Published in final edited form as:
J Aging Stud. 2008 December 1; 22(4): 304–312. doi:10.1016/j.jaging.2008.05.002.

From the Lab to the Front Line: How Individual Biogerontologists Navigate their Contested Field

Richard A. Settersten Jr,
Department of Human Development and Family Sciences, College of Health and Human Sciences, Oregon State University, 322 Milam Hall, Corvallis OR USA 97331-5102, richard.settersten@oregonstate.edu

Michael A. Flatt, and
Department of Bioethics, Case Western Reserve University, 10900 Euclid Avenue, Cleveland, OH 44106-4976 USA, michael.flatt@case.edu

Roselle S. Ponsaran
Department of Bioethics, Case Western Reserve University, 10900 Euclid Avenue, Cleveland, OH 44106-4976 USA, roselle.ponsaran@case.edu

Abstract

This paper infuses a new perspective into scholarship on anti-aging science: the experiences of individual scientists as they entered and navigate this controversial field. We draw on in-depth interviews with 43 prominent biogerontologists to accomplish three objectives. First, we highlight key factors that draw scientists into biogerontology—especially the unique and complex puzzles posed by aging. Second, we examine how biogerontologists define themselves and their research in relation to "anti-aging" science—particularly how scientists distance themselves from the tarnished history of the field and employ powerful language to distinguish legitimate from illegitimate scholarship, and science from industry. Finally, we explore how individual scientists manage any social, religious, and ethical objections to conducting "anti-aging" research—and the repertoire of responses they use to simultaneously dismantle objections and reinforce the legitimacy of their science. The analyses reveal how much is ultimately at stake for these individual scientists on the front line.

Other manuscripts in this special issue (e.g., Fishman, Binstock, & Lambrix; Vincent, Tulle, & Bond) and elsewhere (e.g., Gruman, 2003; Hall, 2003; Juengst, Binstock, Mehlman, & Post, 2003; Olshansky & Carnes, 2001; Post & Binstock, 2004) have charted the turbulent history of anti-aging science as a *field*. These accounts point especially to the controversial nature of the field; to its marginal scientific status even (or especially) within biomedicine; and to its continued struggle for legitimacy. For example, anti-aging science has been undermined by its association, real or imagined, with charlatanic medical practices and with profit-seeking practitioners and entrepreneurs. These associations also foster the perception that the field seeks "forbidden" knowledge and lacks scientific rigor and innovation (Fishman et al., *this issue*). Similarly, scientific and medical efforts to control human aging prompt vehement public

---

Correspondence to: Richard A. Settersten, Jr.

opposition—especially on the grounds that such attempts tinker with nature, violate religious prescriptions, and create serious ethical and social problems (see also Post & Binstock, 2004).

This paper provides an important and complementary perspective to these larger accounts of the evolution of anti-aging science as a field. We drill down to the perspectives of *individual scientists* and gain an intimate view of how they entered and have navigated this contested field. We seek to illuminate: (1) key factors that draw individual scientists to biogerontology; (2) how biogerontologists define themselves and their research in relation to "anti-aging" science; and (3) how they manage any social, religious, and ethical objections they encounter in conducting "anti-aging" research—and the repertoire of responses they use to simultaneously dismantle specific objections and reinforce the legitimacy of their science in scholarly debate and everyday life.

Vincent (2003) posed the provocative question, "What's at stake in the 'war on anti-ageing medicine'"? Our analyses will ultimately reveal what is at stake for these scientists on the front line. And the stakes are big: the everyday rewards of doing science; the trust they have in scientists, practitioners, and industry—and the trust that others have in them; their personal contributions to science and progress; and their basic responsibility to improve the usefulness of the knowledge they generate and put it to work.

Method

For this project, we interviewed a sample of 43 prominent biogerontologists drawn from two key sources: those with funding from the National Institute on Aging (NIA) for related research and those serving on the Editorial Boards of related journals. The first group of 20 scientists had received relevant research funding from NIA in the past 10 years (1997–2007), as identified in the "CRISP" (Computer Retrieval of Information on Scientific Projects) database of projects funded by the National Institutes of Health (NIH). Twelve (12) of these scientists were identified through a keyword search using the phrase "anti-aging." Eight (8) additional scientists were identified using the terms "biology" and "longevity." All of these individuals were recognized by our team and an expert consultant as being influential in the field, based on previous or current research or other institutional roles. Researchers from the social sciences and humanities were excluded.

Added to this pool were interviews with 19 scientists drawn from the current (as of June 2007) Editorial Boards of two significant journals in the field of biogerontology. Eleven (11) of these scientists came from the flagship *Journals of Gerontology-Biological Sciences*, and eight from *Rejuvenation Research*, the journal devoted to anti-aging research and therapies. We also interviewed six individuals who were recognized by our team and an expert consultant as being influential in the field of biogerontology, but who were neither current recipients of NIA funding nor members of the two Editorial Boards. Five (or 12%) of the total participants are women; 38 (88%) are men. Semi-structured interviews were conducted by phone between August 2006 and October 2007, with most conducted between June and September 2007. Interviews ranged in length from 25 minutes to over 3 hours and were tape-recorded and transcribed with the participants' permission.

All transcribed interviews were transferred into Atlas.ti, a computer-assisted qualitative data analysis software program. Codes were developed using both deductive strategies (built on existing scholarship) and inductive strategies (built from the transcript text). First-level coding was done on a question-by-question basis, reflecting the verbatim responses of scientists (e.g., a reference to aging as a scientific "puzzle"). Similar first-level codes were collapsed into higher-order "interpretive codes," to use Huberman and Miles' (2002) term, which spanned

the entire interview (e.g., references to scientific "puzzles" are included in a larger code, "Entry into Field"). As analyses continued, codes were further sorted into broader conceptual categories and incorporated into the theoretical foundation of this project. Using this "grounded theory" approach (Charmaz, 2005) allows us to make direct comparisons across scientists' responses. The semantic "search and retrieve" functions of the software also allow us to carefully examine the range of codes represented within each transcript to ensure that the breadth of each scientist's opinions about the topics of concern in this paper were available and represented.

The transcripts were divided among three coders who had also conducted the interviews. A coding manual was developed in collaboration with the research team. The manual included specific definitions of each code, illustrative quotes, and instructions for applying codes. A common set of interviews was initially coded by all three coders in order to ensure reliability in the process. Coded transcripts were also reviewed and discussed by the research team during weekly project meetings. As new codes were developed, the coders used the same process to ensure consistency in decision-making and the fine-tuning of existing codes.

Pull Factors: What Attracts Scientists to Biogerontology

Most biogerontologists we interviewed did not begin their careers intending to study aging. Rather, they began their work and training in other disciplines and fields, ranging from medicine to genetics to physiology to architecture. Despite their diverse disciplinary origins, half now primarily identify themselves as biogerontologists, which seems to reflect the development of biogerontology into a distinct field.

> I was originally trained in developmental genetics and called myself that for a long time, and when then I switched over in the mid to late '70s into gerontology, I still considered myself a geneticist, a fly geneticist who was working in low flies, and … when I was asked, I called myself even in the '80s a geneticist. But now I think I'm really a gerontologist, and that has to do I think with the changing aspect of the field, the changing integrity of the field. … So there's this coherent thing, it is a field today. (S36)[2]

At the same time, half still primarily identify themselves with the disciplines in which they were trained—which reflects the status of biogerontology as a fledgling field. In a formulaic way, these scientists repeatedly use the same sentence to describe themselves: "I think of myself as a [*fill in the blank*: molecular biologist; neuroscientist; physiologist; etc.] who is *interested in* aging."

Regardless of how deeply these scientists identify with gerontology, the specific interests that these scientists would develop in aging grew—often unexpectedly—out of serendipitous opportunities (such as jobs or post-docs), interactions with colleagues and mentors, or encounters with provocative papers or conference presentations. Despite their specialties, these scientists share a fascination with understanding aging as a fundamental set of biological processes that pose a great scientific "mystery" to "unravel" or "puzzle" to "unlock." Scientists we interviewed so often use these words, which signal their collective curiosity with aging as a "profound" biological issue. Aging is first and foremost a set of scientific questions to understand, not a set of medical problems to treat or processes to alter. The intrigue of aging is only accentuated by its universality across species.

> [M]ice and rats live about two years, a dog about 10 years, and horses about 20 years, and people about 70 or 80 years, and whales … maybe 150 years, and no one has the

[2]All quotations are followed by a subject (S) number.

> slightest clue as to why that should be. I mean old mice and old dogs and old horses and old people all get the same thing. They get cataracts and they lose their hearing and they get cancer and they can't run as fast. I mean they're all pretty much the same thing, but it takes 30 times longer in people than it does in mice. That's obviously a major sort of biological puzzle, a major mystery, and figuring out how that works is sort of the central, the cornerstone issue in biological gerontology. (S11)

> [T]he puzzle of … why … human life span has sort of hit the wall. You know the oldest living person was 122, but we've not been really been able to … increase the people around the world who are more than 110. That is really not happening. So something between 100 to 110, there are people who have some sort of escape factor, escape genes … whatever, which allow them to live, you know, a life beyond 110. (S29)

For many scientists, especially those who entered the field before NIA was established in 1974, the biology of aging was attractive because it was—and remains—an uncharted territory in which scientists could leave their mark:

> [What drew me to aging] was purely realizing that there was probably a biological process there and realizing that I couldn't read about it anywhere, and that meant that there must be, it must be worth working on if you can't, if there are no papers on it. (S32)

> One of my professors pointed out to me that this was an unknown field, even more mysterious than developmental biology and that I might think of doing something in it, since I seemed to be adventuresome. (S7)

While forging a career in an emerging field brought some risks, the science was challenging and the opportunities for scientific discovery and progress were great. Those who entered biogerontology early in its history witnessed remarkable changes over the last four or more decades. For all of the scientists who entered the field before NIA was established, and for approximately half of those who entered afterward, "progress" is described as one of the most rewarding aspects of their careers. These scientists, individually and collectively, created a body of work that established biogerontology as a significant field in its own right and continues to grow:

> This science keeps getting better. The promise of different interventions keeps on coming. … There's always, for me, a tremendous amount of excitement in what will be the next big advance of what's on the horizon, and that's been tremendously gratifying, that and the slow but steady awareness of the public that the aging of the population is a unique and profound experience, and that we'll do it better than it's ever been done in the past. (S30)

The establishment of NIA was particularly important because it created an infrastructure of opportunities and resources that facilitated the development of individual careers and helped crystallize the significance of the field (see Fishman, Binstock, & Lambrix, *this issue*).

Despite the explosion of research in recent decades, biogerontologists are quick to note that even the most basic questions about aging remain unanswered. Scientists often note significant and continuing debate—but surprising lack of consensus—about what aging is, what biological processes comprise it, and how and why those processes occur.

> I think the primary thing is: what is aging, understanding the aging process. … [the field] has dealt with that issue for the last 30 years in trying to define what is aging, and I'm not sure we have a really first-class definition for it yet today, but I think what biogerontology should be primarily focused on is trying to understand what is aging and to define what is the aging process. (S20)

A few scientists give personal reasons for their interests in aging, such as childhood experiences with an elderly relative or a fear of death. For many scientists we interviewed, however, it is the possibility of improving the health of individuals and entire populations that lured them to the field:

> I think because the implications are so huge. You know, I mean it's the number one health problem in the world, well in the developed world, because all of these other health problems really come from aging initially. If we can slow it down, then we can 10 reduce or prevent myriad health problems, disabilities, and so you know I suddenly realized that there is a bigger world out there than the laboratory, and the stuff that I'm doing could potentially have applications to humans ultimately. You know I think that's a very distant goal, but it is nevertheless the goal. (S5)

Given the nature of the research, its implications can feel remote and ambiguous to scientists. It is not only that these achievements seem far away in the future; it is that these scientists must rely on others to use the knowledge they generate to design clinical or social interventions. It is this application of research in biogerontology to which we now turn.

In the World, But Not of It: Situating Oneself in a Contested Field

The potential association of biogerontologists with anti-aging "hucksters," "shysters," and "snake oil vendors"— words often uttered in our interviews—pose challenges with which individual scientists must contend. Against this backdrop of negative social reactions and reputations, scientists must manage their position in a questionable field and make careful choices about where they belong and with whom they associate. One striking example comes from this scientist, for whom the history of the field precluded him from disclosing a primary interest in aging early in his career:

> One of the things that motivated me to go to medical school was my interest in biogerontology, and I literally concealed that interest in writing essays in applying to medical school, because if they knew that, they would've not even let me go to medical school. … I always represented myself as a computer scientist, mathematician, researcher-doing-medicine … [things] considered mainstream conventional medicine.
>
> Biogerontology was fringe, okay? I no longer would have felt compelled if I were applying to medical school today, 25 years later, to hide that information, because I think it's a more accepted mainstream conventional medicine component, although not fully. … So yeah, that was my biggest challenge, how to pursue biogerontology and medicine at the same time, and I did that by concealing my real interest and secretly reading all the papers in biogerontology while I was going to medical school. (S25)

Over the course of a few decades, biogerontologists found that they had moved from occupying a "fringe" position to one of moderate, if not high, regard. (For a detailed account of the history of biogerontology as a field, see Fishman et al., *this issue*.) The words of this scientist reveal how much the experience of biogerontologists had changed:

> [L]et's go back to say the 1970s and 1980s … And I don't mean to belittle the few people who were doing work in the field, but [the field] was probably not taken seriously by serious scientists, and it would be difficult to get a job at universities studying [the] biology of aging. You just wouldn't be seen as doing something of any intellectual worth. That changed *not* because people became enlightened. It changed because a few people actually went out and did the experiments and said, "Look, you can study this thing. You know we don't have to be frightened about studying aging. It's a real process that you can find genetic mutants in which the rate is altered" and

> so on. So it took those people you know a few experiments and a few labs … to change the way in which it was perceived … By 1995 you had prominent scientists, biologists who were taken seriously for studying other things were drawn to aging research, mainly in C. elegans and then yeast and then in flies. … [A]nd then the field looked much more serious to outsiders and to other people, and that combined with getting funding to start doing some biology of aging, that was a huge change. (S32)

Despite these advances in the broader field of biogerontology, each scientist must come to terms with how what he or she does can—and cannot—be construed as "anti-aging" research. Asked whether "anti-aging research" appropriately characterizes their individual research, over half (51%) of the scientists responded with a definitive "no." The dominant reason for rejecting this label relates to the tarnished reputation of the field. Individual scientists took pains to simultaneously disassociate themselves from this blemished history and emphasize the scientific rigor of their research.

"Us" versus "Them": Creating Social Distance by Othering

One way for biogerontologists to create psychological and social distance from the people and groups associated with "anti-aging" is to sort their world in terms of people like "us" or "them." Scientists establish their authority by making it clear that they are not connected to "those people" who are capitalizing on the vulnerability of others. Scientists repeatedly cited the creation of the anti-aging industry and the rise of consumerism for anti-aging products as reasons for not framing their research as "anti-aging":

> Is "anti-aging" medicine an appropriate term to begin with? Now that's a different question. The answer to that would be definitively no. "Anti-aging" implies that you're against aging … I'm not against aging and I'm not against old people, which is what that also implies. But is it appropriate for what I do in evaluating an industry that is out there? Absolutely. Of course, 'cause that's what they call themselves. (S2)

> The model of [anti-aging medicine] is cosmetic, clinical medicine with a goal to make a lot of money, which I don't mind, but I don't think it's right in the sense that … customers are not getting what they think they're getting. They're not getting anti-aging stuff; they're getting cosmetics that are going to make them look better for the most part. And some of what they do, as I understand it, you know growth hormone treatments is actually anti-longevity, and so I think it's a sorry game. (S36)

There are some researchers whose responses suggest that the conspicuous lack of an "anti-aging" specialization within the American Medical Association (AMA) sends an important message. Biogerontologists demonstrate their distance and solidarity by voicing collective opposition to organizations and individuals deemed fraudulent.

> [The] American Board of whatever it's called that evaluates the subspecialties within the field of medicine: there isn't [a specialty] called "anti-aging medicine." So you have a subgroup of docs who have developed themselves this sub-discipline which, when you look at what they actually do is really nothing more than repackaged preventive medicine … and so the public … they get this mixed message. They have somebody with an MD telling them, "I can slow your aging process. If you take this hormone and these antioxidants and take these tests, I can measure how old you actually are biologically." They don't know that this stuff isn't true. They don't know that this field of "anti-aging medicine" is built on a mirage. (S2)

> Anti-aging I think feeds too well into the commercialization of the cosmetic industry and of doctors who can make money by promoting anti-aging, because they therefore don't have to go through the usual insurance roots, and given the constraints in income

> that physicians are facing, it's a very attractive field, but it's not an established specialty. (S28)

The lack of an established specialty in the AMA is notable because it particularly undermines the legitimacy of those who claim to practice "anti-aging" medicine. The group routinely cited as exploiting aging for profit is the American Academy of Anti-Aging Medicine (A4M). The A4M is viewed by most of the biogerontologists we interviewed as the antithesis of rigorous scientific research and good professional ethics (for a discussion of A4M's controversial relationship to the field of biogerontology, see Fishman et al., *this issue*). This schism not only reflects oppositional viewpoints on the potentials of and treatments for longevity, but the A4M becomes the single most important target of biogerontologists in staking their claim as the authorities on the "real" science of aging. For example:

> Well the term has been used by charlatans. There's an anti-aging, you know what they call A4M … and I have absolutely abysmal view of that group. You know I think it's for the most part … quack medicine. … And so that term is tainted. … I don't like the fact that people take advantage of human suffering and offer up, you know, quack remedies, snake oil remedies and take advantage of people. I find that very distasteful and troubling. (S17)

> By overselling their research and by starting companies that may have some eventual product, but which they have to basically oversell in order to get investors to participate in, and in many cases even the sort of bad boys [of] anti-aging research … really have nothing to offer, but are just soaking the general public, taking money in what in my mind is in a fraudulent strategy by promising things that they have never demonstrated can really occur. And there I'm really thinking about A4M and people of that ilk who really have no real research agenda or research results, but don't hesitate to bring in several billions of dollars a year in their anti-aging medications. (S1)

Despite these frustrations, not all respondents resist framing their research in "anti-aging" terms. In fact, 37 percent (16) of our sample said their research could at least partially be described as "anti-aging." Much like those who immediately rejected the term, these scientists opposed the association with the "anti-aging" industry and distanced themselves from organizations such as the A4M. They conceded, however, that their work could ultimately and accurately be classified as "anti-aging":

> Yeah, I think it is okay to use that term. It has a little bit of a negative association in terms of this A4M unit … So I don't like that association, but overall, I think that's really what we are doing. (S1)

> Well I think it's kind of been hijacked by people that I would rather it hadn't been hijacked for, but I do think, I think as a descriptive term, I think it does get at, you know, what we would like to do. I just don't like the way it's used often now. (S5)

Because NIA stands as the legitimate authority on aging research, it is interesting to note its own reservation, if not refusal, to use the term of "anti-aging." Yet scientists themselves note that the stated goals of NIA—which are about improving the health and functional status of the population—are, in effect, about "anti-aging":

> Well the NIA doesn't particularly like the word "anti-aging." … It hearkens back, as I said, a little bit too much to this old idea that you could develop some secret formula and, you know, slow down or stop aging. So it had kind of a bad name to it. So the NIA doesn't use that term, but in fact the NIA's congressional mandate is to study and try to address the problems associated with aging. So even though we don't like the term, well that's what we're doing. (S4)

The biogerontologists we interviewed emphasize their role and status as basic scientists trying to understand basic processes of aging. At the same time, many of these scientists do pin their research aims on the hope that the knowledge that results will lead to interventions that improve the aging process—by reducing disease and disability, or by maintaining function or improving quality of life. In acknowledging this important connection between science and application, scientists express aspirations that are, at least on the surface, consonant with the mission of NIA. But they are also hesitant to make this connection too strongly, for if they do, it becomes difficult to maintain their emphatic stance that what they are doing is *not* about "anti-aging"—*especially* if "aging" is taken to include age-associated diseases and disabilities. As one interviewee put it:

> If you restrict the term aging to the fundamental biology of aging, then [those who use the phrase "anti-aging" are] totally wrong, because one can say today with absolute authority that we know of no way, absolutely no way, to manipulate the fundamental aging process in humans, period. But if you include in the definition of aging age-associated diseases, then what I said is wrong, and that's where the rub exists…And that's critical. (S6)

Defending the Scientific Rigor of Their Research

In addition to distancing themselves from groups and people deemed "non-legitimate," scientists make considerable efforts to explain that the work they do is, above all else, pure and rigorous science. The most important function of such efforts is to lend legitimacy to themselves and biogerontology:

> The problem is … there are these anti-aging medicines that are really just, they're nothing, you know. They're just potions … and those have been called anti-aging. So the word is a little bit tarnished. … but we do serious science. … You can call it whatever you want really. It's still good science. (S41)

> And you know the discipline that I feel that we're studying is a very rigorous discipline. It's based on very good statistical methods and basic science and genetics, and it *is* anti-aging science, but it doesn't have the connotation of anti-aging medicine or whatever … (S40)

In emphasizing the priority of understanding basic processes of aging, biogerontologists divorce their work from the negative connotations of "anti-aging" in both public and professional spheres. Doing this also reaffirms scientific opposition to industry—whereby *science* is presented as a noble and benevolent practice for common good, while *industry* is about consumption, profit, and personal gain. For example:

> I got up in front of the A4M one time and made the statement, "There is no such thing as anti-aging medicine, at least not today," and they only heard the first part of my sentence and not the second half, and so there was a lot of boos and hissing because they had already paid their money to register for the conference on the false assumption that there was anti-aging medicine and they were going to learn what it was and they were going to go back and deal with their patients and make a lot of money. So that's an example of how *business interests can contaminate science*, and the A4M people tend to be pretty much on the business side and pretty unscrupulous when it comes to making claims. (S25)

Another problem with industry is that it jumps ahead of the science—using preliminary scientific findings to make claims that are not yet definitive or are overgeneralized. The key issue is not profit *per se* but instead the irresponsible use of good science:

> I mean until recently you didn't really see the misuse of this kind of information, until the rise of this anti-aging industry. It just wasn't that common. But now, you know,

> somebody comes up with a study saying some particular vitamin or mineral does, you know, A, B or C, it's immediately, somebody immediately creates a pill containing it, selling it to the public saying there's scientific evidence to support that, you know, it has some influence on this or that disease or disorder, when there isn't evidence to support that. (S2)

In stressing their commitment to "good science," biogerontologists actively promote an image of a field aimed first and foremost at improving knowledge—and ultimately at improving health and function. For most, this makes clear from the start their distance from commercialized medicine and industry. Their role as scientists is to generate knowledge, which is wholly separate from what others might then do with it. While a few respondents expressed interest or are already involved in commercial ventures, the dominant view cautioned against premature translation of study results into products. As one scientist warned:

> [O]ne of the biggest problems in aging research right now is the tendency for researchers like me to get hooked into marketing sort of strategies… by starting companies that may have some eventual product, but which they have to basically oversell [research] in order to get investors to participate … but are just soaking the general public, taking money in what in my mind is in a fraudulent strategy by promising things that they have never demonstrated can really occur. (S1)

"Selling out" threatens the very legitimacy these scientists have worked so hard to build and maintain. Indeed, the commercialization of scientific knowledge "taints" the valor of scientific research:

> [M]ost of my colleagues to a degree are the people that promote you know dietary supplements as anti-aging and that type of thing, and it may not be doing any harm, but … I'm from the old school, I guess, and I'm old enough that on these things I believe we should focus on our research, and it still bothers me, I know this is a dinosaur's view, I guess, but I have some difficulty with patenting things. (S1)

The notion of science as a benevolent enterprise serving the greater good is contrasted with the self-serving nature of industry. In clearly demarcating the lines that separate scientific advances from the commercialization of those advances, these scientists reinforce an image of themselves as being engaged in the pure and rigorous pursuit of knowledge. But this strict separation of science and industry leaves them in a difficult position, for these scientists must rely on industry if they are to achieve their ultimate goals of improving the health of individuals and populations.

Given the strong resistance of the scientists we interviewed to the "anti-aging" label, it is surprising that there has been no significant collective effort by biogerontologists to offer a more acceptable and agreed-upon term for their field. When scientists are asked to provide an alternative, their answers illustrate this lack of unity. The dominant response is "aging research" or, more specifically, "biology of aging" research. Other variations on this theme include expressions such as "age-related physiology," "gerontological research," "aging intervention," "interventive gerontology," and "geroscience." Some use more specific terms like "prolongevity" and "longevity science." A few employ disease-related terminology, such as "anti-neurodegenerative disease," while others emphasize health, using "health span" and "health extension."

Regardless of the specific terms that our scientists suggest, most struggle to find a term as descriptive and accessible as "anti-aging," but less volatile. One respondent explained, "I'm not so fiercely against it that if it does become common to use 'anti-aging medicine' to refer to *real* science, I'd be happy to adopt it myself" (S30). Some even defend the term "anti-aging" because they feel it is an appropriate label for their work; avoiding the term simply because

undesirable others also use it is to do biogerontologists a disservice because it should be reclaimed for legitimate scientists. For example:

> [A] lot of researchers don't like to say, "Oh I'm doing anti-aging medicine," because when you say that, people will sort of lump you together with hucksters and con artists who are trying to sell potions to gullible people who'd like to stop aging. So it's a term that has a sort of distasteful smell to it, but *it's a good term*, if you sort of ignore that problem. But yeah, we're trying to—I'm trying to, and I think a lot of us are trying to— work out ways to slow aging. (S11)

> That kind of hokum [the peddling of "pills, potions, and powders"] has been with us for eons and has made it that much harder to acclimate the public and serious thought leaders to the reality that possible intervention and modification of aging is the stuff of real science and may be the reality of science and technology in our lifetimes. (S30)

While there is tacit acknowledgement that scientists have many of the same interventional goals as anti-aging medicine, this association is unsavory and distasteful.

Objects of Objection: How Scientists Manage Opposition to "Anti-Aging" Research

In addition to facing challenges that relate to the legitimacy of their research, biogerontologists also face ethical, political, religious, and other types of objections to conducting "anti-aging" research (see also Post & Binstock, 2004). How do individual scientists frame their research in anticipation of these objections or actively confront these objections as they conduct their research?

The Sacred Laboratory: Naturally Isolated or Actively Protected

Given the charged nature of the field, it is surprising that over a third of scientists indicate that they do *not* personally encounter such objections. While scientists are aware of the controversies about anti-aging research that exist in the world outside, these controversies generally do not penetrate their laboratory walls. The laboratory is and must remain an isolated space in which basic science can happen. Because of the isolated nature of research in biogerontology, it is no surprise that, when biogerontologists do encounter objections to their research, a common reaction is to simply ignore them and plow ahead with their work. (This strategy is mentioned by about a fifth of interviewees.) Science is about discovery, and discovery should not be impeded. Objections are dismissed as unworthy of defense, either because they are deemed far-fetched or because scientists do not consider it their job to respond. In the words of these two scientists:

> [Y]ou know, there's a whole spectrum of these objections. In my experience, though, they are good dinnertime conversation, but they're not really worthy of taking time to write a monograph or address in a more serious way, because I've never considered them serious objections. (S17)

> I just stay out of those arguments. It's just a lot of brow beating. I mean you know why just not put a man on the moon because you know it's a big piece of cheese anyway. I mean we're just going to do it. It's there; we're going to do it. (S18)

For the remainder, and even for those scientists who would prefer to ignore any objections, a key strategy is to frame their research in ways that either minimize or directly confront objections. Specific objections sometimes demand specific responses—and scientists are equipped with an arsenal of arguments to deploy as needed. We now turn to a handful of the most common arguments raised in interviews.

Anti-Aging Science as Pro-Health not Anti-Death

The most common objection is that the goal of anti-aging research is to push human longevity to its limits, and to even achieve immortality. A related concern is that anti-aging research will increase senescence; that is, extending life span also extends what we might call "sick span"—years of illness, disease, and frailty. In response to these objections, scientists argue that anti-aging research is ultimately about improving health. More specifically, it is about ensuring long and vigorous lives that are concluded with a short period of decline, followed relatively swiftly by death—what Fries (1980/2005) called the "compression of morbidity." For example:

> I think the primary goal of biological research and gerontological research and aging research should be the maintenance of function…to be 85 years old and to have very little disease and to have sustained function. So we have healthy 85-year olds who die a couple of months later, hopefully mowing the grass or running around the block or something like that. (S15)

> [The goal] is to improve human health as individuals age, or to rectangularize the life span curve. People should be healthy up until the time they keel over dead. (S26)

In handling objections about the extension of life and illness, scientists reframe these concerns by making positive arguments about eliminating disease—creating comparisons to research on cancer or Alzheimer's disease, or suggesting that anti-aging research is actually anti-disease research:

> [T]he people that raise this critique have never really thought it through very clearly. You would ask them, "Well if you are worried that people are staying healthy too long, one good way to prevent that would be to not allow anyone to take insulin. Is that okay with you?" and generally they say, "No, insulin is good for people. It helps them not die of diabetes." You can ask them would they be in favor then removing seatbelts from cars, because seatbelts help people live a lot longer, and generally they're in favor of seatbelts and insulin and open-heart surgery to save babies' lives and all of that stuff … and they're willing to be operated on by someone who is using drugs for their operation developed through research, it's clear that they don't have a rational reason for wanting to be against research to keep people healthy, which is what anti-aging research is about. (S11)

Extending life span may be an admirable and ambitious goal for biogerontologists—but this is not a goal that most scientists say should be pursued at the expense of health. Still, any discussion of extending life span or health span, especially to its limits, can evoke moral and ethical objections from the public and policy-makers. Extreme goals are not part of the NIH mission and culture. Indeed, most scientists argue that the interventional goals of biogerontologists will result in only modest and incremental effects on life span.

What is "Natural" is Not the Same as Desirable

Another common objection is that anti-aging research and interventions go against nature - that is, scientists should not be meddling with or attempting to alter what are *natural* processes of life, health, and death. In response, scientists often raise examples related to the ways in which most people rely on medicine, even daily, to maintain health and prevent disease, especially through the routine use of immunizations and prescriptions for a wide range of chronic health conditions and diseases. They also make arguments about serious life-threatening conditions that are difficult for even the toughest critics to counter:

> You know it's like saying, "Heart disease is natural or Alzheimer's disease is natural or Parkinson's disease is natural. We don't want to interfere in those things." … I mean they're miserable positions and they impact human existence in major ways and you want to alleviate that—just the same as … the loss of muscle mass and … your

> general susceptibility to infection. All these things are … natural, in a sense, but they are things which are not desirable … It's a strange argument for people to say, "You should have cancer." …Why would you say that? (S21)

Not surprisingly, when objections related to "nature" or "natural processes" emerge in scholarly or public debate, religion often plays a role. Religion is among the most challenging forces with which scientists must contend, or at least be prepared for. This is especially true for those few scientists who are in the public spotlight and hold more extreme views on life span extension and related scientific issues. As this scientist describes:

> I'm not one who shrinks from speaking my mind. … I have debated creationists in front of you know 4,000 or 5,000 creationists baying for my blood and I've not held back. … I mean I've yet to be physically assaulted, but I will tell you that on that occasion I had a police escort. (S34)

The World's Problems are Not the Doing of Biogerontologists

To dismantle concerns about population growth and resource competition with too many old people in the world and a host of associated social problems, biogerontologists especially point to the fact that phenomena of the kinds noted above have little or nothing to do with biogerontologists. These problems would otherwise be occurring and should not inhibit or interfere with scientific progress. For example:

> [People say,] "You must stop what you're doing. It's unethical because we already have a population explosion." It's sort of a reflex. This objection … comes up in virtually any small group that you tell you're doing aging research … population explosion and all the problems [of] resource over-utilization and the enormous number of poor under-serviced people, all of this has come to pass without any contributions in biogerontology at all. (S11)

> [A] number of people have concerns about fairness and distribution: Who is this going to be available to? Is there some sort of just way to distribute it? … I think that's a legitimate thing, but I don't think there's anything in that to justify not doing the research, you know. …just because you can't provide something for everyone, that's no reason not to provide it for some … Because you couldn't save everybody on the Titanic, it doesn't mean that you don't try to save whoever you can save. (S5)

To strengthen these arguments and justify their research, scientists often evoke reminders of how dramatically mortality and morbidity improved during the last century:

> I sometimes point out the parallel with the situation 100 or so years ago when we figured out that hygiene could actually save rather a lot of lives of infants. You know, we could have said to ourselves, "Oh dear, there will be terrible overpopulation if we save all these lives with everybody having 10 kids. Let's not do it. Let's carry on letting these infants die." But we didn't do that… to deny that saving lives is a good thing, it's not something that most people are willing to say. (S8)

Health Creates Wealth

Finally, it is common for scientists to be met with objections anchored in fear about both overpopulation and competition for limited resources. It is therefore not surprising that economic arguments figure heavily into the repertoire of responses. To reduce or dismiss projections of doom-and-gloom in these areas, scientists point to the fact that the better health of individuals makes for a healthier society—and a healthier society in turn makes for a wealthier society. Improving health over years, or *with* years, means that old people will strengthen the workforce and economy, especially through productivity and consumption:

> [H]ealth actually is creative of wealth, and not only … by having a more robust, healthy, better educated workforce, because if you're healthy, you could attend school, etc., but also just as we had a youth market, there's an old person's market … [which will] generate more income for society, more productivity. (S28)

Conclusion

This paper brings a fresh perspective to scholarship on anti-aging science: the experiences of *individual scientists* as they entered and navigate a controversial field. The struggle to obtain professional and public validation is hardly the exclusive domain of biogerontologists. For the time being, however, many of the biogerontologists we interviewed felt they faced unique challenges, relative to other natural scientists, in fighting battles to get research funded, in being understood by the public, and in gaining the respect of other scientists. They also face different data-related challenges. In the absence of clear evidence that the biology of *human* aging can be mapped using molecular or genetic technologies (as opposed to other species, for which there is evidence), biogerontologists find themselves in a precarious position in not yet having hard evidence to back up claims related to human aging. Many think, however, that the human translation of models developed on other species is not far off and is largely hindered by the need for improved technology and the ethical challenges posed in conducting research with human subjects. Overcoming these barriers, they say, will likely change their circumstances.

In the end, so much is at stake for these scientists. Some of what is at stake are the everyday rewards of doing science—recognition in the field, teaching and mentoring, and collaboration with other scientists. So, too, are the very things that led them to the field in the first place—the puzzles of aging, the quest for discovery, and the premium placed on curiosity. Most of all, what is at stake are one's personal contributions to science and, indeed, scientific progress. Science is often pitched as being about improving the common good while commercialized medicine and industry are pitched as being about private gain. This black-and-white rhetoric is overly simplistic, for these scientists also have much to gain privately. True, the battles scientists fight on the "front line of defense," to use Vincent's (2003, p. 678) phrase, help legitimize the field. But every battle won ultimately improves their personal statuses, resources, and careers. Many scientists wonder whether it is even proper for scientists to intervene into the aging process. But it would seem far better for scientists to begin taking an active role in determining how knowledge is being applied than passively leave it to others and be angered by it. This seems necessary if biogerontologists truly want to make good on their claim that science is about the *common* good.

Acknowledgments

The authors wish to acknowledge the assistance of the other members of our research team—Robert Binstock, Jennifer Fishman, and Marcie Lambrix. The lead author would also like to thank Molly Trauten for her editorial comments. This research was supported by a grant from the National Institute on Aging (2 RO1 AG020916-04A1), "Controlling Human Aging: Alternative Rationales and Implications," Eric T. Juengst, Principal Investigator.

References

Charmaz, K. Grounded theory in the 21st century: Applications for advancing social justice research.". In: Denzin, NK.; Lincoln, YS., editors. The Sage Handbook of Qualitative Research. Vol. 3rd ed. Thousand Oaks, CA: Sage Publications; 2005. p. 507-536.

Fishman JR, Binstock RH, Lambrix MA. Anti-aging science: The emergence, maintenance, and enhancement of a discipline. Journal of Aging Studies. (this issue) insert volume, insert page numbers

Fries JF. The compression of morbidity. The Milbank Quarterly 2005;83(4):801–823. [PubMed: 16279968][1983]

Gruman, GJ. A history of ideas about the prolongation of life. New York: Springer Publishing Company; 2003.

Hall, SS. Merchants of immortality: Chasing the dream of human life extension. Boston: Houghton Mifflin Company; 2003.

Huberman, M.; Miles, M. The qualitative researcher's companion. Thousand Oaks, CA: Sage Publications; 2002.

Juengst ET, Binstock RH, Mehlman MJ, Post SG. Antiaging research and the need for public dialogue. Science 2003;299:1323. [PubMed: 12610284]

Olshansky, SJ.; Carnes, BA. The quest for immortality: Science at the frontiers of aging. New York: Norton; 2001.

Post, SG.; Binstock, RH. The fountain of youth: Cultural, scientific, and ethical perspectives on a biomedical goal. New York: Oxford University Press; 2004.

Vincent J. What is at stake in the "war on anti-ageing medicine"? Ageing & Society 2003;23:675–684.

Vincent J, Tulle E, Bond J. Journal of Aging Studies. (this issue), insert title, insert volume, insert page numbers