 70 kDa (U1 snRNP 70 kDa) (snRNP70) (U1-70K)	P08621|RU17_HUMAN	51,540	23
60S ribosomal protein L29 (Cell surface heparin-binding protein HIP)	P47914|RL29_HUMAN	17,735	23
Alanyl-tRNA synthetase, cytoplasmic (EC 6.1.1.7) (Alanine--tRNA ligase) (AlaRS) (Renal carcinoma antigen NY-REN-42)	P49588|SYAC_HUMAN	106,795	22
Serine/threonine-protein kinase PAK 2 (EC 2.7.11.1) (p21-activated kinase 2) (PAK-2) (PAK65) (Gamma-PAK) (S6/H4 kinase)	Q13177|PAK2_HUMAN	57,988	22
E3 SUMO-protein ligase RanBP2 (Ran-binding protein 2) (Nuclear pore complex protein Nup358) (Nucleoporin Nup358) (358 kDa nucleoporin) (p270)	P49792|RBP2_HUMAN	358,180	22
Niban-like protein (Meg-3)	Q96TA1|NIBL_HUMAN	82,666	22
RuvB-like 1 (EC 3.6.1.-) (49 kDa TATA box-binding protein-interacting protein) (49 kDa TBP-interacting protein) (TIP49a) (Pontin 52) (Nuclear matrix protein 238) (NMP 238) (54 kDa erythrocyte cytosolic protein) (ECP-54) (TIP60-associated protein 54-alpha) (TAP54-alpha)	Q9Y265|RUVB1_HUMAN	50,211	22
Mitochondrial inner membrane protein (Mitofilin) (p87/89) (Proliferation-inducing gene 4 protein)	Q16891|IMMT_HUMAN	83,661	22
Probable ATP-dependent RNA helicase DDX5 (EC 3.6.1.-) (DEAD box protein 5) (RNA helicase p68)	P17844|DDX5_HUMAN	69,132	22
NSFL1 cofactor p47 (p97 cofactor p47)	Q9UNZ2|NSF1C_HUMAN	40,555	22
Tripartite motif-containing protein 25 (Zinc finger protein 147) (Estrogen-responsive finger protein) (Efp) (RING finger protein 147)	Q14258|TRI25_HUMAN	70,971	22

Protein Description	Accession Number	Molecular Weight	Total SpC
Kinesin light chain 1 (KLC 1)	Q07866|KLC1_HUMAN	64,769	22
Protein RCC2 (Telophase disk protein of 60 kDa) (RCC1-like protein TD-60)	Q9P258|RCC2_HUMAN	56,067	22
Chromobox protein homolog 3 (Heterochromatin protein 1 homolog gamma) (HP1 gamma) (Modifier 2 protein) (HECH)	Q13185|CBX3_HUMAN	20,794	22
ARMET protein precursor (Arginine-rich protein)	P55145|ARMET_HUMAN	20,240	22
Aldehyde dehydrogenase, mitochondrial precursor (EC 1.2.1.3) (ALDH class 2) (ALDHI) (ALDH-E2)	P05091|ALDH2_HUMAN	56,363	22
Vacuolar protein sorting-associated protein 35 (Vesicle protein sorting 35) (hVPS35) (Maternal-embryonic 3)	Q96QK1|VPS35_HUMAN	91,692	22
Eukaryotic translation initiation factor 3 subunit 3 (eIF-3 gamma) (eIF3 p40 subunit) (eIF3h)	O15372|IF33_HUMAN	39,913	22
Cytochrome c oxidase subunit VIb isoform 1 (EC 1.9.3.1) (COX VIb-1)	P14854|CX6B1_HUMAN	10,174	22
Caveolin-1	Q03135|CAV1_HUMAN	20,454	22
Proteasome subunit alpha type 5 (EC 3.4.25.1) (Proteasome zeta chain) (Macropain zeta chain) (Multicatalytic endopeptidase complex zeta chain)	P28066|PSA5_HUMAN	26,393	22
Ubiquitin-conjugating enzyme E2 L3 (EC 6.3.2.19) (Ubiquitin-protein ligase L3) (Ubiquitin carrier protein L3) (UbcH7) (E2-F1) (L-UBC)	P68036|UB2L3_HUMAN	17,844	22
Plasminogen activator inhibitor 1 precursor (PAI-1) (Endothelial plasminogen activator inhibitor) (PAI)	P05121|PAI1_HUMAN	45,042	22
Nuclear mitotic apparatus protein 1 (NuMA protein) (SP-H antigen)	Q14980|NUMA1_HUMAN	238,257	21
Lamin-B2	Q03252|LMNB2_HUMAN	67,672	21
Methionine aminopeptidase 2 (EC 3.4.11.18) (MetAP 2) (Peptidase M 2) (Initiation factor 2-associated 67 kDa glycoprotein) (p67) (p67eIF2)	P50579|AMPM2_HUMAN	52,874	21
Ezrin (p81) (Cytovillin) (Villin-2)	P15311|EZRI_HUMAN	69,397	21
Sialic acid synthase (N-acetylneuraminate synthase) (EC 2.5.1.56) (N-acetylneuraminic acid synthase) (N-acetylneuraminate-9-phosphate synthase) (EC 2.5.1.57) (N-acetylneuraminic acid phosphate synthase)	Q9NR45|SIAS_HUMAN	40,290	21
Heme oxygenase 2 (EC 1.14.99.3) (HO-2)	P30519|HMOX2_HUMAN	36,016	21
Hsc70-interacting protein (Hip) (Suppression of tumorigenicity protein 13) (Putative tumor suppressor ST13) (Protein FAM10A1) (Progesterone receptor-associated p48 protein) (Renal carcinoma antigen NY-REN-33)	P50502|F10A1_HUMAN	41,314	21
PDZ and LIM domain protein 7 (LIM mineralization protein) (LMP) (Protein enigma)	Q9NR12|PDLI7_HUMAN	49,826	21
cAMP-dependent protein kinase type I-alpha regulatory subunit (Tissue-specific extinguisher 1) (TSE1)	P10644|KAP0_HUMAN	42,964	21
Calponin-3 (Calponin, acidic isoform)	Q15417|CNN3_HUMAN	36,397	21
ATP-dependent RNA helicase DDX19A (EC 3.6.1.-) (DEAD box protein 19A) (DDX19-like protein)	Q9NUU7|DD19A_HUMAN	53,958	21

Protein Description	Accession Number	Molecular Weight	Total SpC
Procollagen-lysine,2-oxoglutarate 5-dioxygenase 3 precursor (EC 1.14.11.4) (Lysyl hydroxylase 3) (LH3)	O60568|PLOD3_HUMAN	84,769	21
Calpastatin (Calpain inhibitor) (Sperm BS-17 component)	P20810|ICAL_HUMAN	76,557	21
Tight junction protein ZO-1 (Zonula occludens 1 protein) (Zona occludens 1 protein) (Tight junction protein 1)	Q07157|ZO1_HUMAN	195,442	21
Synaptopodin	Q8N3V7|SYNPO_HUMAN	99,446	21
Iron-responsive element-binding protein 1 (IRE-BP 1) (Iron regulatory protein 1) (IRP1) (Ferritin repressor protein) (Aconitate hydratase) (EC 4.2.1.3) (Citrate hydro-lyase) (Aconitase)	P21399|IREB1_HUMAN	98,383	21
F-actin capping protein subunit alpha-2 (CapZ alpha-2)	P47755|CAZA2_HUMAN	32,931	21
Astrocytic phosphoprotein PEA-15 (Phosphoprotein enriched in diabetes) (PED)	Q15121|PEA15_HUMAN	15,023	21
Poly [ADP-ribose] polymerase 4 (EC 2.4.2.30) (PARP-4) (Vault poly(ADP-ribose) polymerase) (VPARP) (193 kDa vault protein) (PARP-related/IalphaI-related H5/proline-rich) (PH5P)	Q9UKK3|PARP4_HUMAN	192,574	21
Lysyl-tRNA synthetase (EC 6.1.1.6) (Lysine--tRNA ligase) (LysRS)	Q15046|SYK_HUMAN	68,032	21
Junctional adhesion molecule A precursor (JAM-A) (Junctional adhesion molecule 1) (JAM-1) (Platelet adhesion molecule 1) (PAM-1) (Platelet F11 receptor) (CD321 antigen)	Q9Y624|JAM1_HUMAN	32,565	21
ADP-sugar pyrophosphatase (EC 3.6.1.13) (EC 3.6.1.-) (Nucleoside diphosphate-linked moiety X motif 5) (Nudix motif 5) (YSA1H)	Q9UKK9|NUDT5_HUMAN	24,310	21
Vesicular integral-membrane protein VIP36 precursor (GP36b glycoprotein) (Lectin, mannose-binding 2)	Q12907|LMAN2_HUMAN	40,212	21
Endothelin-converting enzyme 1 (EC 3.4.24.71) (ECE-1)	P42892|ECE1_HUMAN	87,147	21
Leukocyte elastase inhibitor (LEI) (Serpin B1) (Monocyte/neutrophil elastase inhibitor) (M/NEI) (EI)	P30740|ILEU_HUMAN	42,726	21
Platelet-activating factor acetylhydrolase IB subunit beta (EC 3.1.1.47) (PAF acetylhydrolase 30 kDa subunit) (PAF-AH 30 kDa subunit) (PAF-AH subunit beta) (PAFAH subunit beta)	P68402|PA1B2_HUMAN	25,552	21
Drebrin-like protein (SH3 domain-containing protein 7) (Drebrin-F) (Cervical SH3P7) (HPK1-interacting protein of 55 kDa) (HIP-55) (Cervical mucin-associated protein)	Q9UJU6|DBNL_HUMAN	48,188	20
Adenylosuccinate synthetase isozyme 2 (EC 6.3.4.4) (Adenylosuccinate synthetase, acidic isozyme) (IMP--aspartate ligase 2) (AdSS 2) (AMPSase 2)	P30520|PURA2_HUMAN	50,080	20
Protein KIAA1967 (Deleted in breast cancer gene 1 protein) (DBC.1) (DBC-1) (p30 DBC)	Q8N163|K1967_HUMAN	102,885	20
Delta 1-pyrroline-5-carboxylate synthetase (P5CS) (Aldehyde dehydrogenase 18 family member A1) [Includes: Glutamate 5-kinase (EC 2.7.2.11) (Gamma-glutamyl kinase) (GK); Gamma-glutamyl phosphate reductase (GPR) (EC 1.2.1.41) (Glutamate-5-semialdehyde dehydrogenase) (Glutamyl-gamma-semialdehyde dehydrogenase)]	P54886|P5CS_HUMAN	87,285	20
Leukotriene A-4 hydrolase (EC 3.3.2.6) (LTA-4 hydrolase) (Leukotriene A(4) hydrolase)	P09960|LKHA4_HUMAN	69,269	20
Cadherin-5 precursor (Vascular endothelial-cadherin) (VE-cadherin) (7B4 antigen) (CD144 antigen)	P33151|CADH5_HUMAN	87,499	20
Thioredoxin-like protein 1 (32 kDa thioredoxin-related protein)	O43396|TXNL1_HUMAN	32,233	20

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Importin beta-3 (Karyopherin beta-3) (Ran-binding protein 5) (RanBP5)	O00410|IMB3_HUMAN	123,614	20
Double-stranded RNA-specific adenosine deaminase (EC 3.5.4.-) (DRADA) (136 kDa double-stranded RNA-binding protein) (P136) (K88DSRBP) (Interferon-inducible protein 4) (IFI-4 protein)	P55265|DSRAD_HUMAN	135,981	20
Septin-9 (MLL septin-like fusion protein) (MLL septin-like fusion protein MSF-A) (Ovarian/Breast septin) (Ov/Br septin) (Septin D1)	Q9UHD8|SEPT9_HUMAN	65,384	20
Coatomer subunit epsilon (Epsilon-coat protein) (Epsilon-COP)	O14579|COPE_HUMAN	34,465	20
Heat shock protein 75 kDa, mitochondrial precursor (HSP 75) (Tumor necrosis factor type 1 receptor-associated protein) (TRAP-1) (TNFR-associated protein 1)	Q12931|TRAP1_HUMAN	80,095	20
Eukaryotic translation initiation factor 2 subunit 2 (Eukaryotic translation initiation factor 2 subunit beta) (eIF-2-beta)	P20042|IF2B_HUMAN	38,372	20
3-hydroxyacyl-CoA dehydrogenase type-2 (EC 1.1.1.35) (3-hydroxyacyl-CoA dehydrogenase type II) (Type II HADH) (3-hydroxy-2-methylbutyryl-CoA dehydrogenase) (EC 1.1.1.178) (Endoplasmic reticulum-associated amyloid beta-peptide-binding protein) (Short-chain type dehydrogenase/ reductase XH98G2)	Q99714|HCD2_HUMAN	26,905	20
RNA-binding protein FUS (Oncogene FUS) (Oncogene TLS) (Translocated in liposarcoma protein) (POMp75) (75 kDa DNA-pairing protein)	P35637|FUS_HUMAN	53,408	20
Ras-related protein Rab-14	P61106|RAB14_HUMAN	23,880	20
26S proteasome non-ATPase regulatory subunit 4 (26S proteasome regulatory subunit S5A) (Rpn10) (Multiubiquitin chain-binding protein) (Antisecretory factor 1) (AF) (ASF)	P55036|PSMD4_HUMAN	40,719	20
NADH-cytochrome b5 reductase (EC 1.6.2.2) (B5R) (Diaphorase-1) (Cytochrome b5 reductase 3) [Contains: NADH-cytochrome b5 reductase membrane-bound form; NADH-cytochrome b5 reductase soluble form]	P00387|NCB5R_HUMAN	34,218	20
60S ribosomal protein L30	P62888|RL30_HUMAN	12,767	20
Sulfide:quinone oxidoreductase, mitochondrial precursor (EC 1.-.-.-)	Q9Y6N5|SQRD_HUMAN	49,944	20
NG,NG-dimethylarginine dimethylaminohydrolase 2 (EC 3.5.3.18) (Dimethylargininase-2) (Dimethylarginine dimethylaminohydrolase 2) (DDAHII) (DDAH-2) (S-phase protein) (Protein G6a)	O95865|DDAH2_HUMAN	29,626	20
40S ribosomal protein S24	P62847|RS24_HUMAN	15,406	20
40S ribosomal protein S21	P63220|RS21_HUMAN	9,094	20
60S ribosomal protein L36	Q9Y3U8|RL36_HUMAN	12,236	20
Eukaryotic translation initiation factor 3 subunit 4 (eIF-3 delta) (eIF3 p44) (eIF-3 RNA-binding subunit) (eIF3 p42) (eIF3g)	O75821|IF34_HUMAN	35,594	20
Eukaryotic translation initiation factor 6 (eIF-6) (B4 integrin interactor) (CAB) (p27(BBP)) (B(2)GCN homolog)	P56537|IF6_HUMAN	26,580	20
Protein S100-A11 (S100 calcium-binding protein A11) (Protein S100C) (Calgizzarin) (MLN 70)	P31949|S10AB_HUMAN	11,723	20
Proteasome subunit beta type 2 (EC 3.4.25.1) (Proteasome component C7-I) (Macropain subunit C7-I) (Multicatalytic endopeptidase complex subunit C7-I)	P49721|PSB2_HUMAN	22,820	20

Protein Description	Accession Number	Molecular Weight	Total SpC
Hemoglobin subunit alpha (Hemoglobin alpha chain) (Alpha-globin)	P69905|HBA_HUMAN	15,240	20
Lamina-associated polypeptide 2, isoforms beta/gamma (Thymopoietin, isoforms beta/gamma) (TP beta/gamma) (Thymopoietin-related peptide isoforms beta/gamma) (TPRP isoforms beta/gamma) [Contains: Thymopoietin (TP) (Splenin); Thymopentin (TP5)]	P42167|LAP2B_HUMAN	50,653	20
Complement component 1 Q subcomponent-binding protein, mitochondrial precursor (Glycoprotein gC1qBP) (C1qBP) (GC1q-R protein) (Hyaluronan-binding protein 1) (Mitochondrial matrix protein p32) (p33)	Q07021|C1QBP_HUMAN	31,345	20
Integrin alpha-6 precursor (VLA-6) (CD49f antigen) [Contains: Integrin alpha-6 heavy chain; Integrin alpha-6 light chain]	P23229|ITA6_HUMAN	126,604	19
Alpha-taxilin	P40222|TXLNA_HUMAN	61,873	19
6-phosphogluconolactonase (EC 3.1.1.31) (6PGL)	O95336|6PGL_HUMAN	27,530	19
Structural maintenance of chromosomes protein 1A (SMC1alpha protein) (Sb1.8)	Q14683|SMC1A_HUMAN	143,220	19
NADH-ubiquinone oxidoreductase 75 kDa subunit, mitochondrial precursor (EC 1.6.5.3) (EC 1.6.99.3) (Complex I-75kD) (CI-75kD)	P28331|NDUS1_HUMAN	79,450	19
Bifunctional purine biosynthesis protein PURH [Includes: Phosphoribosylaminoimidazolecarboxamide formyltransferase (EC 2.1.2.3) (5-aminoimidazole-4-carboxamide ribonucleotide formyltransferase) (AICAR transformylase); IMP cyclohydrolase (EC 3.5.4.10) (Inosinicase) (IMP synthetase) (ATIC)]	P31939|PUR9_HUMAN	64,599	19
Cold shock domain-containing protein E1 (UNR protein) (N-ras upstream gene protein)	O75534|CSDE1_HUMAN	88,867	19
Xaa-Pro aminopeptidase 1 (EC 3.4.11.9) (X-Pro aminopeptidase 1) (X-prolyl aminopeptidase 1, soluble) (Cytosolic aminopeptidase P) (Soluble aminopeptidase P) (sAmp) (Aminoacylproline aminopeptidase)	Q9NQW7|XPP1_HUMAN	69,901	19
Ras-related protein Rab-7	P51149|RAB7_HUMAN	23,472	19
Vacuolar ATP synthase catalytic subunit A, ubiquitous isoform (EC 3.6.3.14) (V-ATPase subunit A 1) (Vacuolar proton pump alpha subunit 1) (V-ATPase 69 kDa subunit 1) (Isoform VA68)	P38606|VATA1_HUMAN	68,287	19
Seryl-tRNA synthetase, cytoplasmic (EC 6.1.1.11) (Serine--tRNA ligase) (SerRS)	P49591|SYSC_HUMAN	58,761	19
Protein kinase C and casein kinase substrate in neurons protein 2	Q9UNF0|PACN2_HUMAN	55,721	19
Enoyl-CoA hydratase, mitochondrial precursor (EC 4.2.1.17) (Short chain enoyl-CoA hydratase) (SCEH) (Enoyl-CoA hydratase 1)	P30084|ECHM_HUMAN	31,370	19
26S proteasome non-ATPase regulatory subunit 13 (26S proteasome regulatory subunit S11) (26S proteasome regulatory subunit p40.5)	Q9UNM6|PSD13_HUMAN	42,901	19
Dihydrolipoyl dehydrogenase, mitochondrial precursor (EC 1.8.1.4) (Dihydrolipoamide dehydrogenase) (Glycine cleavage system L protein)	P09622|DLDH_HUMAN	54,132	19
40S ribosomal protein S26	P62854|RS26_HUMAN	12,998	19
Dynamin-1-like protein (EC 3.6.5.5) (Dynamin-like protein) (Dnm1p/Vps1p-like protein) (DVLP) (Dynamin family member proline-rich carboxyl-terminal domain less) (Dymple) (Dynamin-related protein 1) (Dynamin-like protein 4) (Dynamin-like protein IV) (HdynIV)	O00429|DNM1L_HUMAN	81,861	19

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Multisynthetase complex auxiliary component p43 [Contains: Endothelial monocyte-activating polypeptide 2 (EMAP-II) (Small inducible cytokine subfamily E member 1)]	Q12904|MCA1_HUMAN	34,335	19
Leucine-rich repeat flightless-interacting protein 1 (LRR FLII-interacting protein 1) (TAR RNA-interacting protein) (GC-binding factor 2)	Q32MZ4|LRRF1_HUMAN	89,235	19
Actin-related protein 2/3 complex subunit 5 (ARP2/3 complex 16 kDa subunit) (p16-ARC)	O15511|ARPC5_HUMAN	16,303	19
4F2 cell-surface antigen heavy chain (4F2hc) (Lymphocyte activation antigen 4F2 large subunit) (4F2 heavy chain antigen) (CD98 antigen)	P08195|4F2_HUMAN	57,929	19
Alcohol dehydrogenase [NADP+] (EC 1.1.1.2) (Aldehyde reductase) (Aldo-keto reductase family 1 member A1)	P14550|AK1A1_HUMAN	36,556	19
CTP synthase 1 (EC 6.3.4.2) (UTP--ammonia ligase 1) (CTP synthetase 1)	P17812|PYRG1_HUMAN	66,673	19
Phenylalanyl-tRNA synthetase alpha chain (EC 6.1.1.20) (Phenylalanine--tRNA ligase alpha chain) (PheRS) (CML33)	Q9Y285|SYFA_HUMAN	57,547	19
DNA-binding protein A (Cold shock domain-containing protein A) (Single-strand DNA-binding protein NF-GMB)	P16989|DBPA_HUMAN	40,071	19
Glucosamine--fructose-6-phosphate aminotransferase [isomerizing] 1 (EC 2.6.1.16) (Hexosephosphate aminotransferase 1) (D-fructose-6-phosphate amidotransferase 1) (GFAT 1) (GFAT1)	Q06210|GFPT1_HUMAN	78,790	19
26S proteasome non-ATPase regulatory subunit 7 (26S proteasome regulatory subunit rpn8) (26S proteasome regulatory subunit S12) (Proteasome subunit p40) (Mov34 protein homolog)	P51665|PSD7_HUMAN	37,008	19
Proteasome subunit alpha type 3 (EC 3.4.25.1) (Proteasome component C8) (Macropain subunit C8) (Multicatalytic endopeptidase complex subunit C8)	P25788|PSA3_HUMAN	28,416	19
Protein C14orf166	Q9Y224|CN166_HUMAN	28,051	19
Myotrophin (Protein V-1)	P58546|MTPN_HUMAN	12,877	19
Peroxiredoxin-4 (EC 1.11.1.15) (Prx-IV) (Thioredoxin peroxidase AO372) (Thioredoxin-dependent peroxide reductase A0372) (Antioxidant enzyme AOE372) (AOE37-2)	Q13162|PRDX4_HUMAN	30,523	19
40S ribosomal protein S27 (Metallopan-stimulin 1) (MPS-1)	P42677|RS27_HUMAN	9,443	19
Mannosyl-oligosaccharide glucosidase (EC 3.2.1.106) (Processing A-glucosidase I)	Q13724|GCS1_HUMAN	91,901	19
Myristoylated alanine-rich C-kinase substrate (MARCKS) (Protein kinase C substrate, 80 kDa protein, light chain) (PKCSL) (80K-L protein)	P29966|MARCS_HUMAN	31,536	19
Platelet-activating factor acetylhydrolase IB subunit alpha (PAF acetylhydrolase 45 kDa subunit) (PAF-AH 45 kDa subunit) (PAF-AH alpha) (PAFAH alpha) (Lissencephaly-1 protein) (LIS-1)	P43034|LIS1_HUMAN	46,619	19
Acyl-CoA-binding protein (ACBP) (Diazepam-binding inhibitor) (DBI) (Endozepine) (EP)	P07108|ACBP_HUMAN	10,027	19
Reticulon-1 (Neuroendocrine-specific protein)	Q16799|RTN1_HUMAN	83,602	19
General vesicular transport factor p115 (Transcytosis-associated protein) (TAP) (Vesicle docking protein)	O60763|VDP_HUMAN	107,880	18
Connective tissue growth factor precursor (Hypertrophic chondrocyte-specific protein 24)	P29279|CTGF_HUMAN	38,073	18

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Isoleucyl-tRNA synthetase, cytoplasmic (EC 6.1.1.5) (Isoleucine--tRNA ligase) (IleRS) (IRS)	P41252|SYIC_HUMAN	144,944	18
Tubulin-specific chaperone A (Tubulin-folding cofactor A) (CFA) (TCP1-chaperonin cofactor A)	O75347|TBCA_HUMAN	12,837	18
Protein LYRIC (Lysine-rich CEACAM1 co-isolated protein) (3D3/lyric) (Metastasis adhesion protein) (Metadherin) (Astrocyte elevated gene-1 protein) (AEG-1)	Q86UE4|LYRIC_HUMAN	63,820	18
Nucleobindin-1 precursor (CALNUC)	Q02818|NUCB1_HUMAN	53,862	18
Pleckstrin homology domain-containing family C member 1 (Kindlin-2) (Mitogen-inducible gene 2 protein) (Mig-2)	Q96AC1|PKHC1_HUMAN	77,846	18
Glyoxylate reductase/hydroxypyruvate reductase (EC 1.1.1.79)	Q9UBQ7|GRHPR_HUMAN	35,651	18
Tripeptidyl-peptidase 2 (EC 3.4.14.10) (Tripeptidyl-peptidase II) (TPP-II) (Tripeptidyl aminopeptidase)	P29144|TPP2_HUMAN	138,335	18
Tropomodulin-3 (Ubiquitous tropomodulin) (U-Tmod)	Q9NYL9|TMOD3_HUMAN	39,578	18
Nuclear protein Hcc-1 (Proliferation-associated cytokine-inducible protein CIP29) (Cytokine-induced protein of 29 kDa)	P82979|HCC1_HUMAN	23,653	18
Lon protease homolog, mitochondrial precursor (EC 3.4.21.-) (Lon protease-like protein) (LONP) (Mitochondrial ATP-dependent protease Lon) (LONHs) (Serine protease 15)	P36776|LONM_HUMAN	106,473	18
DNA-directed RNA polymerase II 140 kDa polypeptide (EC 2.7.7.6) (RNA polymerase II subunit 2) (RPB2)	P30876|RPB2_HUMAN	133,883	18
DnaJ homolog subfamily A member 1 (Heat shock 40 kDa protein 4) (DnaJ protein homolog 2) (HSJ-2) (HSDJ)	P31689|DNJA1_HUMAN	44,851	18
Apoptosis regulator BAX, membrane isoform alpha	Q07812|BAXA_HUMAN, Q07814|BAXB_HUMAN	21,167	18
Proteasome subunit beta type 8 precursor (EC 3.4.25.1) (Proteasome component C13) (Macropain subunit C13) (Multicatalytic endopeptidase complex subunit C13)	P28062|PSB8_HUMAN	30,337	18
S-adenosylmethionine synthetase isoform type-2 (EC 2.5.1.6) (Methionine adenosyltransferase 2) (AdoMet synthetase 2) (Methionine adenosyltransferase II) (MAT-II)	P31153|METK2_HUMAN	43,643	18
Cytosolic acyl coenzyme A thioester hydrolase (EC 3.1.2.2) (Long chain acyl-CoA thioester hydrolase) (CTE-II) (CTE-IIa) (Brain acyl-CoA hydrolase) (Acyl-CoA thioesterase 7)	O00154|BACH_HUMAN	41,777	18
Adipocyte-derived leucine aminopeptidase precursor (EC 3.4.11.-) (A-LAP) (ARTS-1) (Aminopeptidase PILS) (Puromycin-insensitive leucyl-specific aminopeptidase) (PILS-AP) (Type 1 tumor necrosis factor receptor shedding aminopeptidase regulator)	Q9NZ08|ARTS1_HUMAN	105,832	18
Protein S100-A10 (S100 calcium-binding protein A10) (Calpactin-1 light chain) (Calpactin I light chain) (p10 protein) (p11) (Cellular ligand of annexin II)	P60903|S10AA_HUMAN	11,186	18
Sorting nexin-3 (Protein SDP3)	O60493|SNX3_HUMAN	18,745	18
Fibulin-1 precursor	P23142|FBLN1_HUMAN	77,241	18
Arginine/serine-rich-splicing factor 10 (Transformer-2-beta) (HTRA2-beta) (Transformer 2 protein homolog)	P62995|TRA2B_HUMAN	33,649	18
Phosphate carrier protein, mitochondrial precursor (PTP) (Solute carrier family 25 member 3)	Q00325|MPCP_HUMAN	40,078	18

Protein Description	Accession Number	Molecular Weight	Total SpC
Macrophage migration inhibitory factor (MIF) (Phenylpyruvate tautomerase) (EC 5.3.2.1) (Glycosylation-inhibiting factor) (GIF)	P14174|MIF_HUMAN	12,459	18
Lipoma-preferred partner (LIM domain-containing preferred translocation partner in lipoma)	Q93052|LPP_HUMAN	65,728	17
Vacuolar ATP synthase subunit B, brain isoform (EC 3.6.3.14) (V-ATPase B2 subunit) (Vacuolar proton pump B isoform 2) (Endomembrane proton pump 58 kDa subunit) (HO57)	P21281|VATB2_HUMAN	56,484	17
AP-2 complex subunit mu-1 (Adaptin mu-1) (AP-2 mu-2 chain) (Clathrin coat assembly protein AP50) (Clathrin coat-associated protein AP50) (Plasma membrane adaptor AP-2 50 kDa protein) (HA2 50 kDa subunit) (Clathrin assembly protein complex 2 medium chain)	Q96CW1|AP2M1_HUMAN	49,638	17
Phosphoglucomutase-2 (EC 5.4.2.2) (Glucose phosphomutase 2) (PGM 2)	Q96G03|PGM2_HUMAN	68,268	17
Stomatin-like protein 2 (SLP-2) (EPB72-like 2)	Q9UJZ1|STML2_HUMAN	38,517	17
Exportin-2 (Exp2) (Importin-alpha re-exporter) (Chromosome segregation 1-like protein) (Cellular apoptosis susceptibility protein)	P55060|XPO2_HUMAN	110,404	17
ATPase family AAA domain-containing protein 3A	Q9NVI7|ATD3A_HUMAN	71,352	17
Phospholipase A-2-activating protein (PLAP) (PLA2P)	Q9Y263|PLAP_HUMAN	87,141	17
Nucleolar protein NOP5 (Nucleolar protein 5) (NOP58)	Q9Y2X3|NOP5_HUMAN	59,562	17
Ubiquitin-conjugating enzyme E2 N (EC 6.3.2.19) (Ubiquitin-protein ligase N) (Ubiquitin carrier protein N) (Ubc13) (Bendless-like ubiquitin-conjugating enzyme)	P61088|UBE2N_HUMAN	17,121	17
Junction plakoglobin (Desmoplakin-3) (Desmoplakin III)	P14923|PLAK_HUMAN	81,613	17
Long-chain-fatty-acid--CoA ligase 3 (EC 6.2.1.3) (Long-chain acyl-CoA synthetase 3) (LACS 3)	O95573|ACSL3_HUMAN	80,405	17
Myosin-Ib (Myosin I alpha) (MMI-alpha) (MMIa) (MYH-1c)	O43795|MYO1B_HUMAN	131,973	17
Vesicle-trafficking protein SEC22b (SEC22 vesicle-trafficking protein homolog B) (SEC22 vesicle-trafficking protein-like 1) (ERS24) (ERS-24)	O75396|SC22B_HUMAN	24,723	17
SPARC precursor (Secreted protein acidic and rich in cysteine) (Osteonectin) (ON) (Basement-membrane protein 40) (BM-40)	P09486|SPRC_HUMAN	34,614	17
60S ribosomal protein L35	P42766|RL35_HUMAN	14,535	17
DNA topoisomerase 1 (EC 5.99.1.2) (DNA topoisomerase I)	P11387|TOP1_HUMAN	90,712	17
Nuclear protein localization protein 4 homolog (Protein NPL4)	Q8TAT6|NPL4_HUMAN	68,103	17
Histidyl-tRNA synthetase, cytoplasmic (EC 6.1.1.21) (Histidine--tRNA ligase) (HisRS)	P12081|SYHC_HUMAN	57,395	17
Splicing factor, arginine/serine-rich 3 (Pre-mRNA-splicing factor SRP20)	P84103|SFRS3_HUMAN	19,312	17
CD109 antigen precursor (p180) (150 KDa TGF-beta-1-binding protein) (r150) (Platelet-specific Gov antigen)	Q6YHK3|CD109_HUMAN	161,674	17
Four and a half LIM domains protein 1 (FHL-1) (Skeletal muscle LIM-protein 1) (SLIM 1) (SLIM)	Q13642|FHL1_HUMAN	36,244	17
Coactosin-like protein	Q14019|COTL1_HUMAN	15,927	17

Protein Description	Accession Number	Molecular Weight	Total SpC
UV excision repair protein RAD23 homolog B (hHR23B) (XP-C repair-complementing complex 58 kDa protein) (p58)	P54727|RD23B_HUMAN	43,153	17
ATP synthase O subunit, mitochondrial precursor (EC 3.6.3.14) (Oligomycin sensitivity conferral protein) (OSCP)	P48047|ATPO_HUMAN	23,259	17
Dolichyl-diphosphooligosaccharide--protein glycosyltransferase 48 kDa subunit precursor (EC 2.4.1.119) (Oligosaccharyl transferase 48 kDa subunit) (DDOST 48 kDa subunit)	P39656|OST48_HUMAN	48,793	17
B-cell receptor-associated protein 31 (BCR-associated protein Bap31) (p28 Bap31) (Protein CDM) (6C6-AG tumor-associated antigen)	P51572|BAP31_HUMAN	27,975	17
Putative quinone oxidoreductase (EC 1.-.-.-) (Tumor protein p53-inducible protein 3) (p53-induced protein 3)	Q53FA7|QORX_HUMAN	35,519	17
Granulins precursor (Proepithelin) (PEPI) [Contains: Acrogranin; Paragranulin; Granulin-1 (Granulin G); Granulin-2 (Granulin F); Granulin-3 (Granulin B); Granulin-4 (Granulin A); Granulin-5 (Granulin C); Granulin-6 (Granulin D); Granulin-7 (Granulin E)]	P28799|GRN_HUMAN	63,522	17
Aspartyl/asparaginyl beta-hydroxylase (EC 1.14.11.16) (Aspartate beta-hydroxylase) (ASP beta-hydroxylase) (Peptide-aspartate beta-dioxygenase)	Q12797|ASPH_HUMAN	85,873	17
40S ribosomal protein S23	P62266|RS23_HUMAN	15,790	17
Flavin reductase (EC 1.5.1.30) (FR) (NADPH-dependent diaphorase) (NADPH-flavin reductase) (FLR) (Biliverdin reductase B) (EC 1.3.1.24) (BVR-B) (Biliverdin-IX beta-reductase) (Green heme-binding protein) (GHBP)	P30043|BLVRB_HUMAN	22,101	17
Eukaryotic translation initiation factor 1A, X-chromosomal (eIF-1A X isoform) (eIF-4C)	P47813|IF1AX_HUMAN	16,443	17
Ras-related protein Rap-1b precursor (GTP-binding protein smg p21B)	P61224|RAP1B_HUMAN	20,807	17
Acetyl-CoA acetyltransferase, cytosolic (EC 2.3.1.9) (Cytosolic acetoacetyl-CoA thiolase) (Acetyl CoA transferase-like protein)	Q9BWD1|THIC_HUMAN	41,332	16
Dipeptidyl-peptidase 3 (EC 3.4.14.4) (Dipeptidyl-peptidase III) (DPP III) (Dipeptidyl aminopeptidase III) (Dipeptidyl arylamidase III)	Q9NY33|DPP3_HUMAN	82,574	16
Zinc finger protein 185 (LIM domain protein ZNF185) (P1-A)	O15231|ZN185_HUMAN	49,169	16
Annexin A4 (Annexin IV) (Lipocortin IV) (Endonexin I) (Chromobindin-4) (Protein II) (P32.5) (Placental anticoagulant protein II) (PAP-II) (PP4-X) (35-beta calcimedin) (Carbohydrate-binding protein P33/P41) (P33/41)	P09525|ANXA4_HUMAN	35,866	16
Tumor protein D54 (hD54) (Tumor protein D52-like 2)	O43399|TPD54_HUMAN	22,220	16
Uncharacterized protein C17orf25	Q9HC38|CQ025_HUMAN	34,776	16
Eukaryotic translation initiation factor 2 subunit 3 (Eukaryotic translation initiation factor 2 subunit gamma) (eIF-2-gamma)	P41091|IF2G_HUMAN	51,092	16
Interleukin enhancer-binding factor 2 (Nuclear factor of activated T-cells 45 kDa)	Q12905|ILF2_HUMAN	43,045	16
Calpain small subunit 1 (CSS1) (Calcium-dependent protease small subunit 1) (Calcium-dependent protease small subunit) (CDPS) (Calpain regulatory subunit) (Calcium-activated neutral proteinase small subunit) (CANP small subunit)	P04632|CPNS1_HUMAN	28,299	16

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Putative RNA-binding protein Luc7-like 2	Q9Y383|LC7L2_HUMAN	46,497	16
Histidine triad nucleotide-binding protein 1 (Adenosine 5′-monophosphoramidase) (Protein kinase C inhibitor 1) (Protein kinase C-interacting protein 1) (PKCI-1)	P49773|HINT1_HUMAN	13,784	16
Protein diaphanous homolog 1 (Diaphanous-related formin-1) (DRF1)	O60610|DIAP1_HUMAN	138,966	16
CD2-associated protein (Cas ligand with multiple SH3 domains) (Adapter protein CMS)	Q9Y5K6|CD2AP_HUMAN	71,436	16
Testin (TESS)	Q9UGI8|TES_HUMAN	47,978	16
Selenide, water dikinase 1 (EC 2.7.9.3) (Selenophosphate synthetase 1) (Selenium donor protein 1)	P49903|SPS1_HUMAN	42,893	16
Cell division cycle 5-like protein (Cdc5-like protein) (Pombe cdc5-related protein)	Q99459|CDC5L_HUMAN	92,236	16
Phosphatidylinositol transfer protein beta isoform (PtdIns transfer protein beta) (PtdInsTP) (PI-TP-beta)	P48739|PIPNB_HUMAN	31,522	16
Peroxiredoxin-5, mitochondrial precursor (EC 1.11.1.15) (Prx-V) (Peroxisomal antioxidant enzyme) (PLP) (Thioredoxin reductase) (Thioredoxin peroxidase PMP20) (Antioxidant enzyme B166) (AOEB166) (TPx type VI) (Liver tissue 2D-page spot 71B) (Alu corepressor 1)	P30044|PRDX5_HUMAN	22,008	16
Heterogeneous nuclear ribonucleoprotein A0 (hnRNP A0)	Q13151|ROA0_HUMAN	30,823	16
Nuclear pore complex protein Nup93 (Nucleoporin Nup93) (93 kDa nucleoporin)	Q8N1F7|NUP93_HUMAN	93,473	16
Rho-associated protein kinase 2 (EC 2.7.11.1) (Rho-associated, coiled-coil-containing protein kinase 2) (p164 ROCK-2) (Rho kinase 2)	O75116|ROCK2_HUMAN	160,901	16
Ribonucleoside-diphosphate reductase large subunit (EC 1.17.4.1) (Ribonucleoside-diphosphate reductase M1 subunit) (Ribonucleotide reductase large chain)	P23921|RIR1_HUMAN	90,056	16
Serine/threonine-protein kinase 10 (EC 2.7.11.1) (Lymphocyte-oriented kinase)	O94804|STK10_HUMAN	112,120	16
Thioredoxin-like protein 2 (PKC-interacting cousin of thioredoxin) (PKC-theta-interacting protein) (PKCq-interacting protein)	O76003|TXNL2_HU MAN	37,415	16
Lactoylglutathione lyase (EC 4.4.1.5) (Methylglyoxalase) (Aldoketomutase) (Glyoxalase I) (Glx I) (Ketone-aldehyde mutase) (S-D-lactoylglutathione methylglyoxal lyase)	Q04760|LGUL_HUMAN	20,761	16
MARCKS-related protein (MARCKS-like protein 1) (Macrophage myristoylated alanine-rich C kinase substrate) (Mac-MARCKS) (MacMARCKS)	P49006|MRP_HUMAN	19,511	16
Sec1 family domain-containing protein 1 (Syntaxin-binding protein 1-like 2) (Sly1p)	Q8WVM8|SCFD1_HUMAN	72,364	16
40S ribosomal protein S4, Y isoform 1	P22090|RS4Y1_HUMAN	29,438	16
NMDA receptor-regulated protein 1 (N-terminal acetyltransferase) (Protein tubedown-1) (Tbdn100) (Gastric cancer antigen Ga19)	Q9BXJ9|NARG1_HUMAN	101,260	16
Polyadenylate-binding protein 4 (Poly(A)-binding protein 4) (PABP 4) (Inducible poly(A)-binding protein) (iPABP) (Activated-platelet protein 1) (APP-1)	Q13310|PABP4_HUMAN	70,766	16
Interferon-induced guanylate-binding protein 2 (GTP-binding protein 2) (Guanine nucleotide-binding protein 2) (GBP-2) (HuGBP-2)	P32456|GBP2_HUMAN	67,167	16
Ras-related protein Rab-11B (GTP-binding protein YPT3)	P62491|RB11A_HUMAN, Q15907|RB11B_HUMAN	24,471	16

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Alpha-soluble NSF attachment protein (SNAP-alpha) (N-ethylmaleimide-sensitive factor attachment protein, alpha)	P54920|SNAA_HUMAN	33,216	16
Integrin alpha-V precursor (Vitronectin receptor subunit alpha) (CD51 antigen) [Contains: Integrin alpha-V heavy chain; Integrin alpha-V light chain]	P06756|ITAV_HUMAN	116,037	16
N-acetylglucosamine-6-sulfatase precursor (EC 3.1.6.14) (G6S) (Glucosamine-6-sulfatase)	P15586|GNS_HUMAN	62,066	16
Cytochrome c oxidase subunit 5A, mitochondrial precursor (EC 1.9.3.1) (Cytochrome c oxidase polypeptide Va)	P20674|COX5A_HUMAN	16,757	16
Heterogeneous nuclear ribonucleoprotein A/B (hnRNP A/B) (APOBEC-1-binding protein 1) (ABBP-1)	Q99729|ROAA_HUMAN	36,595	16
Basigin precursor (Leukocyte activation antigen M6) (Collagenase stimulatory factor) (Extracellular matrix metalloproteinase inducer) (EMMPRIN) (5F7) (Tumor cell-derived collagenase stimulatory factor) (TCSF) (OK blood group antigen) (CD147 antigen)	P35613|BASI_HUMAN	42,182	16
Coiled-coil domain-containing protein 50 (Protein Ymer)	Q8IVM0|CCD50_HUMAN	35,804	16
Protein S100-A6 (S100 calcium-binding protein A6) (Calcyclin) (Prolactin receptor-associated protein) (PRA) (Growth factor-inducible protein 2A9) (MLN 4)	P06703|S10A6_HUMAN	10,162	16
40S ribosomal protein S29	P62273|RS29_HUMAN	6,659	16
Nucleoside diphosphate kinase A (EC 2.7.4.6) (NDK A) (NDP kinase A) (Tumor metastatic process-associated protein) (Metastasis inhibition factor nm23) (nm23-H1) (Granzyme A-activated DNase) (GAAD)	P15531|NDKA_HUMAN	17,131	16
Nucleosome assembly protein 1-like 4 (Nucleosome assembly protein 2) (NAP2)	Q99733|NP1L4_HUMAN	42,806	15
Annexin A11 (Annexin XI) (Calcyclin-associated annexin 50) (CAP-50) (56 kDa autoantigen)	P50995|ANX11_HUMAN	54,374	15
RNA-binding protein Raly (hnRNP associated with lethal yellow homolog) (Autoantigen p542)	Q9UKM9|RALY_HUMAN	32,446	15
Eukaryotic translation initiation factor 3 subunit 6-interacting protein	Q9Y262|IF3I_HUMAN	66,711	15
Acyl-coenzyme A thioesterase 9 (EC 3.1.2.-) (Acyl-CoA thioesterase 9) (Acyl-CoA thioester hydrolase 9)	Q9Y305|ACOT9_HUMAN	46,337	15
SUMO-activating enzyme subunit 2 (EC 6.3.2.-) (Ubiquitin-like 1-activating enzyme E1B) (Anthracycline-associated resistance ARX)	Q9UBT2|SAE2_HUMAN	71,207	15
Glycogen phosphorylase, liver form (EC 2.4.1.1)	P06737|PYGL_HUMAN	97,134	15
Splicing factor, arginine/serine-rich 7 (Splicing factor 9G8)	Q16629|SFRS7_HUMAN	27,350	15
Nucleolar protein Nop56 (Nucleolar protein 5A)	O00567|NOP56_HUMAN	66,034	15
FK506-binding protein 10 precursor (EC 5.2.1.8) (Peptidyl-prolyl cis-trans isomerase) (PPIase) (Rotamase) (65 kDa FK506-binding protein) (FKBP65) (Immunophilin FKBP65)	Q96AY3|FKB10_HUMAN	64,228	15
Pyruvate dehydrogenase E1 component alpha subunit, somatic form, mitochondrial precursor (EC 1.2.4.1) (PDHE1-A type I)	P08559|ODPA_HUMAN	43,279	15
Adenylosuccinate lyase (EC 4.3.2.2) (Adenylosuccinase) (ASL) (ASASE)	P30566|PUR8_HUMAN	54,873	15

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Serum deprivation-response protein (Phosphatidylserine-binding protein) (PS-p68)	O95810|SDPR_HUMAN	47,155	15
Suppressor of G2 allele of SKP1 homolog (Sgt1) (Putative 40-6-3 protein)	Q9Y2Z0|SUGT1_HUMAN	41,007	15
H/ACA ribonucleoprotein complex subunit 4 (EC 5.4.99.-) (Dyskerin) (Nucleolar protein family A member 4) (snoRNP protein DKC1) (Nopp140-associated protein of 57 kDa) (Nucleolar protein NAP57) (CBF5 homolog)	O60832|DKC1_HUMAN	57,657	15
Uroporphyrinogen decarboxylase (EC 4.1.1.37) (URO-D) (UPD)	P06132|DCUP_HUMAN	40,769	15
Deoxyuridine 5′-triphosphate nucleotidohydrolase, mitochondrial precursor (EC 3.6.1.23) (dUTPase) (dUTP pyrophosphatase)	P33316|DUT_HUMAN	26,689	15
Small nuclear ribonucleoprotein Sm D3 (snRNP core protein D3) (Sm-D3)	P62318|SMD3_HUMAN	13,899	15
Serine/threonine-protein kinase MRCK beta (EC 2.7.11.1) (CDC42-binding protein kinase beta) (Myotonic dystrophy kinase-related CDC42-binding kinase beta) (Myotonic dystrophy protein kinase-like beta) (MRCK beta) (DMPK-like beta)	Q9Y5S2|MRCKB_HUMAN	194,300	15
Mitochondrial precursor proteins import receptor (Translocase of outer membrane TOM70)	O94826|TOM70_HUMAN	67,439	15
Shwachman-Bodian-Diamond syndrome protein	Q9Y3A5|SBDS_HUMAN	28,746	15
Dihydrolipoyllysine-residue succinyltransferase component of 2-oxoglutarate dehydrogenase complex, mitochondrial precursor (EC 2.3.1.61) (Dihydrolipoamide succinyltransferase component of 2-oxoglutarate dehydrogenase complex) (E2) (E2K)	P36957|ODO2_HUMAN	48,622	15
Glutathione transferase omega-1 (EC 2.5.1.18) (GSTO 1-1)	P78417|GSTO1_HUMAN	27,549	15
MIR-interacting saposin-like protein precursor (Transmembrane protein 4) (Putative secreted protein ZSIG9)	Q9Y2B0|MSAP_HUMAN	20,635	15
RRP5 protein homolog (Programmed cell death protein 11)	Q14690|RRP5_HUMAN	208,719	15
Succinyl-CoA ligase [GDP-forming] beta-chain, mitochondrial precursor (EC 6.2.1.4) (Succinyl-CoA synthetase, betaG chain) (SCS-betaG) (GTP-specific succinyl-CoA synthetase subunit beta)	Q96I99|SUCB2_HUMAN	46,494	15
Eukaryotic translation initiation factor 4H (eIF-4H) (Williams-Beuren syndrome chromosome region 1 protein)	Q15056|IF4H_HUMAN	27,368	15
Spermine synthase (EC 2.5.1.22) (Spermidine aminopropyltransferase) (SPMSY)	P52788|SPSY_HUMAN	41,252	15
Proteasome subunit beta type 5 precursor (EC 3.4.25.1) (Proteasome epsilon chain) (Macropain epsilon chain) (Multicatalytic endopeptidase complex epsilon chain) (Proteasome subunit X) (Proteasome chain 6) (Proteasome subunit MB1)	P28074|PSB5_HUMAN	22,879	15
S-phase kinase-associated protein 1A (Cyclin A/CDK2-associated protein p19) (p19A) (p19skp1) (RNA polymerase II elongation factor-like protein) (Organ of Corti protein 2) (OCP-II protein) (OCP-2) (Transcription elongation factor B) (SIII)	P63208|SKP1_HUMAN	18,640	15
KH domain-containing, RNA-binding, signal transduction-associated protein 1 (p21 Ras GTPase-activating protein-associated p62) (GAP-associated tyrosine phosphoprotein p62) (Src-associated in mitosis 68 kDa protein) (Sam68) (p68)	Q07666|SAM68_HUMAN	48,210	15
Ras-related protein Rab-1A (YPT1-related protein)	P62820|RAB1A_HUMAN	22,661	15
Thioredoxin-like protein 5 (14 kDa thioredoxin-related protein) (TRP14) (Protein 42-9-9)	Q9BRA2|TXNL5_HUMAN	13,922	15

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Proline synthetase co-transcribed bacterial homolog protein	O94903|PROSC_HUMAN	30,326	15
Vesicle-associated membrane protein-associated protein A (VAMP-associated protein A) (VAMP-A) (VAP-A) (33 kDa Vamp-associated protein) (VAP-33)	Q9P0L0|VAPA_HUMAN	27,876	15
Calcyclin-binding protein (CacyBP) (hCacyBP) (Siah-interacting protein) (S100A6-binding protein)	Q9HB71|CYBP_HUMAN	26,192	15
Microtubule-associated protein RP/EB family member 2 (APC-binding protein EB2) (End-binding protein 2) (EB2)	Q15555|MARE2_HUMAN	37,014	15
Dolichyl-diphosphooligosaccharide--protein glycosyltransferase 63 kDa subunit precursor (EC 2.4.1.119) (Ribophorin II) (RPN-II) (RIBIIR)	P04844|RIB2_HUMAN	69,267	15
60S ribosomal protein L36a (60S ribosomal protein L44) (Cell migration-inducing gene 6 protein)	P83881|RL36A_HUMAN	12,423	15
ADAMTS-1 precursor (EC 3.4.24.-) (A disintegrin and metalloproteinase with thrombospondin motifs 1) (ADAM-TS 1) (ADAM-TS1) (METH-1)	Q9UHI8|ATS1_HUMAN	105,340	15
Fibrillin-1 precursor	P35555|FBN1_HUMAN	312,283	15
Probable ATP-dependent RNA helicase DDX58 (EC 3.6.1.-) (DEAD-box protein 58) (Retinoic acid-inducible gene 1 protein) (RIG-1) (RIG-I)	O95786|DDX58_HUMAN	106,586	15
ADP-ribosylation factor 4	P18085|ARF4_HUMAN, P61204|ARF3_HUMAN, P84077|ARF1_HUMAN	20,494	15
Insulin-degrading enzyme (EC 3.4.24.56) (Insulysin) (Insulinase) (Insulin protease)	P14735|IDE_HUMAN	118,009	15
NADP-dependent leukotriene B4 12-hydroxydehydrogenase (EC 1.3.1.74) (15-oxoprostaglandin 13-reductase) (EC 1.3.1.48)	Q14914|LTB4D_HUMAN	35,853	14
DNA replication licensing factor MCM4 (CDC21 homolog) (P1-CDC21)	P33991|MCM4_HUMAN	96,543	14
Vesicle-fusing ATPase (EC 3.6.4.6) (Vesicular-fusion protein NSF) (N-ethylmaleimide sensitive fusion protein) (NEM-sensitive fusion protein)	P46459|NSF_HUMAN	82,545	14
Eukaryotic translation initiation factor 4 gamma 2 (eIF-4-gamma 2) (eIF-4G 2) (eIF4G 2) (p97) (Death-associated protein 5) (DAP-5)	P78344|IF4G2_HUMAN	102,349	14
NADPH:adrenodoxin oxidoreductase, mitochondrial precursor (EC 1.18.1.2) (Adrenodoxin reductase) (AR) (Ferredoxin reductase) (Ferredoxin--NADP(+) reductase)	P22570|ADRO_HUMAN	53,819	14
TAR DNA-binding protein 43 (TDP-43)	Q13148|TADBP_HUMAN	44,722	14
GMP synthase [glutamine-hydrolyzing] (EC 6.3.5.2) (Glutamine amidotransferase) (GMP synthetase)	P49915|GUAA_HUMAN	76,699	14
4-trimethylaminobutyraldehyde dehydrogenase (EC 1.2.1.47) (TMABADH) (Aldehyde dehydrogenase 9A1) (EC 1.2.1.3) (Aldehyde dehydrogenase E3 isozyme) (Gamma-aminobutyraldehyde dehydrogenase) (EC 1.2.1.19) (R-aminobutyraldehyde dehydrogenase)	P49189|AL9A1_HUMAN	53,784	14
Alcohol dehydrogenase class 3 chi chain (EC 1.1.1.1) (Alcohol dehydrogenase class III chi chain) (S-(hydroxymethyl)glutathione dehydrogenase) (EC 1.1.1.284) (Glutathione-dependent formaldehyde dehydrogenase) (FDH)	P11766|ADHX_HUMAN	39,706	14
Tubulin beta-2A chain	Q13885|TBB2A_HUMAN	49,889	14
Pre-mRNA-processing-splicing factor 8 (Splicing factor Prp8) (PRP8 homolog) (220 kDa U5 snRNP-specific protein) (p220)	Q6P2Q9|PRP8_HUMAN	273,591	14

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Serine/threonine-protein phosphatase 2A catalytic subunit alpha isoform (EC 3.1.3.16) (PP2A-alpha) (Replication protein C) (RP-C)	P67775|PP2AA_HUMAN	35,577	14
Thyroid hormone receptor-associated protein 3 (Thyroid hormone receptor-associated protein complex 150 kDa component) (Trap150)	Q9Y2W1|TR150_HUMAN	108,651	14
Apoptotic chromatin condensation inducer in the nucleus (Acinus)	Q9UKV3|ACINU_HUMAN	151,870	14
COP9 signalosome complex subunit 2 (Signalosome subunit 2) (SGN2) (JAB1-containing signalosome subunit 2) (Thyroid receptor-interacting protein 15) (TRIP-15) (Alien homolog)	P61201|CSN2_HUMAN	51,582	14
GPI-anchored membrane protein 1 (GPI-anchored protein p137) (p137GPI) (Membrane component chromosome 11 surface marker 1)	Q14444|GPIA1_HUMAN	72,732	14
Cytoplasmic FMR1-interacting protein 1 (Specifically Rac1-associated protein 1) (Sra-1) (p140sra-1)	Q7L576|CYFP1_HUMAN	145,169	14
Sorcin (22 kDa protein) (CP-22) (V19)	P30626|SORCN_HUMAN	21,659	14
14 kDa phosphohistidine phosphatase (EC 3.1.3.-) (Phosphohistidine phosphatase 1) (Protein janus-A homolog)	Q9NRX4|PHP14_HUMAN	13,815	14
Aminopeptidase B (EC 3.4.11.6) (Ap-B) (Arginyl aminopeptidase) (Arginine aminopeptidase)	Q9H4A4|AMPB_HUMAN	72,579	14
COP9 signalosome complex subunit 4 (Signalosome subunit 4) (SGN4) (JAB1-containing signalosome subunit 4)	Q9BT78|CSN4_HUMAN	46,252	14
Twinfilin-1 (Protein A6) (Protein tyrosine kinase 9)	Q12792|TWF1_HUMAN	42,192	14
Clathrin light chain A (Lca)	P09496|CLCA_HUMAN	27,059	14
Mitogen-activated protein kinase 1 (EC 2.7.11.24) (Extracellular signal-regulated kinase 2) (ERK-2) (Mitogen-activated protein kinase 2) (MAP kinase 2) (MAPK 2) (p42-MAPK) (ERT1)	P28482|MK01_HUMAN	41,374	14
DnaJ homolog subfamily C member 13 (Required for receptor-mediated endocytosis 8)	O75165|DNJCD_HUMAN	254,410	14
N-terminal acetyltransferase complex ARD1 subunit homolog A (EC 2.3.1.88) (EC 2.3.1.-)	P41227|ARD1H_HUMAN	26,441	14
NEDD8-activating enzyme E1 catalytic subunit (EC 6.3.2.-) (Ubiquitin-activating enzyme 3) (NEDD8-activating enzyme E1C) (Ubiquitin-activating enzyme E1C)	Q8TBC4|UBA3_HUMAN	51,835	14
Pirin	O00625|PIR_HUMAN	32,096	14
Low molecular weight phosphotyrosine protein phosphatase (EC 3.1.3.48) (LMW-PTPase) (LMW-PTP) (Low molecular weight cytosolic acid phosphatase) (EC 3.1.3.2) (Red cell acid phosphatase 1) (Adipocyte acid phosphatase)	P24666|PPAC_HUMAN	18,025	14
Copine-3 (Copine III)	O75131|CPNE3_HUMAN	60,114	14
Programmed cell death protein 5 (Protein TFAR19) (TF-1 cell apoptosis-related gene 19 protein)	O14737|PDCD5_HUMAN	14,267	14
26S proteasome non-ATPase regulatory subunit 14 (26S proteasome regulatory subunit rpn11) (26S proteasome-associated PAD1 homolog 1)	O00487|PSDE_HUMAN	34,559	14
Plasminogen activator inhibitor 1 RNA-binding protein (PAI1 RNA-binding protein 1) (PAI-RBP1) (SERPINE1 mRNA-binding protein 1)	Q8NC51|PAIRB_HUMAN	44,948	14
Keratin, type I cytoskeletal 10 (Cytokeratin-10) (CK-10) (Keratin-10) (K10)	P13645|K1C10_HUMAN	59,502	14

Protein Description	Accession Number	Molecular Weight	Total SpC
Insulin-like growth factor-binding protein 7 precursor (IGFBP-7) (IBP-7) (IGF-binding protein 7) (MAC25 protein) (Prostacyclin-stimulating factor) (PGI2-stimulating factor) (IGFBP-rP1)	Q16270|IBP7_HUMAN	29,112	14
Interferon-induced, double-stranded RNA-activated protein kinase (EC 2.7.11.1) (Interferon-inducible RNA-dependent protein kinase) (Eukaryotic translation initiation factor 2-alpha kinase 2) (eIF-2A protein kinase 2) (Protein kinase RNA-activated) (PKR) (p68 kinase) (P1/eIF-2A protein kinase)	P19525|E2AK2_HUMAN	62,079	14
Signal recognition particle 72 kDa protein (SRP72)	O76094|SRP72_HUMAN	74,590	14
Uncharacterized protein C19orf10 precursor (Stromal cell-derived growth factor SF20) (Interleukin-25) (IL-25)	Q969H8|CS010_HUMAN	18,777	14
Tripartite motif-containing protein 16 (Estrogen-responsive B box protein)	O95361|TRI16_HUMAN	63,979	14
Serine/threonine-protein phosphatase 2A 55 kDa regulatory subunit B alpha isoform (PP2A, subunit B, B-alpha isoform) (PP2A, subunit B, B55-alpha isoform) (PP2A, subunit B, PR55-alpha isoform) (PP2A, subunit B, R2-alpha isoform)	P63151|2ABA_HUMAN	51,675	14
Crk-like protein	P46109|CRKL_HUMAN	33,759	14
Hematological and neurological expressed 1 protein (Androgen-regulated protein 2)	Q9UK76|HN1_HUMAN	15,997	14
Spermidine synthase (EC 2.5.1.16) (Putrescine aminopropyltransferase) (SPDSY)	P19623|SPEE_HUMAN	33,806	14
Small nuclear ribonucleoprotein Sm D1 (snRNP core protein D1) (Sm-D1) (Sm-D autoantigen)	P62314|SMD1_HUMAN	13,264	14
Podocalyxin-like protein 1 precursor	O00592|PODXL_HUMAN	55,578	14
Plastin-2 (L-plastin) (Lymphocyte cytosolic protein 1) (LCP-1) (LC64P)	P13796|PLSL_HUMAN	70,274	14
182 kDa tankyrase 1-binding protein	Q9C0C2|TB182_HUMAN	181,763	13
Utrophin (Dystrophin-related protein 1) (DRP1) (DRP)	P46939|UTRO_HUMAN	394,477	13
Plasma membrane calcium-transporting ATPase 4 (EC 3.6.3.8) (PMCA4) (Plasma membrane calcium pump isoform 4) (Plasma membrane calcium ATPase isoform 4) (Matrix-remodelling-associated protein 1)	P23634|AT2B4_HUMAN	137,906	13
Alkyldihydroxyacetonephosphate synthase, peroxisomal precursor (EC 2.5.1.26) (Alkyl-DHAP synthase) (Alkylglycerone-phosphate synthase) (Aging-associated gene 5 protein)	O00116|ADAS_HUMAN	72,895	13
Aldehyde dehydrogenase family 7 member A1 (EC 1.2.1.3) (Antiquitin-1)	P49419|AL7A1_HUMAN	55,349	13
Heme oxygenase 1 (EC 1.14.99.3) (HO-1)	P09601|HMOX1_HUMAN	32,801	13
Signal recognition particle 68 kDa protein (SRP68)	Q9UHB9|SRP68_HUMAN	70,714	13
Bcl-2-associated transcription factor 1 (Btf)	Q9NYF8|BCLF1_HUMAN	106,107	13
Complement component C1q receptor precursor (Complement component 1 q subcomponent receptor 1) (C1qR) (C1qRp) (C1qR(p)) (C1q/MBL/SPA receptor) (Matrix-remodelling-associated protein 4) (CD93 antigen) (CDw93)	Q9NPY3|C1QR1_HUMAN	68,541	13
Leucine-rich repeat-containing protein 47	Q8N1G4|LRC47_HUMAN	63,457	13
N-acetylglucosamine kinase (EC 2.7.1.59) (GlcNAc kinase)	Q9UJ70|NAGK_HUMAN	37,359	13

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Ribosomal L1 domain-containing protein 1 (Cellular senescence-inhibited gene protein) (Protein PBK1) (CATX-11)	O76021|RL1D1_HUMAN	54,957	13
Histone H2A.Z (H2A/z)	P0C0S5|H2AZ_HUMAN, Q71UI9|H2AV_HUMAN	13,535	13
Voltage-dependent anion-selective channel protein 3 (VDAC-3) (hVDAC3) (Outer mitochondrial membrane protein porin 3)	Q9Y277|VDAC3_HUMAN	30,642	13
Disabled homolog 2 (Differentially expressed protein 2) (DOC-2)	P98082|DAB2_HUMAN	82,490	13
cAMP-dependent protein kinase type II-alpha regulatory subunit	P13861|KAP2_HUMAN	45,501	13
UPF0318 protein FAM120A	Q9NZB2|F120A_HUMAN	116,684	13
LIM and senescent cell antigen-like-containing domain protein 1 (Particularly interesting new Cys-His protein 1) (PINCH-1) (Renal carcinoma antigen NY-REN-48)	P48059|LIMS1_HUMAN	37,233	13
PRKC apoptosis WT1 regulator protein (Prostate apoptosis response 4 protein) (Par-4)	Q96IZ0|PAWR_HUMAN	36,550	13
Uncharacterized protein KIAA1949	Q6NYC8|K1949_HUMAN	67,925	13
Protein phosphatase 1 regulatory subunit 12A (Myosin phosphatase-targeting subunit 1) (Myosin phosphatase target subunit 1) (Protein phosphatase myosin-binding subunit)	O14974|MYPT1_HUMAN	115,265	13
Mitotic checkpoint protein BUB3	O43684|BUB3_HUMAN	37,137	13
Serine/arginine repetitive matrix protein 2 (Serine/arginine-rich splicing factor-related nuclear matrix protein of 300 kDa) (Ser/Arg-related nuclear matrix protein) (SR-related nuclear matrix protein of 300 kDa) (Splicing coactivator subunit SRm300) (300 kDa nuclear matrix antigen)	Q9UQ35|SRRM2_HUMAN	299,604	13
Importin alpha-2 subunit (Karyopherin alpha-2 subunit) (SRP1-alpha) (RAG cohort protein 1)	P52292|IMA2_HUMAN	57,845	13
60S ribosomal protein L28	P46779|RL28_HUMAN	15,730	13
Rho-related GTP-binding protein RhoG precursor	P84095|RHOG_HUMAN	21,290	13
Adenine phosphoribosyltransferase (EC 2.4.2.7) (APRT)	P07741|APT_HUMAN	19,591	13
Proteasome activator complex subunit 3 (Proteasome activator 28-gamma subunit) (PA28gamma) (PA28g) (Activator of multicatalytic protease subunit 3) (11S regulator complex subunit gamma) (REG-gamma) (Ki nuclear autoantigen)	P61289|PSME3_HUMAN	29,489	13
Ras-related protein Rab-2A	P61019|RAB2A_HUMAN	23,528	13
Ornithine aminotransferase, mitochondrial precursor (EC 2.6.1.13) (Ornithine--oxo-acid aminotransferase) [Contains: Ornithine aminotransferase, hepatic form; Ornithine aminotransferase, renal form]	P04181|OAT_HUMAN	48,518	13
Farnesyl pyrophosphate synthetase (FPP synthetase) (FPS) (Farnesyl diphosphate synthetase) [Includes: Dimethylallyltranstransferase (EC 2.5.1.1); Geranyltranstransferase (EC 2.5.1.10)]	P14324|FPPS_HUMAN	40,516	13
Thioredoxin domain-containing protein 4 precursor (Endoplasmic reticulum resident protein ERp44)	Q9BS26|TXND4_HUMAN	46,955	13
Translin	Q15631|TSN_HUMAN	26,165	13
Signal recognition particle 14 kDa protein (SRP14) (18 kDa Alu RNA-binding protein)	P37108|SRP14_HUMAN	14,553	13

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Peptidyl-prolyl cis-trans isomerase NIMA-interacting 1 (EC 5.2.1.8) (Rotamase Pin1) (PPIase Pin1)	Q13526|PIN1_HUMAN	18,226	13
Signal recognition particle 9 kDa protein (SRP9)	P49458|SRP09_HUMAN	10,094	13
Glutaminase kidney isoform, mitochondrial precursor (EC 3.5.1.2) (GLS) (L-glutamine amidohydrolase) (K-glutaminase)	O94925|GLSK_HUMAN	73,444	13
Sad1/unc-84-like protein 2 (Rab5-interacting protein) (Rab5IP)	Q9UH99|UN84B_HUMAN	80,294	13
Eukaryotic translation initiation factor 5 (eIF-5)	P55010|IF5_HUMAN	49,205	13
Caspase-3 precursor (EC 3.4.22.56) (CASP-3) (Apopain) (Cysteine protease CPP32) (Yama protein) (CPP-32) (SREBP cleavage activity 1) (SCA-1) [Contains: Caspase-3 p17 subunit; Caspase-3 p12 subunit]	P42574|CASP3_HUMAN	31,591	13
Aldose reductase (EC 1.1.1.21) (AR) (Aldehyde reductase)	P15121|ALDR_HUMAN	35,836	13
Tripeptidyl-peptidase 1 precursor (EC 3.4.14.9) (Tripeptidyl-peptidase I) (TPP-1) (TPP-I) (Tripeptidyl aminopeptidase) (Lysosomal pepstatin insensitive protease) (LPIC) (Cell growth-inhibiting gene 1 protein)	O14773|TPP1_HUMAN	61,230	13
Nodal modulator 3 precursor (pM5 protein 3)	P69849|NOMO3_HUMAN, Q15155|NOMO1_HUMAN, Q5JPE7|NOMO2_HUMAN	164,162	13
ATP synthase gamma chain, mitochondrial precursor (EC 3.6.3.14)	P36542|ATPG_HUMAN	32,980	13
Activated RNA polymerase II transcriptional coactivator p15 (SUB1 homolog) (Positive cofactor 4) (PC4) (p14)	P53999|TCP4_HUMAN	14,378	13
Anamorsin (Cytokine-induced apoptosis inhibitor 1) (CUA001)	Q6FI81|CPIN1_HUMAN	33,565	13
Activator of 90 kDa heat shock protein ATPase homolog 1 (AHA1) (p38)	O95433|AHSA1_HUMAN	38,256	13
Histone-binding protein RBBP7 (Retinoblastoma-binding protein 7) (RBBP-7) (Retinoblastoma-binding protein p46) (Histone acetyltransferase type B subunit 2) (Nucleosome remodeling factor subunit RBAP46)	Q16576|RBBP7_HUMAN	47,802	13
Phosphoacetylglucosamine mutase (EC 5.4.2.3) (PAGM) (Acetylglucosamine phosphomutase) (N-acetylglucosamine-phosphate mutase) (Phosphoglucomutase 3)	O95394|AGM1_HUMAN	59,834	13
Reticulocalbin-2 precursor (Calcium-binding protein ERC-55) (E6-binding protein) (E6BP)	Q14257|RCN2_HUMAN	36,860	13
60S ribosomal protein L35a	P18077|RL35A_HUMAN	12,520	13
Arylacetamide deacetylase-like 1 (EC 3.1.1.-)	Q6PIU2|ADCL1_HUMAN	45,791	13
60S acidic ribosomal protein P1	P05386|RLA1_HUMAN	11,496	13
High mobility group protein HMG-I/HMG-Y (HMG-I(Y)) (High mobility group AT-hook protein 1) (High mobility group protein A1) (High mobility group protein-R)	P17096|HMGA1_HUMAN	11,658	13
Calmodulin (CaM)	P62158|CALM_HUMAN	16,820	13
40S ribosomal protein S30	P62861|RS30_HUMAN	6,630	13
CD9 antigen (p24) (Leukocyte antigen MIC3) (Motility-related protein) (MRP-1) (Tetraspanin-29) (Tspan-29)	P21926|CD9_HUMAN	25,399	13

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Serine/threonine-protein phosphatase 2A catalytic subunit beta isoform (EC 3.1.3.16) (PP2A-beta)	P62714|PP2AB_HUMAN	35,557	13
Band 4.1-like protein 3 (4.1B) (Differentially expressed in adenocarcinoma of the lung protein 1) (DAL-1)	Q9Y2J2|E41L3_HUMAN	120,662	13
GTPase NRas precursor (Transforming protein N-Ras)	P01111|RASN_HUMAN	21,211	13
DNA replication licensing factor MCM3 (DNA polymerase alpha holoenzyme-associated protein P1) (RLF subunit beta) (P102 protein) (P1-MCM3)	P25205|MCM3_HUMAN	90,965	12
Dedicator of cytokinesis protein 6	Q96HP0|DOCK6_HUMAN	229,643	12
Structural maintenance of chromosomes protein 2 (Chromosome-associated protein E) (hCAP-E) (XCAP-E homolog)	O95347|SMC2_HUMAN	135,767	12
Cysteinyl-tRNA synthetase, cytoplasmic (EC 6.1.1.16) (Cysteine--tRNA ligase) (CysRS)	P49589|SYCC_HUMAN	85,458	12
Cytoplasmic dynein 1 light intermediate chain 1 (Dynein light intermediate chain 1, cytosolic) (Dynein light chain A) (DLC-A)	Q9Y6G9|DC1L1_HUMAN	56,562	12
ATP-binding cassette sub-family F member 1 (ATP-binding cassette 50) (TNF-alpha-stimulated ABC protein)	Q8NE71|ABCF1_HUMAN	95,910	12
High mobility group protein B3 (High mobility group protein 4) (HMG-4) (High mobility group protein 2a) (HMG-2a)	O15347|HMGB3_HUMAN	22,963	12
Liprin-beta-1 (Protein tyrosine phosphatase receptor type f polypeptide-interacting protein-binding protein 1) (PTPRF-interacting protein-binding protein 1) (hSGT2)	Q86W92|LIPB1_HUMAN	114,010	12
Mitochondrial import receptor subunit TOM34 (Translocase of outer membrane 34 kDa subunit) (hTom34)	Q15785|OM34_HUMAN	34,542	12
Metastasis-associated protein MTA2 (Metastasis-associated 1-like 1) (MTA1-L1 protein) (p53 target protein in deacetylase complex)	O94776|MTA2_HUMAN	75,007	12
Far upstream element-binding protein 3 (FUSE-binding protein 3)	Q96I24|FUBP3_HUMAN	61,622	12
NHP2-like protein 1 (High mobility group-like nuclear protein 2 homolog 1) (U4/U6.U5 tri-snRNP 15.5 kDa protein) (OTK27) (hSNU13)	P55769|NH2L1_HUMAN	14,156	12
PDZ and LIM domain protein 4 (LIM protein RIL) (Reversion-induced LIM protein)	P50479|PDLI4_HUMAN	35,380	12
Large proline-rich protein BAT3 (HLA-B-associated transcript 3) (Protein G3)	P46379|BAT3_HUMAN	119,389	12
Rab GDP dissociation inhibitor alpha (Rab GDI alpha) (Guanosine diphosphate dissociation inhibitor 1) (GDI-1) (XAP-4) (Oligophrenin-2)	P31150|GDIA_HUMAN	50,566	12
GrpE protein homolog 1, mitochondrial precursor (Mt-GrpE#1) (HMGE)	Q9HAV7|GRPE1_HUMAN	24,261	12
UNC45 homolog A (UNC-45A) (Smooth muscle cell-associated protein 1) (SMAP-1)	Q9H3U1|UN45A_HUMAN	103,061	12
La-related protein 1 (La ribonucleoprotein domain family member 1)	Q6PKG0|LARP1_HUMAN	123,495	12
Barrier-to-autointegration factor (Breakpoint cluster region protein 1)	O75531|BAF_HUMAN	10,041	12
Emerin	P50402|EMD_HUMAN	28,977	12

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Ubiquitin carboxyl-terminal hydrolase isozyme L3 (EC 3.4.19.12) (UCH-L3) (Ubiquitin thioesterase L3)	P15374|UCHL3_HUMAN	26,165	12
Dihydrolipoyllysine-residue acetyltransferase component of pyruvate dehydrogenase complex, mitochondrial precursor (EC 2.3.1.12) (Pyruvate dehydrogenase complex E2 subunit) (PDCE2) (E2) (Dihydrolipoamide S-acetyltransferase component of pyruvate dehydrogenase complex) (PDC-E2) (70 kDa mitochondrial autoantigen of primary biliary cirrhosis) (PBC) (M2 antigen complex 70 kDa subunit)	P10515|ODP2_HUMAN	65,764	12
Methionine aminopeptidase 1 (EC 3.4.11.18) (MetAP 1) (MAP 1) (Peptidase M 1)	P53582|AMPM1_HUMAN	43,197	12
Ubiquitin carboxyl-terminal hydrolase 15 (EC 3.1.2.15) (Ubiquitin thioesterase 15) (Ubiquitin-specific-processing protease 15) (Deubiquitinating enzyme 15) (Unph-2) (Unph4)	Q9Y4E8|UBP15_HUMAN	112,405	12
40S ribosomal protein S15 (RIG protein)	P62841|RS15_HUMAN	17,023	12
Copper transport protein ATOX1 (Metal transport protein ATX1)	O00244|ATOX1_HUMAN	7,384	12
Nucleobindin-2 precursor (DNA-binding protein NEFA) (Gastric cancer antigen Zg4)	P80303|NUCB2_HUMAN	50,206	12
Galactokinase (EC 2.7.1.6) (Galactose kinase)	P51570|GALK1_HUMAN	42,254	12
Squamous cell carcinoma antigen recognized by T-cells 3 (SART-3) (hSART-3) (Tat-interacting protein of 110 kDa) (Tip110)	Q15020|SART3_HUMAN	109,918	12
Electron transfer flavoprotein subunit beta (Beta-ETF)	P38117|ETFB_HUMAN	27,826	12
Importin-4 (Importin 4b) (Imp4b) (Ran-binding protein 4) (RanBP4)	Q8TEX9|IPO4_HUMAN	118,701	12
SH3 domain-binding glutamic acid-rich-like protein	O75368|SH3L1_HUMAN	12,757	12
26S proteasome non-ATPase regulatory subunit 5 (26S proteasome subunit S5B) (26S protease subunit S5 basic)	Q16401|PSMD5_HUMAN	56,179	12
Eukaryotic translation initiation factor 3 subunit 1 (eIF-3 alpha) (eIF3 p35) (eIF3j)	O75822|IF31_HUMAN	29,045	12
Mitogen-activated protein kinase 3 (EC 2.7.11.24) (Extracellular signal-regulated kinase 1) (ERK-1) (Insulin-stimulated MAP2 kinase) (MAP kinase 1) (MAPK 1) (p44-ERK1) (ERT2) (p44-MAPK) (Microtubule-associated protein 2 kinase)	P27361|MK03_HUMAN	43,119	12
Cellular nucleic acid-binding protein (CNBP) (Zinc finger protein 9)	P62633|CNBP_HUMAN	19,444	12
Proteasome-associated protein ECM29 homolog (Ecm29)	Q5VYK3|ECM29_HUMAN	204,278	12
Actin-related protein 2/3 complex subunit 4 (ARP2/3 complex 20 kDa subunit) (p20-ARC)	P59998|ARPC4_HUMAN	19,649	12
Casein kinase II subunit alpha′ (EC 2.7.11.1) (CK II)	P19784|CSK22_HUMAN	41,197	12
Carbonyl reductase [NADPH] 3 (EC 1.1.1.184) (NADPH-dependent carbonyl reductase 3)	O75828|DHC3_HUMAN	30,832	12
DnaJ homolog subfamily C member 9 (DnaJ protein SB73)	Q8WXX5|DNJC9_HUMAN	29,892	12
HLA class I histocompatibility antigen, A-1 alpha chain precursor (MHC class I antigen A*1)	P30443|1A01_HUMAN	40,828	12
Adipocyte plasma membrane-associated protein (BSCv protein)	Q9HDC9|APMAP_HUMAN	46,464	12
ATP-dependent DNA helicase Q1 (EC 3.6.1.-) (DNA-dependent ATPase Q1)	P46063|RECQ1_HUMAN	73,440	12

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PEST proteolytic signal-containing nuclear protein (PEST-containing nuclear protein) (PCNP)	Q8WW12|PCNP_HUMAN	18,907	12
Eukaryotic translation initiation factor 4B (eIF-4B)	P23588|IF4B_HUMAN	69,209	12
Epsin-1 (EPS-15-interacting protein 1) (EH domain-binding mitotic phosphoprotein)	Q9Y6I3|EPN1_HUMAN	57,558	12
DAZ-associated protein 1 (Deleted in azoospermia-associated protein 1)	Q96EP5|DAZP1_HUMAN	43,365	12
40 kDa peptidyl-prolyl cis-trans isomerase (EC 5.2.1.8) (PPIase) (Rotamase) (Cyclophilin-40) (CYP-40) (Cyclophilin-related protein)	Q08752|PPID_HUMAN	40,747	12
Proto-oncogene tyrosine-protein kinase Yes (EC 2.7.10.2) (p61-Yes) (c-Yes)	P07947|YES_HUMAN	60,785	12
Uncharacterized protein KIAA0090 precursor	Q8N766|K0090_HUMAN	111,743	12
Protein transport protein Sec24D (SEC24-related protein D)	O94855|SC24D_HUMAN	112,984	12
FUS-interacting serine-arginine-rich protein 1 (TLS-associated protein with Ser-Arg repeats) (TLS-associated protein with SR repeats) (TASR) (TLS-associated serine-arginine protein) (TLS-associated SR protein) (40 kDa SR-repressor protein) (SRrp40) (Splicing factor SRp38)	O75494|FUSIP_HUMAN	31,284	12
U1 small nuclear ribonucleoprotein A (U1 snRNP protein A) (U1A protein) (U1-A)	P09012|SNRPA_HUMAN	31,262	12
PRA1 family protein 3 (ARL-6-interacting protein 5) (ADP-ribosylation-like factor 6-interacting protein 5) (Aip-5) (Glutamate transporter EAAC1-interacting protein) (GTRAP3-18) (Prenylated Rab acceptor protein 2) (Protein JWa) (Dermal papilla-derived protein 11) (JM5) (Putative MAPK-activating protein PM27) (Cytoskeleton-related vitamin A-responsive protein)	O75915|PRAF3_HUMAN	21,598	12
Eukaryotic translation initiation factor 3 subunit 5 (eIF-3 epsilon) (eIF3 p47 subunit) (eIF3f)	O00303|IF35_HUMAN	37,546	12
Diphosphoinositol polyphosphate phosphohydrolase 2 (EC 3.6.1.52) (DIPP-2) (Diadenosine 5′,5‴-P1,P6-hexaphosphate hydrolase 2) (EC 3.6.1.-) (Nucleoside diphosphate-linked moiety X motif 4) (Nudix motif 4)	Q9NZJ9|NUDT4_HUMAN	20,288	12
GTPase IMAP family member 1 (Immunity-associated protein 1) (hIMAP1)	Q8WWP7|GIMA1_HUMAN	34,351	12
NEDD8 precursor (Ubiquitin-like protein Nedd8) (Neddylin)	Q15843|NEDD8_HUMAN	9,054	12
Actin-related protein 2/3 complex subunit 3 (ARP2/3 complex 21 kDa subunit) (p21-ARC)	O15145|ARPC3_HUMAN	20,530	12
Antigen peptide transporter 1 (APT1) (Peptide transporter TAP1) (ATP-binding cassette sub-family B member 2) (Peptide transporter PSF1) (Peptide supply factor 1) (PSF-1) (Peptide transporter involved in antigen processing 1)	Q03518|TAP1_HUMAN	80,948	12
60S ribosomal protein L15	P61313|RL15_HUMAN	24,129	12
Protein S100-A16 (S100 calcium-binding protein A16) (Protein S100F) (Aging-associated protein 13)	Q96FQ6|S10AG_HUMAN	11,784	12
Cytochrome c oxidase subunit 5B, mitochondrial precursor (EC 1.9.3.1) (Cytochrome c oxidase polypeptide Vb)	P10606|COX5B_HUMAN	13,678	12
LIM domain and actin-binding protein 1 (Epithelial protein lost in neoplasm)	Q9UHB6|LIMA1_HUMAN	85,208	11
DNA replication licensing factor MCM7 (CDC47 homolog) (P1.1-MCM3)	P33993|MCM7_HUMAN	81,291	11
Leucine zipper protein 1	Q86V48|LUZP1_HUMAN	120,259	11

Protein Description	Accession Number	Molecular Weight	Total SpC
S-methyl-5-thioadenosine phosphorylase (EC 2.4.2.28) (5′-methylthioadenosine phosphorylase) (MTA phosphorylase) (MTAPase)	Q13126|MTAP_HUMAN	31,232	11
Guanine nucleotide-binding protein G(I)/G(S)/G(T) subunit beta 2 (Transducin beta chain 2) (G protein beta 2 subunit)	P62879|GBB2_HUMAN	37,314	11
Rho GTPase-activating protein 1 (GTPase-activating protein rhoOGAP) (Rho-related small GTPase protein activator) (CDC42 GTPase-activating protein) (p50-RhoGAP)	Q07960|RHG01_HUMAN	50,420	11
Prolyl endopeptidase (EC 3.4.21.26) (Post-proline cleaving enzyme) (PE)	P48147|PPCE_HUMAN	80,748	11
Macrophage capping protein (Actin-regulatory protein CAP-G)	P40121|CAPG_HUMAN	38,500	11
NAD(P) transhydrogenase, mitochondrial precursor (EC 1.6.1.2) (Pyridine nucleotide transhydrogenase) (Nicotinamide nucleotide transhydrogenase)	Q13423|NNTM_HUMAN	113,881	11
rRNA 2′-O-methyltransferase fibrillarin (EC 2.1.1.-) (34 kDa nucleolar scleroderma antigen)	P22087|FBRL_HUMAN	33,766	11
Citrate synthase, mitochondrial precursor (EC 2.3.3.1)	O75390|CISY_HUMAN	51,696	11
Neurolysin, mitochondrial precursor (EC 3.4.24.16) (Neurotensin endopeptidase) (Mitochondrial oligopeptidase M) (Microsomal endopeptidase) (MEP)	Q9BYT8|NEUL_HUMAN	80,636	11
Arsenite-resistance protein 2	Q9BXP5|ARS2_HUMAN	100,652	11
Prolyl 4-hydroxylase subunit alpha-1 precursor (EC 1.14.11.2) (4-PH alpha-1) (Procollagen-proline,2-oxoglutarate-4-dioxygenase alpha-1 subunit)	P13674|P4HA1_HUMAN	61,034	11
Quaking protein (Hqk)	Q96PU8|QKI_HUMAN	37,654	11
1-phosphatidylinositol-4,5-bisphosphate phosphodiesterase gamma 1 (EC 3.1.4.11) (Phosphoinositide phospholipase C) (PLC-gamma-1) (Phospholipase C-gamma-1) (PLC-II) (PLC-148)	P19174|PLCG1_HUMAN	148,518	11
Rho guanine nucleotide exchange factor 1 (p115-RhoGEF) (p115RhoGEF) (115 kDa guanine nucleotide exchange factor) (Sub1.5)	Q92888|ARHG1_HUMAN	102,420	11
Alpha-synuclein (Non-A beta component of AD amyloid) (Non-A4 component of amyloid precursor) (NACP)	P37840|SYUA_HUMAN	14,441	11
BAG family molecular chaperone regulator 3 (BCL-2-binding athanogene-3) (BAG-3) (Bcl-2-binding protein Bis) (Docking protein CAIR-1)	O95817|BAG3_HUMAN	61,575	11
60S ribosomal protein L31	P62899|RL31_HUMAN	14,445	11
Single-stranded DNA-binding protein, mitochondrial precursor (Mt-SSB) (MtSSB) (PWP1-interacting protein 17)	Q04837|SSB_HUMAN	17,242	11
Translocon-associated protein subunit delta precursor (TRAP-delta) (Signal sequence receptor subunit delta) (SSR-delta)	P51571|SSRD_HUMAN	18,981	11
Intercellular adhesion molecule 1 precursor (ICAM-1) (Major group rhinovirus receptor) (CD54 antigen)	P05362|ICAM1_HUMAN	57,807	11
Lanosterol synthase (EC 5.4.99.7) (Oxidosqualene--lanosterol cyclase) (2,3-epoxysqualene--lanosterol cyclase) (OSC)	P48449|ERG7_HUMAN	83,292	11
3-mercaptopyruvate sulfurtransferase (EC 2.8.1.2) (MST)	P25325|THTM_HUMAN	33,161	11

Protein Description	Accession Number	Molecular Weight	Total SpC
Vacuolar protein sorting-associating protein 4B (Suppressor of K(+) transport growth defect 1) (Protein SKD1)	O75351|VPS4B_HUMAN	49,286	11
Transforming acidic coiled-coil-containing protein 1 (Taxin 1) (Gastric cancer antigen Ga55)	O75410|TACC1_HUMAN	87,778	11
Prolyl 3-hydroxylase 1 precursor (EC 1.14.11.7) (Leucine- and proline-enriched proteoglycan 1) (Leprecan-1) (Growth suppressor 1)	Q32P28|P3H1_HUMAN	83,377	11
Pyruvate dehydrogenase E1 component subunit beta, mitochondrial precursor (EC 1.2.4.1) (PDHE1-B)	P11177|ODPB_HUMAN	39,215	11
26S proteasome non-ATPase regulatory subunit 10 (26S proteasome regulatory subunit p28) (Gankyrin)	O75832|PSD10_HUMAN	24,410	11
Glutathione S-transferase kappa 1 (EC 2.5.1.18) (GST 13-13) (Glutathione S-transferase subunit 13) (GST class-kappa) (GSTK1-1) (hGSTK1)	Q9Y2Q3|GSTK1_HUMAN	25,480	11
Proteasome subunit beta type 4 precursor (EC 3.4.25.1) (Proteasome beta chain) (Macropain beta chain) (Multicatalytic endopeptidase complex beta chain) (Proteasome chain 3) (HSN3) (HsBPROS26)	P28070|PSB4_HUMAN	29,187	11
Nitric-oxide synthase, endothelial (EC 1.14.13.39) (EC-NOS) (NOS type III) (NOSIII) (Endothelial NOS) (eNOS) (Constitutive NOS) (cNOS)	P29474|NOS3_HUMAN	133,272	11
Ubiquitin-activating enzyme E1-like protein 2 (Monocyte protein 4) (MOP-4)	A0AVT1|UB1L2_HUMAN	117,955	11
Hypoxanthine-guanine phosphoribosyltransferase (EC 2.4.2.8) (HGPRT) (HGPRTase)	P00492|HPRT_HUMAN	24,562	11
Basic leucine zipper and W2 domain-containing protein 2	Q9Y6E2|BZW2_HUMAN	48,146	11
Protein arginine N-methyltransferase 1 (EC 2.1.1.-) (Interferon receptor 1-bound protein 4)	Q99873|ANM1_HUMAN	41,468	11
Casein kinase II subunit beta (CK II beta) (Phosvitin) (G5a)	P67870|CSK2B_HUMAN	24,925	11
Synaptosomal-associated protein 23 (SNAP-23) (Vesicle-membrane fusion protein SNAP-23)	O00161|SNP23_HUMAN	23,337	11
Protein S100-A13 (S100 calcium-binding protein A13)	Q99584|S10AD_HUMAN	11,454	11
Splicing factor 3A subunit 3 (Spliceosome-associated protein 61) (SAP 61) (SF3a60)	Q12874|SF3A3_HUMAN	58,833	11
Vesicle-associated membrane protein-associated protein B/C (VAMP-associated protein B/C) (VAMP-B/VAMP-C) (VAP-B/VAP-C)	O95292|VAPB_HUMAN	27,211	11
EF-hand domain-containing protein 2 (Swiprosin-1)	Q96C19|EFHD2_HUMAN	26,680	11
AH receptor-interacting protein (AIP) (Aryl-hydrocarbon receptor-interacting protein) (Immunophilin homolog ARA9) (HBV-X-associated protein 2)	O00170|AIP_HUMAN	37,647	11
UDP-N-acetylhexosamine pyrophosphorylase (Antigen X) (AGX) (Sperm-associated antigen 2) [Includes: UDP-N-acetylgalactosamine pyrophosphorylase (EC 2.7.7.-) (AGX-1); UDP-N-acetylglucosamine pyrophosphorylase (EC 2.7.7.23) (AGX-2)]	Q16222|UAP1_HUMAN	58,752	11
Guanylate-binding protein 4 (GTP-binding protein 4) (Guanine nucleotide-binding protein 4) (GBP-4)	Q96PP9|GBP4_HUMAN	73,148	11
TATA-binding protein-associated factor 2N (RNA-binding protein 56) (TAFII68) (TAF(II)68)	Q92804|RBP56_HUMAN	61,813	11

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ADP/ATP translocase 3 (Adenine nucleotide translocator 2) (ANT 3) (ADP,ATP carrier protein 3) (Solute carrier family 25 member 6) (ADP,ATP carrier protein, isoform T2)	P12236|ADT3_HUMAN	32,849	11
Protein TFG (TRK-fused gene protein)	Q92734|TFG_HUMAN	43,416	11
60S ribosomal protein L37a	P61513|RL37A_HUMAN	10,257	11
Acidic leucine-rich nuclear phosphoprotein 32 family member E (LANP-like protein) (LANP-L)	Q9BTT0|AN32E_HUMAN	30,675	11
CD99 antigen precursor (T-cell surface glycoprotein E2) (E2 antigen) (Protein MIC2) (12E7)	P14209|CD99_HUMAN	18,830	11
N6-adenosine-methyltransferase 70 kDa subunit (EC 2.1.1.62) (MT-A70) (Methyltransferase-like protein 3)	Q86U44|MTA70_HUMAN	64,457	11
Plasminogen activator inhibitor 2 precursor (PAI-2) (Placental plasminogen activator inhibitor) (Monocyte Arg-serpin) (Urokinase inhibitor)	P05120|PAI2_HUMAN	46,580	11
Radixin	P35241|RADI_HUMAN	68,548	10
Rho GTPase-activating protein 18 (MacGAP)	Q8N392|RHG18_HUMAN	74,931	10
Nidogen-1 precursor (Entactin)	P14543|NID1_HUMAN	136,434	10
Serine/threonine-protein phosphatase 5 (EC 3.1.3.16) (PP5) (Protein phosphatase T) (PP-T) (PPT)	P53041|PPP5_HUMAN	56,862	10
Ubiquinol-cytochrome c reductase complex 14 kDa protein (EC 1.10.2.2) (Complex III subunit VI) (QP-C)	P14927|UCR6_HUMAN	13,513	10
ELKS/RAB6-interacting/CAST family member 1 (RAB6-interacting protein 2) (ERC protein 1)	Q8IUD2|RB6I2_HUMAN	128,073	10
Myosin phosphatase Rho-interacting protein (Rho-interacting protein 3) (M-RIP) (RIP3) (p116Rip)	Q6WCQ1|MRIP_HUMAN	116,430	10
Secernin-1	Q12765|SCRN1_HUMAN	46,364	10
DnaJ homolog subfamily C member 8 (Splicing protein spf31)	O75937|DNJC8_HUMAN	29,824	10
Acyl-protein thioesterase 2 (EC 3.1.2.-) (Lysophospholipase II) (LPL-I)	O95372|LYPA2_HUMAN	24,719	10
Heme-binding protein 1 (p22HBP)	Q9NRV9|HEBP1_HUMAN	21,079	10
Heme-binding protein 2 (Protein SOUL) (Placental protein 23) (PP23)	Q9Y5Z4|HEBP2_HUMAN	22,858	10
Leucine zipper-EF-hand-containing transmembrane protein 1, mitochondrial precursor	O95202|LETM1_HUMAN	83,338	10
Protein NOXP20 (Nervous system over-expressed protein 20) (Protein FAM114A1)	Q8IWE2|NXP20_HUMAN	60,807	10
Dipeptidyl-peptidase 1 precursor (EC 3.4.14.1) (Dipeptidyl-peptidase I) (DPP-I) (DPPI) (Cathepsin C) (Cathepsin J) (Dipeptidyl transferase) [Contains: Dipeptidyl-peptidase 1 exclusion domain chain (Dipeptidyl-peptidase I exclusion domain chain); Dipeptidyl-peptidase 1 heavy chain (Dipeptidyl-peptidase I heavy chain); Dipeptidyl-peptidase 1 light chain (Dipeptidyl-peptidase I light chain)]	P53634|CATC_HUMAN	51,824	10
Programmed cell death protein 6 (Probable calcium-binding protein ALG-2)	O75340|PDCD6_HUMAN	21,851	10
Uncharacterized protein KIAA0310	O15027|K0310_HUMAN	233,497	10
Casein kinase II subunit alpha (EC 2.7.11.1) (CK II)	P68400|CSK21_HUMAN	45,127	10

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Structural maintenance of chromosomes protein 4 (Chromosome-associated polypeptide C) (hCAP-C) (XCAP-C homolog)	Q9NTJ3|SMC4_HUMAN	147,170	10
Apoptosis-inducing factor 1, mitochondrial precursor (EC 1.-.-.-) (Programmed cell death protein 8)	O95831|AIFM1_HUMAN	66,884	10
DNA fragmentation factor subunit alpha (DNA fragmentation factor 45 kDa subunit) (DFF-45) (Inhibitor of CAD) (ICAD)	O00273|DFFA_HUMAN	36,505	10
Vacuolar ATP synthase subunit E (EC 3.6.3.14) (V-ATPase E subunit) (Vacuolar proton pump E subunit) (V-ATPase 31 kDa subunit) (P31)	P36543|VATE_HUMAN	26,128	10
Latexin (Endogenous carboxypeptidase inhibitor) (ECI) (Tissue carboxypeptidase inhibitor) (TCI) (MUM)	Q9BS40|LXN_HUMAN	25,751	10
Coiled-coil-helix-coiled-coil-helix domain-containing protein 3	Q9NX63|CHCH3_HUMAN	26,135	10
Splicing factor U2AF 65 kDa subunit (U2 auxiliary factor 65 kDa subunit) (U2 snRNP auxiliary factor large subunit) (hU2AF(65))	P26368|U2AF2_HUMAN	53,483	10
26S proteasome non-ATPase regulatory subunit 12 (26S proteasome regulatory subunit p55)	O00232|PSD12_HUMAN	52,888	10
Epididymal secretory protein E1 precursor (Niemann-Pick disease type C2 protein) (hE1)	P61916|NPC2_HUMAN	16,552	10
Coiled-coil domain-containing protein 47 precursor	Q96A33|CCD47_HUMAN	55,857	10
Signal recognition particle receptor subunit beta (SR-beta) (Protein APMCF1)	Q9Y5M8|SRPRB_HUMAN	29,685	10
Protein arginine N-methyltransferase 5 (EC 2.1.1.125) (EC 2.1.1.-) (Shk1 kinase-binding protein 1 homolog) (SKB1Hs) (Jak-binding protein 1) (72 kDa ICln-binding protein)	O14744|ANM5_HUMAN	72,667	10
Importin-7 (Imp7) (Ran-binding protein 7) (RanBP7)	O95373|IPO7_HUMAN	119,502	10
Mitogen-activated protein kinase kinase kinase kinase 4 (EC 2.7.11.1) (MAPK/ERK kinase kinase kinase 4) (MEK kinase kinase 4) (MEKKK 4) (HPK/GCK-like kinase HGK) (Nck-interacting kinase)	O95819|M4K4_HUMAN	142,083	10
Palmdelphin (Paralemnin-like protein)	Q9NP74|PALMD_HUMAN	62,741	10
Histone deacetylase 1 (HD1)	Q13547|HDAC1_HUMAN	55,086	10
Vinexin (Sorbin and SH3 domain-containing protein 3) (SH3-containing adapter molecule 1) (SCAM-1)	O60504|VINEX_HUMAN	75,312	10
Reticulocalbin-3 precursor (EF-hand calcium-binding protein RLP49)	Q96D15|RCN3_HUMAN	37,475	10
C-jun-amino-terminal kinase-interacting protein 4 (JNK-interacting protein 4) (JIP-4) (JNK-associated leucine-zipper protein) (JLP) (Sperm-associated antigen 9) (Mitogen-activated protein kinase 8-interacting protein 4) (Human lung cancer protein 6) (HLC-6) (Proliferation-inducing protein 6) (Sperm-specific protein) (Sperm surface protein) (Protein highly expressed in testis) (PHET) (Sunday driver 1)	O60271|JIP4_HUMAN	146,187	10
Histone acetyltransferase type B catalytic subunit (EC 2.3.1.48)	O14929|HAT1_HUMAN	49,496	10
Nuclear factor NF-kappa-B p105 subunit (DNA-binding factor KBF1) (EBP-1) [Contains: Nuclear factor NF-kappa-B p50 subunit]	P19838|NFKB1_HUMAN	105,341	10
Basic leucine zipper and W2 domain-containing protein 1 (Protein Orf)	Q7L1Q6|BZW1_HUMAN	48,027	10

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Inosine triphosphate pyrophosphatase (EC 3.6.1.19) (ITPase) (Inosine triphosphatase) (Putative oncogene protein hlc14-06-p)	Q9BY32|ITPA_HUMAN	21,428	10
SEC13-related protein (SEC13-like protein 1)	P55735|SEC13_HUMAN	35,522	10
SUMO-conjugating enzyme UBC9 (EC 6.3.2.-) (SUMO-protein ligase) (Ubiquitin-conjugating enzyme E2 I) (Ubiquitin-protein ligase I) (Ubiquitin carrier protein I) (Ubiquitin carrier protein 9) (p18)	P63279|UBC9_HUMAN	17,990	10
U6 snRNA-associated Sm-like protein LSm4 (Glycine-rich protein) (GRP)	Q9Y4Z0|LSM4_HUMAN	15,332	10
RNA-binding protein with serine-rich domain 1 (SR-related protein LDC2)	Q15287|RNPS1_HUMAN	34,192	10
DnaJ homolog subfamily C member 3 (Interferon-induced, double-stranded RNA-activated protein kinase inhibitor) (Protein kinase inhibitor p58) (Protein kinase inhibitor of 58 kDa)	Q13217|DNJC3_HUMAN	57,564	10
Pre-mRNA-processing factor 6 (PRP6 homolog) (U5 snRNP-associated 102 kDa protein) (U5-102 kDa protein)	O94906|PRP6_HUMAN	106,910	10
Endothelial cell-selective adhesion molecule precursor	Q96AP7|ESAM_HUMAN	41,158	10
Cytochrome c oxidase subunit 2 (EC 1.9.3.1) (Cytochrome c oxidase polypeptide II)	P00403|COX2_HUMAN	25,548	10
Replication protein A 70 kDa DNA-binding subunit (RP-A) (RF-A) (Replication factor-A protein 1) (Single-stranded DNA-binding protein) (p70)	P27694|RFA1_HUMAN	68,121	10
Peptidyl-tRNA hydrolase 2, mitochondrial precursor (EC 3.1.1.29) (PTH 2) (Bcl-2 inhibitor of transcription 1)	Q9Y3E5|PTH2_HUMAN	19,176	10
Transmembrane protein 173	Q86WV6|TM173_HUMAN	42,176	10
Keratin, type I cytoskeletal 9 (Cytokeratin-9) (CK-9) (Keratin-9) (K9)	P35527|K1C9_HUMAN	62,113	10
Splicing factor U2AF 35 kDa subunit (U2 auxiliary factor 35 kDa subunit) (U2 snRNP auxiliary factor small subunit)	Q01081|U2AF1_HUMAN	27,854	10
Charged multivesicular body protein 5 (Chromatin-modifying protein 5) (Vacuolar protein sorting 60) (Vps60) (hVps60) (SNF7 domain-containing protein 2)	Q9NZZ3|CHMP5_HUMAN	24,554	10
Interferon-induced 17 kDa protein precursor [Contains: Ubiquitin cross-reactive protein (hUCRP) (Interferon-induced 15 kDa protein)]	P05161|UCRP_HUMAN	17,869	10
Inosine-5′-monophosphate dehydrogenase 1 (EC 1.1.1.205) (IMP dehydrogenase 1) (IMPDH-I) (IMPD 1)	P20839|IMDH1_HUMAN	55,389	10
ERO1-like protein alpha precursor (EC 1.8.4.-) (ERO1-Lalpha) (Oxidoreductin-1-Lalpha) (Endoplasmic oxidoreductin-1-like protein) (ERO1-L)	Q96HE7|ERO1A_HUMAN	54,377	10
Keratin, type I cytoskeletal 16 (Cytokeratin-16) (CK-16) (Keratin-16) (K16)	P08779|K1C16_HUMAN	51,251	10
Thymidine phosphorylase precursor (EC 2.4.2.4) (TdRPase) (TP) (Platelet-derived endothelial cell growth factor) (PD-ECGF) (Gliostatin)	P19971|TYPH_HUMAN	49,938	10
Microtubule-actin cross-linking factor 1, isoforms 1/2/3/5 (Actin cross-linking family protein 7) (Macrophin-1) (Trabeculin-alpha) (620 kDa actin-binding protein) (ABP620)	Q9UPN3|MACF1_HUMAN	620,397	9

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STE20-like serine/threonine-protein kinase (EC 2.7.11.1) (STE20-like kinase) (STE20-related serine/threonine-protein kinase) (STE20-related kinase) (hSLK) (Serine/threonine-protein kinase 2) (CTCL tumor antigen se20-9)	Q9H2G2|SLK_HUMAN	142,680	9
Structural maintenance of chromosomes protein 3 (Chondroitin sulfate proteoglycan 6) (Chromosome-associated polypeptide) (hCAP) (Bamacan) (Basement membrane-associated chondroitin proteoglycan)	Q9UQE7|SMC3_HUMAN	141,529	9
Myosin-Id	O94832|MYO1D_HUMAN	116,188	9
Coronin-7 (70 kDa WD repeat tumor rejection antigen homolog)	P57737|CORO7_HUMAN	100,558	9
Signal recognition particle receptor subunit alpha (SR-alpha) (Docking protein alpha) (DP-alpha)	P08240|SRPR_HUMAN	69,795	9
Biliverdin reductase A precursor (EC 1.3.1.24) (Biliverdin-IX alpha-reductase) (BVR A)	P53004|BIEA_HUMAN	33,411	9
SEC23-interacting protein (p125)	Q9Y6Y8|S23IP_HUMAN	111,060	9
Amyloid beta A4 protein precursor (APP) (ABPP) (Alzheimer disease amyloid protein) (Cerebral vascular amyloid peptide) (CVAP) (Protease nexin-II) (PN-II) (APPI) (PreA4) [Contains: Soluble APP-alpha (S-APP-alpha); Soluble APP-beta (S-APP-beta); C99; Beta-amyloid protein 42 (Beta-APP42); Beta-amyloid protein 40 (Beta-APP40); C83; P3(42); P3(40); Gamma-CTF(59) (Gamma-secretase C-terminal fragment 59) (Amyloid intracellular domain 59) (AID(59)) (AICD-59); Gamma-CTF(57) (Gamma-secretase C-terminal fragment 57) (Amyloid intracellular domain 57) (AID(57)) (AICD-57); Gamma-CTF(50) (Gamma-secretase C-terminal fragment 50) (Amyloid intracellular domain 50) (AID(50)) (AICD-50); C31]	P05067|A4_HUMAN	86,923	9
Fragile X mental retardation syndrome-related protein 1 (hFXR1p)	P51114|FXR1_HUMAN	69,674	9
Flap endonuclease 1 (EC 3.1.-.-) (Flap structure-specific endonuclease 1) (FEN-1) (Maturation factor 1) (MF1) (hFEN-1) (DNase IV)	P39748|FEN1_HUMAN	42,576	9
Protein transport protein Sec24C (SEC24-related protein C)	P53992|SC24C_HUMAN	118,297	9
6-phosphofructokinase, muscle type (EC 2.7.1.11) (Phosphofructokinase 1) (Phosphohexokinase) (Phosphofructo-1-kinase isozyme A) (PFK-A) (Phosphofructokinase-M)	P08237|K6PF_HUMAN	85,166	9
Transcription elongation factor A protein 1 (Transcription elongation factor S-II protein 1) (Transcription elongation factor TFIIS.o)	P23193|TCEA1_HUMAN	33,953	9
Ras-related C3 botulinum toxin substrate 2 precursor (p21-Rac2) (Small G protein) (GX)	P15153|RAC2_HUMAN	21,411	9
SWI/SNF-related matrix-associated actin-dependent regulator of chromatin subfamily C member 2 (SWI/SNF complex 170 kDa subunit) (BRG1-associated factor 170)	Q8TAQ2|SMRC2_HUMAN	132,862	9
DNA (cytosine-5)-methyltransferase 1 (EC 2.1.1.37) (Dnmt1) (DNA methyltransferase HsaI) (DNA MTase HsaI) (MCMT) (M.HsaI)	P26358|DNMT1_HUMAN	183,151	9
Mitochondrial-processing peptidase subunit beta, mitochondrial precursor (EC 3.4.24.64) (Beta-MPP) (P-52)	O75439|MPPB_HUMAN	54,349	9
RNA-binding protein EWS (EWS oncogene) (Ewing sarcoma breakpoint region 1 protein)	Q01844|EWS_HUMAN	68,460	9
Ras-related protein R-Ras precursor (p23)	P10301|RRAS_HUMAN	23,463	9
GDP-fucose protein O-fucosyltransferase 1 precursor (EC 2.4.1.221) (Peptide-O-fucosyltransferase 1) (O-FucT-1)	Q9H488|OFUT1_HUMAN	43,938	9

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40S ribosomal protein S27a	P62979|RS27A_HUMAN	9,400	9
WW domain-binding protein 11 (WBP-11) (SH3 domain-binding protein SNP70) (Npw38-binding protein) (NpwBP)	Q9Y2W2|WBP11_HUMAN	69,982	9
FACT complex subunit SSRP1 (Facilitates chromatin transcription complex subunit SSRP1) (FACT 80 kDa subunit) (FACTp80) (Chromatin-specific transcription elongation factor 80 kDa subunit) (Structure-specific recognition protein 1) (hSSRP1) (Recombination signal sequence recognition protein 1) (T160)	Q08945|SSRP1_HUMAN	81,060	9
DNA replication licensing factor MCM6 (p105MCM)	Q14566|MCM6_HUMAN	92,873	9
Bifunctional 3′-phosphoadenosine 5′-phosphosulfate synthetase 1 (PAPS synthetase 1) (PAPSS 1) (Sulfurylase kinase 1) (SK1) (SK 1) [Includes: Sulfate adenylyltransferase (EC 2.7.7.4) (Sulfate adenylate transferase) (SAT) (ATP-sulfurylase); Adenylyl-sulfate kinase (EC 2.7.1.25) (Adenylylsulfate 3′-phosphotransferase) (APS kinase) (Adenosine-5′-phosphosulfate 3′-phosphotransferase) (3′-phosphoadenosine-5′-phosphosulfate synthetase)]	O43252|PAPS1_HUMAN	70,815	9
Syntaxin-12	Q86Y82|STX12_HUMAN	31,625	9
Peptidyl-prolyl cis-trans isomerase, mitochondrial precursor (EC 5.2.1.8) (PPIase) (Rotamase) (Cyclophilin F)	P30405|PPIF_HUMAN	22,022	9
39S ribosomal protein L12, mitochondrial precursor (L12mt) (MRP-L12) (5c5-2)	P52815|RM12_HUMAN	21,330	9
Ubiquitin	P62988|UBIQ_HUMAN	8,547	9
THO complex subunit 4 (Tho4) (Ally of AML-1 and LEF-1) (Transcriptional coactivator Aly/REF) (bZIP-enhancing factor BEF)	Q86V81|THOC4_HUMAN	26,871	9
Proteasome subunit beta type 6 precursor (EC 3.4.25.1) (Proteasome delta chain) (Macropain delta chain) (Multicatalytic endopeptidase complex delta chain) (Proteasome subunit Y)	P28072|PSB6_HUMAN	25,340	9
Protein phosphatase 1 regulatory subunit 14B (Phospholipase C beta 3 neighbouring gene protein)	Q96C90|PP14B_HUMAN	15,894	9
Chromobox protein homolog 5 (Heterochromatin protein 1 homolog alpha) (HP1 alpha) (Antigen p25)	P45973|CBX5_HUMAN	22,208	9
Supervillin (Archvillin) (p205/p250)	O95425|SVIL_HUMAN	247,689	9
NADH dehydrogenase [ubiquinone] flavoprotein 1, mitochondrial precursor (EC 1.6.5.3) (EC 1.6.99.3) (NADH-ubiquinone oxidoreductase 51 kDa subunit) (Complex I-51kD) (CI-51kD) (NADH dehydrogenase flavoprotein 1)	P49821|NDUV1_HUMAN	50,800	9
ETHE1 protein, mitochondrial precursor (EC 3.-.-.-) (Ethylmalonic encephalopathy protein 1) (Hepatoma subtracted clone one protein)	O95571|ETHE1_HUMAN	27,855	9
Delta(3,5)-Delta(2,4)-dienoyl-CoA isomerase, mitochondrial precursor (EC 5.3.3.-)	Q13011|ECH1_HUMAN	35,798	9
DnaJ homolog subfamily B member 4 (Heat shock 40 kDa protein 1 homolog) (Heat shock protein 40 homolog) (HSP40 homolog)	Q9UDY4|DNJB4_HUMAN	37,791	9
Cytochrome c oxidase polypeptide VIc precursor (EC 1.9.3.1)	P09669|COX6C_HUMAN	8,764	9
Ras suppressor protein 1 (Rsu-1) (RSP-1)	Q15404|RSU1_HUMAN	31,524	9
Developmentally-regulated GTP-binding protein 1 (DRG 1)	Q9Y295|DRG1_HUMAN	40,526	9

Protein Description	Accession Number	Molecular Weight	Total SpC
Prefoldin subunit 2	Q9UHV9|PFD2_HUMAN	16,630	9
AP-2 complex subunit alpha-2 (Adapter-related protein complex 2 alpha-2 subunit) (Alpha-adaptin C) (Adaptor protein complex AP-2 alpha-2 subunit) (Clathrin assembly protein complex 2 alpha-C large chain) (100 kDa coated vesicle protein C) (Plasma membrane adaptor HA2/AP2 adaptin alpha C subunit) (Huntingtin-interacting protein HYPJ)	O94973|AP2A2_HUMAN	103,945	9
2′,3′-cyclic-nucleotide 3′-phosphodiesterase (EC 3.1.4.37) (CNP) (CNPase)	P09543|CN37_HUMAN	47,563	9
Golgi-specific brefeldin A-resistance guanine nucleotide exchange factor 1 (BFA-resistant GEF 1)	Q92538|GBF1_HUMAN	206,433	9
Ubiquitin-conjugating enzyme E2-25 kDa (EC 6.3.2.19) (Ubiquitin-protein ligase) (Ubiquitin carrier protein) (E2(25K)) (Huntingtin-interacting protein 2) (HIP-2)	P61086|UBC1_HUMAN	22,389	9
Cytospin-A (SPECC1-like protein) (Renal carcinoma antigen NY-REN-22)	Q69YQ0|CYTSA_HUMAN	124,578	9
Transferrin receptor protein 1 (TfR1) (TR) (TfR) (Trfr) (CD71 antigen) (T9) (p90)	P02786|TFR1_HUMAN	84,856	9
Succinyl-CoA ligase [GDP-forming] subunit alpha, mitochondrial precursor (EC 6.2.1.4) (Succinyl-CoA synthetase subunit alpha) (SCS-alpha)	P53597|SUCA_HUMAN	35,030	9
Ubiquinol-cytochrome c reductase complex 11 kDa protein, mitochondrial precursor (EC 1.10.2.2) (Mitochondrial hinge protein) (Cytochrome c1 nonheme 11 kDa protein) (Complex III subunit VIII)	P07919|UCRH_HUMAN	10,721	9
GDP-L-fucose synthetase (EC 1.1.1.271) (Protein FX) (Red cell NADP(H)-binding protein) (GDP-4-keto-6-deoxy-D-mannose-3,5-epimerase-4-reductase)	Q13630|FCL_HUMAN	35,875	9
Protein disulfide-isomerase A5 precursor (EC 5.3.4.1) (Protein disulfide isomerase-related protein)	Q14554|PDIA5_HUMAN	59,577	9
Adhesion-regulating molecule 1 precursor (110 kDa cell membrane glycoprotein) (Gp110)	Q16186|ADRM1_HUMAN	42,136	9
Proto-oncogene C-crk (p38) (Adapter molecule crk)	P46108|CRK_HUMAN	33,854	9
Opioid growth factor receptor (OGFr) (Zeta-type opioid receptor) (7–60 protein)	Q9NZT2|OGFR_HUMAN	73,307	9
Eukaryotic translation initiation factor 3 subunit 12 (eIF-3 p25) (eIF-3 p28) (eIF3k) (Muscle-specific gene M9 protein) (PLAC-24)	Q9UBQ5|IF3C_HUMAN	25,042	9
Arsenical pump-driving ATPase (EC 3.6.3.16) (Arsenite-translocating ATPase) (Arsenical resistance ATPase) (Arsenite-transporting ATPase) (ARSA) (ASNA-I)	O43681|ARSA1_HUMAN	38,776	9
Glutamate-rich WD repeat-containing protein 1	Q9BQ67|GRWD1_HUMAN	49,400	9
Poly [ADP-ribose] polymerase 14 (EC 2.4.2.30) (PARP-14) (B aggressive lymphoma protein 2)	Q460N5|PAR14_HUMAN	193,737	9
Small nuclear ribonucleoprotein E (snRNP-E) (Sm protein E) (Sm-E) (SmE)	P62304|RUXE_HUMAN	10,786	9
Tyrosine-protein phosphatase non-receptor type 1 (EC 3.1.3.48) (Protein-tyrosine phosphatase 1B) (PTP-1B)	P18031|PTN1_HUMAN	49,950	9
52 kDa Ro protein (Sjoegren syndrome type A antigen) (SS-A) (Ro(SS-A)) (52 kDa ribonucleoprotein autoantigen Ro/SS-A) (Tripartite motif-containing protein 21) (RING finger protein 81)	P19474|RO52_HUMAN	54,152	9
Parathymosin	P20962|PTMS_HUMAN	11,512	9
Nucleolysin TIAR (TIA-1-related protein)	Q01085|TIAR_HUMAN	41,572	9

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NADH dehydrogenase [ubiquinone] iron-sulfur protein 3, mitochondrial precursor (EC 1.6.5.3) (EC 1.6.99.3) (NADH-ubiquinone oxidoreductase 30 kDa subunit) (Complex I-30kD) (CI-30kD)	O75489|NDUS3_HUMAN	30,224	9
Protein FAM49A	Q9H0Q0|FA49A_HUMAN	37,296	9
WD repeat protein 74 (NOP seven-associated protein 1)	Q6RFH5|WDR74_HUMAN	42,423	9
BolA-like protein 2	Q9H3K6|BOLA2_HUMAN	10,098	9
Ubiquitin-conjugating enzyme E2 variant 1 (UEV-1) (CROC-1) (Ubiquitin-conjugating enzyme variant Kua) (TRAF6-regulated IKK activator 1 beta Uev1A)	Q13404|UB2V1_HUMAN	25,779	9
Cordon-bleu protein-like 1	Q53SF7|CBLL1_HUMAN	131,771	9
Cytochrome c1 heme protein, mitochondrial precursor (Cytochrome c-1)	P08574|CY1_HUMAN	35,373	9
Cytochrome b5 type B precursor (Cytochrome b5 outer mitochondrial membrane isoform)	O43169|CYB5B_HUMAN	16,314	9
Sorting nexin-6 (TRAF4-associated factor 2)	Q9UNH7|SNX6_HUMAN	46,632	8
RNA-binding protein 14 (RNA-binding motif protein 14) (RRM-containing coactivator activator/ modulator) (Synaptotagmin-interacting protein) (SYT-interacting protein)	Q96PK6|RBM14_HUMAN	69,474	8
Tubulin-specific chaperone B (Tubulin folding cofactor B) (Cytoskeleton-associated protein 1) (Cytoskeleton-associated protein CKAPI)	Q99426|TBCB_HUMAN	27,308	8
Ubiquitin carboxyl-terminal hydrolase 10 (EC 3.1.2.15) (Ubiquitin thioesterase 10) (Ubiquitin-specific-processing protease 10) (Deubiquitinating enzyme 10)	Q14694|UBP10_HUMAN	87,117	8
SWI/SNF-related matrix-associated actin-dependent regulator of chromatin subfamily A member 5 (EC 3.6.1.-) (SWI/SNF-related matrix-associated actin-dependent regulator of chromatin A5) (Sucrose nonfermenting protein 2 homolog) (hSNF2H)	O60264|SMCA5_HUMAN	121,893	8
Succinate dehydrogenase [ubiquinone] iron-sulfur subunit, mitochondrial precursor (EC 1.3.5.1) (Ip) (Iron-sulfur subunit of complex II)	P21912|DHSB_HUMAN	31,613	8
Protein FAM21C	Q9Y4E1|FA21C_HUMAN	144,897	8
Chromodomain helicase-DNA-binding protein 4 (EC 3.6.1.-) (ATP-dependent helicase CHD4) (CHD-4) (Mi-2 autoantigen 218 kDa protein) (Mi2-beta)	Q14839|CHD4_HUMAN	217,977	8
Putative RNA methyltransferase NOL1 (EC 2.1.1.-) (Proliferating-cell nucleolar antigen p120) (Proliferation-associated nucleolar protein p120)	P46087|NOL1_HUMAN	89,286	8
Dynactin subunit 4 (Dynactin subunit p62)	Q9UJW0|DCTN4_HUMAN	52,320	8
U4/U6 small nuclear ribonucleoprotein Prp4 (U4/U6 snRNP 60 kDa protein) (WD splicing factor Prp4) (hPrp4) (PRP4 homolog)	O43172|PRP4_HUMAN	58,432	8
Elongation factor G 1, mitochondrial precursor (mEF-G 1) (Elongation factor G1)	Q96RP9|EFG1_HUMAN	83,456	8
Protocadherin-1 precursor (Protocadherin-42) (PC42) (Cadherin-like protein 1)	Q08174|PCDH1_HUMAN	111,253	8
Catalase (EC 1.11.1.6)	P04040|CATA_HUMAN	59,739	8
Actin-binding LIM protein 1 (Actin-binding LIM protein family member 1) (abLIM-1) (Actin-binding double-zinc-finger protein) (LIMAB1) (Limatin)	O14639|ABLM1_HUMAN	87,628	8

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Splicing factor, arginine/serine-rich 9 (Pre-mRNA-splicing factor SRp30C)	Q13242|SFRS9_HUMAN	25,525	8
Thymidylate kinase (EC 2.7.4.9) (dTMP kinase)	P23919|DTYMK_HUMAN	23,802	8
28 kDa heat- and acid-stable phosphoprotein (PDGF-associated protein) (PAP) (PDGFA-associated protein 1) (PAP1)	Q13442|HAP28_HUMAN	20,613	8
Thimet oligopeptidase (EC 3.4.24.15) (Endopeptidase 24.15) (MP78)	P52888|MEPD_HUMAN	78,823	8
Sorting nexin-2 (Transformation-related gene 9 protein) (TRG-9)	O60749|SNX2_HUMAN	58,454	8
Aspartate aminotransferase, cytoplasmic (EC 2.6.1.1) (Transaminase A) (Glutamate oxaloacetate transaminase 1)	P17174|AATC_HUMAN	46,230	8
Proteasome subunit alpha type 4 (EC 3.4.25.1) (Proteasome component C9) (Macropain subunit C9) (Multicatalytic endopeptidase complex subunit C9) (Proteasome subunit L)	P25789|PSA4_HUMAN	29,467	8
NADP-dependent malic enzyme (EC 1.1.1.40) (NADP-ME) (Malic enzyme 1)	P48163|MAOX_HUMAN	64,133	8
Cleavage and polyadenylation specificity factor 5 (Cleavage and polyadenylation specificity factor 25 kDa subunit) (CPSF 25 kDa subunit) (Pre-mRNA cleavage factor Im 25 kDa subunit) (Nucleoside diphosphate-linked moiety X motif 21) (Nudix motif 21)	O43809|CPSF5_HUMAN	26,210	8
Host cell factor (HCF) (HCF-1) (C1 factor) (VP16 accessory protein) (VCAF) (CFF) [Contains: HCF N-terminal chain 1; HCF N-terminal chain 2; HCF N-terminal chain 3; HCF N-terminal chain 4; HCF N-terminal chain 5; HCF N-terminal chain 6; HCF C-terminal chain 1; HCF C-terminal chain 2; HCF C-terminal chain 3; HCF C-terminal chain 4; HCF C-terminal chain 5; HCF C-terminal chain 6]	P51610|HCFC1_HUMAN	208,816	8
NG,NG-dimethylarginine dimethylaminohydrolase 1 (EC 3.5.3.18) (Dimethylargininase-1) (Dimethylarginine dimethylaminohydrolase 1) (DDAHI) (DDAH-1)	O94760|DDAH1_HUMAN	31,104	8
SH3 domain GRB2-like protein B1 (EC 2.3.1.-) (Endophilin-B1) (Bax-interacting factor 1) (Bif-1)	Q9Y371|SHLB1_HUMAN	40,780	8
Glutathione reductase, mitochondrial precursor (EC 1.8.1.7) (GR) (GRase)	P00390|GSHR_HUMAN	56,239	8
Tripartite motif-containing protein 47 (Gene overexpressed in astrocytoma protein) (RING finger protein 100)	Q96LD4|TRI47_HUMAN	69,513	8
SNW domain-containing protein 1 (Nuclear protein SkiP) (Ski-interacting protein) (Nuclear receptor coactivator NCoA-62)	Q13573|SNW1_HUMAN	61,478	8
Acylamino-acid-releasing enzyme (EC 3.4.19.1) (AARE) (Acyl-peptide hydrolase) (APH) (Acylaminoacyl-peptidase) (Oxidized protein hydrolase) (OPH) (DNF15S2 protein)	P13798|ACPH_HUMAN	81,206	8
Guanine nucleotide-binding protein G(s) subunit alpha isoforms short (Adenylate cyclase-stimulating G alpha protein)	P63092|GNAS2_HUMAN, Q5JWF2|GNAS1_HUMAN	45,647	8
Vacuolar protein sorting-associated protein 26A (Vesicle protein sorting 26A) (hVPS26)	O75436|VP26A_HUMAN	38,153	8
26S proteasome non-ATPase regulatory subunit 9 (26S proteasome regulatory subunit p27)	O00233|PSMD9_HUMAN	24,635	8
BH3-interacting domain death agonist (BID) (p22 BID) [Contains: BH3-interacting domain death agonist p15 (p15 BID); BH3-interacting domain death agonist p13 (p13 BID); BH3-interacting domain death agonist p11 (p11 BID)]	P55957|BID_HUMAN	21,977	8
Coatomer subunit zeta-1 (Zeta-1 coat protein) (Zeta-1 COP)	P61923|COPZ1_HUMAN	20,181	8

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Importin alpha-1 subunit (Karyopherin alpha-1 subunit) (SRP1-beta) (RAG cohort protein 2) (Nucleoprotein interactor 1) (NPI-1)	P52294|IMA1_HUMAN	60,232	8
Isoleucyl-tRNA synthetase, mitochondrial precursor (EC 6.1.1.5) (Isoleucine--tRNA ligase) (IleRS)	Q9NSE4|SYIM_HUMAN	113,776	8
Cytoplasmic dynein 1 light intermediate chain 2 (Dynein light intermediate chain 2, cytosolic) (LIC53/55) (LIC-2)	O43237|DC1L2_HUMAN	54,082	8
Na(+)/H(+) exchange regulatory cofactor NHE-RF2 (NHERF-2) (Tyrosine kinase activator protein 1) (TKA-1) (SRY-interacting protein 1) (SIP-1) (Solute carrier family 9 isoform A3 regulatory factor 2) (NHE3 kinase A regulatory protein E3KARP) (Sodium-hydrogen exchanger regulatory factor 2)	Q15599|NHRF2_HUMAN	37,395	8
COP9 signalosome complex subunit 3 (Signalosome subunit 3) (SGN3) (JAB1-containing signalosome subunit 3)	Q9UNS2|CSN3_HUMAN	47,857	8
Prefoldin subunit 3 (Von Hippel-Lindau-binding protein 1) (VHL-binding protein 1) (VBP-1) (HIBBJ46)	P61758|PFD3_HUMAN	22,641	8
CD166 antigen precursor (Activated leukocyte-cell adhesion molecule) (ALCAM)	Q13740|CD166_HUMAN	65,086	8
Ubiquitin-fold modifier 1 precursor	P61960|UFM1_HUMAN	9,100	8
Eukaryotic translation initiation factor 3 subunit 6 (eIF-3 p48) (eIF3e) (Viral integration site protein INT-6 homolog)	P60228|IF36_HUMAN	52,205	8
Small glutamine-rich tetratricopeptide repeat-containing protein A (Vpu-binding protein) (UBP)	O43765|SGTA_HUMAN	34,046	8
UPF0317 protein C14orf159, mitochondrial precursor	Q7Z3D6|CN159_HUMAN	66,419	8
Actin-related protein 2/3 complex subunit 5-like protein (ARP2/3 complex 16 kDa subunit 2) (ARC16-2)	Q9BPX5|ARP5L_HUMAN	16,923	8
2,4-dienoyl-CoA reductase, mitochondrial precursor (EC 1.3.1.34) (2,4-dienoyl-CoA reductase [NADPH]) (4-enoyl-CoA reductase [NADPH])	Q16698|DECR_HUMAN	36,051	8
Eukaryotic translation initiation factor 1 (eIF1) (Protein translation factor SUI1 homolog) (Sui1iso1) (A121)	P41567|EIF1_HUMAN	12,715	8
Nicalin precursor (Nicastrin-like protein)	Q969V3|NCLN_HUMAN	62,957	8
Ras GTPase-activating protein-binding protein 2 (G3BP-2) (GAP SH3 domain-binding protein 2)	Q9UN86|G3BP2_HUMAN	54,102	8
Growth factor receptor-bound protein 2 (Adapter protein GRB2) (SH2/SH3 adapter GRB2) (Protein Ash)	P62993|GRB2_HUMAN	25,189	8
Ras-related protein Rab-18	Q9NP72|RAB18_HUMAN	22,960	8
Complement decay-accelerating factor precursor (CD55 antigen)	P08174|DAF_HUMAN	41,382	8
TRM112-like protein	Q9UI30|TR112_HUMAN	14,181	8
Cytochrome c oxidase subunit 4 isoform 1, mitochondrial precursor (EC 1.9.3.1) (Cytochrome c oxidase subunit IV isoform 1) (COX IV-1) (Cytochrome c oxidase polypeptide IV)	P13073|COX41_HUMAN	19,559	8
Transmembrane emp24 domain-containing protein 9 precursor (Glycoprotein 25L2)	Q9BVK6|TMED9_HUMAN	25,087	8
Nuclear transport factor 2 (NTF-2) (Placental protein 15) (PP15)	P61970|NTF2_HUMAN	14,461	8

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3′(2′),5′-bisphosphate nucleotidase 1 (EC 3.1.3.7) (Bisphosphate 3′-nucleotidase 1) (PAP-inositol-1,4-phosphatase) (PIP)	O95861|BPNT1_HUMAN	33,375	8
Tyrosine-protein kinase CSK (EC 2.7.10.2) (C-SRC kinase) (Protein-tyrosine kinase CYL)	P41240|CSK_HUMAN	50,687	8
Guanylate kinase (EC 2.7.4.8) (GMP kinase)	Q16774|KGUA_HUMAN	21,708	8
Cleavage and polyadenylation specificity factor 6 (Cleavage and polyadenylation specificity factor 68 kDa subunit) (CPSF 68 kDa subunit) (Pre-mRNA cleavage factor Im 68 kDa subunit) (Protein HPBRII-4/7)	Q16630|CPSF6_HUMAN	59,193	8
Prolyl 4-hydroxylase subunit alpha-2 precursor (EC 1.14.11.2) (4-PH alpha-2) (Procollagen-proline,2-oxoglutarate-4-dioxygenase alpha-2 subunit)	O15460|P4HA2_HUMAN	60,885	8
Vesicle-associated membrane protein 3 (VAMP-3) (Synaptobrevin-3) (Cellubrevin) (CEB)	Q15836|VAMP3_HUMAN	11,291	8
Rho GTPase-activating protein 17 (Rho-type GTPase-activating protein 17) (RhoGAP interacting with CIP4 homologs protein 1) (RICH-1)	Q68EM7|RHG17_HUMAN	95,419	8
Cleavage stimulation factor 50 kDa subunit (CSTF 50 kDa subunit) (CF-1 50 kDa subunit) (CstF-50)	Q05048|CSTF1_HUMAN	48,341	8
ATP synthase B chain, mitochondrial precursor (EC 3.6.3.14)	P24539|AT5F1_HUMAN	28,891	8
Putative adenosylhomocysteinase 2 (EC 3.3.1.1) (S-adenosyl-L-homocysteine hydrolase 2) (AdoHcyase 2) (S-adenosylhomocysteine hydrolase-like 1) (DC-expressed AHCY-like molecule)	O43865|SAHH2_HUMAN	58,934	8
C-type lectin domain family 14 member A precursor (Epidermal growth factor receptor 5) (EGFR-5)	Q86T13|CLC14_HUMAN	51,618	8
UDP-glucose 4-epimerase (EC 5.1.3.2) (Galactowaldenase) (UDP-galactose 4-epimerase)	Q14376|GALE_HUMAN	38,264	8
Proteasome subunit beta type 7 precursor (EC 3.4.25.1) (Proteasome subunit Z) (Macropain chain Z) (Multicatalytic endopeptidase complex chain Z)	Q99436|PSB7_HUMAN	29,948	8
Importin-9 (Imp9) (Ran-binding protein 9) (RanbP9)	Q96P70|IPO9_HUMAN	115,946	8
Protein deltex 3-like protein (B-lymphoma- and BAL-associated protein) (Rhysin-2) (Rhysin2)	Q8TDB6|DTX3L_HUMAN	83,538	8
DnaJ homolog subfamily B member 11 precursor (ER-associated dnaJ protein 3) (ErJ3) (ER-associated Hsp40 co-chaperone) (hDj9) (PWP1-interacting protein 4)	Q9UBS4|DJB11_HUMAN	40,497	8
Phosphoglucomutase-1 (EC 5.4.2.2) (Glucose phosphomutase 1) (PGM 1)	P36871|PGM1_HUMAN	61,433	8
Elongation factor Ts, mitochondrial precursor (EF-Ts) (EF-TsMt)	P43897|EFTS_HUMAN	35,373	8
Membrane-associated progesterone receptor component 1 (mPR)	O00264|PGRC1_HUMAN	21,654	8
Ubiquitin carboxyl-terminal hydrolase 7 (EC 3.1.2.15) (Ubiquitin thioesterase 7) (Ubiquitin-specific-processing protease 7) (Deubiquitinating enzyme 7) (Herpesvirus-associated ubiquitin-specific protease)	Q93009|UBP7_HUMAN	128,257	8
Huntingtin-interacting protein 1 (HIP-I)	O00291|HIP1_HUMAN	115,426	8
Signal peptidase complex subunit 2 (EC 3.4.-.-) (Microsomal signal peptidase 25 kDa subunit) (SPase 25 kDa subunit)	Q15005|SPCS2_HUMAN	24,986	8
Solute carrier family 2, facilitated glucose transporter member 1 (Glucose transporter type 1, erythrocyte/brain) (HepG2 glucose transporter)	P11166|GTR1_HUMAN	54,067	8

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Intercellular adhesion molecule 2 precursor (ICAM-2) (CD102 antigen)	P13598|ICAM2_HUMAN	30,636	8
Small nuclear ribonucleoprotein G (snRNP-G) (Sm protein G) (Sm-G) (SmG)	P62308|RUXG_HUMAN	8,478	8
FK506-binding protein 2 precursor (EC 5.2.1.8) (Peptidyl-prolyl cis-trans isomerase) (PPIase) (Rotamase) (13 kDa FKBP) (FKBP-13)	P26885|FKBP2_HUMAN	15,632	8
Transcription elongation factor B polypeptide 2 (RNA polymerase II transcription factor SIII subunit B) (SIII p18) (Elongin B) (EloB) (Elongin 18 kDa subunit)	Q15370|ELOB_HUMAN	13,115	8
ERGIC-53 protein precursor (ER-Golgi intermediate compartment 53 kDa protein) (Lectin, mannose-binding 1) (Gp58) (Intracellular mannose-specific lectin MR60)	P49257|LMAN1_HUMAN	57,531	8
Protein FAM107B	Q9H098|F107B_HUMAN	15,540	8
Splicing factor, arginine/serine-rich 2 (Splicing factor SC35) (SC-35) (Splicing component, 35 kDa) (Protein PR264)	Q01130|SFRS2_HUMAN	25,459	8
WD repeat protein 61 (Meiotic recombination REC14 protein homolog)	Q9GZS3|WDR61_HUMAN	33,563	8
Scavenger mRNA decapping enzyme DcpS (EC 3.-.-.-) (DCS-1) (Hint-related 7meGMP-directed hydrolase) (Histidine triad protein member 5) (HINT-5)	Q96C86|DCPS_HUMAN	38,592	8
Thyroid receptor-interacting protein 6 (TRIP-6) (OPA-interacting protein 1) (Zyxin-related protein 1) (ZRP-1)	Q15654|TRIP6_HUMAN	50,269	8
Transcription factor BTF3 homolog 4 (Basic transcription factor 3-like 4)	Q96K17|BT3L4_HUMAN	17,253	8
39S ribosomal protein L47, mitochondrial precursor (L47mt) (MRP-L47)	Q9HD33|RM47_HUMAN	29,561	8
Replication protein A 14 kDa subunit (RP-A) (RF-A) (Replication factor-A protein 3) (p14)	P35244|RFA3_HUMAN	13,551	8
AP-3 complex subunit beta-1 (Adapter-related protein complex 3 beta-1 subunit) (Beta3A-adaptin) (Adaptor protein complex AP-3 beta-1 subunit) (Clathrin assembly protein complex 3 beta-1 large chain)	O00203|AP3B1_HUMAN	121,336	8
ATP-dependent RNA helicase DDX39 (EC 3.6.1.-) (DEAD box protein 39) (Nuclear RNA helicase URH49)	O00148|DDX39_HUMAN	49,112	7
Flotillin-1	O75955|FLOT1_HUMAN	47,337	7
Uncharacterized protein C10orf58 precursor	Q9BRX8|CJ058_HUMAN	25,748	7
Flotillin-2 (Epidermal surface antigen) (ESA)	Q14254|FLOT2_HUMAN	41,667	7
Calcium/calmodulin-dependent protein kinase type II delta chain (EC 2.7.11.17) (CaM-kinase II delta chain) (CaM kinase II subunit delta) (CaMK-II subunit delta)	Q13557|KCC2D_HUMAN	56,353	7
Thiosulfate sulfurtransferase (EC 2.8.1.1) (Rhodanese)	Q16762|THTR_HUMAN	33,411	7
Tumor suppressor p53-binding protein 1 (p53-binding protein 1) (p53BP1) (53BP1)	Q12888|TP53B_HUMAN	213,554	7
DNA replication licensing factor MCM2 (Minichromosome maintenance protein 2 homolog) (Nuclear protein BM28)	P49736|MCM2_HUMAN	101,880	7
Ras-related protein Rab-5C (RAB5L) (L1880)	P51148|RAB5C_HUMAN	23,465	7

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Signal recognition particle 54 kDa protein (SRP54)	P61011|SRP54_HUMAN	55,688	7
Mothers against decapentaplegic homolog 3 (SMAD 3) (Mothers against DPP homolog 3) (Mad3) (hMAD-3) (JV15-2) (hSMAD3)	P84022|SMAD3_HUMAN	48,063	7
Uncharacterized protein C12orf5	Q9NQ88|CL005_HUMAN	30,045	7
Nck-associated protein 1 (NAP 1) (p125Nap1) (Membrane-associated protein HEM-2)	Q9Y2A7|NCKP1_HUMAN	128,777	7
Inositol monophosphatase (EC 3.1.3.25) (IMPase) (IMP) (Inositol-1(or 4)-monophosphatase) (Lithium-sensitive myo-inositol monophosphatase A1)	P29218|IMPA1_HUMAN	30,171	7
Sideroflexin-3	Q9BWM7|SFXN3_HUMAN	35,486	7
Serine palmitoyltransferase 2 (EC 2.3.1.50) (Long chain base biosynthesis protein 2) (LCB 2) (Serine-palmitoyl-CoA transferase 2) (SPT 2)	O15270|LCB2_HUMAN	62,908	7
mRNA-associated protein mrnp 41 (Rae1 protein homolog)	P78406|RAE1L_HUMAN	40,951	7
Protein NDRG1 (N-myc downstream-regulated gene 1 protein) (Differentiation-related gene 1 protein) (DRG-1) (Reducing agents and tunicamycin-responsive protein) (RTP) (Nickel-specific induction protein Cap43) (Rit42)	Q92597|NDRG1_HUMAN	42,817	7
UTP--glucose-1-phosphate uridylyltransferase 2 (EC 2.7.7.9) (UDP-glucose pyrophosphorylase 2) (UDPGP 2) (UGPase 2)	Q07131|UGPA1_HUMAN, Q16851|UGPA2_HUMAN	56,924	7
Glutathione synthetase (EC 6.3.2.3) (Glutathione synthase) (GSH synthetase) (GSH-S)	P48637|GSHB_HUMAN	52,368	7
Superkiller viralicidic activity 2-like 2 (EC 3.6.1.-) (ATP-dependent helicase SKIV2L2)	P42285|SK2L2_HUMAN	117,790	7
ATP-dependent RNA helicase DDX42 (EC 3.6.1.-) (DEAD box protein 42) (Splicing factor 3B-associated 125 kDa protein) (SF3b125) (RNA helicase-related protein) (RNAHP) (RNA helicase-like protein) (RHELP) (SF3b DEAD-box protein)	Q86XP3|DDX42_HUMAN	102,959	7
Adenosine kinase (EC 2.7.1.20) (AK) (Adenosine 5′-phosphotransferase)	P55263|ADK_HUMAN	40,529	7
ATP synthase coupling factor 6, mitochondrial precursor (EC 3.6.3.14) (ATPase subunit F6)	P18859|ATP5J_HUMAN	12,570	7
U6 snRNA-associated Sm-like protein LSm8	O95777|LSM8_HUMAN	10,385	7
NADH dehydrogenase [ubiquinone] flavoprotein 2, mitochondrial precursor (EC 1.6.5.3) (EC 1.6.99.3) (NADH-ubiquinone oxidoreductase 24 kDa subunit)	P19404|NDUV2_HUMAN	27,374	7
Laminin subunit alpha-5 precursor	O15230|LAMA5_HUMAN	399,725	7
Nucleoporin 50 kDa (Nuclear pore-associated protein 60 kDa-like)	Q9UKX7|NUP50_HUMAN	50,127	7
Mitochondrial carrier homolog 2 (Met-induced mitochondrial protein)	Q9Y6C9|MTCH2_HUMAN	33,314	7
Sulfatase-modifying factor 2 precursor (C-alpha-formylglycine-generating enzyme 2)	Q8NBJ7|SUMF2_HUMAN	33,839	7
Programmed cell death protein 4 (Nuclear antigen H731-like) (Neoplastic transformation inhibitor protein) (Protein 197/15a)	Q53EL6|PDCD4_HUMAN	51,704	7
RNA-binding protein 4 (RNA-binding motif protein 4) (RNA-binding motif protein 4a) (Lark homolog) (hLark)	Q9BWF3|RBM4_HUMAN	40,296	7

Protein Description	Accession Number	Molecular Weight	Total SpC
Exocyst complex component 4 (Exocyst complex component Sec8)	Q96A65|EXOC4_HUMAN	110,485	7
Ubiquilin-1 (Protein linking IAP with cytoskeleton 1) (PLIC-1) (hPLIC-1)	Q9UMX0|UBQL1_HUMAN	62,502	7
NADH dehydrogenase [ubiquinone] iron-sulfur protein 6, mitochondrial precursor (EC 1.6.5.3) (EC 1.6.99.3) (NADH-ubiquinone oxidoreductase 13 kDa-A subunit) (Complex I-13kD-A) (CI-13kD-A)	O75380|NDUS6_HUMAN	13,693	7
Mitochondrial-processing peptidase alpha subunit, mitochondrial precursor (EC 3.4.24.64) (Alpha-MPP) (P-55)	Q10713|MPPA_HUMAN	58,236	7
Enhancer of mRNA decapping protein 4 (Human enhancer of decapping large subunit) (Hedls) (Autoantigen Ge-1) (Autoantigen RCD-8)	Q6P2E9|EDC4_HUMAN	151,644	7
ARF GTPase-activating protein GIT2 (G protein-coupled receptor kinase-interactor 2) (GRK-interacting protein 2) (Cool-interacting tyrosine-phosphorylated protein 2) (CAT2) (CAT-2)	Q14161|GIT2_HUMAN	84,526	7
Protein transport protein Sec24B (SEC24-related protein B)	O95487|SC24B_HUMAN	137,773	7
Diphosphomevalonate decarboxylase (EC 4.1.1.33) (Mevalonate pyrophosphate decarboxylase) (Mevalonate (diphospho)decarboxylase)	P53602|ERG19_HUMAN	43,387	7
Sorbitol dehydrogenase (EC 1.1.1.14) (L-iditol 2-dehydrogenase)	Q00796|DHSO_HUMAN	38,279	7
Sodium/potassium-transporting ATPase subunit beta-3 (Sodium/potassium-dependent ATPase beta-3 subunit) (ATPB-3) (CD298 antigen)	P54709|AT1B3_HUMAN	31,496	7
Splicing factor 3B subunit 5 (SF3b5) (Pre-mRNA-splicing factor SF3b 10 kDa subunit)	Q9BWJ5|SF3B5_HUMAN	10,118	7
Angiopoietin-2 precursor (ANG-2)	O15123|ANGP2_HUMAN	56,902	7
Dynein light chain roadblock-type 1 (Dynein light chain 2A, cytoplasmic) (Dynein-associated protein Km23) (Bithoraxoid-like protein) (BLP)	Q9NP97|DLRB1_HUMAN	10,904	7
Nuclear pore complex protein Nup214 (Nucleoporin Nup214) (214 kDa nucleoporin) (CAN protein)	P35658|NU214_HUMAN	213,748	7
Glycylpeptide N-tetradecanoyltransferase 1 (EC 2.3.1.97) (Peptide N-myristoyltransferase 1) (Myristoyl-CoA:protein N-myristoyltransferase 1) (NMT 1) (Type I N-myristoyltransferase)	P30419|NMT1_HUMAN	56,789	7
39S ribosomal protein L11, mitochondrial precursor (L11mt) (MRP-L11)	Q9Y3B7|RM11_HUMAN	20,666	7
SPFH domain-containing protein 1 precursor (Protein KE04)	O75477|SPFH1_HUMAN	38,909	7
Glycogen debranching enzyme (Glycogen debrancher) [Includes: 4-alpha-glucanotransferase (EC 2.4.1.25) (Oligo-1,4-1,4-glucantransferase); Amylo-alpha-1,6-glucosidase (EC 3.2.1.33) (Amylo-1,6-glucosidase) (Dextrin 6-alpha-D-glucosidase)]	P35573|GDE_HUMAN	174,750	7
Integrin beta-3 precursor (Platelet membrane glycoprotein IIIa) (GPIIIa) (CD61 antigen)	P05106|ITB3_HUMAN	87,040	7
ATP-binding cassette sub-family F member 2 (Iron-inhibited ABC transporter 2)	Q9UG63|ABCF2_HUMAN	71,275	7
Probable ATP-dependent RNA helicase DDX23 (EC 3.6.1.-) (DEAD box protein 23) (100 kDa U5 snRNP-specific protein) (U5-100kD) (PRP28 homolog)	Q9BUQ8|DDX23_HUMAN	95,633	7
Probable ATP-dependent RNA helicase DDX48 (EC 3.6.1.-) (DEAD box protein 48) (Eukaryotic initiation factor 4A-like NUK-34) (Nuclear matrix protein 265) (hNMP 265) (Eukaryotic translation initiation factor 4A isoform 3)	P38919|DDX48_HUMAN	46,854	7

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Synaptic glycoprotein SC2	Q9NZ01|GPSN2_HUMAN	36,018	7
ATPase family AAA domain-containing protein 3B	Q5T9A4|ATD3B_HUMAN	72,556	7
FK506-binding protein 5 (EC 5.2.1.8) (Peptidyl-prolyl cis-trans isomerase) (PPIase) (Rotamase) (51 kDa FK506-binding protein) (FKBP-51) (54 kDa progesterone receptor-associated immunophilin) (FKBP54) (P54) (FF1 antigen) (HSP90-binding immunophilin) (Androgen-regulated protein 6)	Q13451|FKBP5_HUMAN	51,196	7
39S ribosomal protein L15, mitochondrial precursor (L15mt) (MRP-L15)	Q9P015|RM15_HUMAN	33,404	7
Probable ATP-dependent RNA helicase DDX6 (EC 3.6.1.-) (DEAD box protein 6) (ATP-dependent RNA helicase p54) (Oncogene RCK)	P26196|DDX6_HUMAN	54,401	7
Probable RNA-binding protein 25 (RNA-binding motif protein 25) (RNA-binding region-containing protein 7) (Protein S164)	P49756|RBM25_HUMAN	94,108	7
3-ketoacyl-CoA thiolase, peroxisomal precursor (EC 2.3.1.16) (Beta-ketothiolase) (Acetyl-CoA acyltransferase) (Peroxisomal 3-oxoacyl-CoA thiolase)	P09110|THIK_HUMAN	44,274	7
FK506-binding protein 8 (EC 5.2.1.8) (Peptidyl-prolyl cis-trans isomerase) (PPIase) (Rotamase) (38 kDa FK506-binding protein) (FKBPR38) (hFKBP38)	Q14318|FKBP8_HUMAN	38,391	7
AP-1 complex subunit beta-1 (Adapter-related protein complex 1 beta-1 subunit) (Beta-adaptin 1) (Adaptor protein complex AP-1 beta-1 subunit) (Golgi adaptor HA1/AP1 adaptin beta subunit) (Clathrin assembly protein complex 1 beta large chain)	Q10567|AP1B1_HUMAN	104,591	7
Transcription elongation factor B polypeptide 1 (RNA polymerase II transcription factor SIII subunit C) (SIII p15) (Elongin-C) (EloC) (Elongin 15 kDa subunit)	Q15369|ELOC_HUMAN	12,455	7
Tricarboxylate transport protein, mitochondrial precursor (Citrate transport protein) (CTP) (Tricarboxylate carrier protein) (Solute carrier family 25 member 1)	P53007|TXTP_HUMAN	33,995	7
Caspase-7 precursor (EC 3.4.22.60) (CASP-7) (ICE-like apoptotic protease 3) (ICE-LAP3) (Apoptotic protease Mch-3) (CMH-1) [Contains: Caspase-7 subunit p20; Caspase-7 subunit p11]	P55210|CASP7_HUMAN	34,260	7
40S ribosomal protein S27-like protein	Q71UM5|RS27L_HUMAN	9,459	7
E3 ubiquitin-protein ligase BRE1A (EC 6.3.2.-) (BRE1-A) (hBRE1) (RING finger protein 20)	Q5VTR2|BRE1A_HUMAN	113,648	7
Acetyl-CoA carboxylase 1 (EC 6.4.1.2) (ACC-alpha) [Includes: Biotin carboxylase (EC 6.3.4.14)]	Q13085|COA1_HUMAN	265,538	7
Matrix metalloproteinase-14 precursor (EC 3.4.24.80) (MMP-14) (Membrane-type matrix metalloproteinase 1) (MT-MMP 1) (MTMMP1) (Membrane-type-1 matrix metalloproteinase) (MT1-MMP) (MT1MMP) (MMP-X1)	P50281|MMP14_HUMAN	65,868	7
Cell division control protein 2 homolog (EC 2.7.11.22) (EC 2.7.11.23) (p34 protein kinase) (Cyclin-dependent kinase 1) (CDK1)	P06493|CDC2_HUMAN	34,079	7
Proteasome subunit beta type 9 precursor (EC 3.4.25.1) (Proteasome chain 7) (Macropain chain 7) (Multicatalytic endopeptidase complex chain 7) (RING12 protein) (Low molecular mass protein 2)	P28065|PSB9_HUMAN	23,246	7
Salivary alpha-amylase precursor (EC 3.2.1.1) (1,4-alpha-D-glucan glucanohydrolase)	P04745|AMYS_HUMAN	57,750	7
Tyrosine-protein phosphatase non-receptor type 12 (EC 3.1.3.48) (Protein-tyrosine phosphatase G1) (PTPG1)	Q05209|PTN12_HUMAN	88,104	7
Uncharacterized protein KIAA0179	Q14684|K0179_HUMAN	84,396	7

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Glutamate--cysteine ligase regulatory subunit (EC 6.3.2.2) (Gamma-glutamylcysteine synthetase) (Gamma-ECS) (GCS light chain) (Glutamate--cysteine ligase modifier subunit)	P48507|GSH0_HUMAN	30,709	7
Splicing factor 1 (Zinc finger protein 162) (Transcription factor ZFM1) (Zinc finger gene in MEN1 locus) (Mammalian branch point-binding protein mBBP) (BBP)	Q15637|SF01_HUMAN	68,313	7
Pinin (140 kDa nuclear and cell adhesion-related phosphoprotein) (Domain-rich serine protein) (DRS-protein) (DRSP) (Melanoma metastasis clone A protein) (Desmosome-associated protein) (SR-like protein) (Nuclear protein SDK3)	Q9H307|PININ_HUMAN	81,595	7
Histone-binding protein RBBP4 (Retinoblastoma-binding protein 4) (RBBP-4) (Retinoblastoma-binding protein p48) (Chromatin assembly factor 1 subunit C) (CAF-1 subunit C) (Chromatin assembly factor I p48 subunit) (CAF-I 48 kDa subunit) (CAF-I p48) (Nucleosome remodeling factor subunit RBAP48)	Q09028|RBBP4_HUMAN	47,638	7
Phosphoserine aminotransferase (EC 2.6.1.52) (PSAT)	Q9Y617|SERC_HUMAN	40,405	7
SAPK substrate protein 1 (UBA/UBX 33.3 kDa protein)	Q04323|SAKS1_HUMAN	33,307	7
1,2-dihydroxy-3-keto-5-methylthiopentene dioxygenase (EC 1.13.-.-) (Aci-reductone dioxygenase) (ARD) (Membrane-type 1 matrix metalloproteinase cytoplasmic tail-binding protein 1) (MTCBP-1) (Submergence-induced protein 2 homolog) (SIPL)	Q9BV57|MTND_HUMAN	21,481	7
Mitochondrial 28S ribosomal protein S36 (S36mt) (MRP-S36)	P82909|RT36_HUMAN	11,448	7
Nuclear inhibitor of protein phosphatase 1 (NIPP-1) (Protein phosphatase 1 regulatory inhibitor subunit 8) [Includes: Activator of RNA decay (EC 3.1.4.-) (ARD-1)]	Q12972|PP1R8_HUMAN	38,462	7
NADH dehydrogenase [ubiquinone] 1 alpha subcomplex subunit 2 (EC 1.6.5.3) (EC 1.6.99.3) (NADH-ubiquinone oxidoreductase B8 subunit) (Complex I-B8) (CI-B8)	O43678|NDUA2_HUMAN	10,904	7
Optineurin (Optic neuropathy-inducing protein) (E3-14.7K-interacting protein) (FIP-2) (Huntingtin-interacting protein HYPL) (NEMO-related protein) (Transcription factor IIIA-interacting protein) (TFIIIA-IntP)	Q96CV9|OPTN_HUMAN	65,905	7
Dual specificity mitogen-activated protein kinase kinase 1 (EC 2.7.12.2) (MAP kinase kinase 1) (MAPKK 1) (ERK activator kinase 1) (MAPK/ERK kinase 1) (MEK1)	Q02750|MP2K1_HUMAN	43,422	7
Monoamine-sulfating phenol sulfotransferase (EC 2.8.2.1) (Aryl sulfotransferase 1A3) (Sulfotransferase, monoamine-preferring) (M-PST) (Thermolabile phenol sulfotransferase) (TL-PST) (Placental estrogen sulfotransferase) (Catecholamine-sulfating phenol sulfotransferase) (HAST3)	P50224|ST1A3_HUMAN	34,179	7
GMP reductase 2 (EC 1.7.1.7) (Guanosine 5′-monophosphate oxidoreductase 2) (Guanosine monophosphate reductase 2)	Q9P2T1|GMPR2_HUMAN	37,857	7
Protein transport protein Sec23B (SEC23-related protein B)	Q15437|SC23B_HUMAN	86,463	7
Interferon-induced 35 kDa protein (IFP 35)	P80217|IN35_HUMAN	31,496	7
NADH dehydrogenase [ubiquinone] 1 alpha subcomplex subunit 10, mitochondrial precursor (EC 1.6.5.3) (EC 1.6.99.3) (NADH-ubiquinone oxidoreductase 42 kDa subunit) (Complex I-42kD) (CI-42kD)	O95299|NDUAA_HUMAN	40,734	7
Mitochondrial import receptor subunit TOM22 homolog (Translocase of outer membrane 22 kDa subunit homolog) (hTom22) (1C9-2)	Q9NS69|TOM22_HUMAN	15,504	7
Uncharacterized protein C1orf123	Q9NWV4|CA123_HUMAN	18,031	7

Protein Description	Accession Number	Molecular Weight	Total SpC
Cathepsin L precursor (EC 3.4.22.15) (Major excreted protein) (MEP) [Contains: Cathepsin L heavy chain; Cathepsin L light chain]	P07711|CATL_HUMAN	37,546	7
Small acidic protein	O00193|SMAP_HUMAN	20,315	7
Protein ALO17 (ALK lymphoma oligomerization partner on chromosome 17)	Q9HCF4|ALO17_HUMAN	174,882	7
Ras-related protein Ral-B precursor	P11234|RALB_HUMAN	23,391	7
Exportin-5 (Exp5) (Ran-binding protein 21)	Q9HAV4|XPO5_HUMAN	136,297	7
Erythrocyte band 7 integral membrane protein (Stomatin) (Protein 7.2b)	P27105|STOM_HUMAN	31,714	7
Interleukin-6 receptor subunit beta precursor (IL-6R-beta) (Interleukin-6 signal transducer) (Membrane glycoprotein 130) (gp130) (Oncostatin-M receptor alpha subunit) (CD130 antigen) (CDw130)	P40189|IL6RB_HUMAN	103,505	7
Retinol dehydrogenase 11 (EC 1.1.1.-) (Retinal reductase 1) (RalR1) (Prostate short-chain dehydrogenase/reductase 1) (Androgen-regulated short-chain dehydrogenase/reductase 1) (HCV core-binding protein HCBP12)	Q8TC12|RDH11_HUMAN	35,369	7
Dedicator of cytokinesis protein 9 (Cdc42 guanine nucleotide exchange factor zizimin-1)	Q9BZ29|DOCK9_HUMAN	236,433	7
Cisplatin resistance-associated overexpressed protein (cAMP regulatory element-associated protein 1) (CRE-associated protein 1) (CREAP-1) (Luc7A) (Okadaic acid-inducible phosphoprotein OA48-18)	O95232|CROP_HUMAN	51,449	7
Abhydrolase domain-containing protein 14B (CCG1-interacting factor B)	Q96IU4|AB14B_HUMAN	22,328	7
Alpha crystallin B chain (Alpha(B)-crystallin) (Rosenthal fiber component) (Heat-shock protein beta-5) (HspB5) (Renal carcinoma antigen NY-REN-27)	P02511|CRYAB_HUMAN	20,141	7
Netrin-4 precursor (Beta-netrin) (Hepar-derived netrin-like protein)	Q9HB63|NET4_HUMAN	70,052	7
Importin alpha-4 subunit (Karyopherin alpha-4 subunit) (Qip1 protein)	O00629|IMA4_HUMAN	57,869	7
Unc-112-related protein 2 (Kindlin-3) (MIG2-like)	Q86UX7|URP2_HUMAN	75,937	7
Thioredoxin domain-containing protein 1 precursor (Transmembrane Trx-related protein) (Thioredoxin-related transmembrane protein)	Q9H3N1|TXND1_HUMAN	31,774	7
Mannose-6-phosphate isomerase (EC 5.3.1.8) (Phosphomannose isomerase) (PMI) (Phosphohexomutase)	P34949|MANA_HUMAN	46,639	7
C-terminal-binding protein 1 (EC 1.1.1.-) (CtBP1)	Q13363|CTBP1_HUMAN	47,517	7
Nuclear ubiquitous casein and cyclin-dependent kinases substrate (P1)	Q9H1E3|NUCKS_HUMAN	27,279	7
C-Myc-binding protein (Associate of Myc 1) (AMY-1)	Q99417|MYCBP_HUMAN	11,949	7
Nesprin-2 (Nuclear envelope spectrin repeat protein 2) (Syne-2) (Synaptic nuclear envelope protein 2) (Nucleus and actin connecting element protein) (Protein NUANCE)	Q8WXH0|SYNE2_HUMAN	796,436	7
Translin-associated protein X (Translin-associated factor X)	Q99598|TSNAX_HUMAN	33,095	7
Latent-transforming growth factor beta-binding protein, isoform 1S precursor (LTBP-1) (Transforming growth factor beta-1-binding protein 1) (TGF-beta1-BP-1)	P22064|LTB1S_HUMAN	152,767	7

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Protein enabled homolog	Q8N8S7|ENAH_HUMAN	66,493	7
Argininosuccinate lyase (EC 4.3.2.1) (Arginosuccinase) (ASAL)	P04424|ARLY_HUMAN	51,641	7
REVERSED	REV|Q9HCU4|CELR2	317,431	7
Cadherin-6 precursor (Kidney-cadherin) (K-cadherin)	P55285|CADH6_HUMAN	88,293	7
Pancreatic alpha-amylase precursor (EC 3.2.1.1) (PA) (1,4-alpha-D-glucan glucanohydrolase)	P04746|AMYP_HUMAN	57,689	7
Bone marrow stromal antigen 2 precursor (BST-2) (CD317 antigen) (HM1.24 antigen)	Q10589|BST2_HUMAN	19,751	7
Breast cancer anti-estrogen resistance protein 1 (CRK-associated substrate) (p130cas)	P56945|BCAR1_HUMAN	93,343	6
Exportin-1 (Exp1) (Chromosome region maintenance 1 protein homolog)	O14980|XPO1_HUMAN	123,371	6
DNA-directed RNA polymerase II largest subunit (EC 2.7.7.6) (RPB1)	P24928|RPB1_HUMAN	217,193	6
RNA-binding protein Nova-2 (Neuro-oncological ventral antigen 2) (Astrocytic NOVA1-like RNA-binding protein)	Q9UNW9|NOVA2_HUMAN	48,991	6
Afadin (Protein AF-6)	P55196|AFAD_HUMAN	205,592	6
Probable ATP-dependent RNA helicase DDX46 (EC 3.6.1.-) (DEAD box protein 46) (PRP5 homolog)	Q7L014|DDX46_HUMAN	117,348	6
SON protein (SON3) (Negative regulatory element-binding protein) (NRE-binding protein) (DBP-5) (Bax antagonist selected in saccharomyces 1) (BASS1)	P18583|SON_HUMAN	263,828	6
General transcription factor II-I (GTFII-I) (TFII-I) (Bruton tyrosine kinase-associated protein 135) (BTK-associated protein 135) (BAP-135) (SRF-Phox1-interacting protein) (SPIN) (Williams-Beuren syndrome chromosome region 6 protein)	P78347|GTF2I_HUMAN	112,400	6
Tyrosine-protein kinase JAK1 (EC 2.7.10.2) (Janus kinase 1) (JAK-1)	P23458|JAK1_HUMAN	131,943	6
Coiled-coil domain-containing protein 124	Q96CT7|CC124_HUMAN	25,818	6
Osteoclast-stimulating factor 1	Q92882|OSTF1_HUMAN	23,770	6
Sorting nexin-1	Q13596|SNX1_HUMAN	59,053	6
Charged multivesicular body protein 4b (Chromatin-modifying protein 4b) (CHMP4b) (Vacuolar protein sorting 7-2) (SNF7-2) (hSnf7-2) (SNF7 homolog associated with Alix 1) (hVps32)	Q9H444|CHM4B_HUMAN	24,933	6
Golgin subfamily A member 3 (Golgin-160) (Golgi complex-associated protein of 170 kDa) (GCP170)	Q08378|GOGA3_HUMAN	167,338	6
Transcription elongation factor SPT6 (hSPT6) (Tat-cotransactivator 2 protein) (Tat-CT2 protein)	Q7KZ85|SPT6H_HUMAN	199,059	6
Cytoskeleton-associated protein 5 (Colonic and hepatic tumor over-expressed protein) (Ch-TOG protein)	Q14008|CKAP5_HUMAN	225,498	6
Aflatoxin B1 aldehyde reductase member 2 (EC 1.-.-.-) (AFB1-AR 1) (Aldoketoreductase 7)	O43488|ARK72_HUMAN	39,571	6
Tyrosine-protein phosphatase non-receptor type 23 (EC 3.1.3.48) (His-domain-containing protein tyrosine phosphatase) (HD-PTP) (Protein tyrosine phosphatase TD14) (PTP-TD14)	Q9H3S7|PTN23_HUMAN	178,957	6
DNA repair protein RAD50 (EC 3.6.-.-) (hRAD50)	Q92878|RAD50_HUMAN	153,880	6

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Alpha-parvin (Calponin-like integrin-linked kinase-binding protein) (CH-ILKBP) (Matrix-remodelling-associated protein 2)	Q9NVD7|PARVA_HUMAN	42,227	6
RNA-binding protein 39 (RNA-binding motif protein 39) (RNA-binding region-containing protein 2) (Hepatocellular carcinoma protein 1) (Splicing factor HCC1)	Q14498|RBM39_HUMAN	59,363	6
Dual specificity mitogen-activated protein kinase kinase 2 (EC 2.7.12.2) (MAP kinase kinase 2) (MAPKK 2) (ERK activator kinase 2) (MAPK/ERK kinase 2) (MEK2)	P36507|MP2K2_HUMAN	44,407	6
Hematological and neurological expressed 1-like protein (HN1-like protein)	Q9H910|HN1L_HUMAN	20,046	6
U1 small nuclear ribonucleoprotein C (U1 snRNP protein C) (U1C protein) (U1-C)	P09234|RU1C_HUMAN	17,376	6
Golgin subfamily B member 1 (Giantin) (Macrogolgin) (372 kDa Golgi complex-associated protein) (GCP372)	Q14789|GOGB1_HUMAN	376,058	6
Double-stranded RNA-binding protein Staufen homolog 1	O95793|STAU1_HUMAN	63,165	6
U2 small nuclear ribonucleoprotein A′ (U2 snRNP-A′)	P09661|RU2A_HUMAN	28,399	6
COP9 signalosome complex subunit 1 (Signalosome subunit 1) (SGN1) (JAB1-containing signalosome subunit 1) (G protein pathway suppressor 1) (Protein GPS1) (Protein MFH)	Q13098|CSN1_HUMAN	53,356	6
Cofilin-2 (Cofilin, muscle isoform)	Q9Y281|COF2_HUMAN	18,719	6
DnaJ homolog subfamily B member 1 (Heat shock 40 kDa protein 1) (Heat shock protein 40) (HSP40) (DnaJ protein homolog 1) (HDJ-1)	P25685|DNJB1_HUMAN	38,028	6
Polyadenylate-binding protein 2 (Poly(A)-binding protein 2) (Poly(A)-binding protein II) (PABII) (Polyadenylate-binding nuclear protein 1) (Nuclear poly(A)-binding protein 1)	Q86U42|PABP2_HUMAN	32,732	6
ATP-dependent Clp protease ATP-binding subunit ClpX-like, mitochondrial precursor	O76031|CLPX_HUMAN	69,207	6
Nardilysin precursor (EC 3.4.24.61) (N-arginine dibasic convertase) (NRD convertase) (NRD-C)	O43847|NRDC_HUMAN	131,558	6
Nuclear receptor coactivator 5 (NCoA-5) (Coactivator independent of AF-2) (CIA)	Q9HCD5|NCOA5_HUMAN	65,520	6
Gem-associated protein 5 (Gemin5)	Q8TEQ6|GEMI5_HUMAN	168,545	6
Coiled-coil domain-containing protein 6 (H4 protein) (Papillary thyroid carcinoma-encoded protein)	Q16204|CCDC6_HUMAN	65,901	6
5′-3′ exoribonuclease 2 (EC 3.1.13.-) (DHM1-like protein) (DHP protein)	Q9H0D6|XRN2_HUMAN	108,568	6
Melanoma-associated antigen D2 (MAGE-D2 antigen) (MAGE-D) (Breast cancer-associated gene 1 protein) (BCG-1) (11B6) (Hepatocellular carcinoma-associated protein JCL-1)	Q9UNF1|MAGD2_HUMAN	64,938	6
Transcription elongation regulator 1 (TATA box-binding protein-associated factor 2S) (Transcription factor CA150)	O14776|TCRG1_HUMAN	123,944	6
Vacuolar ATP synthase subunit G 1 (EC 3.6.3.14) (V-ATPase G subunit 1) (Vacuolar proton pump G subunit 1) (V-ATPase 13 kDa subunit 1) (Vacuolar ATP synthase subunit M16)	O75348|VATG1_HUMAN	13,740	6
Tyrosine-protein phosphatase non-receptor type 11 (EC 3.1.3.48) (Protein-tyrosine phosphatase 2C) (PTP-2C) (PTP-1D) (SH-PTP3) (SH-PTP2) (SHP-2) (Shp2)	Q06124|PTN11_HUMAN	68,418	6
Cell division control protein 42 homolog precursor (G25K GTP-binding protein)	P60953|CDC42_HUMAN	21,293	6

Protein Description	Accession Number	Molecular Weight	Total SpC
Exocyst complex component 7 (Exocyst complex component Exo70)	Q9UPT5|EXOC7_HUMAN	83,367	6
Beta-catenin-like protein 1 (Nuclear-associated protein) (NAP) (Testis development protein NYD-SP19)	Q8WYA6|CTBL1_HUMAN	65,157	6
H/ACA ribonucleoprotein complex subunit 2 (Nucleolar protein family A member 2) (snoRNP protein NHP2)	Q9NX24|NOLA2_HUMAN	17,183	6
Putative helicase MOV-10 (EC 3.6.1.-) (Moloney leukemia virus 10 protein)	Q9HCE1|MOV10_HUMAN	113,658	6
Syntenin-1 (Syndecan-binding protein 1) (Melanoma differentiation-associated protein 9) (MDA-9) (Scaffold protein Pbp1) (Pro-TGF-alpha cytoplasmic domain-interacting protein 18) (TACIP18)	O00560|SDCB1_HUMAN	32,427	6
Serine palmitoyltransferase 1 (EC 2.3.1.50) (Long chain base biosynthesis protein 1) (LCB 1) (Serine-palmitoyl-CoA transferase 1) (SPT 1) (SPT1)	O15269|LCB1_HUMAN	52,728	6
Vascular endothelial growth factor receptor 2 precursor (EC 2.7.10.1) (VEGFR-2) (Kinase insert domain receptor) (Protein-tyrosine kinase receptor Flk-1) (CD309 antigen)	P35968|VGFR2_HUMAN	151,511	6
Calcium-binding mitochondrial carrier protein Aralar2 (Mitochondrial aspartate glutamate carrier 2) (Solute carrier family 25 member 13) (Citrin)	Q9UJS0|CMC2_HUMAN	74,159	6
Periodic tryptophan protein 1 homolog (Keratinocyte protein IEF SSP 9502)	Q13610|PWP1_HUMAN	55,811	6
Ras-related protein Rab-21	Q9UL25|RAB21_HUMAN	24,330	6
Dual specificity mitogen-activated protein kinase kinase 3 (EC 2.7.12.2) (MAP kinase kinase 3) (MAPKK 3) (MAPK/ERK kinase 3)	P46734|MP2K3_HUMAN	39,301	6
Eukaryotic initiation factor 4A-II (EC 3.6.1.-) (ATP-dependent RNA helicase eIF4A-2) (eIF4A-II) (eIF-4A-II)	Q14240|IF4A2_HUMAN	46,386	6
Glia maturation factor gamma (GMF-gamma)	O60234|GMFG_HUMAN	16,783	6
NADH dehydrogenase [ubiquinone] 1 beta subcomplex subunit 10 (EC 1.6.5.3) (EC 1.6.99.3) (NADH-ubiquinone oxidoreductase PDSW subunit) (Complex I-PDSW) (CI-PDSW)	O96000|NDUBA_HUMAN	20,759	6
Lysosomal alpha-glucosidase precursor (EC 3.2.1.20) (Acid maltase) (Aglucosidase alfa) [Contains: 76 kDa lysosomal alpha-glucosidase; 70 kDa lysosomal alpha-glucosidase]	P10253| LYAG_HU MAN	105,321	6
Heterogeneous nuclear ribonucleoprotein H′ (hnRNP H′) (FTP-3)	P55795|HNRH2_HUMAN	49,246	6
Cullin-3 (CUL-3)	Q13618|CUL3_HUMAN	88,914	6
Tyrosine-protein kinase receptor Tie-1 precursor (EC 2.7.10.1)	P35590|TIE1_HUMAN	125,073	6
DnaJ homolog subfamily A member 2 (HIRA-interacting protein 4) (Cell cycle progression restoration gene 3 protein) (Dnj3) (Renal carcinoma antigen NY-REN-14)	O60884|DNJA2_HUMAN	45,728	6
Serum paraoxonase/arylesterase 2 (EC 3.1.1.2) (EC 3.1.8.1) (PON 2) (Serum aryldialkylphosphatase 2) (A-esterase 2) (Aromatic esterase 2)	Q15165|PON2_HUMAN	39,381	6
Cadherin-2 precursor (Neural-cadherin) (N-cadherin) (CD325 antigen) (CDw325)	P19022|CADH2_HUMAN	99,794	6
FK506-binding protein 9 precursor (EC 5.2.1.8) (Peptidyl-prolyl cis-trans isomerase) (PPIase) (Rotamase)	O95302|FKBP9_HUMAN	63,067	6

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A-kinase anchor protein 8 (A-kinase anchor protein 95 kDa) (AKAP 95)	O43823|AKAP8_HUMAN	76,091	6
Serine/threonine-protein kinase 24 (EC 2.7.11.1) (STE20-like kinase MST3) (MST-3) (Mammalian STE20-like protein kinase 3)	Q9Y6E0|STK24_HUMAN	49,293	6
Isocitrate dehydrogenase [NAD] subunit beta, mitochondrial precursor (EC 1.1.1.41) (Isocitric dehydrogenase) (NAD(+)-specific ICDH)	O43837|IDH3B_HUMAN	42,194	6
Striatin	O43815|STRN_HUMAN	86,116	6
Calcium-binding protein p22 (Calcium-binding protein CHP) (Calcineurin homologous protein) (Calcineurin B homolog)	Q99653|CHP1_HUMAN	22,439	6
Torsin-1A-interacting protein 1	Q5JTV8|TOIP1_HUMAN	66,231	6
Adaptin ear-binding coat-associated protein 2 (NECAP-2)	Q9NVZ3|NECP2_HUMAN	28,321	6
Endothelial differentiation-related factor 1 (EDF-1) (Multiprotein-bridging factor 1) (MBF1)	O60869|EDF1_HUMAN	16,351	6
Gamma-synuclein (Persyn) (Breast cancer-specific gene 1 protein) (Synoretin) (SR)	O76070|SYUG_HUMAN	13,312	6
Dedicator of cytokinesis protein 4	Q8N1I0|DOCK4_HUMAN	225,137	6
Serine/threonine-protein phosphatase 4 regulatory subunit 1	Q8TF05|PP4R1_HUMAN	106,988	6
Egl nine homolog 1 (EC 1.14.11.-) (Hypoxia-inducible factor prolyl hydroxylase 2) (HIF-prolyl hydroxylase 2) (HIF-PH2) (HPH-2) (Prolyl hydroxylase domain-containing protein 2) (PHD2) (SM-20)	Q9GZT9|EGLN1_HUMAN	46,004	6
Transcriptional activator protein Pur-beta (Purine-rich element-binding protein B)	Q96QR8|PURB_HUMAN	33,224	6
Dual specificity protein phosphatase 3 (EC 3.1.3.48) (EC 3.1.3.16) (Dual specificity protein phosphatase VHR)	P51452|DUS3_HUMAN	20,461	6
Semaphorin-6B precursor (Semaphorin Z) (Sema Z)	Q9H3T3|SEM6B_HUMAN	95,267	6
NADPH--cytochrome P450 reductase (EC 1.6.2.4) (CPR) (P450R)	P16435|NCPR_HUMAN	76,673	6
N-acylneuraminate cytidylyltransferase (EC 2.7.7.43) (CMP-N-acetylneuraminic acid synthetase) (CMP-NeuNAc synthetase)	Q8NFW8|NEUA_HUMAN	48,362	6
Isocitrate dehydrogenase [NAD] subunit gamma, mitochondrial precursor (EC 1.1.1.41) (Isocitric dehydrogenase) (NAD(+)-specific ICDH)	P51553|IDH3G_HUMAN	42,776	6
DNA replication licensing factor MCM5 (CDC46 homolog) (P1-CDC46)	P33992|MCM5_HUMAN	82,270	6
Coiled-coil-helix-coiled-coil-helix domain-containing protein 2 (HCV NS2 trans-regulated protein) (NS2TP) (Aging-associated gene 10 protein)	Q9Y6H1|CHCH2_HUMAN	15,494	6
SRA stem-loop-interacting RNA-binding protein, mitochondrial precursor	Q9GZT3|SLIRP_HUMAN	12,331	6
Histone H1.0 (Histone H1(0)) (Histone H1′)	P07305|H10_HUMAN	20,846	6
Nuclear factor NF-kappa-B p100 subunit (DNA-binding factor KBF2) (H2TF1) (Lymphocyte translocation chromosome 10) (Oncogene Lyt-10) (Lyt10) [Contains: Nuclear factor NF-kappa-B p52 subunit]	Q00653|NFKB2_HUMAN	96,733	6

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2′-5′-oligoadenylate synthetase 3 (EC 2.7.7.-) ((2–5′)oligo(A) synthetase 3) (2–5A synthetase 3) (p100 OAS) (p100OAS)	Q9Y6K5|OAS3_HUMAN	121,149	6
ATP-dependent RNA helicase DDX18 (EC 3.6.1.-) (DEAD box protein 18) (Myc-regulated DEAD box protein) (MrDb)	Q9NVP1|DDX18_HUMAN	75,392	6
Sperm-specific antigen 2 (Cleavage signal-1 protein) (CS-1) (Ki-ras-induced actin-interacting protein)	P28290|SSFA2_HUMAN	138,368	6
Estradiol 17-beta-dehydrogenase 12 (EC 1.1.1.62) (17-beta-HSD 12) (17-beta-hydroxysteroid dehydrogenase 12) (3-ketoacyl-CoA reductase) (EC 1.3.1.-) (KAR)	Q53GQ0|DHB12_HUMAN	34,334	6
Tyrosine-protein phosphatase non-receptor type 14 (EC 3.1.3.48) (Protein-tyrosine phosphatase pez)	Q15678|PTN14_HUMAN	135,221	6
ATP synthase e chain, mitochondrial (EC 3.6.3.14)	P56385|ATP5I_HUMAN	7,916	6
Torsin-1A-interacting protein 2 (Lumenal domain-like LAP1)	Q8NFQ8|TOIP2_HUMAN	51,245	6
Multimerin-1 precursor (Endothelial cell multimerin 1) (EMILIN-4) (Elastin microfibril interface located protein 4) (Elastin microfibril interfacer 4)	Q13201|MMRN1_HUMAN	138,150	6
60S ribosomal protein L34	P49207|RL34_HUMAN	13,275	6
NAD-dependent malic enzyme, mitochondrial precursor (EC 1.1.1.38) (NAD-ME) (Malic enzyme 2)	P23368|MAOM_HUMAN	65,428	6
Aspartyl aminopeptidase (EC 3.4.11.21)	Q9ULA0|DNPEP_HUMAN	52,411	6
Acyl-coenzyme A oxidase 1, peroxisomal (EC 1.3.3.6) (Palmitoyl-CoA oxidase) (AOX) (Straight-chain acyl-CoA oxidase) (SCOX)	Q15067|ACOX1_HUMAN	74,407	6
Eukaryotic peptide chain release factor subunit 1 (eRF1) (Eukaryotic release factor 1) (TB3-1) (Protein Cl1)	P62495|ERF1_HUMAN	49,015	6
Small ubiquitin-related modifier 2 precursor (SUMO-2) (Ubiquitin-like protein SMT3B) (SMT3 homolog 2) (Sentrin-2) (HSMT3) (SUMO-3)	P55854|SUMO3_HUMAN, P61956|SUMO2_HUMAN, Q6EEV6|SUMO4_HUMAN	10,863	6
Myb-binding protein 1A	Q9BQG0|MBB1A_HUMAN	148,840	6
Cation-dependent mannose-6-phosphate receptor precursor (CD Man-6-P receptor) (CD-MPR) (46 kDa mannose 6-phosphate receptor) (MPR 46)	P20645|MPRD_HUMAN	30,975	6
Nucleolar GTP-binding protein 1 (Chronic renal failure gene protein) (GTP-binding protein NGB)	Q9BZE4|NOG1_HUMAN	73,949	6
Tetratricopeptide repeat protein 1 (TPR repeat protein 1)	Q99614|TTC1_HUMAN	33,509	6
Autophagy-related protein 7 (APG7-like) (Ubiquitin-activating enzyme E1-like protein) (hAGP7)	O95352|ATG7_HUMAN	77,944	6
Receptor-type tyrosine-protein phosphatase epsilon precursor (EC 3.1.3.48) (Protein-tyrosine phosphatase epsilon) (R-PTP-epsilon)	P23469|PTPRE_HUMAN	80,625	6
Ubiquitin/ISG15-conjugating enzyme E2 L6 (EC 6.3.2.19) (Ubiquitin-protein ligase L6) (Ubiquitin carrier protein L6) (UbcH8) (Retinoic acid-induced gene B protein) (RIG-B)	O14933|UB2L6_HUMAN	17,620	6
Ubiquitin carboxyl-terminal hydrolase 25 (EC 3.1.2.15) (Ubiquitin thioesterase 25) (Ubiquitin-specific-processing protease 25) (Deubiquitinating enzyme 25) (USP on chromosome 21)	Q9UHP3|UBP25_HUMAN	125,736	6

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Receptor-interacting serine/threonine-protein kinase 2 (EC 2.7.11.1) (RIP-like-interacting CLARP kinase) (Receptor-interacting protein 2) (RIP-2) (CARD-containing interleukin-1 beta-converting enzyme-associated kinase) (CARD-containing IL-1 beta ICE-kinase)	O43353|RIPK2_HUMAN	61,179	6
Protein FAM49B (L1)	Q9NUQ9|FA49B_HUMAN	36,731	6
Ribosomal protein L22-like 1	Q6P5R6|RL22L_HUMAN	14,589	6
Glutaredoxin-1 (Thioltransferase-1) (TTase-1)	P35754|GLRX1_HUMAN	11,758	6
Integrin-linked kinase-associated serine/threonine phosphatase 2C (EC 3.1.3.16) (ILKAP)	Q9H0C8|ILKAP_HUMAN	42,889	6
Receptor-type tyrosine-protein phosphatase beta precursor (EC 3.1.3.48) (Protein-tyrosine phosphatase beta) (R-PTP-beta)	P23467|PTPRB_HUMAN	224,250	6
Interferon-induced protein with tetratricopeptide repeats 1 (IFIT-1) (Interferon-induced 56 kDa protein) (IFI-56K)	P09914|IFIT1_HUMAN	55,344	6
Serine/threonine-protein kinase PRP4 homolog (EC 2.7.11.1) (PRP4 pre-mRNA-processing factor 4 homolog) (PRP4 kinase)	Q13523|PRP4B_HUMAN	116,961	6
Membrane-associated progesterone receptor component 2 (Progesterone membrane-binding protein) (Steroid receptor protein DG6)	O15173|PGRC2_HUMAN	23,801	6
Signal transducer and activator of transcription 2 (p113)	P52630|STAT2_HUMAN	97,901	6
TRIO and F-actin-binding protein (Protein Tara) (Trio-associated repeat on actin)	Q9H2D6|TARA_HUMAN	261,356	5
SH3-containing GRB2-like protein 1 (Endophilin-2) (Endophilin-A2) (SH3 domain protein 2B) (Extra eleven-nineteen leukemia fusion gene) (EEN) (EEN fusion partner of MLL)	Q99961|SH3G1_HUMAN	41,473	5
Serine protease HTRA1 precursor (EC 3.4.21.-) (L56) (Serine protease 11)	Q92743|HTRA1_HUMAN	51,269	5
Ataxin-2-like protein (Ataxin-2 domain protein) (Ataxin-2-related protein)	Q8WWM7|ATX2L_HUMAN	113,355	5
Copine-1 (Copine I)	Q99829|CPNE1_HUMAN	59,041	5
Palmitoyl-protein thioesterase 1 precursor (EC 3.1.2.22) (PPT-1) (Palmitoyl-protein hydrolase 1)	P50897|PPT1_HUMAN	34,176	5
Protein DEK	P35659|DEK_HUMAN	42,658	5
Phospholipid hydroperoxide glutathione peroxidase, mitochondrial precursor (EC 1.11.1.12) (PHGPx) (GPX-4)	P36969|GPX4_HUMAN	22,110	5
Exosome component 10 (Polymyositis/scleroderma autoantigen 2) (Autoantigen PM/Scl 2) (Polymyositis/scleroderma autoantigen 100 kDa) (PM/Scl-100) (P100 polymyositis-scleroderma overlap syndrome-associated autoantigen)	Q01780|EXOSX_HUMAN	100,816	5
Beta-arrestin-1 (Arrestin beta 1)	P49407|ARRB1_HUMAN	47,048	5
DnaJ homolog subfamily C member 7 (Tetratricopeptide repeat protein 2) (TPR repeat protein 2)	Q99615|DNJC7_HUMAN	56,425	5
CAP-Gly domain-containing linker protein 1 (Restin) (Cytoplasmic linker protein 170 alpha-2) (CLIP-170) (Reed-Sternberg intermediate filament-associated protein) (Cytoplasmic linker protein 1)	P30622|CLIP1_HUMAN	160,975	5
Nucleotide-binding protein 2 (NBP 2)	Q9Y5Y2|NUBP2_HUMAN	28,807	5

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Splicing factor arginine/serine-rich 11 (Arginine-rich 54 kDa nuclear protein) (p54)	Q05519|SFR11_HUMAN	53,526	5
Peptidyl-prolyl cis-trans isomerase-like 1 (EC 5.2.1.8) (PPIase) (Rotamase)	Q9Y3C6|PPIL1_HUMAN	18,219	5
Quinone oxidoreductase (EC 1.6.5.5) (NADPH:quinone reductase) (Zeta-crystallin)	Q08257|QOR_HUMAN	35,189	5
LIM and senescent cell antigen-like-containing domain protein 3 (Particularly interesting new Cys-His protein 3) (PINCH-3)	Q9HB10|LIMS3_HUMAN	13,233	5
UPF0404 protein C11orf59	Q6IAA8|CK059_HUMAN	17,727	5
Succinyl-CoA ligase [ADP-forming] beta-chain, mitochondrial precursor (EC 6.2.1.5) (Succinyl-CoA synthetase, betaA chain) (SCS-betaA) (ATP-specific succinyl-CoA synthetase subunit beta) (Renal carcinoma antigen NY-REN-39)	Q9P2R7|SUCB1_HUMAN	50,300	5
Polyribonucleotide nucleotidyltransferase 1, mitochondrial precursor (EC 2.7.7.8) (PNPase 1) (Polynucleotide phosphorylase-like protein) (PNPase old-35) (3′-5′ RNA exonuclease OLD35)	Q8TCS8|PNPT1_HUMAN	85,934	5
Protein NDRG3	Q9UGV2|NDRG3_HUMAN	41,391	5
Glycylpeptide N-tetradecanoyltransferase 2 (EC 2.3.1.97) (Peptide N-myristoyltransferase 2) (Myristoyl-CoA:protein N-myristoyltransferase 2) (NMT 2) (Type II N-myristoyltransferase)	O60551|NMT2_HUMAN	56,964	5
UPF0368 protein Cxorf26	Q9BVG4|CX026_HUMAN	26,040	5
Pyrroline-5-carboxylate reductase 1 (EC 1.5.1.2) (P5CR 1) (P5C reductase 1)	P32322|P5CR1_HUMAN	33,343	5
ATP-binding cassette sub-family F member 3	Q9NUQ8|ABCF3_HUMAN	79,729	5
COP9 signalosome complex subunit 8 (Signalosome subunit 8) (SGN8) (JAB1-containing signalosome subunit 8) (COP9 homolog) (hCOP9)	Q99627|CSN8_HUMAN	23,208	5
Negative elongation factor E (NELF-E) (RD protein)	P18615|NELFE_HUMAN	43,223	5
Carnitine O-palmitoyltransferase I, liver isoform (EC 2.3.1.21) (CPT I) (CPTI-L) (Carnitine palmitoyltransferase 1A)	P50416|CPT1A_HUMAN	88,352	5
Glucosamine 6-phosphate N-acetyltransferase (EC 2.3.1.4) (Phosphoglucosamine transacetylase) (Phosphoglucosamine acetylase)	Q96EK6|GNA1_HUMAN	20,731	5
Vacuolar protein sorting-associated protein 29 (Vesicle protein sorting 29) (hVPS29) (PEP11)	Q9UBQ0|VPS29_HUMAN	20,488	5
Nucleolar transcription factor 1 (Upstream-binding factor 1) (UBF-1) (Autoantigen NOR-90)	P17480|UBF1_HUMAN	89,392	5
Alanyl-tRNA synthetase domain-containing protein 1	Q9BTE6|AASD1_HUMAN	45,462	5
WD repeat protein 57 (Prp8-binding protein) (hPRP8BP) (U5 snRNP-specific 40 kDa protein) (38 kDa-splicing factor)	Q96DI7|WDR57_HUMAN	39,293	5
NudC domain-containing protein 2	Q8WVJ2|NUDC2_HUMAN	17,658	5
Mitochondrial antiviral-signaling protein (Interferon-beta promoter stimulator protein 1) (IPS-1) (Virus-induced-signaling adapter) (CARD adapter inducing interferon-beta) (Cardif) (Putative NF-kappa-B-activating protein 031N)	Q7Z434|MAVS_HUMAN	56,510	5
PC4 and SFRS1-interacting protein (Lens epithelium-derived growth factor) (Transcriptional coactivator p75/p52) (Dense fine speckles 70 kDa protein) (DFS 70) (CLL-associated antigen KW-7)	O75475|PSIP1_HUMAN	60,086	5

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Thyroid receptor-interacting protein 12 (TRIP-12)	Q14669|TRIPC_HUMAN	220,420	5
Rab3 GTPase-activating protein catalytic subunit (RAB3 GTPase-activating protein 130 kDa subunit) (Rab3-GAP p130) (Rab3-GAP)	Q15042|RB3GP_HUMAN	110,508	5
Coproporphyrinogen III oxidase, mitochondrial precursor (EC 1.3.3.3) (Coproporphyrinogenase) (Coprogen oxidase) (COX)	P36551|HEM6_HUMAN	50,134	5
Ubiquitin-activating enzyme E1 domain-containing protein 1 (UFM1-activating enzyme) (Ubiquitin-activating enzyme 5) (ThiFP1)	Q9GZZ9|UE1D1_HUMAN	44,845	5
ADP-dependent glucokinase (EC 2.7.1.147) (ADPGK) (ADP-GK) (RbBP-35)	Q9BRR6|ADPGK_HUMAN	54,071	5
Mitochondrial 28S ribosomal protein S22 (S22mt) (MRP-S22)	P82650|RT22_HUMAN	41,264	5
Mitochondrial Rho GTPase 2 (EC 3.6.5.-) (MIRO-2) (hMiro-2) (Ras homolog gene family member T2)	Q8IXI1|MIRO2_HUMAN	68,100	5
Polypeptide N-acetylgalactosaminyltransferase 2 (EC 2.4.1.41) (Protein-UDP acetylgalactosaminyltransferase 2) (UDP-GalNAc:polypeptide N-acetylgalactosaminyltransferase 2) (Polypeptide GalNAc transferase 2) (GalNAc-T2) (pp-GaNTase 2) [Contains: Polypeptide N-acetylgalactosaminyltransferase 2 soluble form]	Q10471|GALT2_HUMAN	64,715	5
GRIP1-associated protein 1 (GRASP-1)	Q4V328|GRAP1_HUMAN	95,973	5
Septin-8	Q92599|SEPT8_HUMAN	55,738	5
Tubulin gamma-1 chain (Gamma-1 tubulin) (Gamma-tubulin complex component 1) (GCP-1)	P23258|TBG1_HUMAN	51,153	5
Glycerol-3-phosphate dehydrogenase, mitochondrial precursor (EC 1.1.99.5) (GPD-M) (GPDH-M) (mtGPD)	P43304|GPDM_HUMAN	80,818	5
ADP-ribosylation factor GTPase-activating protein 1 (ADP-ribosylation factor 1 GTPase-activating protein) (ARF1 GAP) (ARF1-directed GTPase-activating protein) (GAP protein)	Q8N6T3|ARFG1_HUMAN	44,649	5
Scaffold attachment factor B (Scaffold attachment factor B1) (SAF-B) (HSP27 estrogen response element-TATA box-binding protein) (HSP27 ERE-TATA-binding protein)	Q15424|SAFB1_HUMAN	102,625	5
Nucleoporin-like protein RIP (HIV-1 Rev-binding protein) (Rev-interacting protein) (Rev/Rex activation domain-binding protein)	P52594|NUPL_HUMAN	58,242	5
Putative RNA-binding protein Luc7-like 1 (SR+89) (Putative SR protein LUC7B1)	Q9NQ29|LUC7L_HUMAN	43,711	5
RNA-binding protein 12 (RNA-binding motif protein 12) (SH3/WW domain anchor protein in the nucleus) (SWAN)	Q9NTZ6|RBM12_HUMAN	97,379	5
Transformer-2 protein homolog (TRA-2 alpha)	Q13595|TRA2A_HUMAN	32,671	5
AP-3 complex subunit delta-1 (Adapter-related protein complex 3 subunit delta-1) (Delta-adaptin 3) (AP-3 complex subunit delta) (Delta-adaptin)	O14617|AP3D1_HUMAN	130,144	5
Protein memo (Mediator of ErbB2-driven cell motility) (C21orf19-like protein) (Hepatitis C virus NS5A-transactivated protein 7) (HCV NS5A-transactivated protein 7)	Q9Y316|MEMO_HUMAN	33,716	5
AP2-associated protein kinase 1 (EC 2.7.11.1) (Adaptor-associated kinase 1)	Q2M2I8|AAK1_HUMAN	93,560	5

Protein Description	Accession Number	Molecular Weight	Total SpC
Ezrin-radixin-moesin-binding phosphoprotein 50 (EBP50) (Na(+)/H(+) exchange regulatory cofactor NHE-RF) (NHERF-1) (Regulatory cofactor of Na(+)/H(+) exchanger) (Sodium-hydrogen exchanger regulatory factor 1) (Solute carrier family 9 isoform 3 regulatory factor 1)	O14745|NHERF_HUMAN	38,850	5
Multisynthetase complex auxiliary component p38 (Protein JTV-1)	Q13155|MCA2_HUMAN	35,331	5
Proteasome subunit beta type 3 (EC 3.4.25.1) (Proteasome theta chain) (Proteasome chain 13) (Proteasome component C10-II)	P49720|PSB3_HUMAN	22,932	5
Amyloid-like protein 2 precursor (Amyloid protein homolog) (APPH) (CDEI box-binding protein) (CDEBP)	Q06481|APLP2_HUMAN	86,937	5
Muscleblind-like protein (Triplet-expansion RNA-binding protein)	Q9NR56|MBNL_HUMAN	41,799	5
DNA topoisomerase 2-beta (EC 5.99.1.3) (DNA topoisomerase II, beta isozyme)	Q02880|TOP2B_HUMAN	183,255	5
Glycogenin-1 (EC 2.4.1.186)	P46976|GLYG_HUMAN	39,366	5
ATP-dependent RNA helicase DDX24 (EC 3.6.1.-) (DEAD box protein 24)	Q9GZR7|DDX24_HUMAN	96,317	5
NADH dehydrogenase [ubiquinone] 1 alpha subcomplex subunit 8 (EC 1.6.5.3) (EC 1.6.99.3) (NADH-ubiquinone oxidoreductase 19 kDa subunit) (Complex I-19kD) (CI-19kD) (Complex I-PGIV) (CI-PGIV)	P51970|NDUA8_HUMAN	20,087	5
Probable G-protein coupled receptor 116 precursor	Q8IZF2|GP116_HUMAN	149,441	5
Prefoldin subunit 4 (Protein C-1)	Q9NQP4|PFD4_HUMAN	15,297	5
Smu-1 suppressor of mec-8 and unc-52 protein homolog	Q2TAY7|SMU1_HUMAN	57,527	5
Peptidyl-prolyl cis-trans isomerase H (EC 5.2.1.8) (PPIase H) (Rotamase H) (U-snRNP-associated cyclophilin SnuCyp-20) (USA-CYP) (Small nuclear ribonucleoprotein particle-specific cyclophilin H) (CypH)	O43447|PPIH_HUMAN	19,190	5
Exocyst complex component 5 (Exocyst complex component Sec10) (hSec10)	O00471|EXOC5_HUMAN	81,837	5
Lysyl oxidase homolog 2 precursor (EC 1.4.3.-) (Lysyl oxidase-like protein 2) (Lysyl oxidase-related protein 2) (Lysyl oxidase-related protein WS9-14)	Q9Y4K0|LOXL2_HUMAN	86,705	5
N-acetyltransferase 10 (EC 2.3.1.-)	Q9H0A0|NAT10_HUMAN	115,690	5
G patch domain and KOW motifs-containing protein (G patch domain-containing protein 5) (Protein MOS2 homolog) (Protein T54)	Q92917|GPKOW_HUMAN	52,211	5
Putative ATP-dependent Clp protease proteolytic subunit, mitochondrial precursor (EC 3.4.21.92) (Endopeptidase Clp)	Q16740|CLPP_HUMAN	30,163	5
Ufm1-conjugating enzyme 1 (Ubiquitin-fold modifier-conjugating enzyme 1)	Q9Y3C8|UFC1_HUMAN	19,441	5
Nuclear pore complex protein Nup205 (Nucleoporin Nup205) (205 kDa nucleoporin)	Q92621|NU205_HUMAN	227,909	5
Beta-hexosaminidase alpha chain precursor (EC 3.2.1.52) (N-acetyl-beta-glucosaminidase) (Beta-N-acetylhexosaminidase) (Hexosaminidase A)	P06865|HEXA_HUMAN	60,672	5
NADH dehydrogenase [ubiquinone] 1 alpha subcomplex subunit 5 (EC 1.6.5.3) (EC 1.6.99.3) (NADH-ubiquinone oxidoreductase 13 kDa-B subunit) (Complex I-13kD-B) (CI-13kD-B) (Complex I subunit B13)	Q16718|NDUA5_HUMAN	13,441	5

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Large proline-rich protein BAT2 (HLA-B-associated transcript 2)	P48634|BAT2_HUMAN	228,845	5
Acyl-CoA dehydrogenase family member 9, mitochondrial precursor (EC 1.3.99.-) (ACAD-9)	Q9H845|ACAD9_HUMAN	68,745	5
Xaa-Pro dipeptidase (EC 3.4.13.9) (X-Pro dipeptidase) (Proline dipeptidase) (Prolidase) (Imidodipeptidase)	P12955|PEPD_HUMAN	54,530	5
Thymidylate synthase (EC 2.1.1.45) (TS) (TSase)	P04818|TYSY_HUMAN	35,699	5
Oligoribonuclease, mitochondrial precursor (EC 3.1.-.-) (Small fragment nuclease) (RNA exonuclease 2 homolog)	Q9Y3B8|ORN_HUMAN	26,816	5
Huntingtin-interacting protein HYPK (Huntingtin yeast partner K)	Q9NX55|HYPK_HUMAN	19,314	5
Proline-, glutamic acid- and leucine-rich protein 1 (Modulator of nongenomic activity of estrogen receptor) (Transcription factor HMX3)	Q8IZL8|PELP1_HUMAN	119,683	5
U6 snRNA-associated Sm-like protein LSm6 (Sm protein F)	P62312|LSM6_HUMAN	9,110	5
Dpy-30-like protein	Q9C005|DPY30_HUMAN	11,232	5
H/ACA ribonucleoprotein complex subunit 1 (Nucleolar protein family A member 1) (snoRNP protein GAR1)	Q9NY12|NOLA1_HUMAN	22,331	5
Isovaleryl-CoA dehydrogenase, mitochondrial precursor (EC 1.3.99.10) (IVD)	P26440|IVD_HUMAN	46,303	5
CD81 antigen (26 kDa cell surface protein TAPA-1) (Target of the antiproliferative antibody 1) (Tetraspanin-28) (Tspan-28)	P60033|CD81_HUMAN	25,792	5
Putative rRNA methyltransferase 3 (EC 2.1.1.-) (rRNA (uridine-2′-O-)-methyltransferase 3)	Q8IY81|RRMJ3_HUMAN	96,560	5
Regulator of G-protein signaling 10 (RGS10)	O43665|RGS10_HUMAN	20,219	5
Long-chain fatty acid transport protein 4 (EC 6.2.1.-) (Fatty acid transport protein 4) (FATP-4) (Solute carrier family 27 member 4)	Q6P1 M0|S27A4_HUMAN	72,048	5
Probable cation-transporting ATPase 13A1 (EC 3.6.3.-)	Q9HD20|AT131_HUMAN	132,940	5
Transcription elongation factor SPT5 (hSPT5) (DRB sensitivity-inducing factor large subunit) (DSIF large subunit) (DSIF p160) (Tat-cotransactivator 1 protein) (Tat-CT1 protein)	O00267|SPT5H_HUMAN	120,982	5
Glycogen [starch] synthase, muscle (EC 2.4.1.11)	P13807|GYS1_HUMAN	83,769	5
Neurogenic locus notch homolog protein 1 precursor (Notch 1) (hN1) (Translocation-associated notch protein TAN-1) [Contains: Notch 1 extracellular truncation; Notch 1 intracellular domain]	P46531|NOTC1_HUMAN	272,471	5
BRCA2 and CDKN1A-interacting protein (Protein TOK-1)	Q9P287|BCCIP_HUMAN	35,962	5
Eukaryotic translation initiation factor 4E (eIF4E) (eIF-4E) (mRNA cap-binding protein) (eIF-4F 25 kDa subunit)	P06730|IF4E_HUMAN	25,080	5
AP-3 complex subunit mu-1 (Adapter-related protein complex 3 mu-1 subunit) (Mu-adaptin 3A) (AP-3 adapter complex mu3A subunit)	Q9Y2T2|AP3M1_HUMAN	46,922	5
Import inner membrane translocase subunit TIM50, mitochondrial precursor	Q3ZCQ8|TIM50_HUMAN	39,630	5
Translocation protein SEC63 homolog	Q9UGP8|SEC63_HUMAN	87,981	5

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ATP synthase delta chain, mitochondrial precursor (EC 3.6.3.14)	P30049|ATPD_HUMAN	17,472	5
Cysteine-rich motor neuron 1 protein precursor (CRIM-1) (Cysteine-rich repeat-containing protein S52)	Q9NZV1|CRIM1_HUMAN	113,717	5
RNA-binding protein 9 (RNA-binding motif protein 9) (Hexaribonucleotide-binding protein 2) (Repressor of tamoxifen transcriptional activity)	O43251|RBM9_HUMAN	41,356	5
Wiskott-Aldrich syndrome protein family member 2 (WASP-family protein member 2) (Protein WAVE-2) (Verprolin homology domain-containing protein 2)	Q9Y6W5|WASF2_HU MAN	54,267	5
MAK16-like protein RBM13 (RNA-binding motif protein 13) (NNP78)	Q9BXY0|RBM13_HUMAN	35,352	5
Pre-mRNA 3′-end-processing factor FIP1 (FIP1-like 1) (Factor interacting with PAP) (hFip1) (Rearranged in hypereosinophilia)	Q6UN15|FIP1_HUMAN	66,509	5
Polypeptide N-acetylgalactosaminyltransferase 1 (EC 2.4.1.41) (Protein-UDP acetylgalactosaminyltransferase 1) (UDP-GalNAc:polypeptide N-acetylgalactosaminyltransferase 1) (Polypeptide GalNAc transferase 1) (GalNAc-T1) (pp-GaNTase 1) [Contains: Polypeptide N-acetylgalactosaminyltransferase 1 soluble form]	Q10472|GALT1_HUMAN	64,202	5
Cell division cycle and apoptosis regulator protein 1 (Cell cycle and apoptosis regulatory protein 1) (CARP-1) (Death inducer with SAP domain)	Q8IX12|CCAR1_HUMAN	132,806	5
Receptor expression-enhancing protein 5 (Polyposis locus protein 1) (TB2 protein)	Q00765|REEP5_HUMAN	21,477	5
Profilin-2 (Profilin II)	P35080|PROF2_HUMAN	15,028	5
Septin-10	Q9P0V9|SEP10_HUMAN	59,964	5
Serine/threonine-protein kinase Nek9 (EC 2.7.11.1) (NimA-related protein kinase 9) (Never in mitosis A-related kinase 9) (Nercc1 kinase) (NIMA-related kinase 8) (Nek8)	Q8TD19|NEK9_HUMAN	107,152	5
Syntaxin-binding protein 2 (Unc-18 homolog 2) (Unc-18B) (Unc18-2)	Q15833|STXB2_HUMAN	66,423	5
YTH domain family protein 2 (High-glucose-regulated protein 8) (CLL-associated antigen KW-14) (Renal carcinoma antigen NY-REN-2)	Q9Y5A9|YTHD2_HUMAN	62,316	5
Ras-related protein Rab-6A (Rab-6)	P20340|RAB6A_HUMAN	23,575	5
Thioredoxin domain-containing protein 12 precursor (EC 1.8.4.2) (Thioredoxin-like protein p19) (Endoplasmic reticulum protein ERp19) (ERp18) (hTLP19)	O95881|TXD12_HUMAN	19,188	5
Protein phosphatase inhibitor 2 (IPP-2)	P41236|IPP2_HUMAN	22,998	5
E3 ubiquitin-protein ligase RNF25 (EC 6.3.2.-) (RING finger protein 25)	Q96BH1|RNF25_HUMAN	51,200	5
ADP-ribosylation factor-like protein 8A (ADP-ribosylation factor-like protein 10B) (Novel small G protein indispensable for equal chromosome segregation 2)	Q96BM9|ARL8A_HUMAN	21,399	5
Amidophosphoribosyltransferase precursor (EC 2.4.2.14) (Glutamine phosphoribosylpyrophosphate amidotransferase) (ATASE) (GPAT)	Q06203|PUR1_HUMAN	57,381	5
Poliovirus receptor-related protein 2 precursor (Herpes virus entry mediator B) (HveB) (Nectin-2) (CD112 antigen)	Q92692|PVRL2_HUMAN	57,724	5

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N-acetylgalactosaminyltransferase 7 (EC 2.4.1.-) (Protein-UDP acetylgalactosaminyltransferase 7) (UDP-GalNAc:polypeptide N-acetylgalactosaminyltransferase 7) (Polypeptide GalNAc transferase 7) (GalNAc-T7) (pp-GaNTase 7)	Q86SF2|GALT7_HUMAN	75,373	5
Platelet-activating factor acetylhydrolase IB subunit gamma (EC 3.1.1.47) (PAF acetylhydrolase 29 kDa subunit) (PAF-AH 29 kDa subunit) (PAF-AH subunit gamma) (PAFAH subunit gamma)	Q15102|PA1B3_HUMAN	25,716	5
Nuclear pore glycoprotein p62 (62 kDa nucleoporin)	P37198|NUP62_HUMAN	53,238	5
Caspase-4 precursor (EC 3.4.22.57) (CASP-4) (ICH-2 protease) (TX protease) (ICE(rel)-II) [Contains: Caspase-4 subunit 1; Caspase-4 subunit 2]	P49662| CASP4_HU MAN	43,245	5
Galectin-9 (HOM-HD-21) (Ecalectin)	O00182|LEG9_HUMAN	39,500	5
Isopentenyl-diphosphate Delta-isomerase 1 (EC 5.3.3.2) (IPP isomerase 1) (Isopentenyl pyrophosphate isomerase 1) (IPPI1)	Q13907|IDI1_HUMAN	26,302	5
TGF-beta receptor type-2 precursor (EC 2.7.11.30) (TGF-beta receptor type II) (TGFR-2) (TGF-beta type II receptor) (Transforming growth factor-beta receptor type II) (TbetaR-II)	P37173|TGFR2_HUMAN	64,551	5
Mps one binder kinase activator-like 1A (Mob1 homolog 1A) (Mob1A) (Mob1B) (Protein Mob4A)	Q7L9L4|MOL1A_HUMAN, Q9H8S9|MOL1B_HUMAN	25,074	5
Ribosome biogenesis protein BOP1 (Block of proliferation 1 protein)	Q14137|BOP1_HUMAN	83,611	5
Protein BUD31 homolog (Protein G10 homolog) (EDG-2)	P41223|BUD31_HUMAN	16,982	5
Keratin, type II cytoskeletal 2 epidermal (Cytokeratin-2e) (K2e) (CK 2e) (Keratin 2)	P35908|K22E_HUMAN	65,848	5
Import inner membrane translocase subunit TIM44, mitochondrial precursor	O43615|TIM44_HUMAN	51,339	5
Lysosome membrane protein 2 (Lysosome membrane protein II) (LIMP II) (Scavenger receptor class B member 2) (85 kDa lysosomal membrane sialoglycoprotein) (LGP85) (CD36 antigen-like 2)	Q14108|SCRB2_HUMAN	54,274	5
Focal adhesion kinase 1 (EC 2.7.10.2) (FADK 1) (pp125FAK) (Protein-tyrosine kinase 2)	Q05397|FAK1_HUMAN	119,218	5
MICAL-like protein 1 (Molecule interacting with Rab13) (MIRab13)	Q8N3F8|MILK1_HUMAN	93,424	5
Protein FAM98A	Q8NCA5|FA98A_HUMAN	55,383	5
Apolipoprotein-L2 (Apolipoprotein L-II) (ApoL-II)	Q9BQE5|APOL2_HUMAN	37,075	5
Splicing factor, arginine/serine-rich 5 (Pre-mRNA-splicing factor SRP40) (Delayed-early protein HRS)	Q13243|SFRS5_HUMAN	31,247	5
Sulfotransferase family cytosolic 1B member 1 (EC 2.8.2.-) (Sulfotransferase 1B2) (Thyroid hormone sulfotransferase)	O43704|ST1B1_HUMAN	34,883	5
Transmembrane protein 165 (Transmembrane protein TPARL) (Transmembrane protein PT27)	Q9HC07|TM165_HUMAN	34,888	5
Ras-related protein R-Ras2 precursor (Ras-like protein TC21) (Teratocarcinoma oncogene)	P62070|RRAS2_HUMAN	23,382	5
ATP synthase f chain, mitochondrial (EC 3.6.3.14)	P56134|ATPK_HUMAN	10,900	5
Probable rRNA-processing protein EBP2 (EBNA1-binding protein 2) (Nucleolar protein p40)	Q99848|EBP2_HUMAN	34,835	5
Activity-dependent neuroprotector (Activity-dependent neuroprotective protein)	Q9H2P0|ADNP_HUMAN	123,546	5

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Keratin, type II cytoskeletal 6A (Cytokeratin-6A) (CK 6A) (K6a keratin)	P02538|K2C6A_HUMAN, P48666|K2C6C_HUMAN	60,028	5
Dihydroxyacetone kinase (EC 2.7.1.29) (Glycerone kinase) (DHA kinase)	Q3LXA3|DAK_HUMAN	58,960	5
Cullin-1 (CUL-1)	Q13616|CUL1_HUMAN	89,663	5
Interferon-induced protein with tetratricopeptide repeats 5 (IFIT-5) (Retinoic acid- and interferon-inducible 58 kDa protein)	Q13325|IFIT5_HUMAN	55,831	5
Urokinase plasminogen activator surface receptor precursor (uPAR) (U-PAR) (Monocyte activation antigen Mo3) (CD87 antigen)	Q03405|UPAR_HUMAN	36,959	5
Sjoegren syndrome/scleroderma autoantigen 1 (Autoantigen p27)	O60232|SSA27_HUMAN	21,457	5
Ras-related protein Rab-8A (Oncogene c-mel)	P61006|RAB8A_HUMAN	23,652	5
Multidrug resistance-associated protein 1 (ATP-binding cassette sub-family C member 1) (Leukotriene C(4) transporter) (LTC4 transporter)	P33527|MRP1_HUMAN	171,547	5
Golgi reassembly-stacking protein 2 (GRS2) (Golgi reassembly-stacking protein of 55 kDa) (GRASP55) (p59) (Golgi phosphoprotein 6) (GOLPH6)	Q9H8Y8|GORS2_HUMAN	47,128	4
Insulin-like growth factor 2 mRNA-binding protein 2 (IGF-II mRNA-binding protein 2) (IMP-2) (Hepatocellular carcinoma autoantigen p62)	Q9Y6M1|IF2B2_HUMAN	61,825	4
Gamma-soluble NSF attachment protein (SNAP-gamma) (N-ethylmaleimide-sensitive factor attachment protein, gamma)	Q99747|SNAG_HUMAN	34,729	4
Rho guanine nucleotide exchange factor 7 (PAK-interacting exchange factor beta) (Beta-Pix) (COOL-1) (p85)	Q14155|ARHG7_HUMAN	89,996	4
Cation-independent mannose-6-phosphate receptor precursor (CI Man-6-P receptor) (CI-MPR) (M6PR) (Insulin-like growth factor 2 receptor) (Insulin-like growth factor II receptor) (IGF-II receptor) (M6P/IGF2 receptor) (M6P/IGF2R) (300 kDa mannose 6-phosphate receptor) (MPR 300) (MPR300) (CD222 antigen)	P11717|MPRI_HUMAN	274,256	4
Ephrin type-A receptor 2 precursor (EC 2.7.10.1) (Tyrosine-protein kinase receptor ECK) (Epithelial cell kinase)	P29317|EPHA2_HUMAN	108,237	4
Tubulin--tyrosine ligase-like protein 12	Q14166|TTL12_HUMAN	74,386	4
YLP motif-containing protein 1 (Nuclear protein ZAP3) (ZAP113)	P49750|YLPM1_HUMAN	219,970	4
Hydroxyacyl-coenzyme A dehydrogenase, mitochondrial precursor (EC 1.1.1.35) (Short chain 3-hydroxyacyl-CoA dehydrogenase) (HCDH) (Medium and short chain L-3-hydroxyacyl-coenzyme A dehydrogenase)	Q16836|HCDH_HUMAN	34,260	4
Uncharacterized protein C1orf77	Q9Y3Y2|CA077_HUMAN	26,380	4
Density-regulated protein (DRP) (Protein DRP1) (Smooth muscle cell-associated protein 3) (SMAP-3)	O43583|DENR_HUMAN	22,074	4
Prefoldin subunit 5 (C-myc-binding protein Mm-1) (Myc modulator 1)	Q99471|PFD5_HUMAN	17,310	4
5′-AMP-activated protein kinase catalytic subunit alpha-1 (EC 2.7.11.1) (AMPK alpha-1 chain)	Q13131|AAPK1_HUMAN	62,791	4
Neuropilin-1 precursor (Vascular endothelial cell growth factor 165 receptor) (CD304 antigen)	O14786|NRP1_HUMAN	103,105	4

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Band 4.1-like protein 2 (Generally expressed protein 4.1) (4.1G)	O43491|E41L2_HUMAN	112,570	4
Annexin A7 (Annexin VII) (Synexin)	P20073|ANXA7_HUMAN	52,723	4
NEDD8-conjugating enzyme Ubc12 (EC 6.3.2.-) (Ubiquitin-conjugating enzyme E2 M) (NEDD8 protein ligase) (NEDD8 carrier protein)	P61081|UBC12_HUMAN	20,883	4
Hydroxymethylglutaryl-CoA synthase, cytoplasmic (EC 2.3.3.10) (HMG-CoA synthase) (3-hydroxy-3-methylglutaryl coenzyme A synthase)	Q01581|HMCS1_HUMAN	57,277	4
Cleavage stimulation factor 64 kDa subunit (CSTF 64 kDa subunit) (CF-1 64 kDa subunit) (CstF-64)	P33240|CSTF2_HUMAN	60,941	4
Translation initiation factor eIF-2B subunit delta (eIF-2B GDP-GTP exchange factor subunit delta)	Q9UI10|EI2BD_HUMAN	57,539	4
Hepatocyte growth factor-regulated tyrosine kinase substrate (Protein pp110) (Hrs)	O14964|HGS_HUMAN	86,174	4
Ubiquitin-conjugating enzyme E2 O (EC 6.3.2.19) (Ubiquitin-protein ligase O) (Ubiquitin carrier protein O) (Ubiquitin-conjugating enzyme E2 of 230 kDa) (E2-230K)	Q9C0C9|UBE2O_HUMAN	141,336	4
Glycogen synthase kinase-3 beta (EC 2.7.11.26) (GSK-3 beta)	P49841|GSK3B_HUMAN	46,727	4
Mitochondrial 39S ribosomal protein L4 (L4mt) (MRP-L4)	Q9BYD3|RM04_HUMAN	34,902	4
Ribose-phosphate pyrophosphokinase I (EC 2.7.6.1) (Phosphoribosyl pyrophosphate synthetase I) (PRS-I) (PPRibP)	P60891|PRPS1_HUMAN	34,817	4
3-hydroxyisobutyrate dehydrogenase, mitochondrial precursor (EC 1.1.1.31) (HIBADH)	P31937|3HIDH_HUMAN	35,312	4
Medium-chain specific acyl-CoA dehydrogenase, mitochondrial precursor (EC 1.3.99.3) (MCAD)	P11310|ACADM_HUMAN	46,572	4
RNA polymerase I-associated factor PAF49 (Anti-sense to ERCC-1 protein) (ASE-1) (CD3-epsilon-associated protein) (CD3E-associated protein) (CAST)	O15446|PAF49_HUMAN	54,968	4
Guanine nucleotide-binding protein alpha-13 subunit (G alpha-13)	Q14344|GNA13_HUMAN	44,033	4
Serine/threonine-protein kinase N1 (EC 2.7.11.13) (Protein kinase C-like 1) (Protein-kinase C-related kinase 1) (Protein kinase C-like PKN) (Serine-threonine protein kinase N) (Protein kinase PKN-alpha)	Q16512|PKN1_HUMAN	103,975	4
SPFH domain-containing protein 2 precursor	O94905|SPFH2_HUMAN	37,822	4
Guanine nucleotide-binding protein G(I)/G(S)/G(O) gamma-12 subunit precursor	Q9UBI6|GBG12_HUMAN	7,989	4
Nuclear pore complex protein Nup98-Nup96 precursor [Contains: Nuclear pore complex protein Nup98 (Nucleoporin Nup98) (98 kDa nucleoporin); Nuclear pore complex protein Nup96 (Nucleoporin Nup96) (96 kDa nucleoporin)]	P52948|NUP98_HUMAN	187,776	4
Actin-like protein 6A (53 kDa BRG1-associated factor A) (Actin-related protein Baf53a) (ArpNbeta)	O96019|ACL6A_HUMAN	47,443	4
Protein LAP4 (Protein scribble homolog) (hScrib)	Q14160|LAP4_HUMAN	174,915	4
Tetratricopeptide repeat protein 37 (TPR repeat protein 37)	Q6PGP7|TTC37_HUMAN	175,474	4
ATP-dependent RNA helicase DDX50 (EC 3.6.1.-) (DEAD box protein 50) (Nucleolar protein Gu2) (Gu-beta)	Q9BQ39|DDX50_HUMAN	82,549	4
Prostaglandin E synthase 2 (EC 5.3.99.3) (Microsomal prostaglandin E synthase 2) (mPGES-2) [Contains: Prostaglandin E synthase 2 truncated form]	Q9H7Z7|PGES2_HUMAN	41,926	4

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Peroxisomal biogenesis factor 19 (Peroxin-19) (Peroxisomal farnesylated protein) (33 kDa housekeeping protein)	P40855|PEX19_HUMAN	32,789	4
Selenocysteine-specific elongation factor (Elongation factor sec) (Eukaryotic elongation factor, selenocysteine-tRNA-specific)	P57772|SELB_HUMAN	65,322	4
GTPase-activating protein ZNF289	Q8N6H7|ZN289_HUMAN	56,703	4
CUG triplet repeat RNA-binding protein 1 (CUG-BP1) (RNA-binding protein BRUNOL-2) (Deadenylation factor CUG-BP) (50 kDa Nuclear polyadenylated RNA-binding protein) (EDEN-BP)	Q92879|CUGB1_HUMAN	52,046	4
FYVE, RhoGEF and PH domain-containing protein 5 (Zinc finger FYVE domain-containing protein 23)	Q6ZNL6|FGD5_HUMAN	159,890	4
Succinyl-CoA:3-ketoacid-coenzyme A transferase 1, mitochondrial precursor (EC 2.8.3.5) (Somatic-type succinyl CoA:3-oxoacid CoA-transferase) (Scot-S)	P55809|SCOT_HUMAN	56,141	4
Zinc phosphodiesterase ELAC protein 2 (EC 3.1.26.11) (Ribonuclease Z 2) (RNase Z 2) (tRNase Z 2) (tRNA 3 endonuclease 2) (ElaC homolog protein 2) (Heredity prostate cancer protein 2)	Q9BQ52|RNZ2_HUMAN	92,202	4
Alpha-N-acetylgalactosaminidase precursor (EC 3.2.1.49) (Alpha-galactosidase B)	P17050|NAGAB_HUMAN	46,548	4
Activating signal cointegrator 1 (ASC-1) (Thyroid receptor-interacting protein 4) (TRIP-4)	Q15650|TRIP4_HUMAN	66,130	4
Uncharacterized potential DNA-binding protein C17orf49	Q8IXM2|CQ049_HUMAN	17,883	4
Translation initiation factor eIF-2B subunit beta (eIF-2B GDP-GTP exchange factor subunit beta) (S20I15) (S20III15)	P49770|EI2BB_HUMAN	38,972	4
Dehydrogenase/reductase SDR family member 4 (EC 1.1.1.184) (NADPH-dependent carbonyl reductase/NADP-retinol dehydrogenase) (CR) (PHCR) (Peroxisomal short-chain alcohol dehydrogenase) (NADPH-dependent retinol dehydrogenase/reductase) (NDRD) (SCAD-SRL) (humNRDR) (PSCD)	Q9BTZ2|DHRS4_HUMAN	27,554	4
Cadherin-13 precursor (Truncated-cadherin) (T-cadherin) (T-cad) (Heart-cadherin) (H-cadherin) (P105)	P55290|CAD13_HUMAN	78,270	4
Transcriptional activator protein Pur-alpha (Purine-rich single-stranded DNA-binding protein alpha)	Q00577|PURA_HUMAN	34,893	4
Guanine nucleotide-binding protein subunit beta 4 (Transducin beta chain 4)	Q9HAV0|GBB4_HUMAN	37,550	4
Peptidyl-prolyl cis-trans isomerase-like 3 (EC 5.2.1.8) (PPIase) (Rotamase) (Cyclophilin-like protein PPIL3) (Cyclophilin J) (CyPJ)	Q9H2H8|PPIL3_HUMAN	18,137	4
Abl interactor 1 (Abelson interactor 1) (Abi-1) (Spectrin SH3 domain-binding protein 1) (Eps8 SH3 domain-binding protein) (Eps8-binding protein) (e3B1) (Nap1-binding protein) (Nap1BP) (Abl-binding protein 4) (AblBP4)	Q8IZP0|ABI1_HUMAN	55,064	4
Nucleolar phosphoprotein p130 (Nucleolar 130 kDa protein) (140 kDa nucleolar phosphoprotein) (Nopp140) (Nucleolar and coiled-body phosphoprotein 1)	Q14978|NOLC1_HUMAN	73,703	4
FK506-binding protein 11 precursor (EC 5.2.1.8) (Peptidyl-prolyl cis-trans isomerase) (PPIase) (Rotamase) (19 kDa FK506-binding protein) (FKBP-19)	Q9NYL4|FKB11_HUMAN	22,163	4
cAMP-dependent protein kinase, alpha-catalytic subunit (EC 2.7.11.11) (PKA C-alpha)	P17612|KAPCA_HUMAN	40,573	4
Promega trypsin artifact 5 K to R mods (2239.1, 2914)(1987, 2003)	CONT|Trypa5|PromTArt5	5,543	4

Protein Description	Accession Number	Molecular Weight	Total SpC
Serine/threonine-protein kinase OSR1 (EC 2.7.11.1) (Oxidative stress-responsive 1 protein)	O95747|OXSR1_HUMAN	58,005	4
GTPase IMAP family member 7 (Immunity-associated nucleotide 7 protein)	Q8NHV1|GIMA7_HUMAN	34,492	4
Armadillo repeat protein deleted in velo-cardio-facial syndrome	O00192|ARVC_HUMAN	104,624	4
NEDD9-interacting protein with calponin homology and LIM domains (Molecule interacting with CasL protein 1)	Q8TDZ2|MICA1_HUMAN	117,858	4
COP9 signalosome complex subunit 6 (Signalosome subunit 6) (SGN6) (JAB1-containing signalosome subunit 6) (Vpr-interacting protein) (hVIP) (MOV34 homolog)	Q7L5N1|CSN6_HUMAN	36,145	4
Protein phosphatase methylesterase 1 (EC 3.1.1.-) (PME-1)	Q9Y570|PPME1_HUMAN	42,298	4
Putative eukaryotic translation initiation factor 3 subunit (eIF-3)	O75153|IF3X_HUMAN	146,654	4
Histone-arginine methyltransferase CARM1 (EC 2.1.1.125) (EC 2.1.1.-) (Protein arginine N-methyltransferase 4) (Coactivator-associated arginine methyltransferase 1)	Q86X55|CARM1_HUMAN	63,442	4
Transcriptional repressor p66 alpha (Hp66alpha) (GATA zinc finger domain-containing protein 2A)	Q86YP4|P66A_HUMAN	68,045	4
Interferon-inducible double stranded RNA-dependent protein kinase activator A (Protein kinase, interferon-inducible double stranded RNA-dependent activator) (Protein activator of the interferon-induced protein kinase) (PKR-associated protein X) (PKR-associating protein X)	O75569|PRKRA_HUMAN	34,387	4
Pseudouridylate synthase 7 homolog (EC 5.4.99.-)	Q96PZ0|PUS7_HUMAN	75,020	4
Synembryn-A (Protein Ric-8A)	Q9NPQ8|RIC8A_HUMAN	59,595	4
Apoptosis inhibitor 5 (API-5) (Fibroblast growth factor 2-interacting factor) (FIF) (Protein XAGL) (Antiapoptosis clone 11 protein) (AAC-11)	Q9BZZ5|API5_HUMAN	57,545	4
UBX domain-containing protein 2	Q92575|UBXD2_HUMAN	56,760	4
Methylosome subunit pICln (Chloride conductance regulatory protein ICln) (I(Cln)) (Chloride channel, nucleotide sensitive 1A) (Chloride ion current inducer protein) (ClCI) (Reticulocyte pICln)	P54105|ICLN_HUMAN	26,197	4
Nitric oxide synthase-interacting protein (eNOS-interacting protein)	Q9Y314|NOSIP_HUMAN	33,154	4
RNA 3′-terminal phosphate cyclase (EC 6.5.1.4) (RNA-3′-phosphate cyclase) (RNA cyclase)	O00442|RTC1_HUMAN	39,320	4
RAC-alpha serine/threonine-protein kinase (EC 2.7.11.1) (RAC-PK-alpha) (Protein kinase B) (PKB) (C-AKT)	P31749|AKT1_HUMAN	55,670	4
Nuclear receptor-binding protein	Q9UHY1|NRBP_HUMAN	59,827	4
Ubiquitin-associated protein 2	Q5T6F2|UBAP2_HUMAN	117,097	4
Symplekin	Q92797|SYMPK_HUMAN	141,136	4
Stromal cell-derived factor 2-like protein 1 precursor (SDF2-like protein 1) (PWP1-interacting protein 8)	Q9HCN8|SDF2L_HUMAN	23,580	4
Eukaryotic translation initiation factor 4E-binding protein 1 (4E-BP1) (eIF4E-binding protein 1) (Phosphorylated heat- and acid-stable protein regulated by insulin 1) (PHAS-I)	Q13541|4EBP1_HUMAN	12,562	4

Prog Retin Eye Res. Author manuscript; available in PMC 2014 January 01.

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Deoxyhypusine hydroxylase (EC 1.14.99.29) (Deoxyhypusine monooxygenase) (hDOHH) (HEAT-like repeat-containing protein 1)	Q9BU89|DOHH_HUMAN	32,886	4
Protein FAM96B	Q9Y3D0|FA96B_HUMAN	17,645	4
Acyl-protein thioesterase 1 (EC 3.1.2.-) (Lysophospholipase 1) (Lysophospholipase I)	O75608|LYPA1_HUMAN	24,652	4
Cytoplasmic protein NCK1 (NCK adaptor protein 1) (SH2/SH3 adaptor protein NCK-alpha)	P16333|NCK1_HUMAN	42,846	4
DnaJ homolog subfamily C member 11	Q9NVH1|DCJ11_HUMAN	63,261	4
Queuine tRNA-ribosyltransferase (EC 2.4.2.29) (tRNA-guanine transglycosylase) (Guanine insertion enzyme)	Q9BXR0|TGT_HUMAN	42,474	4
WD repeat protein 36 (T-cell activation WD repeat-containing protein) (TA-WDRP)	Q8NI36|WDR36_HUMAN	105,308	4
U6 snRNA-associated Sm-like protein LSm2 (snRNP core Sm-like protein Sm-x5) (Small nuclear ribonuclear protein D homolog) (Protein G7b)	Q9Y333|LSM2_HUMAN	10,817	4
Dynamin-like 120 kDa protein, mitochondrial precursor (Optic atrophy protein 1) [Contains: Dynamin-like 120 kDa protein, form S1]	O60313|OPA1_HUMAN	111,643	4
Monocarboxylate transporter 1 (MCT 1) (Solute carrier family 16 member 1)	P53985|MOT1_HUMAN	53,942	4
Golgi resident protein GCP60 (Acyl-CoA-binding domain-containing protein 3) (Golgi phosphoprotein 1) (GOLPH1) (Golgi complex-associated protein 1) (GOCAP1) (PBR- and PKA-associated protein 7) (Peripheral benzodiazepine receptor-associated protein PAP7)	Q9H3P7|GCP60_HUMAN	60,575	4
SWI/SNF-related matrix-associated actin-dependent regulator of chromatin subfamily E member 1 (BRG1-associated factor 57)	Q969G3|SMCE1_HUMAN	46,632	4
Ubiquitin fusion degradation protein 1 homolog (UB fusion protein 1)	Q92890|UFD1_HUMAN	38,708	4
EGF, latrophilin and seven transmembrane domain-containing protein 1 precursor (EGF-TM7-latrophilin-related protein) (ETL protein)	Q9HBW9|ELTD1_HUMAN	77,809	4
Phospholipid scramblase 1 (PL scramblase 1) (Ca(2+)-dependent phospholipid scramblase 1) (Erythrocyte phospholipid scramblase) (MmTRA1b)	O15162|PLS1_HUMAN	35,031	4
U4/U6 small nuclear ribonucleoprotein Prp31 (Pre-mRNA-processing factor 31) (U4/U6 snRNP 61 kDa protein) (hPrp31) (Protein 61K) (Serologically defined breast cancer antigen NY-BR-99)	Q8WWY3|PRP31_HUMAN	55,439	4
Helicase SKI2W (EC 3.6.1.-) (Helicase-like protein) (HLP)	Q15477|SKIV2_HUMAN	137,784	4
Probable ubiquitin carboxyl-terminal hydrolase FAF-X (EC 3.1.2.15) (Ubiquitin thioesterase FAF-X) (Ubiquitin-specific-processing protease FAF-X) (Deubiquitinating enzyme FAF-X) (Fat facets protein-related, X-linked) (Ubiquitin-specific protease 9, X chromosome)	Q93008|USP9X_HUMAN	289,527	4
FACT complex subunit SPT16 (Facilitates chromatin transcription complex subunit SPT16) (hSPT16) (FACT 140 kDa subunit) (FACTp140) (Chromatin-specific transcription elongation factor 140 kDa subunit)	Q9Y5B9|SPT16_HUMAN	119,899	4
Superoxide dismutase [Mn], mitochondrial precursor (EC 1.15.1.1)	P04179|SODM_HUMAN	24,705	4
Lamin-B receptor (Integral nuclear envelope inner membrane protein) (LMN2R)	Q14739|LBR_HUMAN	70,688	4

Protein Description	Accession Number	Molecular Weight	Total SpC
H/ACA ribonucleoprotein complex subunit 3 (Nucleolar protein family A member 3) (snoRNP protein NOP10)	Q9NPE3|NOLA3_HUMAN	7,688	4
Hook homolog 3 (hHK3)	Q86VS8|HOOK3_HUMAN	83,110	4
Nucleolar complex protein 3 homolog (NOC3 protein homolog) (NOC3-like protein) (Nucleolar complex-associated protein 3-like protein) (Factor for adipocyte differentiation 24)	Q8WTT2|NOC3L_HUMAN	92,534	4
Tumor susceptibility gene 101 protein	Q99816|TS101_HUMAN	43,928	4
Protein disulfide-isomerase TXNDC10 precursor (EC 5.3.4.1) (Thioredoxin domain-containing protein 10) (Thioredoxin-related transmembrane protein 3)	Q96JJ7|TXD10_HUMAN	51,855	4
Serine/threonine-protein phosphatase 2B catalytic subunit alpha isoform (EC 3.1.3.16) (Calmodulin-dependent calcineurin A subunit alpha isoform) (CAM-PRP catalytic subunit)	Q08209|PP2BA_HUMAN	58,672	4
cAMP-dependent protein kinase inhibitor gamma (PKI-gamma)	Q9Y2B9|IPKG_HUMAN	7,892	4
Polyglutamine-binding protein 1 (Polyglutamine tract-binding protein 1) (PQBP-1) (38 kDa nuclear protein containing a WW domain) (Npw38)	O60828|PQBP1_HUMAN	30,455	4
Ubiquitin-conjugating enzyme E2 Z (EC 6.3.2.19) (Ubiquitin-protein ligase Z) (Ubiquitin carrier protein Z)	Q9H832|UBE2Z_HUMAN	38,193	4
cAMP-dependent protein kinase type II-beta regulatory subunit	P31323|KAP3_HUMAN	46,329	4
Transcription factor p65 (Nuclear factor NF-kappa-B p65 subunit)	Q04206|TF65_HUMAN	60,202	4
Neutral amino acid transporter B(0) (ATB(0)) (Sodium-dependent neutral amino acid transporter type 2) (RD114/simian type D retrovirus receptor) (Baboon M7 virus receptor)	Q15758|AAAT_HUMAN	56,582	4
HBS1-like protein (ERFS)	Q9Y450|HBS1L_HUMAN	75,456	4
ATP synthase subunit g, mitochondrial (EC 3.6.3.14) (ATPase subunit g)	O75964|ATP5L_HUMAN	11,411	4
Sorting and assembly machinery component 50 homolog	Q9Y512|SAM50_HUMAN	51,960	4
Gasdermin domain-containing protein 1	P57764|GSDC1_HUMAN	52,783	4
DCN1-like protein 1 (Defective in cullin neddylation protein 1-like protein 1) (DCUN1 domain-containing protein 1) (Squamous cell carcinoma-related oncogene)	Q96GG9|DCNL1_HUMAN	30,108	4
Small nuclear ribonucleoprotein F (snRNP-F) (Sm protein F) (Sm-F) (SmF)	P62306|RUXF_HUMAN	9,707	4
Developmentally-regulated GTP-binding protein 2 (DRG 2)	P55039|DRG2_HUMAN	40,730	4
Nuclear fragile X mental retardation-interacting protein 2 (FMRP-interacting protein 2) (82 kDa FMRP-interacting protein) (82-FIP) (Proliferation-inducing gene 1 protein)	Q7Z417|NUFP2_HUMAN	76,103	4
Phosphomannomutase 2 (EC 5.4.2.8) (PMM 2)	O15305|PMM2_HUMAN	28,065	4
Uridine phosphorylase 1 (EC 2.4.2.3) (UrdPase 1) (UPase 1)	Q16831|UPP1_HUMAN	33,917	4
Hepatitis B virus X-interacting protein (HBX-interacting protein) (HBV X-interacting protein)	O43504|XIP_HUMAN	9,596	4
Sorting nexin-4	O95219|SNX4_HUMAN	51,892	4

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Oxidoreductase HTATIP2 (EC 1.1.1.-) (HIV-1 TAT-interactive protein 2) (30 kDa HIV-1 TAT-interacting protein)	Q9BUP3|TIP30_HUMAN	27,100	4
Rho-related GTP-binding protein RhoB precursor (H6)	P62745|RHOB_HUMAN	22,105	4
Sorting nexin-12	Q9UMY4|SNX12_HUMAN	19,713	4
Caspase-8 precursor (EC 3.4.22.61) (CASP-8) (ICE-like apoptotic protease 5) (MORT1-associated CED-3 homolog) (MACH) (FADD-homologous ICE/CED-3-like protease) (FADD-like ICE) (FLICE) (Apoptotic cysteine protease) (Apoptotic protease Mch-5) (CAP4) [Contains: Caspase-8 subunit p18; Caspase-8 subunit p10]	Q14790|CASP8_HUMAN	55,376	4
Bullous pemphigoid antigen 1, isoforms 6/9/10 (Trabeculin-beta) (Bullous pemphigoid antigen) (BPA) (Hemidesmosomal plaque protein) (Dystonia musculorum protein) (Dystonin)	O94833|BPAEA_HUMAN	590,974	4
Serpin B8 (Cytoplasmic antiproteinase 2) (CAP-2) (CAP2) (Protease inhibitor 8)	P50452|SPB8_HUMAN	42,769	4
Leucine-rich repeat flightless-interacting protein 2 (LRR FLII-interacting protein 2)	Q9Y608|LRRF2_HUMAN	82,157	4
UPF0384 protein CGI-117 (HBV pre-S2 trans-regulated protein 3)	Q9Y3C1|U384_HUMAN	21,171	4
Bifunctional coenzyme A synthase (CoA synthase) (NBP) (POV-2) [Includes: Phosphopantetheine adenylyltransferase (EC 2.7.7.3) (Pantetheine-phosphate adenylyltransferase) (PPAT) (Dephospho-CoA pyrophosphorylase); Dephospho-CoA kinase (EC 2.7.1.24) (DPCK) (Dephosphocoenzyme A kinase) (DPCOAK)]	Q13057|COASY_HUMAN	62,312	4
Protein ariadne-1 homolog (ARI-1) (Ubiquitin-conjugating enzyme E2-binding protein 1) (UbcH7-binding protein) (UbcM4-interacting protein) (HHARI) (H7-AP2) (Monocyte protein 6) (MOP-6)	Q9Y4X5|ARI1_HUMAN	64,099	4
Angiotensin-converting enzyme, somatic isoform precursor (EC 3.4.15.1) (Dipeptidyl carboxypeptidase I) (Kininase II) (CD143 antigen) [Contains: Angiotensin-converting enzyme, somatic isoform, soluble form]	P12821|ACE_HUMAN	149,701	4
GTP-binding protein SAR1a (COPII-associated small GTPase)	Q9NR31|SAR1A_HUMAN	22,350	4
E3 ubiquitin-protein ligase HECTD1 (HECT domain-containing protein 1) (E3 ligase for inhibin receptor) (EULIR)	Q9ULT8|HECD1_HUMAN	289,580	4
BET1 homolog (Golgi vesicular membrane-trafficking protein p18) (hBET1)	O15155|BET1_HUMAN	13,272	4
Transmembrane protein 109 precursor (Mitsugumin-23) (Mg23)	Q9BVC6|TM109_HUMAN	26,193	4
Alpha-endosulfine (ARPP-19e)	O43768|ENSA_HUMAN, P56211|ARP19_HUMAN	13,371	4
mRNA turnover protein 4 homolog	Q9UKD2|MRT4_HUMAN	27,543	4
CAAX prenyl protease 1 homolog (EC 3.4.24.84) (Prenyl protein-specific endoprotease 1) (Farnesylated proteins-converting enzyme 1) (FACE-1) (Zinc metalloproteinase Ste24 homolog)	O75844|FACE1_HUMAN	54,798	4
26S proteasome non-ATPase regulatory subunit 8 (26S proteasome regulatory subunit S14) (p31)	P48556|PSMD8_HUMAN	29,989	4
Ubiquitin-activating enzyme E1 homolog (D8)	P41226|UBE1L_HUMAN	111,703	4
Metaxin-1	Q13505|MTX1_HUMAN	35,760	4
Sterol-4-alpha-carboxylate 3-dehydrogenase, decarboxylating (EC 1.1.1.170) (H105e3 protein)	Q15738|NSDHL_HUMAN	41,883	4

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Protein FAM98B	Q52LJ0|FA98B_HUMAN	37,175	4
RNA-binding protein 34 (RNA-binding motif protein 34)	P42696|RBM34_HUMAN	48,548	4
Dolichyl-phosphate beta-glucosyltransferase (EC 2.4.1.117) (DolP-glucosyltransferase)	Q9Y673|ALG5_HUMAN	36,930	4
Glutamine-dependent NAD(+) synthetase (EC 6.3.5.1) (NAD(+) synthase [glutamine-hydrolyzing]) (NAD(+) synthetase 1)	Q6IA69|NADE1_HUMAN	79,277	4
Brix domain-containing protein 1	Q9H7B2|BXDC1_HUMAN	35,568	4
Actin-related protein 10 (hARP11)	Q9NZ32|ARP10_HUMAN	46,290	4
Cysteine-rich with EGF-like domain protein 2 precursor	Q6UXH1|CREL2_HUMAN	38,173	4
Cysteine-rich protein 1 (Cysteine-rich intestinal protein) (CRIP) (Cysteine-rich heart protein) (hCRHP)	P50238|CRIP1_HUMAN	8,515	4
MMS19-like protein (hMMS19) (MET18 homolog)	Q96T76|MMS19_HUMAN	113,259	4
Hippocalcin-like protein 1 (Visinin-like protein 3) (VILIP-3) (Calcium-binding protein BDR-1) (HLP2)	P37235|HPCL1_HUMAN, P84074|HPCA_HUMAN	22,296	4
Echinoderm microtubule-associated protein-like 1 (EMAP-1) (HuEMAP-1)	O00423|EMAL1_HUMAN	79,009	4
Putative ATP-dependent RNA helicase DHX30 (EC 3.6.1.-) (DEAH box protein 30)	Q7L2E3|DHX30_HUMAN	133,924	4
Glutathione peroxidase 7 precursor (EC 1.11.1.9) (CL683)	Q96SL4|GPX7_HUMAN	20,978	4
Dedicator of cytokinesis protein 1 (180 kDa protein downstream of CRK) (DOCK180)	Q14185|DOCK1_HUMAN	215,365	4
Striatin-3 (Cell-cycle autoantigen SG2NA) (S/G2 antigen)	Q13033|STRN3_HUMAN	87,117	4
Lipopolysaccharide-responsive and beige-like anchor protein (CDC4-like protein) (Beige-like protein)	P50851|LRBA_HUMAN	319,145	4
2′-5′-oligoadenylate synthetase 2 (EC 2.7.7.-) ((2–5′)oligo(A) synthetase 2) (2–5A synthetase 2) (p69 OAS/p71 OAS) (p69OAS/p71OAS)	P29728|OAS2_HUMAN	82,415	4
mRNA decapping enzyme 1A (EC 3.-.-.-) (Transcription factor SMIF) (Smad4-interacting transcriptional co-activator)	Q9NPI6|DCP1A_HUMAN	63,261	4
Exocyst complex component 6 (Exocyst complex component Sec15A) (Sec15-like 1)	Q8TAG9|EXOC6_HUMAN	93,620	4
Cullin-4A (CUL-4A)	Q13619|CUL4A_HUMAN	87,666	4
Ephrin-B2 precursor (EPH-related receptor tyrosine kinase ligand 5) (LERK-5) (HTK ligand) (HTK-L)	P52799|EFNB2_HUMAN	36,906	4
Testis-expressed sequence 10 protein	Q9NXF1|TEX10_HUMAN	105,661	4
Protein mago nashi homolog	P61326|MGN_HUMAN, Q96A72|MGN2_HUMAN	17,146	4
Serine/threonine-protein phosphatase 2A regulatory subunit B′ (PP2A, subunit B′, PR53 isoform) (Phosphotyrosyl phosphatase activator) (PTPA)	Q15257|PTPA_HUMAN	40,650	4
Dedicator of cytokinesis protein 10 (Zizimin-3)	Q96BY6|DOC10_HUMAN	249,300	4

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Fatty aldehyde dehydrogenase (EC 1.2.1.3) (Aldehyde dehydrogenase, microsomal) (Aldehyde dehydrogenase family 3 member A2) (Aldehyde dehydrogenase 10)	P51648|AL3A2_HUMAN	54,832	4
Multidrug resistance protein 1 (EC 3.6.3.44) (ATP-binding cassette sub-family B member 1) (P-glycoprotein 1) (CD243 antigen)	P08183|MDR1_HUMAN	141,450	4
Transmembrane emp24 domain-containing protein 7 precursor	Q9Y3B3|TMED7_HUMAN	25,154	4
Dolichyl-diphosphooligosaccharide--protein glycosyltransferase subunit STT3B (EC 2.4.1.119) (Oligosaccharyl transferase subunit STT3B) (STT3-B) (Source of immunodominant MHC-associated peptides homolog)	Q8TCJ2|STT3B_HUMAN	93,660	4
Mitochondrial 2-oxoglutarate/malate carrier protein (OGCP) (Solute carrier family 25 member 11)	Q02978|M2OM_HUMAN	34,045	4
Forkhead box protein K1 (Myocyte nuclear factor) (MNF)	P85037|FOXK1_HUMAN	75,439	4
Lysosomal acid phosphatase precursor (EC 3.1.3.2) (LAP)	P11117|PPAL_HUMAN	48,327	4
Uveal autoantigen with coiled-coil domains and ankyrin repeats protein	Q9BZF9|UACA_HUMAN	162,492	3
Ubiquitin-conjugating enzyme E2 variant 2 (MMS2) (Enterocyte differentiation-associated factor EDAF-1) (Enterocyte differentiation-promoting factor) (EDPF-1) (Vitamin D3-inducible protein) (DDVit 1)	Q15819|UB2V2_HUMAN	16,345	3
UPF0160 protein MYG1	Q9HB07|MYG1_HUMAN	42,428	3
U4/U6 small nuclear ribonucleoprotein Prp3 (Pre-mRNA-splicing factor 3) (U4/U6 snRNP 90 kDa protein) (hPrp3)	O43395|PRPF3_HUMAN	77,513	3
Uncharacterized protein C2orf32	Q96F85|CB032_HUMAN	18,630	3
Four and a half LIM domains protein 2 (FHL-2) (Skeletal muscle LIM-protein 3) (SLIM 3) (LIM domain protein DRAL)	Q14192|FHL2_HUMAN	32,174	3
Myosin-Va (Dilute myosin heavy chain, non-muscle) (Myosin-12) (Myosin heavy chain 12) (Myoxin)	Q9Y4I1|MYO5A_HUMAN	215,411	3
Fumarylacetoacetate hydrolase domain-containing protein 1 (EC 3.-.-.-) (YISK-like)	Q6P587|FAHD1_HUMAN	24,825	3
Importin alpha-3 subunit (Karyopherin alpha-3 subunit) (SRP1-gamma)	O00505|IMA3_HUMAN	57,793	3
SHC-transforming protein 1 (SH2 domain protein C1) (Src homology 2 domain-containing-transforming protein C1)	P29353|SHC1_HUMAN	62,835	3
Splicing factor 3A subunit 2 (Spliceosome-associated protein 62) (SAP 62) (SF3a66)	Q15428|SF3A2_HUMAN	49,237	3
Target of Myb protein 1	O60784|TOM1_HUMAN	53,801	3
STIP1 homology and U box-containing protein 1 (EC 6.3.2.-) (STIP1 homology and U-box-containing protein 1) (Carboxy terminus of Hsp70-interacting protein) (E3 ubiquitin protein ligase CHIP) (CLL-associated antigen KW-8) (Antigen NY-CO-7)	Q9UNE7|STUB1_HUMAN	34,839	3
ATP-dependent metalloprotease YME1L1 (EC 3.4.24.-) (YME1-like protein 1) (ATP-dependent metalloprotease FtsH1) (Meg-4) (Presenilin-associated metalloprotease) (PAMP)	Q96TA2|YMEL1_HUMAN	86,440	3
Rab11 family-interacting protein 5 (Rab11-FIP5) (Rab11-interacting protein Rip11) (Gamma-SNAP-associated factor 1) (Gaf-1) (Phosphoprotein pp75)	Q9BXF6|RFIP5_HUMAN	70,398	3

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Mesoderm development candidate 2 (Renal carcinoma antigen NY-REN-61)	Q14696|MESD2_HUMAN	26,060	3
Sad1/unc-84 protein-like 1 (Unc-84 homolog A)	O94901|UN84A_HUMAN	90,046	3
Serine beta-lactamase-like protein LACTB, mitochondrial precursor (EC 3.4.-.-)	P83111|LACTB_HUMAN	60,677	3
Clathrin interactor 1 (Epsin-4) (Epsin-related protein) (EpsinR) (Enthoprotin) (Clathrin-interacting protein localized in the trans-Golgi region) (Clint)	Q14677|EPN4_HUMAN	68,243	3
Cleavage stimulation factor 77 kDa subunit (CSTF 77 kDa subunit) (CF-1 77 kDa subunit) (CstF-77)	Q12996|CSTF3_HUMAN	82,906	3
Protein FAM3C precursor (Protein GS3786)	Q92520|FAM3C_HUMAN	24,663	3
Protein bicaudal D homolog 2 (Bic-D 2)	Q8TD16|BICD2_HUMAN	93,518	3
Centromere/kinetochore protein zw10 homolog	O43264|ZW10_HUMAN	88,815	3
ES1 protein homolog, mitochondrial precursor (Protein KNP-I) (Protein GT335)	P30042|ES1_HUMAN	28,152	3
Probable saccharopine dehydrogenase (EC 1.5.1.9)	Q8NBX0|SCPDH_HUMAN	47,135	3
Nuclear pore complex protein Nup133 (Nucleoporin Nup133) (133 kDa nucleoporin)	Q8WUM0|NU133_HUMAN	129,000	3
Serine protease 23 precursor (EC 3.4.21.-) (Putative secreted protein ZSIG13)	O95084|PRS23_HUMAN	42,984	3
AP-1 complex subunit mu-1 (Adaptor-related protein complex 1 mu-1 subunit) (Mu-adaptin 1) (Adaptor protein complex AP-1 mu-1 subunit) (Golgi adaptor HA1/AP1 adaptin mu-1 subunit) (Clathrin assembly protein assembly protein complex 1 medium chain 1) (AP-mu chain family member mu1A) (Clathrin coat assembly protein AP47) (Clathrin coat-associated protein AP47)	Q9BXS5|AP1 M1_HUMAN	48,570	3
Phosphatidylinositol-4-phosphate 5-kinase type-2 alpha (EC 2.7.1.68) (Phosphatidylinositol-4-phosphate 5-kinase type II alpha) (1-phosphatidylinositol-4-phosphate 5-kinase 2-alpha) (PtdIns(4)P-5-kinase isoform 2-alpha) (PIP5KII-alpha) (Diphosphoinositide kinase 2-alpha) (PtdIns(4)P-5-kinase B isoform) (PIP5KIII) (PtdIns(4)P-5-kinase C isoform)	P48426|PI52A_HUMAN	46,208	3
Phosphoenolpyruvate carboxykinase [GTP], mitochondrial precursor (EC 4.1.1.32) (Phosphoenolpyruvate carboxylase) (PEPCK-M)	Q16822|PPCKM_HUMAN	70,620	3
Autophagy-related protein 3 (APG3-like) (hApg3) (Protein PC3-96)	Q9NT62|ATG3_HUMAN	35,846	3
Dihydropteridine reductase (EC 1.5.1.34) (HDHPR) (Quinoid dihydropteridine reductase)	P09417|DHPR_HUMAN	25,772	3
Long-chain-fatty-acid--CoA ligase 4 (EC 6.2.1.3) (Long-chain acyl-CoA synthetase 4) (LACS 4)	O60488|ACSL4_HUMAN	79,174	3
39S ribosomal protein L1, mitochondrial precursor (L1mt) (MRP-L1)	Q9BYD6|RM01_HUMAN	34,436	3
Histone-lysine N-methyltransferase, H3 lysine-4 specific SET7 (EC 2.1.1.43) (Histone H3-K4 methyltransferase) (H3-K4-HMTase) (SET domain-containing protein 7) (Set9) (SET7/9)	Q8WTS6|SETD7_HUMAN	40,703	3
Bifunctional protein NCOAT (Nuclear cytoplasmic O-GlcNAcase and acetyltransferase) (Meningioma-expressed antigen 5) [Includes: Beta-hexosaminidase (EC 3.2.1.52) (N-acetyl-beta-glucosaminidase) (Beta-N-acetylhexosaminidase) (Hexosaminidase C) (N-acetyl-beta-D-glucosaminidase) (O-GlcNAcase); Histone acetyltransferase (EC 2.3.1.48) (HAT)]	O60502|NCOAT_HUMAN	102,900	3
Tubulin alpha-1 chain (Alpha-tubulin 1) (Testis-specific alpha-tubulin) (Tubulin H2-alpha)	P68366|TBA1_HUMAN	49,907	3

Protein Description	Accession Number	Molecular Weight	Total SpC
Condensin complex subunit 1 (Non-SMC condensin I complex subunit D2) (Chromosome condensation-related SMC-associated protein 1) (Chromosome-associated protein D2) (hCAP-D2) (XCAP-D2 homolog)	Q15021|CND1_HUMAN	157,155	3
SH2 domain-containing protein 3C (Novel SH2-containing protein 3)	Q8N5H7|SH2D3_HUMAN	94,394	3
NADH dehydrogenase [ubiquinone] iron-sulfur protein 8, mitochondrial precursor (EC 1.6.5.3) (EC 1.6.99.3) (NADH-ubiquinone oxidoreductase 23 kDa subunit) (Complex I-23kD) (CI-23kD) (TYKY subunit)	O00217|NDUS8_HUMAN	23,688	3
Translation initiation factor eIF-2B subunit gamma (eIF-2B GDP-GTP exchange factor subunit gamma)	Q9NR50|EI2BG_HUMAN	50,223	3
Peptidyl-prolyl cis-trans isomerase NIMA-interacting 4 (EC 5.2.1.8) (Rotamase Pin4) (PPIase Pin4) (Parvulin 14) (Par14) (Peptidyl-prolyl cis/trans isomerase EPVH) (hPar14)	Q9Y237|PIN4_HUMAN	13,792	3
Eukaryotic translation initiation factor 2C 2 (eIF2C 2) (eIF-2C 2) (Argonaute-2) (Slicer protein) (PAZ Piwi domain protein) (PPD)	Q9UKV8|I2C2_HUMAN	96,780	3
Dihydrofolate reductase (EC 1.5.1.3)	P00374|DYR_HUMAN	21,435	3
Ferritin light chain (Ferritin L subunit)	P02792|FRIL_HUMAN	20,003	3
Programmed cell death protein 10 (TF-1 cell apoptosis-related protein 15) (Cerebral cavernous malformations 3 protein)	Q9BUL8|PDC10_HUMAN	24,685	3
Transmembrane protein 111	Q9P0I2|TM111_HUMAN	29,935	3
Protein diaphanous homolog 2 (Diaphanous-related formin-2) (DRF2)	O60879|DIAP2_HUMAN	125,558	3
Ankyrin repeat and FYVE domain-containing protein 1 (Ankyrin repeats hooked to a zinc finger motif)	Q9P2R3|ANFY1_HUMAN	128,384	3
Cdc42-interacting protein 4 (Thyroid receptor-interacting protein 10) (TRIP-10) (Protein Felic) (Salt-tolerant protein) (hSTP)	Q15642|CIP4_HUMAN	68,335	3
NADH dehydrogenase [ubiquinone] 1 alpha subcomplex subunit 9, mitochondrial precursor (EC 1.6.5.3) (EC 1.6.99.3) (NADH-ubiquinone oxidoreductase 39 kDa subunit) (Complex I-39kD) (CI-39kD)	Q16795|NDUA9_HUMAN	42,492	3
Replication protein A 32 kDa subunit (RP-A) (RF-A) (Replication factor-A protein 2) (p32) (p34)	P15927|RFA2_HUMAN	29,229	3
Rho/Rac guanine nucleotide exchange factor 2 (GEF-H1 protein) (Proliferating cell nucleolar antigen p40)	Q92974|ARHG2_HUMAN	101,159	3
Ferritin heavy chain (EC 1.16.3.1) (Ferritin H subunit) (Proliferation-inducing gene 15 protein)	P02794|FRIH_HUMAN	21,208	3
Translation initiation factor eIF-2B subunit alpha (eIF-2B GDP-GTP exchange factor subunit alpha)	Q14232|EI2BA_HUMAN	33,695	3
39S ribosomal protein L37, mitochondrial precursor (L37mt) (MRP-L37)	Q9BZE1|RM37_HUMAN	48,085	3
Poly(ADP-ribose) glycohydrolase ARH3 (EC 3.2.1.143) ([Protein ADP-ribosylarginine] hydrolase-like protein 2) (ADP-ribosylhydrolase 3)	Q9NX46|ARHL2_HUMAN	38,929	3
Isochorismatase domain-containing protein 2, mitochondrial precursor	Q96AB3|ISOC2_HUMAN	22,319	3

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Probable mitochondrial import receptor subunit TOM40 homolog (Translocase of outer membrane 40 kDa subunit homolog) (Haymaker protein) (p38.5)	O96008|TOM40_HUMAN	37,875	3
Mitochondrial import inner membrane translocase subunit Tim8 A (Deafness dystonia protein 1) (X-linked deafness dystonia protein)	O60220|TIM8A_HUMAN	10,980	3
Glutaredoxin-related protein 5	Q86SX6|GLRX5_HUMAN	16,610	3
Secretory carrier-associated membrane protein 3 (Secretory carrier membrane protein 3)	O14828|SCAM3_HUMAN	38,302	3
60 kDa SS-A/Ro ribonucleoprotein (60 kDa Ro protein) (60 kDa ribonucleoprotein Ro) (RoRNP) (Ro 60 kDa autoantigen) (TROVE domain family member 2) (Sjoegren syndrome type A antigen) (SS-A) (Sjoegren syndrome antigen A2)	P10155|RO60_HUMAN	60,654	3
COP9 signalosome complex subunit 5 (EC 3.4.-.-) (Signalosome subunit 5) (SGN5) (Jun activation domain-binding protein 1)	Q92905|CSN5_HUMAN	37,562	3
28S ribosomal protein S7, mitochondrial precursor (S7mt) (MRP-S7) (bMRP27a) (bMRP-27a)	Q9Y2R9|RT07_HUMAN	28,145	3
NF-kappa-B essential modulator (NEMO) (NF-kappa-B essential modifier) (Inhibitor of nuclear factor kappa-B kinase subunit gamma) (IkB kinase subunit gamma) (I-kappa-B kinase gamma) (IKK-gamma) (IKKG) (IkB kinase-associated protein 1) (IKKAP1) (FIP-3)	Q9Y6K9|NEMO_HUMAN	48,179	3
Kinesin-like protein KIF1B (Klp)	O60333|KIF1B_HUMAN	204,463	3
APAF1-interacting protein	Q96GX9|APIP_HUMAN	27,107	3
Oxysterol-binding protein 1	P22059|OSBP1_HUMAN	89,404	3
Syntaxin-4 (Renal carcinoma antigen NY-REN-31)	Q12846|STX4_HUMAN	34,162	3
Beta-hexosaminidase beta chain precursor (EC 3.2.1.52) (N-acetyl-beta-glucosaminidase) (Beta-N-acetylhexosaminidase) (Hexosaminidase B) (Cervical cancer proto-oncogene 7) (HCC-7) [Contains: Beta-hexosaminidase beta-B chain; Beta-hexosaminidase beta-A chain]	P07686|HEXB_HUMAN	63,095	3
Ataxin-2 (Spinocerebellar ataxia type 2 protein) (Trinucleotide repeat-containing gene 13 protein)	Q99700|ATX2_HUMAN	140,120	3
Kinesin light chain 2 (KLC 2)	Q9H0B6|KLC2_HUMAN	68,918	3
Translocation protein SEC62 (Translocation protein 1) (TP-1) (hTP-1)	Q99442|SEC62_HUMAN	45,845	3
ADP-ribose pyrophosphatase, mitochondrial precursor (EC 3.6.1.13) (ADP-ribose diphosphatase) (Adenosine diphosphoribose pyrophosphatase) (ADPR-PPase) (ADP-ribose phosphohydrolase) (Nucleoside diphosphate-linked moiety X motif 9) (Nudix motif 9)	Q9BW91|NUDT9_HUMAN	39,108	3
Charged multivesicular body protein 6 (Chromatin-modifying protein 6) (Vacuolar protein sorting-associated protein 20) (hVps20)	Q96FZ7|CHMP6_HUMAN	23,467	3
Bifunctional polynucleotide phosphatase/kinase (Polynucleotide kinase-3′-phosphatase) (DNA 5′-kinase/3′-phosphatase) [Includes: Polynucleotide 3′-phosphatase (EC 3.1.3.32) (2′(3′)-polynucleotidase); Polynucleotide 5′-hydroxyl-kinase (EC 2.7.1.78)]	Q96T60|PNKP_HUMAN	57,059	3
Ras-related protein Rap-2b precursor	P61225|RAP2B_HUMAN	20,486	3
UDP-N-acetylglucosamine--peptide N-acetylglucosaminyltransferase 110 kDa subunit (EC 2.4.1.-) (O-GlcNAc transferase p110 subunit)	O15294|OGT1_HUMAN	116,910	3

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NADH dehydrogenase [ubiquinone] 1 beta subcomplex subunit 8, mitochondrial precursor (EC 1.6.5.3) (EC 1.6.99.3) (NADH-ubiquinone oxidoreductase ASHI subunit) (Complex I-ASHI) (CI-ASHI)	O95169|NDUB8_HUMAN	21,748	3
Valacyclovir hydrolase precursor (EC 3.1.-.-) (VACVase) (Biphenyl hydrolase-like protein) (Biphenyl hydrolase-related protein) (Bph-rp) (Breast epithelial mucin-associated antigen) (MCNAA)	Q86WA6|BPHL_HUMAN	32,525	3
Thioredoxin domain-containing protein 9 (Protein 1-4) (ATP-binding protein associated with cell differentiation)	O14530|TXND9_HUMAN	26,517	3
Ubiquitin-conjugating enzyme E2 Q1 (EC 6.3.2.19) (Ubiquitin-protein ligase Q1) (Ubiquitin carrier protein Q1) (Protein NICE-5)	Q7Z7E8|UB2Q1_HUMAN	46,110	3
AFG3-like protein 2 (EC 3.4.24.-) (Paraplegin-like protein)	Q9Y4W6|AFG32_HUMAN	88,569	3
Huntingtin-interacting protein 1-related protein (Hip1-related) (Hip 12)	O75146|HIP1R_HUMAN	119,372	3
45 kDa calcium-binding protein precursor (Cab45) (Stromal cell-derived factor 4) (SDF-4)	Q9BRK5|CAB45_HUMAN	41,789	3
Uncharacterized protein C20orf116 precursor	Q96HY6|CT116_HUMAN	35,593	3
ADP-ribosylation factor-like protein 3	P36405|ARL3_HUMAN	20,438	3
Protein phosphatase 2C isoform alpha (EC 3.1.3.16) (PP2C-alpha) (IA) (Protein phosphatase 1A)	P35813|PP2CA_HUMAN	42,429	3
Mitochondrial 39S ribosomal protein L39 (L39mt) (MRP-L39) (MRP-L5)	Q9NYK5|RM39_HUMAN	38,704	3
Tyrosine-protein kinase Lyn (EC 2.7.10.2)	P07948|LYN_HUMAN	58,558	3
PERQ amino acid-rich with GYF domain-containing protein 2 (Grb10-interacting GYF protein 2) (Trinucleotide repeat-containing protein 15)	Q6Y7W6|PERQ2_HUMAN	150,051	3
Exosome complex exonuclease RRP43 (EC 3.1.13.-) (Ribosomal RNA-processing protein 43) (Exosome component 8) (p9) (Opa-interacting protein 2)	Q96B26|EXOS8_HUMAN	30,022	3
28S ribosomal protein S35, mitochondrial precursor (S35mt) (MRP-S35) (Mitochondrial ribosomal protein S28) (MRP-S28)	P82673|RT35_HUMAN	36,827	3
Zinc finger protein 313 (RING finger protein 114)	Q9Y508|ZN313_HUMAN	25,676	3
Diablo homolog, mitochondrial precursor (Second mitochondria-derived activator of caspase) (Smac protein) (Direct IAP-binding protein with low pI)	Q9NR28|DBLOH_HUMAN	27,113	3
Enhancer of rudimentary homolog	P84090|ERH_HUMAN	12,241	3
39S ribosomal protein L28, mitochondrial precursor (L28mt) (MRP-L28) (Melanoma antigen p15) (Melanoma-associated antigen recognized by T lymphocytes)	Q13084|RM28_HUMAN	30,140	3
Nucleotide-binding protein 1 (NBP 1)	P53384|NUBP1_HUMAN	34,571	3
RRP12-like protein	Q5JTH9|RRP12_HUMAN	143,687	3
Zinc-finger protein ubi-d4 (Requiem) (Apoptosis response zinc finger protein) (D4, zinc and double PHD fingers family 2)	Q92785|REQU_HUMAN	44,138	3
Cold-inducible RNA-binding protein (Glycine-rich RNA-binding protein CIRP) (A18 hnRNP)	Q14011|CIRBP_HUMAN	18,630	3

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Receptor-type tyrosine-protein phosphatase F precursor (EC 3.1.3.48) (LAR protein) (Leukocyte antigen related)	P10586|PTPRF_HUMAN	211,826	3
Breast carcinoma amplified sequence 2 (DNA amplified in mammary carcinoma 1 protein) (Spliceosome-associated protein SPF 27)	O75934|BCAS2_HUMAN	26,114	3
28S ribosomal protein S18b, mitochondrial precursor (MRP-S18-b) (Mrps18b) (MRP-S18-2)	Q9Y676|RT18B_HUMAN	29,378	3
28S ribosomal protein S31, mitochondrial precursor (S31mt) (MRP-S31) (Imogen 38)	Q92665|RT31_HUMAN	45,302	3
Ribosome biogenesis protein BMS1 homolog	Q14692|BMS1_HUMAN	145,794	3
FKBP12-rapamycin complex-associated protein (FK506-binding protein 12-rapamycin complex-associated protein 1) (Rapamycin target protein) (RAPT1) (Mammalian target of rapamycin) (mTOR)	P42345|FRAP_HUMAN	288,878	3
Peroxisomal proliferator-activated receptor A-interacting complex 285 kDa protein (EC 3.6.1.-) (ATP-dependent helicase PRIC285) (PPAR-alpha-interacting complex protein 285) (PPAR-gamma DBD-interacting protein 1) (PDIP1)	Q9BYK8|PR285_HUMAN	294,512	3
DNA-directed RNA polymerase I 40 kDa polypeptide (EC 2.7.7.6) (RPA40) (RPA39)	O15160|RPA5_HUMAN	39,232	3
Vacuolar protein sorting-associating protein 4A (Protein SKD2) (hVPS4) (VPS4-1)	Q9UN37|VPS4A_HUMAN	48,881	3
Gephyrin	Q9NQX3|GEPH_HUMAN	79,732	3
Core-binding factor subunit beta (CBF-beta) (Polyomavirus enhancer-binding protein 2 beta subunit) (PEBP2-beta) (PEA2-beta) (SL3-3 enhancer factor 1 beta subunit) (SL3/AKV core-binding factor beta subunit)	Q13951|PEBB_HUMAN	21,490	3
Zinc finger CCCH domain-containing protein 7B (Rotavirus ‘X’-associated non-structural protein) (RoXaN)	Q9UGR2|Z3H7B_HUMAN	111,563	3
Nuclear cap-binding protein subunit 2 (20 kDa nuclear cap-binding protein) (NCBP 20 kDa subunit) (CBP20) (NCBP-interacting protein 1) (NIP1) (Cell proliferation-inducing gene 55 protein)	P52298|NCBP2_HUMAN	17,984	3
Dynamin-binding protein (Scaffold protein Tuba)	Q6XZF7|DNMBP_HUMAN	177,332	3
Putative C10 protein	Q99622|C10_HUMAN	13,160	3
Double-strand-break repair protein rad21 homolog (hHR21) (Nuclear matrix protein 1) (NXP-1) (SCC1 homolog)	O60216|RAD21_HUMAN	71,674	3
Intron-binding protein aquarius (Intron-binding protein of 160 kDa) (IBP160)	O60306|AQR_HUMAN	171,282	3
Dehydrogenase/reductase SDR family member 1 (EC 1.1.-.-)	Q96LJ7|DHRS1_HUMAN	33,890	3
Raftlin (Raft-linking protein) (Cell migration-inducing gene 2 protein)	Q14699|RFTN1_HUMAN	63,127	3
15 kDa selenoprotein precursor	O60613|SEP15_HUMAN	17,726	3
39S ribosomal protein L45, mitochondrial precursor (L45mt) (MRP-L45)	Q9BRJ2|RM45_HUMAN	35,333	3
WD repeat protein 82	Q6UXN9|WDR82_HUMAN	35,062	3
Placenta growth factor precursor (PlGF)	P49763|PLGF_HUMAN	24,770	3
Nucleoplasmin-3	O75607|NPM3_HUMAN	19,325	3

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Pescadillo homolog 1	O00541|PESC_HUMAN	67,987	3
Probable peptidyl-tRNA hydrolase (EC 3.1.1.29) (PTH)	Q86Y79|PTH_HUMAN	22,919	3
Poly [ADP-ribose] polymerase 10 (EC 2.4.2.30) (PARP-10)	Q53GL7|PAR10_HUMAN	109,979	3
Nuclear RNA export factor 1 (Tip-associating protein) (Tip-associated protein) (mRNA export factor TAP)	Q9UBU9|NXF1_HUMAN	70,167	3
Legumain precursor (EC 3.4.22.34) (Asparaginyl endopeptidase) (Protease, cysteine 1)	Q99538|LGMN_HUMAN	49,393	3
Myc box-dependent-interacting protein 1 (Bridging integrator 1) (Amphiphysin-like protein) (Amphiphysin II) (Box-dependent myc-interacting protein 1)	O00499|BIN1_HUMAN	64,681	3
Centrin-2 (Caltractin isoform 1)	P41208|CETN2_HUMAN	19,722	3
Methionine synthase (EC 2.1.1.13) (5-methyltetrahydrofolate--homocysteine methyltransferase) (Methionine synthase, vitamin-B12 dependent) (MS)	Q99707|METH_HUMAN	140,514	3
Geranylgeranyl transferase type-2 alpha subunit (EC 2.5.1.60) (Geranylgeranyl transferase type II alpha subunit) (Rab geranylgeranyltransferase alpha subunit) (Rab geranyl-geranyltransferase alpha subunit) (Rab GG transferase alpha) (Rab GGTase alpha)	Q92696|PGTA_HUMAN	65,055	3
SET domain-containing protein 3	Q86TU7|SETD3_HUMAN	67,241	3
Dolichol-phosphate mannosyltransferase (EC 2.4.1.83) (Dolichol-phosphate mannose synthase) (Dolichyl-phosphate beta-D-mannosyltransferase) (Mannose-P-dolichol synthase) (MPD synthase) (DPM synthase)	O60762|DPM1_HUMAN	29,618	3
Signal transducing adapter molecule 1 (STAM-1)	Q92783|STAM1_HUMAN	59,162	3
Nuclear autoantigen Sp-100 (Speckled 100 kDa) (Nuclear dot-associated Sp100 protein) (Lysp100b)	P23497|SP100_HUMAN	100,401	3
Phosphatidylinositol-binding clathrin assembly protein (Clathrin assembly lymphoid myeloid leukemia protein)	Q13492|PICAL_HUMAN	70,738	3
Cartilage-associated protein precursor	O75718|CRTAP_HUMAN	46,546	3
Condensin complex subunit 2 (Non-SMC condensin I complex subunit H) (Barren homolog protein 1) (Chromosome-associated protein H) (hCAP-H) (XCAP-H homolog)	Q15003|CND2_HUMAN	82,547	3
BTB/POZ domain-containing protein 14B (Nucleus accumbens-1) (NAC-1)	Q96RE7|BTB14_HUMAN	57,239	3
Lysosome-associated membrane glycoprotein 1 precursor (LAMP-1) (CD107a antigen)	P11279|LAMP1_HUMAN	44,756	3
Cell death regulator Aven	Q9NQS1|AVEN_HUMAN	38,488	3
Uncharacterized protein C6orf55 (Dopamine-responsive protein DRG-1)	Q9NP79|CF055_HUMAN	33,862	3
WD repeat protein 6	Q9NNW5|WDR6_HUMAN	121,706	3
WD repeat and FYVE domain-containing protein 1 (WD40- and FYVE domain-containing protein 1) (Phosphoinositide-binding protein 1) (FENS-1) (Zinc finger FYVE domain-containing protein 17)	Q8IWB7|WDFY1_HUMAN	46,306	3
Vacuolar ATP synthase subunit H (EC 3.6.3.14) (V-ATPase H subunit) (Vacuolar proton pump subunit H) (V-ATPase 50/57 kDa subunits) (Vacuolar proton pump subunit SFD) (VMA13) (Nef-binding protein 1) (NBP1)	Q9UI12|VATH_HUMAN	55,865	3

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Polymerase delta-interacting protein 3 (46 kDa DNA polymerase delta interaction protein) (p46)	Q9BY77|PDIP3_HUMAN	46,072	3
Centaurin-delta 3 (Cnt-d3) (Arf-GAP, Rho-GAP, ankyrin repeat and pleckstrin homology domain-containing protein 3)	Q8WWN8|CEND3_HUMAN	169,830	3
ANK repeat and LEM domain-containing KIAA0692	Q86XL3|K0692_HUMAN	104,106	3
Sulfite oxidase, mitochondrial precursor (EC 1.8.3.1)	P51687|SUOX_HUMAN	53,865	3
Nuclear pore complex protein Nup153 (Nucleoporin Nup153) (153 kDa nucleoporin)	P49790|NU153_HUMAN	153,872	3
Pleiotropic regulator 1	O43660|PLRG1_HUMAN	57,175	3
Coiled-coil domain-containing protein 44	Q9BSH4|CCD44_HUMAN	32,459	3
Brix domain-containing protein 2 (Ribosome biogenesis protein Brix)	Q8TDN6|BXDC2_HUMAN	41,385	3
SWI/SNF-related matrix-associated actin-dependent regulator of chromatin subfamily D member 1 (SWI/SNF complex 60 kDa subunit) (60 kDa BRG-1/Brm-associated factor subunit A) (BRG1-associated factor 60A)	Q96GM5|SMRD1_HUMAN	54,928	3
Coronin-1A (Coronin-like protein p57) (Coronin-like protein A) (Clipin-A) (Tryptophan aspartate-containing coat protein) (TACO)	P31146|COR1A_HUMAN	51,008	3
Cleavage and polyadenylation specificity factor subunit 1 (Cleavage and polyadenylation specificity factor 160 kDa subunit) (CPSF 160 kDa subunit)	Q10570|CPSF1_HUMAN	160,868	3
Kinesin-like protein KIF2A (Kinesin-2) (HK2)	O00139|KIF2A_HUMAN	76,938	3
Uncharacterized protein C10orf119	Q9BTE3|CJ119_HUMAN	72,963	3
Tripartite motif-containing protein 22 (RING finger protein 94) (50 kDa-stimulated trans-acting factor) (Staf-50)	Q8IYM9|TRI22_HUMAN	56,929	3
Ribosome recycling factor, mitochondrial precursor	Q96E11|RRFM_HUMAN	29,260	3
Glutathione S-transferase theta-2 (EC 2.5.1.18) (GST class-theta-2)	P30712|GSTT2_HUMAN	27,490	3
39S ribosomal protein L24, mitochondrial precursor (L24mt) (MRP-L24)	Q96A35|RM24_HUMAN	24,897	3
Signal transducer and activator of transcription 5B	P42229|STA5A_HUMAN, P51692|STA5B_HUMAN	89,849	3
Tensin-1	Q9HBL0|TENS1_HUMAN	185,660	3
REVERSED	REV|Q9HCF4|ALO17_HUM AN	174,882	3
Serine/threonine-protein phosphatase 2A 56 kDa regulatory subunit delta isoform (PP2A, B subunit, B ′ delta isoform) (PP2A, B subunit, B56 delta isoform) (PP2A, B subunit, PR61 delta isoform) (PP2A, B subunit, R5 delta isoform)	Q14738|2A5D_HUMAN	69,976	3
Transcriptional repressor CTCF (CCCTC-binding factor) (CTCFL paralog) (11-zinc finger protein)	P49711|CTCF_HUMAN	82,766	3
Mitogen-activated protein kinase kinase kinase kinase 5 (EC 2.7.11.1) (MAPK/ERK kinase kinase kinase 5) (MEK kinase kinase 5) (MEKKK 5) (Kinase homologous to SPS1/STE20) (KHS)	Q9Y4K4|M4K5_HUMAN	95,025	3
Acylglycerol kinase, mitochondrial precursor (EC 2.7.1.94) (EC 2.7.1.107) (hAGK) (Multiple substrate lipid kinase) (Multi-substrate lipid kinase) (MuLK) (HsMuLK)	Q53H12|AGK_HUMAN	47,120	3

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Arylsulfatase A precursor (EC 3.1.6.8) (ASA) (Cerebroside-sulfatase) [Contains: Arylsulfatase A component B; Arylsulfatase A component C]	P15289|ARSA_HUMAN	53,571	3
Zinc finger CCCH domain-containing protein 11A	O75152|ZC11A_HUMAN	89,113	3
c-Myc-responsive protein Rcl	O43598|RCL_HUMAN	19,090	3
Tyrosyl-tRNA synthetase, mitochondrial precursor (EC 6.1.1.1) (Tyrosine--tRNA ligase) (TyrRS)	Q9 Y2Z4|SYYM_HU M AN	53,183	3
E3 ubiquitin-protein ligase LRSAM1 (EC 6.3.2.-) (Leucine-rich repeat and sterile alpha motif-containing protein 1) (Tsg101-associated ligase) (hTAL)	Q6UWE0|LRSM1_HUMAN	83,578	3
CAP-Gly domain-containing linker protein 2 (Cytoplasmic linker protein 2) (Cytoplasmic linker protein 115) (CLIP-115) (Williams-Beuren syndrome chromosome region 4 protein)	Q9UDT6|CLIP2_HUMAN	115,821	3
Gamma-enolase (EC 4.2.1.11) (2-phospho-D-glycerate hydro-lyase) (Neural enolase) (Neuron-specific enolase) (NSE) (Enolase 2)	P09104|ENOG_HUMAN	47,252	3
60S ribosomal protein L10-like	Q96L21|RL10L_HUMAN	24,501	3
Thioredoxin reductase 2, mitochondrial precursor (EC 1.8.1.9) (TR3) (TR-beta) (Selenoprotein Z) (SelZ)	Q9NNW7|TRXR2_HUMAN	56,441	3
Mitochondrial 28S ribosomal protein S27 (S27mt) (MRP-S27)	Q92552|RT27_HUMAN	47,653	3
SAPS domain family member 1	Q9UPN7|SAPS1_HUMAN	96,706	3
PHD finger-like domain-containing protein 5A (PHD finger-like domain protein 5A) (Splicing factor 3B-associated 14 kDa protein) (SF3b14b)	Q7RTV0|PHF5A_HUMAN	12,387	3
Nuclear cap-binding protein subunit 1 (80 kDa nuclear cap-binding protein) (NCBP 80 kDa subunit) (CBP80)	Q09161|NCBP1_HUMAN	91,823	3
Transcriptional regulator ISGF3 subunit gamma (Interferon regulatory factor 9) (IRF-9) (IFN-alpha-responsive transcription factor subunit) (Interferon-stimulated gene factor 3 gamma) (ISGF3 p48 subunit) (ISGF-3 gamma)	Q00978|IRTF_HUMAN	43,678	3
Sodium/hydrogen exchanger 1 (Na(+)/H(+) exchanger 1) (NHE-1) (Solute carrier family 9 member 1) (Na(+)/H(+) antiporter, amiloride-sensitive) (APNH)	P19634|SL9A1_HUMAN	90,748	3
Epoxide hydrolase 1 (EC 3.3.2.9) (Microsomal epoxide hydrolase) (Epoxide hydratase)	P07099|HYEP_HUMAN	52,933	3
Serine/threonine-protein kinase receptor R3 precursor (EC 2.7.11.30) (SKR3) (Activin receptor-like kinase 1) (ALK-1) (TGF-B superfamily receptor type I) (TSR-I)	P37023|ACVL1_HUMAN	56,106	3
Small ubiquitin-related modifier 1 precursor (SUMO-1) (Sentrin) (Ubiquitin-like protein SMT3C) (SMT3 homolog 3) (Ubiquitin-homology domain protein PIC1) (Ubiquitin-like protein UBL1) (GAP-modifying protein 1) (GMP1)	P63165|SUMO1_HUMAN	11,539	3
Phosphomevalonate kinase (EC 2.7.4.2) (PMKase)	Q15126|PMVK_HUMAN	21,977	3
Actin-related protein 2/3 complex subunit 1A (SOP2-like protein)	Q92747|ARC1A_HUMAN	41,551	3
Exosome complex exonuclease RRP45 (EC 3.1.13.-) (Exosome component 9) (Polymyositis/scleroderma autoantigen 1) (Autoantigen PM/Scl 1) (Polymyositis/scleroderma autoantigen 75 kDa) (PM/Scl-75) (P75 polymyositis-scleroderma overlap syndrome-associated autoantigen)	Q06265|EXOS9_HUMAN	46,961	3

Protein Description	Accession Number	Molecular Weight	Total SpC
N-myc-interactor (Nmi) (N-myc and STAT interactor)	Q13287|NMI_HUMAN	35,039	3
Intersectin-1 (SH3 domain-containing protein 1A) (SH3P17)	Q15811|ITSN1_HUMAN	195,407	3
Lysosome-associated membrane glycoprotein 2 precursor (LAMP-2) (CD107b antigen)	P13473|LAMP2_HUMAN	44,943	3
Pre-mRNA-splicing factor RBM22 (RNA-binding motif protein 22) (Zinc finger CCCH domain-containing protein 16)	Q9NW64|RBM22_HUMAN	46,879	3
CCR4-NOT transcription complex subunit 2 (CCR4-associated factor 2)	Q9NZN8|CNOT2_HUMAN	59,721	3
Coiled-coil-helix-coiled-coil-helix domain-containing protein 6	Q9BRQ6|CHCH6_HUMAN	26,439	3
Methylcrotonoyl-CoA carboxylase subunit alpha, mitochondrial precursor (EC 6.4.1.4) (3-methylcrotonyl-CoA carboxylase 1) (MCCase subunit alpha) (3-methylcrotonyl-CoA:carbon dioxide ligase subunit alpha) (3-methylcrotonyl-CoA carboxylase biotin-containing subunit)	Q96RQ3|MCCA_HUMAN	80,456	3
THO complex subunit 2 (Tho2)	Q8NI27|THOC2_HUMAN	169,569	3
Endothelial cells scavenger receptor precursor (Acetyl LDL receptor) (Scavenger receptor class F member 1)	Q14162|SREC_HUMAN	87,408	3
Proteolipid protein 2 (Intestinal membrane A4 protein) (Differentiation-dependent protein A4)	Q04941|PLP2_HUMAN	16,673	3
Glucosamine-6-phosphate isomerase (EC 3.5.99.6) (Glucosamine-6-phosphate deaminase) (GNPDA) (GlcN6P deaminase) (Oscillin)	P46926|GNPI_HUMAN	32,651	3
Heat shock factor-binding protein 1 (Nasopharyngeal carcinoma-associated antigen 13) (NPC-A-13)	O75506|HSBP1_HUMAN	8,526	3
U3 small nucleolar ribonucleoprotein protein MPP10 (M phase phosphoprotein 10)	O00566|MPP10_HUMAN	78,849	3
Implantation-associated protein precursor (IAP) (Magnesium transporter protein 1) (MagT1)	Q9H0U3|IAG2_HUMAN	38,019	3
Acyl-coenzyme A oxidase 3, peroxisomal (EC 1.3.3.6) (Pristanoyl-CoA oxidase) (Branched-chain acyl-CoA oxidase) (BRCACox)	O15254|ACOX3_HUMAN	77,613	3
Poliovirus receptor precursor (Nectin-like protein 5) (Necl-5) (CD155 antigen)	P15151|PVR_HUMAN	45,284	3
ARL-6-interacting protein 1 (ADP-ribosylation-like factor 6-interacting protein 1) (Aip-1)	Q15041|AR6P1_HUMAN	23,346	3
Alpha-2-macroglobulin receptor-associated protein precursor (Alpha-2-MRAP) (Low density lipoprotein receptor-related protein-associated protein 1) (RAP)	P30533|AMRP_HUMAN	41,450	3
Antigen KI-67	P46013|KI67_HUMAN	358,678	3
Ubiquitin-conjugating enzyme E2 D3 (EC 6.3.2.19) (Ubiquitin-protein ligase D3) (Ubiquitin carrier protein D3) (Ubiquitin-conjugating enzyme E2-17 kDa 3) (E2(17)KB 3)	P61077|UB2D3_HUMAN, P62837|UB2D2_HUMAN, Q9NTT1|UB2D1_HUMAN	16,370	3
Dolichyl-diphosphooligosaccharide--protein glycosyltransferase subunit STT3A (EC 2.4.1.119) (Oligosaccharyl transferase subunit STT3A) (STT3-A) (B5) (Integral membrane protein 1) (TMC)	P46977|STT3A_HUMAN	80,457	3
WD repeat protein 44 (Rabphilin-11)	Q5JSH3|WDR44_HUMAN	101,351	3
Uncharacterized calcium-binding protein KIAA0494	O75071|K0494_HUMAN	55,015	3
39S ribosomal protein L16, mitochondrial precursor (L16mt) (MRP-L16)	Q9NX20|RM16_HUMAN	28,432	3

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Probable E3 ubiquitin-protein ligase HECTD3 (HECT domain-containing protein 3)	Q5T447|HECD3_HUMAN	97,096	3
Microtubule-associated protein 1A (MAP 1A) (Proliferation-related protein p80) [Contains: MAP1 light chain LC2]	P78559|MAP1A_HUMAN	306,456	3
Nicotinamide N-methyltransferase (EC 2.1.1.1)	P40261|NNMT_HUMAN	29,557	3
Transcription initiation factor IIE subunit alpha (TFIIE-alpha) (General transcription factor IIE subunit 1) (General transcription factor IIE 56 kDa subunit)	P29083|T2EA_HUMAN	49,435	3
Triple functional domain protein (EC 2.7.11.1) (PTPRF-interacting protein)	O75962|TRIO_HUMAN	341,600	3
AP-1 complex subunit gamma-1 (Adapter-related protein complex 1 gamma-1 subunit) (Gamma-adaptin) (Adaptor protein complex AP-1 gamma-1 subunit) (Golgi adaptor HA1/AP1 adaptin subunit gamma-1) (Clathrin assembly protein complex 1 gamma-1 large chain)	O43747|AP1G1_HUMAN	91,376	3
HLA class I histocompatibility antigen, Cw-7 alpha chain precursor (MHC class I antigen Cw*7)	P10321|1C07_HUMAN	40,630	3
Syntaxin-binding protein 1 (Unc-18 homolog) (Unc-18A) (Unc-18-1) (N-Sec1) (p67)	P61764|STXB1_HUMAN	67,554	3
Spectrin beta chain, brain 2 (Spectrin, non-erythroid beta chain 2) (Beta-III spectrin)	O15020|SPTN2_HUMAN	271,278	3
Vacuolar protein sorting-associated protein 36 (ELL-associated protein of 45 kDa)	Q86VN1|VPS36_HUMAN	43,800	3
Histone H2A.x (H2a/x)	P16104|H2AX_HUMAN, Q96QV6|H2A1A_HUMAN	15,127	3
Pre-mRNA-splicing factor ISY1 homolog	Q9ULR0|ISY1_HUMAN	37,549	3
Sel-1 homolog precursor (Suppressor of lin-12-like protein) (Sel-1L)	Q9UBV2|SEL1L_HUMAN	88,739	3
Toll-interacting protein	Q9H0E2|TOLIP_HUMAN	30,263	3
Sorting nexin-18 (Sorting nexin-associated Golgi protein 1) (SH3 and PX domain-containing protein 3B)	Q96RF0|SNX18_HUMAN	68,863	3
Secernin-2	Q96FV2|SCRN2_HUMAN	46,546	3
Splicing factor 3B subunit 4 (Spliceosome-associated protein 49) (SAP 49) (SF3b50) (Pre-mRNA-splicing factor SF3b 49 kDa subunit)	Q15427|SF3B4_HUMAN	44,369	3
Serine/threonine-protein phosphatase 2B catalytic subunit beta isoform (EC 3.1.3.16) (Calmodulin-dependent calcineurin A subunit beta isoform) (CAM-PRP catalytic subunit)	P16298|PP2BB_HUMAN	59,007	3
HD domain-containing protein 3	Q8N4P3|HDDC3_HUMAN	20,311	3
Protein AATF (Apoptosis-antagonizing transcription factor) (Rb-binding protein Che-1)	Q9NY61|AATF_HUMAN	63,117	3
Metaxin-2	O75431|MTX2_HUMAN	29,745	3
Choline transporter-like protein 2 (Solute carrier family 44 member 2)	Q8IWA5|CTL2_HUMAN	80,138	3
UPF0364 protein C6orf211	Q9H993|CF211_HUMAN	51,156	3
Splicing factor, arginine/serine-rich 6 (Pre-mRNA-splicing factor SRP55)	Q13247|SFRS6_HUMAN	39,570	3
Cathepsin S precursor (EC 3.4.22.27)	P25774|CATS_HUMAN	37,478	3
Inhibitor of Bruton tyrosine kinase (IBtk)	Q9P2D0|IBTK_HUMAN	150,512	3

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REVERSED	REV|O94909|K0819_HUMA N	126,510	3
Neuroplastin precursor (Stromal cell-derived receptor 1) (SDR-1)	Q9Y639|NPTN_HUMAN	31,274	3
Mitochondrial fission 1 protein (Fis1 homolog) (hFis1) (Tetratricopeptide repeat protein 11) (TPR repeat protein 11)	Q9Y3D6|FIS1_HUMAN	16,920	3
5′-nucleotidase domain-containing protein 2	Q9H857|NT5D2_HUMAN	60,703	3
Phosphoglucomutase-2-like 1 (EC 5.4.2.2) (PMMLP)	Q6PCE3|PGM2L_HUMAN	70,439	3
Bleomycin hydrolase (EC 3.4.22.40) (BLM hydrolase) (BMH) (BH)	Q13867|BLMH_HUMAN	52,545	3
Synaptojanin-2-binding protein (Mitochondrial outer membrane protein 25)	P57105|SYJ2B_HUMAN	15,910	3
Cytoplasmic tyrosine-protein kinase BMX (EC 2.7.10.2) (Bone marrow tyrosine kinase gene in chromosome X protein) (Epithelial and endothelial tyrosine kinase) (ETK) (NTK38)	P51813|BMX_HUMAN	77,994	3
Huntingtin (Huntington disease protein) (HD protein)	P42858|HD_HUMAN	347,841	3
Phosphoribosyl pyrophosphate synthetase-associated protein 2 (PRPP synthetase-associated protein 2) (41 kDa phosphoribosypyrophosphate synthetase-associated protein) (PAP41)	O60256|KPRB_HUMAN	40,909	3
Eukaryotic translation elongation factor 1 epsilon-1 (Multisynthetase complex auxiliary component p18) (Elongation factor p18)	O43324|MCA3_HUMAN	19,793	3
Collagen alpha-2(VI) chain precursor	P12110|CO6A2_HUMAN	108,563	3
Leupaxin	O60711|LPXN_HUMAN	43,314	3
Casein kinase I isoform alpha (EC 2.7.11.1) (CKI-alpha) (CK1)	P48729|KC1A_HUMAN	38,899	3
REVERSED	REV|Q05469|LIPS_HUMAN	116,552	3
CRSP complex subunit 2 (Cofactor required for Sp1 transcriptional activation subunit 2) (Transcriptional coactivator CRSP150) (Vitamin D3 receptor-interacting protein complex 150 kDa component) (DRIP150) (Thyroid hormone receptor-associated protein complex 170 kDa component) (Trap170) (Activator-recruited cofactor 150 kDa component) (ARC150)	O60244|CRSP2_HUMAN	160,649	3
ATP-dependent RNA helicase DDX54 (EC 3.6.1.-) (DEAD box protein 54) (ATP-dependent RNA helicase DP97)	Q8TDD1|DDX54_HUMAN	98,580	3
REVERSED	REV|O14497|ARI1A_HUMA N	242,026	3
Sulfhydryl oxidase 2 precursor (EC 1.8.3.2) (Quiescin Q6-like protein 1) (Neuroblastoma-derived sulfhydryl oxidase)	Q6ZRP7|QSC6L_HUMAN	77,526	3
SAPS domain family member 3 (Sporulation-induced transcript 4-associated protein SAPL) (Protein phosphatase 6 regulatory subunit 3)	Q5H9R7|SAPS3_HUMAN	97,653	3
Transmembrane emp24 domain-containing protein 2 precursor (Membrane protein p24A)	Q15363|TMED2_HUMAN	22,743	3
Tapasin precursor (TPSN) (TPN) (TAP-binding protein) (TAP-associated protein) (NGS-17)	O15533|TPSN_HUMAN	47,609	3
Beta crystallin B2 (Beta-crystallin Bp)	P43320|CRBB2_HUMAN	23,362	3
REVERSED	REV|O14980|XPO1_HUMA N	123,371	3

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Lamina-associated polypeptide 2 isoform alpha (Thymopoietin isoform alpha) (TP alpha) (Thymopoietin-related peptide isoform alpha) (TPRP isoform alpha) [Contains: Thymopoietin (TP) (Splenin); Thymopentin (TP5)]	P42166|LAP2A_HUMAN	75,476	2
Ras-related protein Rap-1A precursor (GTP-binding protein smg-p21A) (Ras-related protein Krev-1) (C21KG) (G-22K)	P62834|RAP1A_HUMAN	20,969	2
Prefoldin subunit 6 (Protein Ke2)	O15212|PFD6_HUMAN	14,565	2
Branched-chain-amino-acid aminotransferase, cytosolic (EC 2.6.1.42) (BCAT(c)) (ECA39 protein)	P54687|BCAT1_HUMAN	42,935	2
CD2 antigen cytoplasmic tail-binding protein 2 (CD2 cytoplasmic domain-binding protein) (CD2 tail-binding protein)	O95400|CD2B2_HUMAN	37,629	2
Homer protein homolog 3 (Homer-3)	Q9NSC5|HOME3_HUMAN	39,818	2
Absent in melanoma 1 protein	Q9Y4K1|AIM1_HUMAN	188,659	2
PDZ and LIM domain protein 2 (PDZ-LIM protein mystique) (PDZ-LIM protein)	Q96JY6|PDLI2_HUMAN	37,442	2
Phosphoribosyl pyrophosphate synthetase-associated protein 1 (PRPP synthetase-associated protein 1) (39 kDa phosphoribosypyrophosphate synthetase-associated protein) (PAP39)	Q14558|KPRA_HUMAN	39,377	2
Epidermal growth factor receptor substrate 15-like 1 (Eps15-related protein) (Eps15R)	Q9UBC2|EP15R_HUMAN	94,240	2
FH1/FH2 domain-containing protein (Formin homolog overexpressed in spleen) (FHOS) (Formin homology 2 domain-containing protein 1)	Q9Y613|FHOD1_HUMAN	126,537	2
Chloride intracellular channel protein 2 (XAP121)	O15247|CLIC2_HUMAN	28,340	2
Adenylyl cyclase-associated protein 2 (CAP 2)	P40123|CAP2_HUMAN	52,806	2
Ribulose-phosphate 3-epimerase (EC 5.1.3.1) (Ribulose-5-phosphate-3-epimerase)	Q96AT9|RPE_HUMAN	24,910	2
MKI67 FHA domain-interacting nucleolar phosphoprotein (Nucleolar protein interacting with the FHA domain of pKI-67) (hNIFK) (Nucleolar phosphoprotein Nopp34)	Q9BYG3|MK67I_HUMAN	34,205	2
U4/U6.U5 tri-snRNP-associated protein 1 (U4/U6.U5 tri-snRNP-associated 110 kDa protein) (Squamous cell carcinoma antigen recognized by T cells 1) (SART-1) (hSART-1) (hSnu66)	O43290|SNUT1_HUMAN	90,239	2
Rap1 GTPase-GDP dissociation stimulator 1 (SMG P21 stimulatory GDP/GTP exchange protein) (SMG GDS protein) (Exchange factor smgGDS)	P52306|GDS1_HUMAN	66,386	2
TBC1 domain family member 13	Q9NVG8|TBC13_HUMAN	32,143	2
Syntaxin-7	O15400|STX7_HUMAN	29,798	2
Wolframin	O76024|WFS1_HUMAN	100,290	2
RUN and FYVE domain-containing protein 1 (FYVE-finger protein EIP1) (Zinc finger FYVE domain-containing protein 12) (La-binding protein 1) (Rab4-interacting protein)	Q96T51|RUFY1_HUMAN	79,801	2
Hydroxyacylglutathione hydrolase (EC 3.1.2.6) (Glyoxalase II) (GLX II)	Q16775|GLO2_HUMAN	28,842	2
Solute carrier family 12 member 2 (Bumetanide-sensitive sodium-(potassium)-chloride cotransporter 1) (Basolateral Na-K-Cl symporter)	P55011|S12A2_HUMAN	131,434	2

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RNA-binding motif, single-stranded-interacting protein 2 (Suppressor of CDC2 with RNA-binding motif 3)	Q15434|RBMS2_HUMAN	43,941	2
Pituitary tumor-transforming gene 1 protein-interacting protein precursor (Pituitary tumor-transforming gene protein-binding factor) (PTTG-binding factor) (PBF)	P53801|PTTG_HUMAN	20,306	2
Cell division protein kinase 2 (EC 2.7.11.22) (p33 protein kinase)	P24941|CDK2_HUMAN	33,913	2
Breakpoint cluster region protein (EC 2.7.11.1) (Renal carcinoma antigen NY-REN-26)	P11274|BCR_HUMAN	142,792	2
DNA damage-binding protein 2 (Damage-specific DNA-binding protein 2) (DDB p48 subunit) (DDBb) (UV-damaged DNA-binding protein 2) (UV-DDB 2)	Q92466|DDB2_HUMAN	47,847	2
Pleckstrin homology-like domain family B member 1 (Protein LL5-alpha)	Q86UU1|PHLB1_HUMAN	151,147	2
Double-strand break repair protein MRE11A (MRE11 homolog 1) (MRE11 meiotic recombination 11 homolog A)	P49959|MRE11_HUMAN	80,577	2
NADH dehydrogenase [ubiquinone] 1 beta subcomplex subunit 7 (EC 1.6.5.3) (EC 1.6.99.3) (NADH-ubiquinone oxidoreductase B18 subunit) (Complex I-B18) (CI-B18) (Cell adhesion protein SQM1)	P17568|NDUB7_HUMAN	16,384	2
Signal recognition particle 19 kDa protein (SRP19)	P09132|SRP19_HUMAN	16,138	2
Uncharacterized protein C12orf23	Q8WUH6|CL023_HUMAN	11,730	2
ARF GTPase-activating protein GIT1 (G protein-coupled receptor kinase-interactor 1) (GRK-interacting protein 1) (Cool-associated and tyrosine-phosphorylated protein 1) (Cat-1)	Q9Y2X7|GIT1_HUMAN	84,324	2
Cullin-2 (CUL-2)	Q13617|CUL2_HUMAN	86,967	2
Receptor-type tyrosine-protein phosphatase kappa precursor (EC 3.1.3.48) (Protein-tyrosine phosphatase kappa) (R-PTP-kappa)	Q15262|PTPRK_HUMAN	162,071	2
Mitochondrial 39S ribosomal protein L50 (L50mt) (MRP-L50)	Q8N5N7|RM50_HUMAN	18,307	2
Sorting nexin-9 (SH3 and PX domain-containing protein 1) (Protein SDP1) (SH3 and PX domain-containing protein 3A)	Q9Y5X1|SNX9_HUMAN	66,575	2
Protein FAM50A (Protein XAP-5) (Protein HXC-26)	Q14320|FA50A_HUMAN	40,225	2
La-related protein 7 (La ribonucleoprotein domain family member 7)	Q4G0J3|LARP7_HUMAN	66,883	2
Nucleoporin NUP53 (Nuclear pore complex protein Nup53) (Nucleoporin Nup35) (35 kDa nucleoporin) (Mitotic phosphoprotein 44) (MP-44)	Q8NFH5|NUP53_HUMAN	34,757	2
Zinc-finger protein ZPR1 (Zinc finger protein 259)	O75312|ZPR1_HUMAN	50,908	2
Uncharacterized protein KIAA0152 precursor	Q14165|K0152_HUMAN	32,216	2
Cleavage and polyadenylation specificity factor subunit 3 (Cleavage and polyadenylation specificity factor 73 kDa subunit) (CPSF 73 kDa subunit)	Q9UKF6|CPSF3_HUMAN	77,470	2
Cleavage and polyadenylation specificity factor subunit 2 (Cleavage and polyadenylation specificity factor 100 kDa subunit) (CPSF 100 kDa subunit)	Q9P2I0|CPSF2_HUMAN	88,472	2
Treacle protein (Treacher Collins syndrome protein)	Q13428|TCOF_HUMAN	152,085	2

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Protein FAM125A (CIN85/CD2AP family-binding protein)	Q96EY5|F125A_HUMAN	28,766	2
CTTNBP2 N-terminal-like protein	Q9P2B4|CT2NL_HUMAN	70,141	2
AP-1 complex subunit sigma-1A (Adapter-related protein complex 1 sigma-1A subunit) (Sigma-adaptin 1A) (Adaptor protein complex AP-1 sigma-1A subunit) (Golgi adaptor HA1/AP1 adaptin sigma-1A subunit) (Clathrin assembly protein complex 1 sigma-1A small chain) (Clathrin coat assembly protein AP19) (HA1 19 kDa subunit) (Sigma 1a subunit of AP-1 clathrin)	P61966|AP1S1_HUMAN	18,716	2
28S ribosomal protein S9, mitochondrial precursor (S9mt) (MRP-S9)	P82933|RT09_HUMAN	45,806	2
Probable ribosome biogenesis protein RLP24 (Ribosomal protein L24-like)	Q9UHA3|RLP24_HUMAN	19,604	2
Transcription factor 25 (Nuclear localized protein 1)	Q9BQ70|TCF25_HUMAN	76,651	2
Exosome complex exonuclease RRP42 (EC 3.1.13.-) (Ribosomal RNA-processing protein 42) (Exosome component 7) (p8)	Q15024|EXOS7_HUMAN	31,817	2
Down syndrome critical region protein 3 (Down syndrome critical region protein A)	O14972|DSCR3_HUMAN	32,992	2
Stromal interaction molecule 1 precursor	Q13586|STIM1_HUMAN	77,475	2
Angio-associated migratory cell protein	Q13685|AAMP_HUMAN	46,732	2
Ubiquitin-conjugating enzyme E2 G2 (EC 6.3.2.19) (Ubiquitin-protein ligase G2) (Ubiquitin carrier protein G2)	P60604|UB2G2_HUMAN	18,549	2
Guanine nucleotide-binding protein-like 3 (Nucleolar GTP-binding protein 3) (Nucleostemin) (E2-induced gene 3-protein) (Novel nucleolar protein 47) (NNP47)	Q9BVP2|GNL3_HUMAN	61,981	2
Remodeling and spacing factor 1 (Rsf-1) (Hepatitis B virus X-associated protein) (HBV pX-associated protein 8) (p325 subunit of RSF chromatin remodelling complex)	Q96T23|RSF1_HUMAN	162,992	2
TBC1 domain family member 15	Q8TC07|TBC15_HUMAN	79,445	2
Ras and Rab interactor 2 (Ras interaction/interference protein 2) (Ras inhibitor JC265) (Ras association domain family 4)	Q8WYP3|RIN2_HUMAN	100,148	2
Ubiquinol-cytochrome c reductase complex ubiquinone-binding protein QP-C (EC 1.10.2.2) (Ubiquinol-cytochrome c reductase complex 9.5 kDa protein) (Complex III subunit VII)	O14949|UCRQ_HUMAN	9,889	2
AT-rich interactive domain-containing protein 1A (ARID domain-containing protein 1A) (SWI/SNF-related, matrix-associated, actin-dependent regulator of chromatin subfamily F member 1) (SWI-SNF complex protein p270) (B120) (SWI-like protein) (Osa homolog 1) (hOSA1) (hELD) (BRG1-associated factor 250) (BAF250) (BRG1-associated factor 250a) (BAF250A)	O14497|ARI1A_HUMAN	242,026	2
Neural Wiskott-Aldrich syndrome protein (N-WASP)	O00401|WASL_HUMAN	54,810	2
Splicing factor, arginine/serine-rich 15 (CTD-binding SR-like protein RA4)	O95104|SFR15_HUMAN	125,850	2
C-terminal-binding protein 2 (CtBP2)	P56545|CTBP2_HUMAN	48,927	2
Cytosolic purine 5′-nucleotidase (EC 3.1.3.5) (5′-nucleotidase cytosolic II)	P49902|5NTC_HUMAN	64,955	2
Uncharacterized protein KIAA0776	O94874|K0776_HUMAN	89,580	2
Protein numb homolog (h-Numb) (Protein S171)	P49757|NUMB_HUMAN	70,784	2

Protein Description	Accession Number	Molecular Weight	Total SpC
Exosome complex exonuclease RRP44 (EC 3.1.13.-) (Ribosomal RNA-processing protein 44) (DIS3 protein homolog)	Q9Y2L1|RRP44_HUMAN	108,988	2
Mitochondrial 28S ribosomal protein S14 (S14mt) (MRP-S14)	O60783|RT14_HUMAN	15,121	2
Proteasome subunit beta type 10 precursor (EC 3.4.25.1) (Proteasome MECl-1) (Macropain subunit MECl-1) (Multicatalytic endopeptidase complex subunit MECl-1)	P40306|PSB10_HUMAN	28,918	2
Conserved oligomeric Golgi complex component 7	P83436|COG7_HUMAN	86,329	2
Uncharacterized protein C17orf28 (Down-regulated in multiple cancers-1)	Q8IV36|CQ028_HUMAN	88,729	2
Zinc finger protein 207	O43670|ZN207_HUMAN	50,733	2
Rab GTPase-binding effector protein 2 (Rabaptin-5beta)	Q9H5N1|RABE2_HUMAN	63,524	2
Zinc finger protein 326	Q5BKZ1|ZN326_HUMAN	65,636	2
Beta-galactosidase precursor (EC 3.2.1.23) (Lactase) (Acid beta-galactosidase)	P16278|BGAL_HUMAN, P16279|BGAM_HUMAN	76,076	2
Alpha-adducin (Erythrocyte adducin subunit alpha)	P35611|ADDA_HUMAN	80,938	2
Exocyst complex component 1 (Exocyst complex component Sec3)	Q9NV70|EXOC1_HUMAN	101,966	2
Prefoldin subunit 1	O60925|PFD1_HUMAN	14,193	2
Serine/threonine-protein phosphatase 2A 56 kDa regulatory subunit epsilon isoform (PP2A, B subunit, B´ epsilon isoform) (PP2A, B subunit, B56 epsilon isoform) (PP2A, B subunit, PR61 epsilon isoform) (PP2A, B subunit, R5 epsilon isoform)	Q16537|2A5E_HUMAN	54,684	2
Myosin regulatory light chain 2, smooth muscle isoform (Myosin RLC) (Myosin regulatory light chain 9) (LC20)	P24844|MLRN_HUMAN	19,810	2
Heat shock 70 kDa protein 12B	Q96MM6|HS12B_HUMAN	75,670	2
RAC-gamma serine/threonine-protein kinase (EC 2.7.11.1) (RAC-PK-gamma) (Protein kinase Akt-3) (Protein kinase B, gamma) (PKB gamma) (STK-2)	Q9Y243|AKT3_HUMAN	55,758	2
Kanadaptin (Kidney anion exchanger adapter protein) (Solute carrier family 4 anion exchanger member 1 adapter protein) (Lung cancer oncogene 3 protein)	Q9BWU0|NADAP_HUMAN	88,798	2
Protein NipSnap1	Q9BPW8|NIPS1_HUMAN	33,293	2
Glycine cleavage system H protein, mitochondrial precursor	P23434|GCSH_HUMAN	18,893	2
GPI-anchor transamidase precursor (EC 3.-.-.-) (GPI transamidase) (Phosphatidylinositol-glycan biosynthesis class K protein) (PIG-K) (hGPI8)	Q92643|GPI8_HUMAN	45,235	2
Mitochondrial 39S ribosomal protein L23 (L23mt) (MRP-L23) (L23 mitochondrial-related protein) (Ribosomal protein L23-like)	Q16540|RM23_HUMAN	17,763	2
RNA-binding protein 10 (RNA-binding motif protein 10) (G patch domain-containing protein 9)	P98175|RBM10_HUMAN	103,444	2
Serine/threonine-protein kinase TBK1 (EC 2.7.11.1) (TANK-binding kinase 1) (T2K) (NF-kappa-B-activating kinase)	Q9UHD2|TBK1_HUMAN	83,627	2
Sideroflexin-1 (Tricarboxylate carrier protein) (TCC)	Q9H9B4|SFXN1_HUMAN	35,602	2

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Leucine-rich repeat-containing protein 8A	Q8IWT6|LRC8A_HUMAN	94,186	2
KDEL motif-containing protein 2 precursor	Q7Z4H8|KDEL2_HUMAN	58,556	2
Serine/threonine-protein kinase N2 (EC 2.7.11.13) (Protein kinase C-like 2) (Protein-kinase C-related kinase 2)	Q16513|PKN2_HUMAN	112,020	2
Phakinin (Beaded filament structural protein 2) (Lens fiber cell beaded filament protein CP 49) (CP49) (49 kDa cytoskeletal protein) (CP 47) (CP47) (Lens intermediate filament-like light) (LIFL-L)	Q13515|BFSP2_HUMAN	45,861	2
Peptidyl-prolyl cis-trans isomerase G (EC 5.2.1.8) (Peptidyl-prolyl isomerase G) (PPIase G) (Rotamase G) (Cyclophilin G) (Clk-associating RS-cyclophilin) (CARS-cyclophilin) (CARS-Cyp) (SR-cyclophilin) (SRcyp) (SR-cyp) (CASP10)	Q13427|PPIG_HUMAN	88,602	2
Glucosylceramidase precursor (EC 3.2.1.45) (Beta-glucocerebrosidase) (Acid beta-glucosidase) (D-glucosyl-N-acylsphingosine glucohydrolase) (Alglucerase) (Imiglucerase)	P04062|GLCM_HUMAN	59,700	2
Trafficking protein particle complex subunit 3 (BET3 homolog)	O43617|TPPC3_HUMAN	20,257	2
Kinetochore protein Hec1 (HsHec1) (Kinetochore-associated protein 2) (Highly expressed in cancer protein) (Retinoblastoma-associated protein HEC)	O14777|KNTC2_HUMAN	73,897	2
Mitochondrial import inner membrane translocase subunit Tim9	Q9Y5J7|TIM9_HUMAN	10,360	2
Mitochondrial ribosomal protein S23 (S23mt) (MRP-S23)	Q9Y3D9|RT23_HUMAN	21,753	2
XPA-binding protein 1	Q9HCN4|XAB1_HUMAN	41,722	2
Cat eye syndrome critical region protein 5 precursor	Q9BXW7|CECR5_HUMAN	46,304	2
Mitogen-activated protein kinase kinase kinase 7-interacting protein 1 (TGF-beta-activated kinase 1-binding protein 1) (TAK1-binding protein 1)	Q15750|TAB1_HUMAN	54,626	2
Cdc42 effector protein 1 (Binder of Rho GTPases 5) (Serum protein MSE55)	Q00587|BORG5_HUMAN	40,277	2
Alpha-1,3-mannosyl-glycoprotein 2-beta-N-acetylglucosaminyltransferase (EC 2.4.1.101) (N-glycosyl-oligosaccharide-glycoprotein N-acetylglucosaminyltransferase I) (GNT-I) (GlcNAc-T I)	P26572|MGAT1_HUMAN	50,845	2
SLIT-ROBO Rho GTPase-activating protein 2 (srGAP2) (Formin-binding protein 2)	O75044|FNBP2_HUMAN	120,865	2
HECT domain and RCC1-like domain-containing protein 4 (EC 6.3.2.-)	Q5GLZ8|HERC4_HUMAN	118,549	2
Kinesin-like protein KIF13B (Kinesin-like protein GAKIN)	Q9NQT8|KI13B_HUMAN	202,649	2
Heterogeneous nuclear ribonucleoprotein L-like (Stromal RNA-regulating factor) (BLOCK24 protein)	Q8WVV9|HNRLL_HUMAN	60,065	2
Acyl-coenzyme A thioesterase 2 (EC 3.1.2.2) (Acyl-CoA thioesterase 2) (Peroxisomal acyl-coenzyme A thioester hydrolase 2a) (Peroxisomal long-chain acyl-coA thioesterase 2) (ZAP128) (CTE-Ia)	P49753|ACOT2_HUMAN, Q86TX2|ACOT1_HUMAN	53,240	2
IkappaB kinase complex-associated protein (IKK complex-associated protein) (p150)	O95163|IKAP_HUMAN	150,174	2
Neurabin-2 (Neurabin-II) (Spinophilin) (Protein phosphatase 1 regulatory subunit 9B)	Q96SB3|NEB2_HUMAN	89,174	2
Serine/threonine-protein kinase VRK1 (EC 2.7.11.1) (Vaccinia-related kinase 1)	Q99986|VRK1_HUMAN	45,460	2
RNA polymerase-associated protein RTF1 homolog	Q92541|RTF1_HUMAN	76,565	2

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NADH dehydrogenase [ubiquinone] 1 alpha subcomplex subunit 13 (EC 1.6.5.3) (EC 1.6.99.3) (NADH-ubiquinone oxidoreductase B16.6 subunit) (Complex I-B16.6) (CI-B16.6) (Gene associated with retinoic-interferon-induced mortality 19 protein) (GRIM-19) (Cell death-regulatory protein GRIM-19)	Q9P0J0|NDUAD_HUMAN	16,681	2
Mitogen-activated protein-binding protein-interacting protein (Late endosomal/lysosomal Mp1-interacting protein) (p14)	Q9Y2Q5| MAPIP_HU MAN	13,490	2
Zinc finger Ran-binding domain-containing protein 2 (Zinc finger protein 265) (Zinc finger, splicing)	O95218|ZRAB2_HUMAN	38,206	2
RNA-binding motif, single-stranded-interacting protein 1 (Single-stranded DNA-binding protein MSSP-1) (Suppressor of CDC2 with RNA-binding motif 2)	P29558|RBMS1_HUMAN	44,488	2
Caseinolytic peptidase B protein homolog (Suppressor of potassium transport defect 3)	Q9H078|CLPB_HUMAN	78,713	2
Tubulin-specific chaperone C (Tubulin-folding cofactor C) (CFC)	Q15814|TBCC_HUMAN	39,202	2
Dipeptidyl peptidase 9 (EC 3.4.14.5) (Dipeptidyl peptidase IX) (DP9) (Dipeptidyl peptidase-like protein 9) (DPLP9) (Dipeptidyl peptidase IV-related protein 2) (DPRP-2)	Q86TI2|DPP9_HUMAN	98,246	2
Chromodomain-helicase-DNA-binding protein 1 (EC 3.6.1.-) (ATP-dependent helicase CHD1) (CHD-1)	O14646|CHD1_HUMAN	196,507	2
Inositol polyphosphate 5-phosphatase OCRL-1 (EC 3.1.3.36) (Lowe oculocerebrorenal syndrome protein)	Q01968|OCRL_HUMAN	104,190	2
Microsomal signal peptidase 18 kDa subunit (EC 3.4.-.-) (SPase 18 kDa subunit) (SPC18) (Endopeptidase SP18) (SEC11-like 1)	P67812|SPC18_HUMAN	20,608	2
Ubiquitin carboxyl-terminal hydrolase 19 (EC 3.1.2.15) (Ubiquitin thioesterase 19) (Ubiquitin-specific-processing protease 19) (Deubiquitinating enzyme 19) (Zinc finger MYND domain-containing protein 9) (Fragment)	O94966|UBP19_HUMAN	151,323	2
NADH dehydrogenase [ubiquinone] 1 beta subcomplex subunit 9 (EC 1.6.5.3) (EC 1.6.99.3) (NADH-ubiquinone oxidoreductase B22 subunit) (Complex I-B22) (CI-B22)	Q9Y6M9|NDUB9_HUMAN	21,813	2
Synaptojanin-2 (EC 3.1.3.36) (Synaptic inositol-1,4,5-trisphosphate 5-phosphatase 2)	O15056|SYNJ2_HUMAN	165,523	2
Cysteine-rich with EGF-like domain protein 1 precursor	Q96HD1|CREL1_HUMAN	45,389	2
Isocitrate dehydrogenase [NAD] subunit alpha, mitochondrial precursor (EC 1.1.1.41) (Isocitric dehydrogenase) (NAD(+)-specific ICDH)	P50213|IDH3A_HUMAN	39,575	2
Steroid receptor RNA activator 1 (Steroid receptor RNA activator protein) (SRAP)	Q9HD15|SRA1_HUMAN	25,655	2
Pentraxin-related protein PTX3 precursor (Pentaxin-related protein PTX3) (Tumor necrosis factor-inducible protein TSG-14)	P26022|PTX3_HUMAN	42,002	2
N-acetylserotonin O-methyltransferase-like protein (ASMTL)	O95671|ASML_HUMAN	68,840	2
Serine/threonine-protein phosphatase 2A 65 kDa regulatory subunit A beta isoform (PP2A, subunit A, PR65-beta isoform) (PP2A, subunit A, R1-beta isoform)	P30154|2AAB_HUMAN	66,197	2
Development and differentiation-enhancing factor 2 (Pyk2 C-terminus-associated protein) (PAP) (Paxillin-associated protein with ARFGAP activity 3) (PAG3)	O43150|DDEF2_HUMAN	111,635	2
GTP-binding protein 1 (G-protein 1) (GP-1) (GP1)	O00178|GTPB1_HUMAN	71,446	2

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IWS1 homolog (IWS1-like protein)	Q96ST2|IWS1_HUMAN	91,938	2
SWI/SNF-related matrix-associated actin-dependent regulator of chromatin subfamily C member 1 (SWI/SNF complex 155 kDa subunit) (BRG1-associated factor 155)	Q92922|SMRC1_HUMAN	122,735	2
tRNA (guanine-N(7)-)-methyltransferase (EC 2.1.1.33) (tRNA(m7G46)-methyltransferase) (Methyltransferase-like protein 1)	Q9UBP6|TRMB_HUMAN	31,454	2
Mitogen-activated protein kinase kinase 1-interacting protein 1 (MEK-binding partner 1) (Mp1)	Q9UHA4|MK1I1_HUMAN	13,605	2
Serine/threonine-protein kinase D2 (EC 2.7.11.13) (nPKC-D2)	Q9BZL6|KPCD2_HUMAN	96,706	2
Myeloid differentiation primary response protein MyD88	Q99836|MYD88_HUMAN	33,216	2
Histone H1x	Q92522|H1X_HUMAN	22,470	2
Probable aminopeptidase NPEPL1 (EC 3.4.11.-) (Aminopeptidase-like 1)	Q8NDH3|PEPL1_HUMAN	55,843	2
E3 ubiquitin-protein ligase RING1 (EC 6.3.2.-) (Polycomb complex protein RING1) (RING finger protein 1)	Q06587|RING1_HUMAN, Q99496|RING2_HUMAN	42,412	2
BAG family molecular chaperone regulator 2 (BCL2-associated athanogene 2) (BAG-2)	O95816|BAG2_HUMAN	23,755	2
PDZ domain-containing protein GIPC1 (RGS19-interacting protein 1) (GAIP C-terminus-interacting protein) (RGS-GAIP-interacting protein) (Tax interaction protein 2) (TIP-2)	O14908|GIPC1_HUMAN	36,033	2
Adenylate kinase isoenzyme 6 (EC 2.7.4.3) (ATP-AMP transphosphorylase 6)	Q9Y3D8|KAD6_HUMAN	20,044	2
Poly(A) polymerase alpha (EC 2.7.7.19) (PAP) (Polynucleotide adenylyltransferase alpha)	P51003|PAPOA_HUMAN	82,826	2
Endothelial protein C receptor precursor (Endothelial cell protein C receptor) (Activated protein C receptor) (APC receptor) (CD201 antigen)	Q9UNN8|EPCR_HUMAN	26,653	2
NNP-1 protein (Novel nuclear protein 1) (Nucleolar protein Nop52) (D21S2056E)	P56182|NNP1_HUMAN	52,823	2
Clathrin light chain B (Lcb)	P09497|CLCB_HUMAN	25,173	2
Transcription factor SOX-18	P35713|SOX18_HUMAN	40,875	2
Proteasome maturation protein (Proteassemblin) (Protein UMP1 homolog) (hUMP1) (Voltage-gated K channel beta subunit 4.1)	Q9Y244|POMP_HUMAN	15,772	2
Caskin-2	Q8WXE0|CSKI2_HUMAN	126,696	2
ADAM 9 precursor (EC 3.4.24.-) (A disintegrin and metalloproteinase domain 9) (Metalloprotease/ disintegrin/cysteine-rich protein 9) (Myeloma cell metalloproteinase) (Meltrin gamma) (Cellular disintegrin-related protein)	Q13443|ADAM9_HUMAN	90,538	2
Splicing factor 4 (RNA-binding protein RBP)	Q8IWZ8|SF04_HUMAN	72,455	2
Anaphase-promoting complex subunit 7 (APC7) (Cyclosome subunit 7)	Q9UJX3|APC7_HUMAN	63,117	2
Ras-related protein Rab-10	P61026|RAB10_HUMAN	22,524	2
Putative GTP-binding protein Parf (Partner of ARF)	Q3YEC7|PARF_HUMAN	79,532	2
Pyridoxine-5′-phosphate oxidase (EC 1.4.3.5) (Pyridoxamine-phosphate oxidase)	Q9NVS9|PNPO_HUMAN	29,970	2

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Mitochondrial import inner membrane translocase subunit Tim10	P62072|TIM10_HUMAN	10,315	2
Translocon-associated protein subunit gamma (TRAP-gamma) (Signal sequence receptor subunit gamma) (SSR-gamma)	Q9UNL2|SSRG_HUMAN	21,063	2
Methyl-CpG-binding domain protein 2 (Methyl-CpG-binding protein MBD2) (Demethylase) (DMTase)	Q9UBB5|MBD2_HUMAN	43,237	2
Exocyst complex component 8 (Exocyst complex 84 kDa subunit)	Q8IYI6|EXOC8_HUMAN	81,782	2
Adipose most abundant gene transcript 2	Q15847|APM2_HUMAN	7,837	2
Small EDRK-rich factor 2 (4F5rel) (h4F5rel) (Gastric cancer-related protein VRG107)	P84101|SERF2_HUMAN	6,882	2
Fumarylacetoacetase (EC 3.7.1.2) (Fumarylacetoacetate hydrolase) (Beta-diketonase) (FAA)	P16930|FAAA_HUMAN	46,358	2
Cytochrome c oxidase subunit 7C, mitochondrial precursor (EC 1.9.3.1) (Cytochrome c oxidase polypeptide VIIc)	P15954|COX7C_HUMAN	7,228	2
Pyruvate carboxylase, mitochondrial precursor (EC 6.4.1.1) (Pyruvic carboxylase) (PCB)	P11498|PYC_HUMAN	129,617	2
Hexokinase-2 (EC 2.7.1.1) (Hexokinase type II) (HK II) (Muscle form hexokinase)	P52789|HXK2_HUMAN	102,363	2
Regulator of differentiation 1 (Rod1)	O95758|ROD1_HUMAN	56,486	2
NADH dehydrogenase [ubiquinone] 1 alpha subcomplex subunit 12 (EC 1.6.5.3) (EC 1.6.99.3) (NADH-ubiquinone oxidoreductase subunit B17.2) (Complex I-B17.2) (CI-B17.2) (CIB17.2) (13 kDa differentiation-associated protein)	Q9UI09|NDUAC_HUMAN	17,097	2
Carbohydrate kinase-like protein (EC 2.7.1.-)	Q9UHJ6|CARKL_HUMAN	51,485	2
ADP-ribosylation factor GTPase-activating protein 3 (ARF GAP 3)	Q9NP61|ARFG3_HUMAN	56,911	2
Enhancer of mRNA decapping protein 3 (YjeF domain-containing protein 1)	Q96F86|EDC3_HUMAN	56,059	2
Minor histocompatibility antigen H13 (EC 3.4.99.-) (Signal peptide peptidase) (Presenilin-like protein 3) (hIMP1 protein)	Q8TCT9|HM13_HUMAN	41,473	2
Phosphatidylinositol 3-kinase catalytic subunit type 3 (EC 2.7.1.137) (PtdIns-3-kinase type 3) (PI3-kinase type 3) (PI3K type 3) (Phosphoinositide-3-kinase class 3) (Phosphatidylinositol 3-kinase p100 subunit)	Q8NEB9|PK3C3_HUMAN	101,535	2
Mixed lineage kinase domain-like protein	Q8NB16|MLKL_HUMAN	54,463	2
Prolyl 3-hydroxylase 3 precursor (EC 1.14.11.7) (Leprecan-like protein 2) (Protein B)	Q8IVL6|P3H3_HUMAN	81,820	2
SAM and SH3 domain-containing protein 1 (Proline-glutamate repeat-containing protein)	O94885|SASH1_HUMAN	136,666	2
NADH dehydrogenase [ubiquinone] iron-sulfur protein 2, mitochondrial precursor (EC 1.6.5.3) (EC 1.6.99.3) (NADH-ubiquinone oxidoreductase 49 kDa subunit) (Complex I-49kD) (CI-49kD)	O75306|NDUS2_HUMAN	52,529	2
GDP-mannose 4,6 dehydratase (EC 4.2.1.47) (GDP-D-mannose dehydratase) (GMD)	O60547|GMDS_HUMAN	41,932	2
Branched-chain-amino-acid aminotransferase, mitochondrial precursor (EC 2.6.1.42) (BCAT(m)) (Placental protein 18) (PP18)	O15382|BCAT2_HUMAN	44,270	2

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Multiple inositol polyphosphate phosphatase 1 precursor (EC 3.1.3.62) (Inositol (1,3,4,5)-tetrakisphosphate 3-phosphatase) (Ins(1,3,4,5)P(4) 3-phosphatase)	Q9UNW1|MINP1_HUMAN	55,035	2
Double-stranded RNA-binding protein Staufen homolog 2	Q9NUL3|STAU2_HUMAN	62,624	2
Pantothenate kinase 2, mitochondrial precursor (EC 2.7.1.33) (Pantothenic acid kinase 2) (hPANK2)	Q9BZ23|PANK2_HUMAN	62,665	2
Apolipoprotein O precursor (Protein FAM121B)	Q9BUR5|APOO_HUMAN	22,267	2
Stromal cell-derived factor 2 precursor (SDF-2)	Q99470|SDF2_HUMAN	23,007	2
THO complex subunit 1 (Tho1) (Nuclear matrix protein p84)	Q96FV9|THOC1_HUMAN	75,651	2
Histone deacetylase 7a (HD7a)	Q8WUI4|HDAC7_HUMAN	102,910	2
HEAT repeat-containing protein 3	Q7Z4Q2|HEAT3_HUMAN	74,567	2
COMM domain-containing protein 6	Q7Z4G1|COMD6_HUMAN	9,620	2
GTP-binding protein Rheb precursor (Ras homolog enriched in brain)	Q15382|RHEB_HUMAN	20,480	2
Inositol 1,4,5-trisphosphate receptor type 3 (Type 3 inositol 1,4,5-trisphosphate receptor) (Type 3 InsP3 receptor) (IP3 receptor isoform 3) (InsP3R3)	Q14573|ITPR3_HUMAN	304,024	2
Eukaryotic translation initiation factor 4E-binding protein 2 (4E-BP2) (eIF4E-binding protein 2)	Q13542|4EBP2_HUMAN	12,922	2
Golgin subfamily A member 4 (Trans-Golgi p230) (256 kDa golgin) (Golgin-245) (Protein 72.1)	Q13439|GOGA4_HUMAN	261,126	2
Protein OS-9 precursor (Amplified in osteosarcoma 9)	Q13438|OS9_HUMAN	75,546	2
Ubiquitin-protein ligase E3A (EC 6.3.2.-) (E6AP ubiquitin-protein ligase) (Oncogenic protein-associated protein E6-AP) (Human papillomavirus E6-associated protein) (Renal carcinoma antigen NY-REN-54)	Q05086|UBE3A_HUMAN	100,632	2
Contactin-associated protein 1 precursor (Caspr) (Caspr1) (Neurexin 4) (Neurexin IV) (p190)	P78357|CNTP1_HUMAN	156,250	2
Acylphosphatase-1 (EC 3.6.1.7) (Acylphosphate phosphohydrolase 1) (Acylphosphatase, organ-common type isozyme) (Acylphosphatase, erythrocyte isozyme)	P07311|ACYP1_HUMAN	11,243	2
Protein phosphatase 1 regulatory subunit 11 (Protein phosphatase inhibitor 3) (Hemochromatosis candidate protein V) (HCG V) (HCG-V)	O60927|PP1RB_HUMAN	13,934	2
Cdc42 effector protein 2 (Binder of Rho GTPases 1)	O14613|BORG1_HUMAN	22,467	2
Nuclear factor of activated T-cells, cytoplasmic 2 (T cell transcription factor NFAT1) (NFAT pre-existing subunit) (NF-ATp)	Q13469|NFAC2_HUMAN	100,128	2
L-aminoadipate-semialdehyde dehydrogenase-phosphopantetheinyl transferase (EC 2.7.8.-) (4′-phosphopantetheinyl transferase) (Alpha-aminoadipic semialdehyde dehydrogenase-phosphopantetheinyl transferase) (AASD-PPT) (LYS5 ortholog)	Q9NRN7|ADPPT_HUMAN	35,759	2
Transcriptional repressor p66 beta (p66/p68) (GATA zinc finger domain-containing protein 2B)	Q8WXI9|P66B_HUMAN	65,244	2
Chitinase domain-containing protein 1 precursor (Stabilin-1-interacting chitinase-like protein) (SI-CLP)	Q9BWS9|CHID1_HUMAN	44,923	2

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Bifunctional methylenetetrahydrofolate dehydrogenase/cyclohydrolase, mitochondrial precursor [Includes: NAD-dependent methylenetetrahydrofolate dehydrogenase (EC 1.5.1.15); Methenyltetrahydrofolate cyclohydrolase (EC 3.5.4.9)]	P13995|MTDC_HUMAN	37,877	2
Splicing factor 45 (45 kDa-splicing factor) (RNA-binding motif protein 17)	Q96I25|SPF45_HUMAN	44,944	2
OTU domain-containing protein 6B	Q8N6M0|OTU6B_HUMAN	33,795	2
39S ribosomal protein L34, mitochondrial precursor (L34mt) (MRP-L34)	Q9BQ48|RM34_HUMAN	10,147	2
Gamma-aminobutyric acid receptor-associated protein (GABA(A) receptor-associated protein) (MM46)	O95166|GBRAP_HUMAN	13,901	2
Pantothenate kinase 4 (EC 2.7.1.33) (Pantothenic acid kinase 4) (hPanK4)	Q9NVE7|PANK4_HUMAN	85,975	2
Integrator complex subunit 1 (Int1)	Q8N201|INT1_HUMAN	244,285	2
Alpha-1,3-mannosyltransferase ALG2 (EC 2.4.1.-) (GDP-Man:Man(1)GlcNAc(2)-PP-dolichol mannosyltransferase)	Q9H553|ALG2_HUMAN	47,074	2
Probable global transcription activator SNF2L2 (EC 3.6.1.-) (ATP-dependent helicase SMARCA2) (SNF2-alpha) (SWI/SNF-related matrix-associated actin-dependent regulator of chromatin subfamily A member 2) (hBRM)	P51531|SMCA2_HUMAN	180,749	2
Calcium-transporting ATPase type 2C member 1 (EC 3.6.3.8) (ATPase 2C1) (ATP-dependent Ca(2+) pump PMR1)	P98194|AT2C1_HUMAN	100,561	2
RNA-binding protein 26 (RNA-binding motif protein 26) (CTCL tumor antigen se70-2)	Q5T8P6|RBM26_HUMAN	113,582	2
Follistatin-related protein 1 precursor (Follistatin-like 1)	Q12841|FSTL1_HUMAN	34,967	2
3′-5′ exoribonuclease CSL4 homolog (EC 3.1.13.-) (Exosome component 1)	Q9Y3B2|EXOS1_HUMAN	21,434	2
Spartin (Trans-activated by hepatitis C virus core protein 1)	Q8N0X7|SPG20_HUMAN	72,815	2
Hedgehog-interacting protein precursor (HHIP) (HIP)	Q96QV1|HHIP_HUMAN	78,835	2
Transcription initiation factor IIF subunit alpha (EC 2.7.11.1) (TFIIF-alpha) (General transcription factor IIF subunit 1) (Transcription initiation factor RAP74) (General transcription factor IIF polypeptide 1 74 kDa subunit protein)	P35269|T2FA_HUMAN	58,224	2
39S ribosomal protein L19, mitochondrial precursor (L19mt) (MRP-L19) (MRP-L15)	P49406|RM19_HUMAN	33,518	2
Tumor necrosis factor receptor type 1-associated DEATH domain protein (TNFR1-associated DEATH domain protein) (TNFRSF1A-associated via death domain)	Q15628|TRADD_HUMAN	34,230	2
Disabled homolog 2-interacting protein (DAB2-interacting protein) (DAB2 interaction protein) (ASK-interacting protein 1)	Q5 VWQ8| DAB2P_HUMAN	131,612	2
TSC22 domain family protein 1 (Transforming growth factor beta-1-induced transcript 4 protein) (Regulatory protein TSC-22) (TGFB-stimulated clone 22 homolog) (Cerebral protein 2)	Q15714|T22D1_HUMAN	15,662	2
Integrin beta-5 precursor	P18084|ITB5_HUMAN	88,037	2
Cytochrome c oxidase polypeptide VIIa-liver/heart, mitochondrial precursor (EC 1.9.3.1) (Cytochrome c oxidase subunit VIIa-L) (VIIaL)	P14406|CX7A2_HUMAN	9,379	2

Protein Description	Accession Number	Molecular Weight	Total SpC
Ribonucleases P/MRP protein subunit POP1 (EC 3.1.26.5) (hPOP1)	Q99575|POP1_HUMAN	114,692	2
E3 ubiquitin-protein ligase NEDD4 (EC 6.3.2.-)	P46934|NEDD4_HUMAN	114,922	2
Ubiquitin carboxyl-terminal hydrolase 4 (EC 3.1.2.15) (Ubiquitin thioesterase 4) (Ubiquitin-specific-processing protease 4) (Deubiquitinating enzyme 4) (Ubiquitous nuclear protein homolog)	Q13107|UBP4_HUMAN	108,549	2
Asparagine synthetase [glutamine-hydrolyzing] (EC 6.3.5.4) (Glutamine-dependent asparagine synthetase) (Cell cycle control protein TS11)	P08243|ASNS_HUMAN	64,354	2
DnaJ homolog subfamily C member 1 (DnaJ protein homolog MTJ1)	Q96KC8|DNJC1_HUMAN	63,867	2
F-box-like/WD repeat protein TBL1XR1 (Transducin beta-like 1X-related protein 1) (Nuclear receptor corepressor/HDAC3 complex subunit TBLR1) (TBL1-related protein 1)	O60907|TBL1X_HUMAN, Q9BQ87|TBL1Y_HUMAN, Q9BZK7|TBL1R_HUMAN	56,577	2
Tripartite motif-containing protein 5 (EC 6.3.2.-) (RING finger protein 88)	Q9C035|TRIM5_HUMAN	56,320	2
Gamma-glutamyl hydrolase precursor (EC 3.4.19.9) (Gamma-Glu-X carboxypeptidase) (Conjugase) (GH)	Q92820|GGH_HUMAN	35,948	2
Histidine triad nucleotide-binding protein 2 (EC 3.-.-.-) (HINT-2) (HINT-3) (HIT-17kDa) (PKCI-1-related HIT protein)	Q9BX68|HINT2_HUMAN	17,144	2
Activating signal cointegrator 1 complex subunit 3 (EC 3.6.1.-) (ASC-1 complex subunit p200) (Trip4 complex subunit p200) (Helicase, ATP binding 1)	Q8N3C0|HELC1_HUMAN	251,479	2
Mitochondrial 28S ribosomal protein S34 (S34mt) (MRP-S34)	P82930|RT34_HUMAN	25,633	2
LanC-like protein 1 (40 kDa erythrocyte membrane protein) (p40)	O43813|LANC1_HUMAN	45,267	2
Baculoviral IAP repeat-containing protein 4 (Inhibitor of apoptosis protein 3) (X-linked inhibitor of apoptosis protein) (X-linked IAP) (IAP-like protein) (HILP)	P98170|BIRC4_HUMAN	56,667	2
Collagen alpha-1(VI) chain precursor	P12109|CO6A1_HUMAN	108,513	2
Death-associated protein kinase 3 (EC 2.7.11.1) (DAP kinase 3) (DAP-like kinase) (Dlk) (ZIP-kinase)	O43293|DAPK3_HUMAN	52,520	2
Caskin-1 (CASK-interacting protein 1)	Q8WXD9|CSKI1_HUMAN	149,797	2
Immunoglobulin-binding protein 1 (CD79a-binding protein 1) (B cell signal transduction molecule alpha 4) (Alpha 4 protein) (Renal carcinoma antigen NY-REN-16)	P78318|IGBP1_HUMAN	39,205	2
Protein furry homolog-like (ALL1-fused gene from chromosome 4p12)	O94915|FRYL_HUMAN	339,585	2
Mitochondrial carrier homolog 1 (Presenilin-associated protein)	Q9NZJ7|MTCH1_HUMAN	41,527	2
Transmembrane 9 superfamily protein member 4	Q92544|TM9S4_HUMAN	72,526	2
Ubiquitin-conjugating enzyme E2 R1 (EC 6.3.2.19) (Ubiquitin-protein ligase R1) (Ubiquitin-conjugating enzyme E2-32 kDa complementing) (E2-CDC34)	P49427|UB2R1_HUMAN	26,719	2
Pre-mRNA branch site protein p14 (SF3B 14 kDa subunit)	Q9Y3B4|PM14_HUMAN	14,568	2
UV excision repair protein RAD23 homolog A (hHR23A)	P54725|RD23A_HUMAN	39,591	2
Synaptotagmin-like protein 4 (Exophilin-2) (Granuphilin)	Q96C24|SYTL4_HUMAN	75,993	2

Protein Description	Accession Number	Molecular Weight	Total SpC
Pyridoxal kinase (EC 2.7.1.35) (Pyridoxine kinase)	O00764|PDXK_HUMAN	35,084	2
Target of EGR1 protein 1	Q96GM8|TOE1_HUMAN	56,530	2
PCI domain-containing protein 2 (CSN12-like protein)	Q5JVF3|PCID2_HUMAN	46,013	2
Inorganic pyrophosphatase 2, mitochondrial precursor (EC 3.6.1.1) (PPase 2) (Pyrophosphatase SID6-306)	Q9H2U2|IPYR2_HUMAN	37,903	2
Transportin-3 (Transportin-SR) (TRN-SR) (Importin-12)	Q9Y5L0|TNPO3_HUMAN	109,798	2
Cdc42 effector protein 3 (Binder of Rho GTPases 2) (MSE55-related Cdc42-binding protein)	Q9UKI2|BORG2_HUMAN	27,661	2
THUMP domain-containing protein 1	Q9NXG2|THUM1_HUMAN	39,298	2
Cell growth-regulating nucleolar protein	Q9NX58|LYAR_HUMAN	43,597	2
Transmembrane protein C1orf78	Q9NVM1|CA078_HUMAN	18,356	2
WD repeat protein 55	Q9H6Y2|WDR55_HUMAN	42,106	2
Phosducin-like protein 3 (Viral IAP-associated factor 1) (VIAF-1) (HTPHLP)	Q9H2J4|PDCL3_HUMAN	27,598	2
Mediator of RNA polymerase II transcription subunit 28 (Mediator complex subunit 28) (Tumor angiogenesis marker EG-1) (Endothelial-derived protein 1) (Merlin and Grb2-interacting cytoskeletal protein) (Magicin)	Q9H204|MED28_HUMAN	19,502	2
Nucleolar protein 10	Q9BSC4|NOL10_HUMAN	80,287	2
Exocyst complex component 2 (Exocyst complex component Sec5)	Q96KP1|EXOC2_HUMAN	104,052	2
Uncharacterized protein KIAA1279	Q96EK5|K1279_HUMAN	71,798	2
Glutaryl-CoA dehydrogenase, mitochondrial precursor (EC 1.3.99.7) (GCD)	Q92947|GCDH_HUMAN	48,111	2
Protein PTDSR (Phosphatidylserine receptor)	Q6NYC1|PTDSR_HUMAN	46,445	2
Sterile alpha motif domain-containing protein 9	Q5K651|SAMD9_HUMAN	184,272	2
Glutamine-rich protein 1	Q2TAL8|QRIC1_HUMAN	86,415	2
Active breakpoint cluster region-related protein	Q12979|ABR_HUMAN	97,682	2
Filensin (Beaded filament structural protein 1) (Lens fiber cell beaded-filament structural protein CP 115) (CP115) (Lens intermediate filament-like heavy) (LIFL-H)	Q12934|BFSP1_HUMAN	74,527	2
Forkhead box protein O1A (Forkhead in rhabdomyosarcoma)	Q12778|FOXO1_HUMAN	69,644	2
Guanine nucleotide-binding protein-like 1 (GTP-binding protein HSR1)	P36915|GNL1_HUMAN	47,447	2
Colorectal mutant cancer protein (Protein MCC)	P23508|CRCM_HUMAN	93,039	2
Lysosomal protective protein precursor (EC 3.4.16.5) (Cathepsin A) (Carboxypeptidase C) (Protective protein for beta-galactosidase) [Contains: Lysosomal protective protein 32 kDa chain; Lysosomal protective protein 20 kDa chain]	P10619|PPGB_HUMAN	54,450	2
Alpha-2-macroglobulin precursor (Alpha-2-M)	P01023|A2MG_HUMAN	163,259	2

Protein Description	Accession Number	Molecular Weight	Total SpC
Prothrombin precursor (EC 3.4.21.5) (Coagulation factor II) [Contains: Activation peptide fragment 1; Activation peptide fragment 2; Thrombin light chain; Thrombin heavy chain]	P00734|THRB_HUMAN	70,019	2
Carboxypeptidase D precursor (EC 3.4.17.22) (Metallocarboxypeptidase D) (gp180)	O75976|CBPD_HUMAN	152,915	2
Glycosylphosphatidylinositol anchor attachment 1 protein (GPI anchor attachment protein 1) (GAA1 protein homolog) (hGAA1)	O43292|GPAA1_HUMAN	67,607	2
Tumor necrosis factor receptor superfamily member 10B precursor (Death receptor 5) (TNF-related apoptosis-inducing ligand receptor 2) (TRAIL receptor 2) (TRAIL-R2) (CD262 antigen)	O14763|TR10B_HUMAN	47,832	2
Copper chaperone for superoxide dismutase (Superoxide dismutase copper chaperone)	O14618|CCS_HUMAN	29,022	2
Nuclear factor 1 B-type (Nuclear factor 1/B) (NF1-B) (NFI-B) (NF-I/B) (CCAAT-box-binding transcription factor) (CTF) (TGGCA-binding protein)	O00712|NFIB_HUMAN	47,425	2
DNA-directed RNA polymerase III subunit 127.6 kDa polypeptide (EC 2.7.7.6) (RNA polymerase III subunit 2) (RPC2)	Q9NW08|RPC2_HUMAN	127,771	2
Transmembrane 9 superfamily protein member 2 precursor (p76)	Q99805|TM9S2_HUMAN	75,761	2
Amyloid beta A4 precursor protein-binding family B member 2 (Fe65-like protein)	Q92870|APBB2_HUMAN	83,328	2
39S ribosomal protein L38, mitochondrial precursor (L38mt) (MRP-L38)	Q96DV4|RM38_HUMAN	44,579	2
Nucleoporin SEH1-like (SEC13-like protein)	Q96EE3|SEH1L_HUMAN	46,560	2
Diacylglycerol kinase alpha (EC 2.7.1.107) (Diglyceride kinase alpha) (DGK-alpha) (DAG kinase alpha) (80 kDa diacylglycerol kinase)	P23743|DGKA_HUMAN	82,656	2
Nicastrin precursor	Q92542|NICA_HUMAN	78,394	2
RWD domain-containing protein 1	Q9H446|RWDD1_HUMAN	27,922	2
Bystin	Q13895|BYST_HUMAN	49,585	2
Transforming growth factor beta-1 precursor (TGF-beta-1) [Contains: Latency-associated peptide (LAP)]	P01137|TGFB1_HUMAN	44,324	2
REVERSED	REV|Q14573|ITPR3	304,024	2
REVERSED	REV|P14618|KPYM	57,920	2
NFX1-type zinc finger-containing protein 1	Q9P2E3|ZNFX1_HUMAN	220,207	2
Diphosphoinositol polyphosphate phosphohydrolase 1 (EC 3.6.1.52) (DIPP-1) (Diadenosine 5′,5‴-P1,P6-hexaphosphate hydrolase 1) (EC 3.6.1.-) (Nucleoside diphosphate-linked moiety X motif 3) (Nudix motif 3)	O95989|NUDT3_HUMAN	19,453	2
NAD-dependent deacetylase sirtuin-5 (EC 3.5.1.-) (SIR2-like protein 5)	Q9NXA8|SIRT5_HUMAN	33,863	2
Gamma-aminobutyric acid receptor-associated protein-like 2 (GABA(A) receptor-associated protein-like 2) (Ganglioside expression factor 2) (GEF-2) (General protein transport factor p16) (MAP1 light chain 3-related protein)	P60520|GBRL2_HUMAN	13,649	2
Squalene synthetase (EC 2.5.1.21) (SQS) (SS) (Farnesyl-diphosphate farnesyltransferase) (FPP:FPP farnesyltransferase)	P37268|FDFT_HUMAN	48,098	2

Protein Description	Accession Number	Molecular Weight	Total SpC
REVERSED	REV|Q9Y623|MYH4	223,001	2
Activating signal cointegrator 1 complex subunit 1 (ASC-1 complex subunit p50) (Trip4 complex subunit p50)	Q8N9N2|ASCC1_HUMAN	45,492	2
cAMP-dependent protein kinase, beta-catalytic subunit (EC 2.7.11.11) (PKA C-beta)	P22694|KAPCB_HUMAN	40,606	2
DNA polymerase delta catalytic subunit (EC 2.7.7.7) (DNA polymerase subunit delta p125)	P28340|DPOD1_HUMAN	123,616	2
Myosin-2 (Myosin heavy chain 2) (Myosin heavy chain 2a) (MyHC-2a) (Myosin heavy chain, skeletal muscle, adult 2) (Myosin heavy chain IIa) (MyHC-IIa)	Q9UKX2|MYH2_HUMAN	223,032	2
1-acyl-sn-glycerol-3-phosphate acyltransferase gamma (EC 2.3.1.51) (1-AGP acyltransferase 3) (1-AGPAT 3) (Lysophosphatidic acid acyltransferase gamma) (LPAAT-gamma) (1-acylglycerol-3-phosphate O-acyltransferase 3)	Q9NRZ7|PLCC_HUMAN	43,364	2
REVERSED	REV|P35609|ACTN2	103,840	2
Transcription factor MafK (Erythroid transcription factor NF-E2 p18 subunit)	O60675|MAFK_HUMAN	17,505	2
REVERSED	REV|Q92673|SORL	248,424	2
Myeloid/lymphoid or mixed-lineage leukemia protein 2 (ALL1-related protein)	O14686|MLL2_HUMAN	564,164	2
REVERSED	REV|P20929|NEBU	773,209	2
Uncharacterized protein C6orf115	Q9P1F3|CF115_HUMAN	9,039	2
REVERSED	REV|Q9UJ83|HACL1	63,711	2
REVERSED	REV|Q9HCE9|TM16H	136,019	2
Ryanodine receptor 3 (Brain-type ryanodine receptor) (RyR3) (RYR-3) (Brain ryanodine receptor-calcium release channel)	Q15413|RYR3_HUMAN	551,916	2
REVERSED	REV|P25391|LAMA1	337,133	2
Aldo-keto reductase family 1 member C1 (EC 1.1.1.-) (20-alpha-hydroxysteroid dehydrogenase) (EC 1.1.1.149) (20-alpha-HSD) (Trans-1,2-dihydrobenzene-1,2-diol dehydrogenase) (EC 1.3.1.20) (High-affinity hepatic bile acid-binding protein) (HBAB) (Chlordecone reductase homolog HAKRC) (Dihydrodiol dehydrogenase 1/2) (DD1/DD2)	Q04828|AK1C1_HUMAN	36,771	2
Nucleolysin TIA-1 isoform p40 (RNA-binding protein TIA-1) (p40-TIA-1) [Contains: Nucleolysin TIA-1 isoform p15 (p15-TIA-1)]	P31483|TIA1_HUMAN	42,942	2
REVERSED	REV|Q9NYC9|DYH9	511,915	2
REVERSED	REV|Q9NRM7|LATS2	120,177	2
Casein kinase I isoform gamma-2 (EC 2.7.11.1) (CKI-gamma 2)	P78368|KC1G2_HUMAN, Q9Y6M4|KC1G3_HUMAN	47,441	2
Protein TRS85 homolog	Q9Y2L5|TRS85_HUMAN	160,926	2
ATP-binding cassette sub-family G member 2 (Placenta-specific ATP-binding cassette transporter) (Breast cancer resistance protein) (Mitoxantrone resistance-associated protein) (CD338 antigen) (CDw338)	Q9UNQ0|ABCG2_HUMAN	72,299	2

Protein Description	Accession Number	Molecular Weight	Total SpC
Uncharacterized protein C1orf149 (Sarcoma antigen NY-SAR-91)	Q9HAF1|CA149_HUMAN	21,617	2
Vacuolar protein sorting-associated protein 16 homolog (hVPS16)	Q9H269|VPS16_HUMAN	94,678	2
Sialidase-1 precursor (EC 3.2.1.18) (Lysosomal sialidase) (N-acetyl-alpha-neuraminidase 1) (Acetylneuraminyl hydrolase) (G9 sialidase)	Q99519|NEUR1_HUMAN	45,449	2
Putative RNA-binding protein 15 (RNA-binding motif protein 15) (One-twenty two protein)	Q96T37|RBM15_HUMAN	107,175	2
Positive cofactor 2 glutamine/Q-rich-associated protein (PC2 glutamine/Q-rich-associated protein) (TPA-inducible gene 1 protein) (TIG-1) (Activator-recruited cofactor 105 kDa component) (ARC105) (CTG repeat protein 7a)	Q96RN5|PCQAP_HUMAN	86,733	2
COMM domain-containing protein 1 (Protein Murr1)	Q8N668|COMD1_HUMAN	21,161	2
Serine/arginine repetitive matrix protein 1 (Ser/Arg-related nuclear matrix protein) (SR-related nuclear matrix protein of 160 kDa) (SRm160)	Q8IYB3|SRRM1_HUMAN	102,319	2
39S ribosomal protein L21, mitochondrial precursor (L21mt) (MRP-L21)	Q7Z2W9|RM21_HUMAN	23,142	2
SSXT protein (Synovial sarcoma, translocated to X chromosome) (SYT protein)	Q15532|SSXT_HUMAN	45,910	2
Transmembrane protein 33 (DB83 protein)	P57088|TMM33_HUMAN	27,962	2
Cyclin-H (MO15-associated protein) (p37) (p34)	P51946|CCNH_HUMAN	37,627	2
E3 ubiquitin-protein ligase CBL (EC 6.3.2.-) (Signal transduction protein CBL) (Proto-oncogene c-CBL) (Casitas B-lineage lymphoma proto-oncogene) (RING finger protein 55)	P22681|CBL_HUMAN	99,631	2
Reticulon-3 (Neuroendocrine-specific protein-like 2) (NSP-like protein II) (NSPLII)	O95197|RTN3_HUMAN	112,596	2
A-kinase anchor protein 3 (Protein kinase A-anchoring protein 3) (PRKA3) (A-kinase anchor protein 110 kDa) (AKAP 110) (Sperm oocyte-binding protein) (Fibrousheathin-1) (Fibrousheathin I) (Fibrous sheath protein of 95 kDa) (FSP95)	O75969|AKAP3_HUMAN	94,720	2
U2-associated protein SR140 (140 kDa Ser/Arg-rich domain protein)	O15042|SR140_HUMAN	118,278	2
Ferrochelatase, mitochondrial precursor (EC 4.99.1.1) (Protoheme ferro-lyase) (Heme synthetase)	P22830|HEMH_HUMAN	47,845	2
Lactadherin precursor (Milk fat globule-EGF factor 8) (MFG-E8) (HMFG) (Breast epithelial antigen BA46) (MFGM) [Contains: Lactadherin short form; Medin]	Q08431|MFGM_HUMAN	43,105	2
REVERSED	REV|Q14678|ANR15	147,270	2
Probable histone-lysine N-methyltransferase ASH1L (EC 2.1.1.43) (ASH1-like protein) (Absent small and homeotic disks protein 1 homolog) (huASH1)	Q9NR48|ASH1L_HUMAN	332,778	2
Transcription initiation factor IIE subunit beta (TFIIE-beta) (General transcription factor IIE subunit 2)	P29084|T2EB_HUMAN	33,027	2
REVERSED	REV|Q8TDM6|DLG5	202,043	2
Ubiquitin carboxyl-terminal hydrolase isozyme L5 (EC 3.4.19.12) (UCH-L5) (Ubiquitin thioesterase L5) (Ubiquitin C-terminal hydrolase UCH37)	Q9Y5K5|UCHL5_HUMAN	37,589	2
REVERSED	REV|Q96CN5|LRC45	75,935	2

Table 2

Primer pairs and product sizes for selected gene transcripts studied in human retinal endothelial cells.

Gene Transcript	Primer Pair (Product Size)[Reference (if applicable)]
Supervillin	for: 5′-TGGTGTTTGATTTTGGTAGTGAA-3′ rev: 5′-TAAGCGGATTGCATTCTCCA-3′(165 bp)
ICAM-1	for: 5′-TAAGCCAAGAGGAAGGAGCA-3′ rev: 5′-CATATCATCAAGGGTTGGGG-3′ (282 bp)[1]
VCAM-1	for: 5′-CGTCTCATTGACTTGCAGCACC-3′ rev: 5′-GTGATCGGCTTCCCAGCCTC-3′ (276 bp) [2]
E-selectin	for: 5′-GAGCCTTCAGTGTACCTCATC-3′ rev: 5′-GACAATTCATGTAGCCTCGCTC-3′ (296 bp) [2]
P-selectin	for: 5′-GGATTGTTCTGACACTCGTGG-3′ rev: 5′-GAGGTTGGAGCAGTTCATCG-3′ (412 bp)
CD44	for: 5′-ACATCAGTCACAGACCTGCC-3′ rev: 3′-GCAAACTGCAAGAATCAAAGCC-3′ (471 bp)[3]
CXCL10	for: 5′-AAGAGATGTCTGAATCCAGAATCGAAGG-3′ rev: 5′-CCTCAGTAGAGCTTACATTATAGTGCCAG-3′ (333 bp)
CCL20	for: 5′-TGCTGTACCAAGAGTTTGCTC-3′ rev: 5′-GATTTGCGCACACAGACAAC-3′ (226 bp)
VEGF-165	for: 5′-ATCTTCAAGCCATCCTGTGTGC-3′ rev: 5′-CAAGGCCCACAGGGATTTTC-3′ (224 bp)[4]
GAPDH	for: 5′-AGCTGAACGGGAAGCTCACTGG-3′ rev: 5′-GGAGTGGGTGTCGCTGTTGAAGTC-3′ (209 bp)[5]

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[3] Liu NP, Roberts WL, Hale LP, et al. Expression of CD44 and variant isoforms in cultured human retinal pigment epithelial cells. *Invest Ophthalmol Vis Sci* 1997; 38: 2027–2037.

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[5] Silverman MD, Zamora DO, Pan Y, et al. Constitutive and inflammatory mediator-regulated fractalkine expression in human ocular tissues and cultured cells. *Invest Ophthalmol Vis Sci* 2003; 44: 1608–1615.

Table 3

List of genes for which expression was significantly altered in human retinal endothelial cells following exposure to hypoxia for 48 hours, by PCR array of 84 autophagy-related transcripts. Subtable A shows 21 gene transcripts that were up-regulated in hypoxic retinal endothelial cells. Subtable B shows 11 gene transcripts that were down-regulated in hypoxic retinal endothelial cells. Transcripts are ranked according to fold change in expression as a result of hypoxia, from highest to lowest.

A. Gene transcripts that were up-regulated in hypoxic retinal endothelial cells				
Symbol	**Description**	**Role in Autophagy***	**P-value**	**Fold Regulation**
TNF	Tumor necrosis factor	Regulation: Co-regulator of autophagy and apoptosis	0.008158	2.5747
CTSS	Cathepsin S	Regulation: Autophagy in response to other intracellular signals	0.000073	1.8979
CXCR4	Chemokine (C-X-C motif) receptor 4	Regulation: Co-regulator of autophagy and apoptosis	0.000017	1.8666
DRAM1	DNA-damage regulated autophagy modulator 1	Gene linking autophagosome to lysosome, Co-regulator of autophagy and apoptosis	0.000343	1.6454
BNIP3	BCL2/adenovirus E1B 19kDa interacting protein 3	Regulation: Co-regulator of autophagy and apoptosis	0.000007	1.487
GABARAPL1	GABA(A) receptor-associated protein like 1	Gene involved in autophagic vacuole formation	0.002547	1.4544
HGS	Hepatocyte growth factor-regulated tyrosine kinase substrate	Autophagy in response to other Intracellular Signals	0.007782	1.3913
IGF1	Insulin-like growth factor 1 (somatomedin C)	Co-regulator of autophagy and apoptosis	0.021975	1.3913
TNFSF10	Tumor necrosis factor (ligand) superfamily, member 10	Regulation: Co-regulator of autophagy and apoptosis	0.000046	1.3836
TGFB1	Transforming growth factor, beta 1	Co-regulator of autophagy and apoptosis, co-regulator of autophagy and the cell cycle	0.005692	1.3797
FAM176A	Family with sequence similarity 176, member A	Gene linking autophagosome to lysosome	0.00415	1.3759
EIF2AK3	Eukaryotic translation initiation factor 2-alpha kinase 3	Regulation: Co-regulator of autophagy and apoptosis, autophagy induction by intracellular pathogens	0.002122	1.3721
RAB24	RAB24, member RAS oncogene family	Gene responsible for protein transport	0.028074	1.3383
TGM2	Transglutaminase 2 (C polypeptide, protein-glutamine-gamma-glutamyltransferase)	Regulation: Co-regulator of autophagy and apoptosis	0.006108	1.3089
GAA	Glucosidase, alpha; acid	Autophagy in response to other Intracellular Signals	0.018178	1.2838
ARSA	Arylsulfatase A	Autophagy in response to other Intracellular Signals	0.008347	1.2315
ULK2	Unc-51-like kinase 2 (C. elegans)	Autophagy in response to other Intracellular Signals	0.027169	1.2179
ATG16L2	ATG16 autophagy related 16-like 2 (S. cerevisiae)	Gene responsible for protein transport	0.031784	1.1978
APP	Amyloid beta (A4) precursor protein	Regulation: Co-regulator of autophagy and apoptosis	0.037293	1.1895
ATG9A	ATG9 autophagy related 9 homolog A (S. cerevisiae)	Gene involved in autophagic vacuole formation, Gene responsible for protein transport	0.027697	1.178

A. Gene transcripts that were up-regulated in hypoxic retinal endothelial cells				
Symbol	**Description**	**Role in Autophagy***	**P-value**	**Fold Regulation**
RB1	Retinoblastoma 1	Co-regulator of autophagy and the cell cycle	0.008745	1.1748

B. Gene transcripts that were down-regulated in hypoxic retinal endothelial cells				
Symbol	**Description**	**Role in autophagy***	**P-value**	**Fold Regulation**
ATG4A	ATG4 autophagy related 4 homolog A (S. cerevisiae)	Gene involved in autophagic vacuole formation, Gene responsible for targeting to vacuole, protein transport, Protease activity	0.0001	−1.6196
ATG9B	ATG9 autophagy related 9 homolog B (S. cerevisiae)	Gene involved in autophagic vacuole formation	0.002454	−1.5301
ATG4C	ATG4 autophagy related 4 homolog C (S. cerevisiae)	Gene involved in autophagic vacuole formation, Gene responsible for targeting to vacuole, protein transport, Protease activity	0.000944	−1.4475
ATG3	ATG3 autophagy related 3 homolog (S. cerevisiae)	gene involved in protein ubiquitination	0.00055	−1.4375
FAS	Fas (TNF receptor superfamily, member 6)	Regulation: Co-regulator of autophagy and apoptosis	0.001326	−1.4177
CTSB	Cathepsin B	Regulation: Co-regulator of autophagy and apoptosis	0.00375	−1.3866
HSP90AA1	Heat shock protein 90kDa alpha (cytosolic), class A member 1	Chaperone medicated autophagy	0.003395	−1.3809
HSPA8	Heat shock 70kDa protein 8	Chaperone medicated autophagy	0.014572	−1.2938
CDKN2A	Cyclin-dependent kinase inhibitor 2A (melanoma, p16, inhibits CDK4)	Co-regulator of autophagy and apoptosis, and the cell cycle	0.000663	−1.2394
CASP8	Caspase 8, apoptosis-related cysteine peptidase	Regulation: Co-regulator of autophagy and apoptosis	0.046233	−1.2359
HDAC1	Histone deacetylase 1	Regulation: Co-regulator of autophagy and apoptosis	0.039701	−1.2055

* Role in autophagy is as listed at www.sabiosciences.com/rt_pcr_product/HTML/PAHS-084A.html