

Supp. Table S1. Germline mutations of the Gs-alpha encoding GNAS gene

Mutation ^a	Predicted Effect on Protein	Mutation Type ^b	Phenotype ^c	Reference	Original designation
Exon 1					
c.1-10_2del	p.(?)	fs	PPHP	[Elli et al., 2013b]	c.1-10_2del
c.1A>G	p.(M1?)	ms	PHPIA, PPHP	[Patten et al., 1990]	codon 1 (ATG→GTG)
c.1A>G	p.(M1?)	ms	AHO	[Aldred et al., 2000b]	c.1A>G
c.1A>G	p.(M1?)	ms	PHPIA, PPHP	[Klaassens et al., 2010]	c.1A>G
c.2T>G	p.(M1?)	ms	PPHP	[Long et al., 2007]	c.2T>G
c.3G>A	p.(M1?)	ms	PPHP	[Puzhko et al., 2011]	c.3G>A
c.3G>A	p.(M1?)	ms	PHPIA	[Fernandez-Rebollo et al., 2013]	c.3G>A
c.7T>C	p.(Cys3Arg)	ms	PHPIA, PPHP	[Alves et al., 2013; Elli et al., 2013b]	Cys3→Arg
c.21dupT	p.(Lys8*)	fs	PHPIA	[Germain-Lee et al., 2003]	21insT
c.21dupT	p.(Lys8*)	fs	PHPIA, PPHP	[Long et al., 2007]	c.21insT
c.21dupT	p.(Lys8*)	fs	PHPIA	[Elli et al., 2013b]	c.21_22insT
c.34C>T	p.(Gln12*)	ns	POH	[Eddy et al., 2000]	Q12X (CAG→TAG)
c.34C>T	p.(Gln12*)	ns	PHPIA (2 kindreds)	[Fernandez-Rebollo et al., 2013]	c.34C>T
n/a (del6ins14)	n/a	fs	PHPIA	[Freson et al., 2008b]	codon 24-25 replaced by 14bp
c.77T>A	p.(Ile26Asn)	ms	PHPIA	[Long et al., 2007]	c.77T>A
c.83dupA	p.(Gln29Alafs*25)	fs	PHPIA	[De Sanctis et al., 2003]	c.83-84insA
c.85C>T	p.(Gln29*)	ns	PHPIA (2 kindreds)	[Germain-Lee et al., 2003]	85C>T
c.85C>T	p.(Gln29*)	ns	PHPIA, PPHP (3 kindreds)	[Long et al., 2007]	c.85C>T
c.85C>T	p.(Gln29*)	ns	PHPIA	[Nwosu et al., 2009]	nt85C>t
c.85C>T	p.(Gln29*)	ns	POH/ PHPIA	[Lebrun et al., 2010]	c.85C>T
c.85C>T	p.(Gln29*)	ns	POH (2 kindreds)	[Lebrun et al., 2010]	c.85C>T
c.85C>T	p.(Gln29*)	ns	PHPIA, PPHP (3 kindreds)	[Elli et al., 2013b]	c.85C>T
c.85C>T	p.(Gln29*)	ns	OC	[Elli et al., 2013a]	c.85C>T
c.85C>T	p.(Gln29*)	ns	PHPIA	[Fernandez-Rebollo et al., 2013]	c.85C>T
c.85C>T	p.(Gln29*)	ns	PHPIA	[Cho et al., 2013]	c.85C>T
c.85C>T	p.(Gln29*)	ns	PHPIA	[Wu, Y. L. et al., 2014]	c.85C>T
c.91C>T	p.(Gln31*)	ns	AHO	[Aldred et al., 2000b]	c.91C>T
c.91C>T	p.(Gln31*)	ns	PHPIA, PPHP	[De Sanctis et al., 2003]	c.91C>T
c.91C>T	p.(Gln31*)	ns	PHPIA (2 kindreds)	[Fernandez-Rebollo et al., 2013]	c.91C>T
c.93delG	p.(Lys32Argfs*26)	fs	PHPIA	[Thiele et al., 2010]	c.93delG
c.94A>T	p.(Lys32*)	ns	PHPIA, PPHP	[Park et al., 2010]	c.94A>T
c.94A>T	p.(Lys32*)	ns	PHPIA	[Cho et al., 2013]	c.94A>T
c.97G>A	p.(Asp33Asn)	ms	PHPIA	[Elli et al., 2013b]	c.97G>A
c.103C>T	p.(Gln35*)	ns	PHPIA	[Germain-Lee et al., 2003]	103C>T
c.103C>T	p.(Gln35*)	ns	PHPIA	[Long et al., 2007]	c.103C>T
c.103C>T	p.(Gln35*)	ns	PHPIA, PPHP	[Kacerovska et al., 2008]	c.103C>T
c.103C>T	p.(Gln35*)	ns	PHPIA	[Freson et al., 2008b]	Q35X
c.103C>T	p.(Gln35*)	ns	PHPIA, PPHP	[Klagge et al., 2010]	103C>T

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c.103C>T	p.(Gln35*)	ns	PHPIA (3 kindreds)	[Elli et al., 2013b]	c.103C>T
c.103C>T	p.(Gln35*)	ns	PHPIA	[Wu, Y. L. et al., 2014]	c.103C>T
c.110delA	p.(Tyr37Serfs*21)	fs	PHPIA	[Elli et al., 2013b]	c.110del
c.111C>G	p.(Tyr37*)	ns	AHO	[Aldred et al., 2000b]	c.111C>G
c.112delC	p.(Arg38Glyfs*20)	fs	PHPIA, PPHP	[Mantovani et al., 2000]	codon 38, delC
c.112delC	p.(Arg38Glyfs*20)	fs	PHPIA	[Elli et al., 2013b]	c.112del
c.115delG	p.(Ala39Profs*19)	fs	AHO	[Aldred et al., 2000b]	c.115delG
c.119_139+17del38	p.(?)	sp	PHPIA, PPHP	[Fischer et al., 1998]	exon 1/ intron 1, del38
c.124C>A	p.(Arg42Ser)	ms	PHPIA	[Fernandez-Rebollo et al., 2013]	c.124C>A
c.124C>T	p.(Arg42Cys)	ms	AHO	[Aldred et al., 2000b]	c.124C>T
c.125G>T	p.(Arg42Leu)	ms	PHPIA	[Balavoine et al., 2008]	R42L
c.136_138dupCTG	p.(Leu46dup)	if	PHPIA	[Lim et al., 2002]	codon 47, insCTG
c.136_138dupCTG	p.(Leu46dup)	if	PHPIA	[Fernandez-Rebollo et al., 2013]	c.136_138dup
Intron 1					
c.139+1G>C	p.(?)	sp	PHPIA	[Alvarez et al., 2010]	139+1G>C
c.139+1G>C	p.(?)	sp	POH	[Lebrun et al., 2010]	c.139+1G>C
n/a	p.(?)	sp	PHPIA	[Elli et al., 2013b]	c.139+1T>A ^d
c.140-12_211inv84	p.(?)	sp	PHPIA	[Fernandez-Rebollo et al., 2008]	inversion nt 56904042-56904139
Exon 2					
c.144dupT	p.(Gly49Trpfs*5)	fs	AHO	[Aldred et al., 2000b]	c.144-145insT
c.150dupA	p.(Ser51Ilefs*3)	fs	PHPIA, PPHP	[Ahrens et al., 2001]	codon 51, insA(GAA TCT→GAAATC)
c.188_189delITG	p.(Leu63Profs*3)	fs	PHPIA, PPHP	Authors unpublished data [§]	
c.191A>T	p.(His64Leu)	ms	PHPIA	[Long et al., 2007]	c.191A>T
Intron 2					
c.212+3_+6delAAGT	p.(?)	sp	PHPIA	[De Sanctis et al., 2003]	IVS2 +3_6delAAGT
c.212+3_+6delAAGT	p.(?)	sp	POH	[Long et al., 2007]	c.212+3delAAGT
c.212+3_+6delAAGT	p.(?)	sp	PHPIA	[Elli et al., 2013b]	c.212+2_+6del
Exon 3					
c.254dupA	p.(Asp85Glu fs*3)	fs	PHPIA	[Thiele et al., 2007]	codon 85, insA
Intron 3					
c.257+1G>A	p.(?)	sp	PHPIA	[Elli et al., 2013b]	c.257+1G>A
c.258-2A>G	p.(?)	sp	AHO	[Ringel et al., 1996]	A→G (intron 3 acceptor sp)
Exon 4					
c.265delG	p.(Ala89Glnfs*11)	fs	PHPIA	[Ishikawa et al., 2001]	codon 88, delG
c.269_272delCCAA	p.(Thr90Lysfs*9)	fs	PHPIA, PPHP	[Lingart et al., 2002]	codon 89/90, delCAAC
c.275T>A	p.(Val92Glu)	ms	AHO	[Aldred et al., 2000b]	c.275T>A
c.278_312+8del43	p.(?)	sp	AHO	[Luttikhuis et al., 1994]	exon4/ intron4 del43
c.292_294delAAC	p.(Asn98del)	if	AHO	[Weinstein et al., 2001]	Asn98del
c.292_294delAAC	p.(Asn98del)	if	PHPIA	[Long et al., 2007]	c.292-294del

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c.296T>C	p.(Leu99Pro)	ms	AHO	[Miric et al., 1993]	Leu99Pro (T→C)
c.302_303delAG	p.(Glu101Glyfs*3)	fs	PHPIA, PPHP	[Yu, D. et al., 1999]	codon 100/101, delAG
c.305C>A	p.(Ala102Glu)	ms	PHPIA, PPHP	[Ahrens et al., 2001]	codon 102 (GCG→GAG)
c.305C>A	p.(Ala102Glu)	ms	PHPIA	[Pinsker et al., 2006]	c.305C>A
c.305C>A	p.(Ala102Glu)	ms	PHPIA	[Elli et al., 2013b]	c.308C>A
c.305C>T	p.(Ala102Val)	ms	PHPIA, PPHP	[Ahrens et al., 2001]	codon 102 (GCG→GTG)
c.308T>C	p.(Ile103Thr)	ms	AHO	[Aldred et al., 2000b]	c.308T>C
c.308T>C	p.(Ile103Thr)	ms	PHPIA	[Lim et al., 2002]	I103T
c.308T>C	p.(Ile103Thr)	ms	PHPIA	[Elli et al., 2013b]	c.311T>C
Intron 4					
c.312+5G>A	p.(?)	sp	PHPIA	[Lietman et al., 2008]	IVS4+5G→A
c.312+5G>A	p.(?)	sp	PHPIA	[Fernandez-Rebollo et al., 2013]	c.312+5G>A
c.313-11A>G	p.(?)	sp	PHPIA	[Rickard et al., 2003]	IVS4 -11A→G
Exon 5					
c.317T>C	p.(Ile106Thr)	ms	PHPIA	[Reis et al., 2010]	c.673T>C, I106T ^d
c.317T>G	p.(Ile106Ser)	ms	PHPIA	[Riepe et al., 2005]	c.364T>G, Ile106Ser (ATT→AGT) ^d
n/a (ins21)	n/a	if	PHPIA	[Freson et al., 2008b]	codon 110, ins 21 bp
c.330G>C	p.(Met110Ile)	ms	PHPIA	[Fernandez-Rebollo et al., 2013]	c.330G>C
c.343C>T	p.(Pro115Ser)	ms	PHPIA	[Ahmed et al., 1998]	codon 115 (CCC→TCC)
c.343C>T	p.(Pro115Ser)	ms	PHPIA	[Savas Erdeve et al., 2010]	Pro115Ser (CCC→TCC)
c.343_344insT	p.(Pro115Leufs*25)	fs	PHPIA	[Inta et al., 2014]	codon 115 CCC→CTCC
c.344C>T	p.(Pro115Leu)	ms	PHPIA, PPHP	[Ahrens et al., 2001]	codon 115 (CCC→CTC)
c.344C>T	p.(Pro115Leu)	ms	PHPIA, PPHP	[De Sanctis et al., 2003]	c.344C>T
c.344_345insT	p.(Val117Argfs*23)	fs	POH	[Shore et al., 2002]	344-345insT
c.344_345insT	p.(Val117Argfs*23)	fs	PHPIA	[Park et al., 2010]	c.344-345insT
c.344_345insT	p.(Val117Argfs*23)	fs	POH	[Lebrun et al., 2010]	c.345-346insT ^d
c.344_345insT	p.(Val117Argfs*23)	fs	PHPIA	[Elli et al., 2013b]	c.347_348insT
c.344_345insT	p.(Val117Argfs*23)	fs	PHPIA	[Cho et al., 2013]	c.344_345insT
c.348delC	p.(Val117Trpfs*16)	fs	PHPIA	[Shapira et al., 1996]	codon 116, delC
c.348delC	p.(Val117Trpfs*16)	fs	PHPIA	[Mantovani et al., 2000]	codon 116, delC
c.348delC	p.(Val117Trpfs*16)	fs	AHO	[Aldred et al., 2000b]	c.348delC
c.348delC	p.(Val117Trpfs*16)	fs	PHPIA	[Lim et al., 2002]	codon 115, delC
c.348delC	p.(Val117Trpfs*16)	fs	POH (2 kindreds)	[Shore et al., 2002]	348delC
c.348delC	p.(Val117Trpfs*16)	fs	PHPIA, PPHP	[De Sanctis et al., 2003]	c.348delC
c.348delC	p.(Val117Trpfs*16)	fs	PHPIA	[Fernandez-Rebollo et al., 2013]	c.348delC
c.348dupC	p.(Val117Argfs*23)	fs	PHPIA (2 kindreds)	[De Sanctis et al., 2003]	c.348-349insC
c.348dupC	p.(Val117Argfs*23)	fs	PHPIA (2 kindreds)	[Jin et al., 2011]	c.348-349insC
c.348dupC	p.(Val117Argfs*23)	fs	PHPIA (3 kindreds)	[Elli et al., 2013b]	c.351dup

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c.348_349insT	p.(Val117Cysfs*23)	fs	PHPIA	[de Sanctis et al., 2004]	c.348-349insT
c.355delC	p.(Leu119Trpfs*14)	fs	PPHP	[Schimmel et al., 2010]	c.355delC
c.360delC	p.(Asn121Thrfs*12)	fs	PHPIA	[Elli et al., 2013b]	c.363del
c.366delC	p.(Glu123Argfs*10)	fs	PHPIA, PPHP	[De Sanctis et al., 2003]	c.366delC
c.395T>C	p.(Leu132Pro)	ms	AHO	[Aldred et al., 2000b]	c.395T>C
c.419_420delTT	p.(Phe140*)	fs	PHPIA	[Elli et al., 2013b]	c.421_422del
c.420dupT	p.(Asp141*)	fs	PHPIA, PPHP	[Ahrens et al., 2001]	codon 140, insT(TTT GAC→TTTTGA)
c.432delC	p.(Glu145Asnfs*27)	fs	PHPIA, PPHP	[Linglart et al., 2002]	del C432
Intron 5					
c.432+1G>A	p.(?)	sp	PHPIA, PPHP	[Wilson et al., 1994]	intron5 +1G→A
c.432+1G>A	p.(?)	sp	AHO	[Aldred et al., 2000b]	c.432+1G>A
c.432+1G>A	p.(?)	sp	PPHP	[Rickard et al., 2003]	c.432+1G>A
c.432+1G>A	p.(?)	sp	PHPIA	[Elli et al., 2013b]	c.435+1G>A
Exon 6					
c.457C>G	p.(Leu153Val)	ms	PPHP	[Cho et al., 2013]	c.457C>G
n/a	p.(Trp154*)	ns	PHPIA, PPHP	[Linglart et al., 2002]	W154X
c.466G>A	p.(Asp156Asn)	ms	PHPIA	[Linglart et al., 2002]	D156N (A→G)
c.470_472delAAG	p.(Glu157del)	if	PHPIA	[Long et al., 2007]	c.469-471del
c.472G>A	p.(Gly158Arg)	ms	PHPIA	[Fernandez-Rebollo et al., 2013]	c.472G>A
c.473dupG	p.(Val159Serfs*15)	fs	AHO	[Aldred et al., 2000b]	c.473-474insG
c.475G>A	p.(Val159Met)	ms	PHPIA	[Linglart et al., 2002]	V159M (A→G) ^d
c.475G>A	p.(Val159Met)	ms	PPHP	[Elli et al., 2013b]	c.478G>A
c.476T>C	p.(Val159Ala)	ms	PPHP	[Rump et al., 2011]	c.476T>C
c.478C>T	p.(Arg160Cys)	ms	AHO	[Aldred et al., 2000b]	c.478C>T
c.478C>T	p.(Arg160Cys)	ms	PHPIA	[Elli et al., 2013b]	c.481C>T
c.489C>G	p.(Tyr163*)	ns	AHO	[Aldred et al., 2000b]	c.489C>G
c.493C>T	p.(Arg165Cys)	ms	AHO	[Miric et al., 1993]	Arg165Cys (C→T)
c.493C>T	p.(Arg165Cys)	ms	PHPIA	[Ahrens et al., 2001]	codon 165 (CGC→TGC)
c.493C>T	p.(Arg165Cys)	ms	PHPIA	[Elli et al., 2013b]	c.496C>T
c.509_510dupAG	p.(Leu171Serfs*2)	fs	PHPIA	[Fernandez-Rebollo et al., 2013]	c.509_510dup
c.517G>A	p.(Asp173Asn)	ms	PHPIA	[Freson et al., 2008b]	D173N
c.518_521delACTG	p.(Asp173Valfs*11)	fs	PHPIA	[Fernandez-Rebollo et al., 2013]	c.518_521delACTG
c.522_523delTG	p.(Ala175Profs*14)	fs	PHPIA	[Elli et al., 2013b]	c.523_524del
Intron 6					
c.531-2A>G	p.(?)	sp	PHPIA, PPHP	[Ahrens et al., 2001]	I6/E7 (agCTTC→ggCTTC)
c.531-1G>C	p.(?)	sp	PHPIA	[Linglart et al., 2002]	G→C (intron 6 acceptor sp)
Exon 7					
c.546delC	p.(Ile182Metfs*3)	fs	POH/ PHPIA	[Gelfand et al., 2007]	546delC
c.551delT	p.(Val184Glyfs*20)	fs	OC	[Elli et al., 2013a]	c.554del
c.555delC	p.(Lys186Serfs*18)	fs	PHPIA, PPHP	[De Sanctis et al., 2003]	c.555delC
c.565_568delGACT	p.(Asp189Metfs*14)	fs	AHO	[Weinstein et al., 1992]	codon 189/190 delGACT

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c.565_568delGACT	p.(Asp189Metfs*14)	fs	AHO (4 kindreds)	[Yu, S. et al., 1995]	codon 189/190 delGACT
c.565_568delGACT	p.(Asp189Metfs*14)	fs	PHPIA, PPHP	[Yokoyama et al., 1996]	codon 189/190 delGACT
c.565_568delGACT	p.(Asp189Metfs*14)	fs	PHPIA, PPHP (2 kindreds)	[Ahmed et al., 1998]	codon 189/190 delGACT
c.565_568delGACT	p.(Asp189Metfs*14)	fs	PHPIA, PPHP	[Nakamoto et al., 1998]	codon 189/190 delGACT
c.565_568delGACT	p.(Asp189Metfs*14)	fs	PHPIA, PPHP	[Walden et al., 1999]	exon7 4bp del
c.565_568delGACT	p.(Asp189Metfs*14)	fs	PHPIA	[Mantovani et al., 2000]	codon 189/190 del4
c.565_568delGACT	p.(Asp189Metfs*14)	fs	AHO	[Aldred et al., 2000b]	c.565-568delGACT
c.565_568delGACT	p.(Asp189Metfs*14)	fs	POH	[Yeh et al., 2000]	codon 189/190 delGACT
c.565_568delGACT	p.(Asp189Metfs*14)	fs	PHPIA, PPHP (6 kindreds)	[Ahrens et al., 2001]	codon 189/190 delGACT
c.565_568delGACT	p.(Asp189Metfs*14)	fs	PHPIA, PPHP (3 kindreds)	[Linglart et al., 2002]	codon 189/190 delGACT
c.565_568delGACT	p.(Asp189Metfs*14)	fs	PHPIA	[Lim et al., 2002]	codon 189/190 delGACT
c.565_568delGACT	p.(Asp189Metfs*14)	fs	POH (3 kindreds)	[Shore et al., 2002]	565-568delGACT
c.565_568delGACT	p.(Asp189Metfs*14)	fs	POH, AHO	[Shore et al., 2002]	565-568delGACT
c.565_568delGACT	p.(Asp189Metfs*14)	fs	PHPIA, PPHP (3 kindreds)	[De Sanctis et al., 2003]	c.565-568delGACT
c.565_568delGACT	p.(Asp189Metfs*14)	fs	PHPIA (3 kindreds)	[Germain-Lee et al., 2003]	565-568del
c.565_568delGACT	p.(Asp189Metfs*14)	fs	PHPIA, PPHP (9 kindreds)	[Long et al., 2007]	c.565-568del
c.565_568delGACT	p.(Asp189Metfs*14)	fs	PHPIA, PPHP	[Semiz et al., 2009]	codon 189/190 del4
c.565_568delGACT	p.(Asp189Metfs*14)	fs	PHPIA	[Lecumberri et al., 2009]	c.565-568delGACT
c.565_568delGACT	p.(Asp189Metfs*14)	fs	PHPIA	[Dekelbab et al., 2009]	Nt565delGACT
c.565_568delGACT	p.(Asp189Metfs*14)	fs	POH (2 kindreds)	[Lebrun et al., 2010]	c.565-568delGACT
c.565_568delGACT	p.(Asp189Metfs*14)	fs	PHPIA, PPHP (2 kindreds)	[Jin et al., 2011]	c.565-568del
c.565_568delGACT	p.(Asp189Metfs*14)	fs	PHPIA, PPHP (4 kindreds)	[Elli et al., 2013b]	c.568_571del
c.565_568delGACT	p.(Asp189Metfs*14)	fs	POH/ PHPIA ^f	[Elli et al., 2013b] [Elli et al., 2013a]	c.568_571del
c.565_568delGACT	p.(Asp189Metfs*14)	fs	POH (2 kindreds)	[Elli et al., 2013a]	c.568_571del
c.565_568delGACT	p.(Asp189Metfs*14)	fs	PHPIA (3 kindreds)	[Fernandez-Rebollo et al., 2013]	c.565_568delGACT
c.565_568delGACT	p.(Asp189Metfs*14)	fs	PHPIA	[Inta et al., 2014]	codon 189/190 delGACT
c.565_568delGACT	p.(Asp189Metfs*14)	fs	POH	[Schrander et al., 2014]	c.565_568delGACT
c.568T>G	p.(Tyr190Asp)	ms	AHO	[Ringel et al., 1996]	Tyr190Asp
c.569_570delIAT	p.(Tyr190Cysfs*19)	fs	PHPIA	[Jin et al., 2011]	c.569-570del
c.569_570delIAT	p.(Tyr190Cysfs*19)	fs	PHPIA	[Fernandez-Rebollo et al., 2013]	c.569_570delIAT
c.572_573delITG	p.(Val191Alafs*18)	fs	POH	[Lebrun et al., 2010]	c.571-572delITG ^d
c.575C>T	p.(Pro192Leu)	ms	PHPIA, PPHP	[Long et al., 2007]	c.575C>T
n/a	n/a	fs	PHPIA, PPHP	[Mouallem et al., 2008]	c.575C>A + 576-577insC ^g
c.583C>T	p.(Gln195*)	ns	PHPIA	[Balavoine et al., 2008]	Q195X

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Intron 7					
c.586-1G>A	p.(?)	sp	PHPIA	[Rickard et al., 2003]	c.586-1G>A
c.586-1G>T	p.(?)	sp	PHPIA	[Long et al., 2007]	c.586-1G>T
Exon 8					
c.586G>A	p.(Asp196Asn)	ms	PHPIA, PPHP	[Winter et al., 2011]	D196N
c.617_618delGA	p.(Gly206Aspfs*3)	fs	PHPIA, PPHP	[Yu, D. et al., 1999]	codon 206, delGA
c.617_618delGA	p.(Gly206Aspfs*3)	fs	PHPIA	[Long et al., 2007]	c.617-618del
c.624dupT	p.(Glu209*)	fs	POH	[Lebrun et al., 2010]	c.623-624insT
c.624dupT	p.(Glu209*)	fs	PHPIA	[Fernandez-Rebollo et al., 2013]	c.624_625insT (p.E208X) ^d
c.637C>T	p.(Gln213*)	ns	PHPIA	[Balavoine et al., 2008]	Q213X
c.640_643delGTGG	p.(Val214Thrfs*27)	fs	AHO	[Miric et al., 1993]	codon 214, delGTGG
Intron 8					
c.659+1G>A	p.(?)	sp	PHPIA	[Jin et al., 2011]	c.659+1G>A
c.659+2T>G	p.(?)	sp	POH	[Elli et al., 2013a]	c.662+2T>G
Exon 9					
c.679dupC	p.(Gln227Profs*4)	fs	POH	[Shore et al., 2002]	679-680insC
c.682C>T	p.(Arg228Cys)	ms	PHPIA	[Tam et al., 2014]	c.682C>T
c.691C>T	p.(Arg231Cys)	ms	PPHP	[Ahrens et al., 2001]	codon 231 (CGC→TGC)
c.691C>T	p.(Arg231Cys)	ms	AHO	[Weinstein et al., 2001]	Arg231Cys
c.691C>T	p.(Arg231Cys)	ms	PHPIA	[Freson et al., 2008a]	R231C
c.691C>T	p.(Arg231Cys)	ms	PPHP	[Freson et al., 2008b]	R231C
c.691C>T	p.(Arg231Cys)	ms	PHPIA	[Elli et al., 2013b]	c.694C>T
c.692G>A	p.(Arg231His)	ms	PHPIA	[Farfel et al., 1996]	R231H
c.692G>A	p.(Arg231His)	ms	PHPIA	[Ishikawa et al., 2001]	R231H (CGC→CAC)
c.692G>A	p.(Arg231His)	ms	PHPIA	[Ngai et al., 2010]	c.692G>A
Intron 9					
c.719-2A>G	p.(?)	sp	PHPIA	[Linglart et al., 2002]	A→G (intron 9 acceptor sp)
Exon 10					
c.725C>T	p.(Thr242Ile)	ms	PHPIA, PPHP	[Rickard et al., 2003]	c.725C>T
c.725C>T	p.(Thr242Ile)	ms	PHPIA	[Elli et al., 2013b]	c.728C>T
c.725delC	p.(Thr242Metfs*29)	fs	POH	[Shore et al., 2002]	725delC
c.730A>T	p.(Ile244Phe)	ms	PHPIA, PPHP	[Long et al., 2007]	c.730A>T, I224F
c.737T>C	p.(Phe246Ser)	ms	PPHP	[Rickard et al., 2003]	c.737T>C
c.739G>C	p.(Val247Leu)	ms	PHPIA	[Elli et al., 2013b]	c.742G>C
c.750C>G	p.(Ser250Arg)	ms	PHPIA	[Warner et al., 1997]	S250R (AGG→AGC)
c.750C>G	p.(Ser250Arg)	ms	PHPIA	[Long et al., 2007]	c.750C>G
c.751dupA	p.(Ser251Lysfs*49)	fs	PHPIA, PPHP	[Lado-Abeal et al., 2011]	c.750-751insA
c.772C>T	p.(Arg258Trp)	ms	PPHP	[Warner et al., 1998]	R258W (TGG→CGG)
c.772C>T	p.(Arg258Trp)	ms	PPHP	[Long et al., 2007]	c.772C>T, R258N
c.776A>T	p.(Glu259Val)	ms	PHPIA	[Ahmed et al., 1998]	codon 259 (GAG→GTG)
c.776A>T	p.(Glu259Val)	ms	PHPIA	[Rickard et al., 2003]	c.776A>T

Mutation ^a	Predicted Effect on Protein	Mutation Type ^b	Phenotype ^c	Reference	Original designation
n/a (insCCAG)		fs	PHPIA, PPHP	[Linglart et al., 2002]	codon 262, insCCAG
c.790A>C	p.(Asn264His)	ms	AHO	[Aldred et al., 2000b]	c.790A>C
c.791dupA	p.(Asn264Lysfs*36)	fs	PHPIA, PPHP	[de Arriba Munoz et al., 2011]	codon 264, insA
c.794G>A	p.(Arg265His)	ms	PHPIA, PPHP	[Bastida Eizaguirre et al., 2001]	c.794G>A
c.799dupC	p.(Gln267Profs*33)	fs	PHPIA	[Shapira et al., 1996]	codon 267, insC
c.802G>T	p.(Glu268*)	ns	PHPIA, PPHP	[Kacerovska et al., 2008]	c.802G>T
c.803A>G	p.(Glu268Gly)	ms	PHPIA	[Elli et al., 2013b]	c.806A>G
c.814delC	p.(Leu272Serfs*16)	fs	PHPIA, PPHP	[Weinstein et al., 1990]	codon 272, delC
c.814delC	p.(Leu272Serfs*16)	fs	PHPIA, PPHP	[Long et al., 2007]	c.814del
c.828C>G	p.(Ile276Met)	ms	PHPIA	[Fernandez-Rebollo et al., 2013]	c.828C>G
c.835_839dupAACAG	p.(Trp281Thrfs*9)	fs	POH	[Shore et al., 2002]	835-839dupAACAG
c.838A>G	p.(Arg280Gly)	ms	PHPIA	[Lim et al., 2002]	Arg280Gly
c.838A>T	p.(Arg280*)	ns	OC	[Huh et al., 2014]	c.838A>T
c.839G>A	p.(Arg280Lys)	ms	PHPIA	[Linglart et al., 2002]	R280K (G→C) ^d
c.839G>T	p.(Arg280Ile)	ms	PHPIA	[Fernandez-Rebollo et al., 2013]	c.839G>T
Intron 10					
c.839+1G>C	p.(?)	sp	PHPIA, PPHP	[Weinstein et al., 1990]	intron10 +1G→C
c.839+1G>C	p.(?)	sp	PHPIA, PPHP	[Long et al., 2007]	IVS10+1G>C
c.840-2A>G	p.(?)	sp	PHPIA, PPHP	[Wu, Y. L. et al., 2014]	c.840-2A>G
Exon 11					
c.841T>C	p.(Trp281Arg)	ms	POH	[Chan et al., 2004]	841T>C
c.845T>C	p.(Leu282Pro)	ms	AHO	[Aldred et al., 2000b]	c.845T>C
c.860_861delITG	p.(Val287Aspfs*12)	fs	PHPIA	[Mantovani et al., 2000]	codon 287, delITG
c.860_861delITG	p.(Val287Aspfs*12)	fs	POH	[Faust et al., 2003]	860-861delITG
c.860_861delITG	p.(Val287Aspfs*12)	fs	PHPIA	[de Sanctis et al., 2004]	c.861-862delITG ^d
c.860_861delITG	p.(Val287Aspfs*12)	fs	PHPIA	[Elli et al., 2013b]	c.863_864del
c.871delC	p.(Leu291Serfs*44)	fs	PHPIA	[Sun et al., 2009]	codon 291 del1bp
c.892G>C	p.(Ala298Pro)	ms	PHPIA (2 kindreds)	[Ahrens et al., 2001]	codon 298 (GCT→CCT)
c.896dupA	p.(Lys300Glufs*10)	fs	PHPIA	[Ahrens et al., 2001]	codon 299, insA(GAG→GAAG)
n/a	n/a	fs	PHPIA	[Fernandez-Rebollo et al., 2013]	c.896_910del (p.E299GfsX36) ^e
c.909dupT	p.(Gly304Trpfs*6)	fs	AHO	[Aldred et al., 2000b]	c.909-910insT
c.938C>T	p.(Pro313Leu)	ms	PHPIA, PPHP	[Ahrens et al., 2001]	codon 313 (CCA→CTA)
c.952T>C	p.(Tyr318His)	ms	PHPIA, PPHP	[Miao et al., 2011]	c.952T>C
c.960_961dupTC	p.(Pro321Leufs*15)	fs	POH	[Shore et al., 2002]	960-961insCT
Intron 11					
c.971-1G>A	p.(?)	sp	PHPIA	[Lecumberri et al., 2009]	c.971-1G>A
Exon 12					
c.984delC	p.(Gly329Glufs*6)	fs	PHPIA	[Freson et al., 2008b]	codon 328, del 1bp

Mutation ^a	Predicted Effect on Protein	Mutation Type ^b	Phenotype ^c	Reference	Original designation
c.996_1018dup	p.(Phe340Tyrfs*3)	fs	PHPIA	[Elli et al., 2013b]	c.1021_1022insACG CGTGACCCGGGC CAAGTACT
c.1006C>T	p.(Arg336Trp)	ms	PHPIA	[Ahrens et al., 2001]	codon 336 (CGG→TGG)
c.1006C>T	p.(Arg336Trp)	ms	PHPIA	[De Sanctis et al., 2003]	c.1006C>T
c.1006C>T	p.(Arg336Trp)	ms	PHPIA (2 kindreds)	[Elli et al., 2013b]	c.1009C>T
c.1006dupC	p.(Arg336Profs*9)	fs	POH, PHPIA	[Long et al., 2007]	c.1007insC
c.1014G>C	p.(Lys338Asn)	ms	PHPIA, PPHP	[Pohlentz et al., 2003]	L338N (AAG→AAC)
c.1021_1024delATTC	p.(Ile341Glu fs*5)	fs	PHPIA	[Elli et al., 2013b]	c.1021_1024del
c.1024C>T	p.(Arg342*)	ns	PHPIA	[Linglart et al., 2002]	R342X
c.1024C>T	p.(Arg342*)	ns	POH	[Goto et al., 2010]	R342X
c.1027_1028delGA	p.(Asp343*)	fs	PHPIA, PPHP	[Wu, Y. L. et al., 2014]	c.1027_1028delGA
Intron 12					
c.1039-1G>A	p.(?)	sp	POH, PPHP, PHPIA	[Lebrun et al., 2010]	c.1039-1G>A
c.1039-1G>C	p.(?)	sp	POH	[Shore et al., 2002]	IVS12 -1G→C
Exon 13					
c.1053_1077dup	p.(Tyr360Gln fs*19)	fs	POH	[Shore et al., 2002]	1053-1077dupl(25n)
c.1070A>T	p.(His357Leu)	ms	PPHP	[Ahrens et al., 2001]	codon 357 (CAC→CTC)
c.1082dupC	p.(His362Ser fs*9)	fs	PHPIA	[Germain-Lee et al., 2003]	1083insC
c.1082dupC	p.(His362Ser fs*9)	fs	PHPIA	[Long et al., 2007]	c.1083insC
c.1085A>C	p.(His362Pro)	ms	PHPIA	[Long et al., 2007]	c.1088A>C, H362P ^d
c.1085A>C	p.(His362Pro)	ms	PHPIA	[Linglart et al., 2006]	c.1085A→C
c.1096G>T	p.(Ala366Ser)	ms	PHPIA with testotoxicosis (2 kindreds)	[Iiri et al., 1994]	A366S
c.1097_1108dup	p.(Ala366_Thr369dup)	if	PHPIA	[Aldred et al., 2000a]	c.1107-1108ins GCTGTGGACACT
c.1100_1101insA	p.(Asp368Gly fs*3)	fs	PHPIA, PPHP	[Lubell et al., 2009]	c.1100-1101insA
c.1106_1107delICT	p.(Thr369Arg fs*12)	fs	AHO	[Aldred et al., 2000b]	c.1106-1107delICT
c.1107_1108delTG	p.(Asn371His fs*10)	fs	AHO	[Aldred et al., 2000b]	c.1107-1108delTG
c.1107_1108delTG	p.(Asn371His fs*10)	fs	POH	[Schimmel et al., 2010]	c.1107-1108delTG
c.1107_1108delTG	p.(Asn371His fs*10)	fs	PPHP	[Elli et al., 2013b]	c.1110_1111del
c.1129_1131delAAC	p.(Asn377del)	if	PHPIA	[Ahrens et al., 2001]	codon 317 (delAAC)
c.1129_1131delAAC	p.(Asn377del)	if	PHPIA	[Graul-Neumann et al., 2009]	c.1129-1131delAAC
c.1146_1148delCAT	p.(Ile383del)	if	PHPIB	[Wu, W. I. et al., 2001]	codon 382, delCAT
n/a	p.(Ile383del)	if	AHO	[Ringel et al., 1996]	del Ile383
c.1150C>T	p.(Gln384*)	ns	PHPIA	[Garavelli et al., 2005]	codon 384 (CAG→TAG)
c.1150C>T	p.(Gln384*)	ns	PHPIA	[Elli et al., 2013b]	c.1153C>T
c.1154G>A	p.(Arg385His)	ms	PHPIA	[Schwindinger et al., 1994]	R385H (G→A)
c.1154G>A	p.(Arg385His)	ms	PHPIA	[Tamada et al., 2008]	R385H
c.1163T>C	p.(Leu388Pro)	ms	PHPIA, PPHP	[Thiele et al., 2011]	c.1163T>C
c.1163T>G	p.(Leu388Arg)	ms	PHPIC, PPHP	[Thiele et al., 2011]	c.1163T>G
c.1173C>A or G (not specified)	p.(Tyr391*)	ns	PHPIC	[Linglart et al., 2002]	Y391X
c.1174G>A	p.(Glu392Lys)	ms	PHPIA	[Germain-Lee et al., 2003]	1174G>A
c.1174G>A	p.(Glu392Lys)	ms	PHPIA	[Long et al., 2007]	c.1174G>A

Mutation ^a	Predicted Effect on Protein	Mutation Type ^b	Phenotype ^c	Reference	Original designation
c.1174G>A	p.(Glu392Lys)	ms	PHPIC, PPHP	[Thiele et al., 2011]	c.1174G>A
c.1174G>A	p.(Glu392Lys)	ms	PPHP	[Wu, Y. L. et al., 2014]	c.1174G>A
c.1174G>T	p.(Glu392*)	ns	PHPIC, PPHP (2 kindreds) ^f	[De Sanctis et al., 2003] [Thiele et al., 2011]	c.1174G>T
Gross deletion	p.0?	gross deletion	PHPIA	[Fernandez-Rebollo et al., 2010]	30Kb deletion (exons A/B→intron 5)
Gross deletion	p.0?	gross deletion	PHPIA, PPHP	[Mitsui et al., 2012]	850Kb deletion
Gross deletion	p.0?	gross deletion	PHPIA	[Cho et al., 2013]	deletion exons 1-13

^aMutations are numbered in relation to the *GNAS* cDNA reference sequence (GenBank accession number NM_000516.4), whereby nucleotide +1 corresponds to the A of the ATG-translation initiation codon.

^bMutation type: fs, frameshift mutation; ns, nonsense mutation; ms, missense mutation; if, in-frame deletion or insertion; sp, splice site mutation.

^cPhenotype: PHPIA, pseudohypoparathyroidism type IA; PPHP, pseudopseudohypoparathyroidism; AHO, Albright Hereditary Osteodystrophy (when not specified as PHPIA or PPHP); PHPIB, pseudohypoparathyroidism type IB; PHPIC, pseudohypoparathyroidism type IC; POH, progressive osseous heteroplasia; OC, osteoma cutis (isolated). The number of reported kindreds is included (when more than one).

^dDiscordant codon/nucleotide number in the original report.

^eAmbiguity between nucleotide number and type of mutation (in frame deletion vs frameshift).

^fPreviously classified as PHPIA.

^gNot determined if both mutations are on the same allele.

n/a, exact nucleotide change not available in the original report.

^h Variant submitted to a locus-specific public database (www.lovd.nl/GNAS).

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