

PTCH1 (updated: old version not available)

Identity

Other names	PTC, but this term was confusing with PTC/PKA
	PTCH
	patched
Hugo	<u>PTCH</u>
Location	9q22.3 (between FACC and XPAC PTCH1 is flanked by the microsatellite markers D9S196 and D9S287; a microsatellite marker, 1AJL, is located inside the gene)

DNA/RNA

Description	24 exons, exon 24 is non-coding; 34 kb
Transcription	alternate splicing: 3 different 5' termini; 6.5 kb mRNA; coding sequence: CDS 1 ... 4344

Protein

Description	glycoprotein; 12 transmembrane domains, 2 extra cellular loops, intracellular N-term and C-term and sterol-sensing domain (SSD)
Expression	widely expressed at low levels; increased levels in cells receiving a hedgehog signal
Localisation	transmembrane protein, cellular membrane, intracellular vesicles
Function	part of a signalling pathway; opposed by the gene products of hedgehog genes; transmembrane protein; is thought to have a repressive activity on cell proliferation; the recent demonstration of NBCCS syndrome (see below) as a chromosome instability syndrome suggests that this protein has a role in DNA maintenance, repair and/or replication
Homology	patched (drosophila segment polarity gene), PTCH2 (human gene with unknown function)

Mutations

Germinal	germ-line mutations lead to protein truncation in naevoid basal cell carcinoma syndrome (NBCCS) patients (see below); mutations types are variable : nucleotide substitutions (missense/nonsense), small deletions, or small insertions mainly, leading to protein truncation; these mutations have been observed in most exons; there is, so far, no hot-spot.
Somatic	mutation and allele loss events in basal cell carcinoma, in NBCCS and in sporadic basal cell carcinoma are, so far, in accordance with the two-hit model for neoplasia, as is found in retinoblastoma; mutation and allele loss have also been found in sporadic primitive neuroectodermal tumours (PNETs) , sporadic medulloblastomas and in a few cases of

esophageal squamous cell carcinoma and invasive [transitional cell carcinoma of the bladder](#); mutations have also been reported in a low frequency of sporadic trichoepitheliomas and in sporadic odontogenic keratocysts

Implicated in

Entity naevoid basal cell carcinoma syndrome (NBCCS) or [Gorlin syndrome](#)
Disease autosomal dominant condition; cancer prone disease (multiple basal cell carcinomas, medulloblastomas); malformations; it is also a chromosome instability syndrome

Cytogenetic s spontaneous and induced chromosome instability

Entity skin cancers
Disease sporadic basal cell carcinoma, but also in the benign trichoepithelioma, a tumor often associated with basal cell carcinomas
 sporadic basal cell carcinoma from [xeroderma pigmentosum](#) patients have a high frequency of typical UV-induced mutations in PTCH1

Entity brain diseases
Disease in a subset of sporadic [primitive neuroectodermal tumours \(PNETs\)](#) of the central nervous system (cerebral PNETs, [medulloblastomas](#), and desmoplastic medulloblastomas); note: NBCCS patients have a predisposition for the development of PNETs, while, herein mentioned are sporadic PNETs
 PTCH1 have also been found mutated in both familiar and sporadic cases of Holoprosencephaly (HPE)

Entity various cancers and benign tumors
Disease invasive [transitional cell carcinoma of the bladder](#): PTCH1 has been found mutated in rare cases
 sporadic esophageal squamous cell carcinoma
 jaws: in sporadic odontogenic keratocysts and in odontogenic keratocysts from NBCCS patients

External links

Nomenclature
[Hugo](#) [PTCH](#)
[GDB](#) [PTCH](#)
[Entrez_Gene](#) [PTCH 5727](#) patched homolog (Drosophila)

Cards
[Atlas](#) [PTCH100](#)
[GeneCards](#) [PTCH](#)
[Ensembl](#) [PTCH](#)
[CancerGene](#) [PTCH](#)
[Genatlas](#) [PTCH](#)
[GeneLynx](#) [PTCH](#)
[eGenome](#) [PTCH](#)
[euGene](#) [5727](#)

Genomic and cartography
[GoldenPath](#) [PTCH](#) - [9q22.3](#) [chr9:95285955-95350386](#) - [9q22.32](#) (hg17-

	May_2004)
Ensembl	PTCH - 9q22.32 [CytoView]
NCBI	Genes Cyto Gene Seq [Map View - NCBI]
OMIM	Disease map [OMIM]
HomoloGene	PTCH
Gene and transcription	
Genbank	AY395758 [SRS] AY395758 [ENTREZ]
Genbank	AY395768 [SRS] AY395768 [ENTREZ]
Genbank	AY395772 [SRS] AY395772 [ENTREZ]
Genbank	AB189436 [SRS] AB189436 [ENTREZ]
Genbank	AB189437 [SRS] AB189437 [ENTREZ]
RefSeq	NM_000264 [SRS] NM_000264 [ENTREZ]
RefSeq	NT_086752 [SRS] NT_086752 [ENTREZ]
AceView	PTCH AceView - NCBI
TRASER	PTCH Traser - Stanford
Unigene	Hs.494538 [SRS] Hs.494538 [NCBI] HS494538 [spliceNest]
Protein : pattern, domain, 3D structure	
SwissProt	Q13635 [SRS] Q13635 [EXPASY] Q13635 [INTERPRO]
Prosite	PS50156 SSD [SRS] PS50156 SSD [Expasy]
Interpro	IPR003392 Patched [SRS] IPR003392 Patched [EBI]
Interpro	IPR004766 Patchedtm_recept [SRS] IPR004766 Patchedtm_recept [EBI]
Interpro	IPR000731 SSD_5TM [SRS] IPR000731 SSD_5TM [EBI]
CluSTr	Q13635
Pfam	PF02460 Patched [SRS] PF02460 Patched [Sanger] pfam02460 [NCBI-CDD]
Blocks	Q13635
Polymorphism : SNP, mutations, diseases	
OMIM	601309 [map]
GENECLINICS	601309
SNP	PTCH [dbSNP-NCBI]
SNP	NM_000264 [SNP-NCI]
SNP	PTCH [GeneSNPs - Utah] PTCH [SNP - CSHL] PTCH [HGBASE - SRS]
General knowledge	
Family	PTCH [UCSC Family Browser]
Browser	
SOURCE	NM_000264
SMD	Hs.494538
SAGE	Hs.494538
Amigo	process cell proliferation
Amigo	function hedgehog receptor activity
Amigo	component integral to plasma membrane
Amigo	process morphogenesis
Amigo	process negative regulation of cell cycle
Amigo	function receptor activity
Amigo	process signal transduction
BIOCARTA	Sonic Hedgehog (SHH) Receptor Ptc1 Regulates cell cycle
BIOCARTA	Sonic Hedgehog (Shh) Pathway
PubGene	PTCH
Other databases	
Other	Locus specific database; PTCH Mutation Database

database

Probes

[Probe](#) [PTCH Related clones \(RZPD - Berlin\)](#)

PubMed

[PubMed](#) [21 Pubmed reference\(s\) in LocusLink](#)

Bibliography

The Drosophila hedgehog gene is expressed specifically in posterior compartment cells and is a target of engrailed regulation.

Tabata T, Eaton S, Kornberg TB
Genes Dev 1992 Dec;6(12B):2635-45
Medline [94040725](#)

Compartment boundaries and the control of Drosophila limb pattern by hedgehog protein.

Basler K, Struhl G
Nature 1994 Mar 17;368(6468):208-14
Medline [94195387](#)

The Drosophila segment polarity gene patched interacts with decapentaplegic in wing development.

Capdevila J, Estrada MP, Sanchez-Herrero E, Guerrero I
EMBO J 1994 Jan 1;13(1):71-82
Medline [94139676](#)

The role of the human homologue of Drosophila patched in sporadic basal cell carcinomas.

Gailani MR, Stahle-Backdahl M, Leffell DJ, Glynn M, Zaphiropoulos PG, Pressman C, Uden AB, Dean M, Brash DE, Bale AE, Toftgard R
Nat Genet 1996 Sep;14(1):78-81
Medline [96376974](#)

A mammalian patched homolog is expressed in target tissues of sonic hedgehog and maps to a region associated with developmental abnormalities.

Hahn H, Christiansen J, Wicking C, Zaphiropoulos PG, Chidambaram A, Gerrard B, Vorechovsky I, Bale AE, Toftgard R, Dean M, Wainwright B
J Biol Chem 1996 May 24;271(21):12125-8
Medline [96218118](#)

Mutations of the human homolog of Drosophila patched in the nevoid basal cell carcinoma syndrome.

Hahn H, Wicking C, Zaphiropoulos PG, Gailani MR, Shanley S, Chidambaram A, Vorechovsky I, Holmberg E, Uden AB, Gillies S, Negus K, Smyth I, Pressman C, Leffell DJ, Gerrard B, Goldstein AM, Dean M, Toftgard R, Chenevix-Trench G, Wainwright B, Bale AE
Cell 1996 Jun 14;85(6):841-51
Medline [96279829](#)

Human homolog of patched, a candidate gene for the basal cell nevus syndrome.

Johnson RL, Rothman AL, Xie J, Goodrich LV, Bare JW, Bonifas JM, Quinn AG,

Myers RM, Cox DR, Epstein EH Jr, Scott MP
Science 1996 Jun 14;272(5268):1668-71
Medline [96247324](#)

Characterisation of human patched germ line mutations in naevoid basal cell carcinoma syndrome.

Lench NJ, Telford EA, High AS, Markham AF, Wicking C, Wainwright BJ.
Hum Genet. 1997 Oct;100(5-6):497-502.
Medline [98001068](#)

Sporadic medulloblastomas contain PTCH mutations.

Raffel C, Jenkins RB, Frederick L, Hebrink D, Alderete B, Fults DW, James CD
Cancer Res 1997 Mar 1;57(5):842-5
Medline [97193598](#)

Trichoepitheliomas contain somatic mutations in the overexpressed PTCH gene: support for a gatekeeper mechanism in skin tumorigenesis.

Vorechovsky I, Unden AB, Sandstedt B, Toftgard R, Stahle-Backdahl M
Cancer Res 1997 Nov 1;57(21):4677-81
Medline [98014543](#)

Most germ-line mutations in the nevoid basal cell carcinoma syndrome lead to a premature termination of the PATCHED protein, and no genotype-phenotype correlations are evident.

Wicking C, Shanley S, Smyth I, Gillies S, Negus K, Graham S, Suthers G, Haites N, Edwards M, Wainwright B, Chenevix-Trench G
Am J Hum Genet 1997 Jan;60(1):21-6
Medline [97136566](#)

Mutations in the human homologue of the Drosophila segment polarity gene patched (PTCH) in sporadic basal cell carcinomas of the skin and primitive neuroectodermal tumors of the central nervous system.

Wolter M, Reifenberger J, Sommer C, Ruzicka T, Reifenberger G
Cancer Res 1997 Jul 1;57(13):2581-5
Medline [97349054](#)

Mutations of the PATCHED gene in several types of sporadic extracutaneous tumors.

Xie J, Johnson RL, Zhang X, Bare JW, Waldman FM, Cogen PH, Menon AG, Warren RS, Chen LC, Scott MP, Epstein EH Jr.
Cancer Res 1997 Jun 15; 57(12):2369-72
Medline [97336016](#)

Identification of mutations in the human PATCHED gene in sporadic basal cell carcinomas and in patients with the basal cell nevus syndrome.

Aszterbaum M, Rothman A, Johnson RL, Fisher M, Xie J, Bonifas JM, Zhang X, Scott MP, Epstein EH Jr
J Invest Dermatol 1998 Jun;110(6):885-8
Medline [98281604](#)

Patching together the genetics of Gorlin syndrome

Bale SJ, Falk RT, Rogers GR
J Cutan Med Surg 1998 Jul;3(1):31-4
Medline [99088403](#)

Dinucleotide repeat polymorphism within the tumor suppressor gene PTCH at 9q22.

Louhelainen J. Lindstrom E. Hemminki K. Toftgard R.
Clin Genet 1998 Sep; 54(3):239-41
Medline [99002778](#)

Mutations in the human homologue of the Drosophila patched gene in esophageal squamous cell carcinoma.

Maesawa C. Tamura G. Iwaya T. Ogasawara S. Ishida K. Sato N. Nishizuka S. Suzuki Y. Ikeda K. Aoki K. Saito K. Satodate R.
Genes Chromosom Cancer 1998; Mar;21(3):276-9

PTCH gene mutations in invasive transitional cell carcinoma of the bladder.

McGarvey TW, Maruta Y, Tomaszewski JE, Linnenbach AJ, Malkowicz SB
Oncogene 1998 Sep 3;17(9):1167-72
Medline [98435856](#)

Mutations of PATCHED in holoprosencephaly.

Ming JE, Kaupas ME, Roessler E, Brunner HG, Nance WE, Stratton RF, Sujansky E, Bale Sj, Muenke M
Am J Hum Genet 1998; 63 Suppl 140

The naevoid basal-cell carcinoma syndrome (Gorlin syndrome) is a chromosomal instability syndrome.

Shafei-Benaissa E, Savage JR, Babin P, Larregue M, Papworth D, Tanzer J, Bonnetblanc JM, Huret JL
Mutat Res 1998 Feb 2;397(2):287-92
Medline [98202735](#)

High levels of patched gene mutations in basal-cell carcinomas from patients with xeroderma pigmentosum.

Bodak N. Queille S. Avril MF. Bouadjar B. Drougard C. Sarasin A. Daya-Grosjean L.
Proc Natl Acad Sci USA 1999 Apr 27; 96(9):5117-22.
Medline [99238492](#)

The hedgehog signalling pathway and its role in basal cell carcinoma. [Review]

Booth DR.
Cancer & Metastasis Reviews 1999;18(2):261-84
Medline [20191332](#)

PTCH gene mutations in odontogenic keratocysts.

Barreto DC. Gomez RS. Bale AE. Boson WL. De Marco L.
J Dent Res 2000 Jun; 79(6):1418-22
Medline [20346776](#)

UV-specific mutations of the human patched gene in basal cell carcinomas from normal individuals and xeroderma pigmentosum patients. [Review]

Daya-Grosjean L. Sarasin A
Mut Res 2000 May 30;450(1-2):193-9
Medline [20299177](#)

UV mutation signature in tumor suppressor genes involved in skin carcinogenesis in xeroderma pigmentosum patients.

D'Errico M. Calcagnile A. Canzona F. Didona B. Posteraro P. Cavalieri R. Corona R. Vorechovsky I. Nardo T. Stefanini M. Dogliotti E.
Oncogene 2000 Jan 20;19(3):463-7
Medline [20120488](#)

Identification of PATCHED mutations in medulloblastomas by direct sequencing.

Dong J. Gailani MR. Pomeroy SL. Reardon D. Bale AE.
Hum Mut 2000 Jul;16(1):89-90
Medline [20334946](#)

The spectrum of patched mutations in a collection of Australian basal cell carcinomas.

Evans T. Boonchai W. Shanley S. Smyth I. Gillies S. Georgas K. Wainwright B. Chenevix-Trench G. Wicking C.
Hum Mut 2000;16(1):43-8
Medline [20334495](#)

Hedgehog signaling in animal development and human disease. [Review]

Bailey EC. Scott MP. Johnson RL
Ernst Schering Research Foundation Workshop. 2000;(29):211-35
Medline [20399009](#)

Hedgehog signalling in cancer. (Review)

Toftgård R.
Cell Mol Life Sci 2000;(57):1720-1731

[REVIEW articles](#) *automatic search in PubMed*
[Last year publications](#) *automatic search in PubMed*

[BiblioGene - INIST](#)

Contributor(s)

Written 05-1997 Jean-Loup Huret
Updated 01-1999 Jean-Loup Huret
Updated 12-2000 Erika Lindström, Rune Toftgård

Citation

This paper should be referenced as such :

Huret JL . PTCH1. Atlas Genet Cytogenet Oncol Haematol. May 1997 .
URL : <http://www.infobiogen.fr/services/chromcancer/Genes/PTCH100.html>

Huret JL . PTCH1. Atlas Genet Cytogenet Oncol Haematol. January 1999 .

URL : <http://www.infobiogen.fr/services/chromcancer/Genes/PTCH100.html>

Lindstrom E, Toftgård R . PTCH1. Atlas Genet Cytogenet Oncol Haematol.

December 2000 .

URL : <http://www.infobiogen.fr/services/chromcancer/Genes/PTCH100.html>

© *Atlas of Genetics and Cytogenetics in Oncology and Haematology*
