

Jean-Pierre Changeux, né le 6 avril 1936, est professeur au Collège de France et professeur à l'Institut Pasteur.

### **Formation et carrière**

1955-1958	Élève à l'École normale supérieure (ENS)
1958	Agrégation des sciences naturelles
1958-1960	Agrégé-préparateur de zoologie à l'École normale supérieure
1960-1967	Maître assistant à la faculté des sciences de Paris, Chaire de chimie du métabolisme (professeur Jacques Monod)
1964	Doctorat ès sciences
1965-1966	Postdoctoral fellow, University of California, Berkeley
1966-1967	Assistant visiting Professor, Columbia University College of Physicians & Surgeons, New-York
1967-1975	Sous-Directeur, Chaire de Biologie moléculaire du Collège de France
1972- 2006	Directeur de l'Unité de Neurobiologie moléculaire, Institut Pasteur,
1975- 2006	Professeur à l'Institut Pasteur
1975- 2006	Professeur au Collège de France
1975-2006	Directeur de l'Unité Récepteurs et Cognition, URA CNRS, Institut Pasteur
2008-2009-2010	Skaggs distinguished visiting Professor in Pharmacology University of California San Diego

### *Responsabilités scientifiques et administratives*

Membre du Conseil Scientifique de l'Action Concertée Membranes Biologiques de la Délégation générale à la Recherche Scientifique et Technique (DGRST) (1969-1977)

Membre de la Commission 6 de l'INSERM (1974-1979)

Membre du Conseil d'Administration de l'Association des Pharmacologistes (1978-1983) Président de l'Action Concertée "Dynamique du Neurone" (DGRST) (1977-1983)

Membre de la Commission 22 du CNRS, "Interactions Cellulaires" (1980-1982)

Membre du Comité Sectoriel Sciences de la Vie (CNRS) (1981-1982)

Vice-Président du Conseil Scientifique de la Fondation Fyssen (1979-2000)

Président du Conseil Scientifique de l'INSERM (1983-1987)

Membre du Conseil Supérieur de la Recherche et de la Technologie (1987-1989)

Membre du Conseil Scientifique de l'Institut Pasteur (1989-1992)

Président de la Société des Neurosciences (1989-1992)

Président de la Commission inter-ministérielle pour la Conservation du Patrimoine Artistique National (1999-)

Président de l'Action Concertée "Sciences de la Cognition" du Ministère de la Recherche Scientifique et Technique et du Ministère de l'Education Nationale (1988-1992)

Membre du Conseil Scientifique de "Human Frontiers Science Program" (1990-1992)

Membre du Comité Scientifique "Life Sciences" de l'European Science Foundation (ESF) (1990-1992)

Membre du Conseil du Développement Européen de la Science et de la Technologie (CODEST) (1991-1992)

Président du Comité Consultatif National d'Ethique pour les Sciences de la Vie et de la Santé (1992-1998) (actuellement Président d'Honneur)

Membre du Comité de l'Energie Atomique 1998-2003

Membre du Conseil d'Administration de l'Institut Pasteur (2000-2005)

Président du Comité de Vigilance Ethique de l'Institut Pasteur (2007-)

Membre du Conseil Scientifique de l'Agence Internationale des Musées, France Muséums, (2007-)

### **Œuvre scientifique**

Jean-Pierre Changeux a effectué des travaux de recherche dans plusieurs domaines de la biologie qui se fondent sur ses premières recherches sur la structure et la régulation des protéines et plus spécifiquement sur les mécanismes de transduction des signaux biologiques par interaction allostérique (1961-1968). En 1970, Changeux isole le récepteur nicotinique de l'acétylcholine à partir de l'organe électrique de gymnote : le premier récepteur membranaire de neurotransmetteur jamais isolé et cela grâce aux propriétés d'une toxine de venin de serpent. Il contribue à l'élucidation de sa

structure et à la démonstration qu'il s'agit bien d'une protéine allostérique. En 1973, avec A Danchin, il propose une théorie sur l'épigénèse des synapses en développement par sélection et la documente au niveau moléculaire. Enfin, depuis les années 80, il s'intéresse aux fonctions cognitives auxquelles il apporte à la fois des modèles théoriques et des fondements expérimentaux, principalement au niveau moléculaire chez la souris.

### **Distinctions et Prix**

Membre étranger de la Deutsche Akademie der Naturforscher Leopoldina (1974)  
Membre étranger de l'Académie de Médecine de Turin (1976)  
Associé étranger de la National Academy of Sciences, (États-Unis) (1983)  
Membre étranger de la Royal Academy of Sciences de Suède (1985)  
Membre honoraire étranger de l'Académie Royale de Médecine de Belgique (1988) et de l'Académie Royale des Sciences de Belgique (2010)  
Membre fondateur de l'Academia Europaea (1988)  
Membre étranger de l'American Academy of Arts and Sciences, (États-Unis) (1994)  
Membre étranger de la Romanian Academy of Medical Sciences, Bucarest (1996)  
Associé étranger de l'Institute of Medicine of the National Academies (États-Unis) (2000)  
Membre de l'Istituto Veneto di Scienze, Lettere ed Arti, de Venise (2001)  
Membre associé étranger de l'Hungarian Academy of Sciences (2004)  
Membre de l'European Academy of Sciences, Bruxelles (2004).  
Doctor honoris causa des Universités de Turin, Italy, 1989 ; Dundee, Scotland, 1992 ; Genève, Suisse, 1994 ; Stockholm, Suède, 1994 ; Liège, Belgique, 1996 ; Ecole Polytechnique Fédérale of Lausanne, Suisse, 1996 ; University of Southern California, Los Angeles, États-Unis, 1997 ; Bath, UK, 1997 ; Université de Montréal, Canada, 2000 ; The Hebrew University of Jerusalem, Israël, 2004 ; Ohio State University, Columbus, États-Unis, 2007)

Prix Alexandre Joannidès de l'Académie des sciences (1977)  
Gairdner Foundation Award, Toronto, (1978)  
Richard Lounsbery Prize, National Academy of Sciences (USA) et Académie des sciences (1983)  
Wolf Foundation Prize in Medicine, Jerusalem (1983)  
Prix Broquette-Gonin de l'Académie Française (1983)  
Ciba Geigy Drew Award in Biomedical Research, Madison (1985)  
F.O. Schmitt medal and prize, Neuroscience Research Program, Rockefeller University (1986)  
Rita Levi-Montalcini Award, Fidia Research Foundation (1988)  
Bristol-Myers-Squibb Award in Neuroscience, New York (1990)  
Carl-Gustaf Bernhard medal, Swedish Royal Academy of Sciences, (1991)  
Science for Art, Prix d'Honneur LVMH, Paris (1992)  
International Prize Amedeo e Frances Herlitzka for Physiological Sciences, Torino (1992)  
Médaille d'Or du CNRS (1992)  
Louis Jeantet Prize for Medicine, Genève (1993)  
Thudichum medal, Biochemical Society, Londres (1993)  
Goodman and Gilman Award in drug receptor pharmacology, American Society for Pharmacology and Experimental Therapeutics, (1994)  
Camillo Golgi medal, Accademia Nazionale dei Lincei, (1994)  
Sir Hans Krebs medal, FEBS, Helsinki, 1994)  
Max-Delbrück medal, in Molecular Medicine, Berlin (1996)  
Grand Prix de la Fondation pour la Recherche Médicale (1997)  
Prix Jean-Louis Signoret en neuropsychologie (1997)  
Emanuel Merck prize in Chemistry, Darmstadt (1998)  
Linus Pauling medal, 1998/1999, Stanford, USA  
Eli Lilly award in preclinical Neuroscience, European College of Neuropsychopharmacology (1999)  
Langley Award for basic research on nicotine and tobacco, Washington (2000)  
Balzan Prize for Cognitive Neuroscience, Berne (2001)  
American Philosophical Society's Karl Spencer Lashley Award in neuroscience, Philadelphia (2002)  
Lewis Thomas Prize for Writing about Science, Rockefeller University, New-York (2005)

Dart/NYU Biotechnology Award in Basic Biotechnology, New-York (2006)  
Golden Eurydice Award from International Forum of Biophilosophy, Bruxelles (2006)  
National Academy of Sciences Award in the Neurosciences, Washington (2007)  
Neuronal plasticity prize, IPSEN Foundation, Genève (2008)  
CINP Pioneer Award, Munich (2008)  
Passarow award in neuropsychiatry , Los Angeles (2010)

Grand-Officier de la Légion d'Honneur  
Grand' Croix de l'Ordre national du Mérite  
Chevalier des palmes académiques  
Commandeur dans l'Ordre des Arts et des Lettres

## **Publications**

### **Principaux ouvrages**

J.-P. CHANGEUX

L'Homme neuronal

Ed. Fayard (1983)

J.-P. CHANGEUX

Molécule et Mémoire

Ed. Bedou Gourdon (1988)

J.-P. CHANGEUX (dir.)

Fondements naturels de l'Éthique

Ed. Odile Jacob (1993)

J.-P. CHANGEUX (dir.)

Une même éthique pour tous ?

Ed. Odile Jacob (1997)

J.-P. CHANGEUX, A. CONNES

Matière à pensée

Ed. Odile Jacob (1989, 2000, 2008)

J.-P. CHANGEUX

Raison et Plaisir

Ed. Odile Jacob (1994, 2002)

J.-P. CHANGEUX, P. RICOEUR

Ce qui nous fait penser : La Nature et la Règle

Ed. Odile Jacob (1998, 2008)

J.-P. CHANGEUX

L'homme de vérité

Ed. Odile Jacob (2002, 2004, 2008)

J.-P. CHANGEUX (dir.)

Gènes et Culture

Ed. Odile Jacob , Colloque annuel du Collège de France (2003)

J.-P. CHANGEUX (dir.)

La Vérité dans les sciences, janvier 2003

Ed. Odile Jacob, Colloque annuel du Collège de France (2003)

J.-P. CHANGEUX catalogue  
La lumière au siècle des Lumières et aujourd'hui  
Ed. Odile Jacob (2005)

J.-P. CHANGEUX catalogue  
Les passions de l'âme  
Ed. Odile Jacob (2006)

J.-P. CHANGEUX(dir.)  
L'Homme artificiel  
Ed. Odile Jacob, Colloque annuel du Collège de France (2007)

J.-P. CHANGEUX  
Du vrai, du beau, du bien  
Ed. Odile Jacob (2008)

J.-P. CHANGEUX  
Entretien avec M. Alberganti (vidéo)  
Ed. Odile Jacob (2009)

## **I. ALLOSTERIC PROTEINS & RECEPTOR MECHANISMS**

### **A. Allosteric proteins**

- Changeux J.P. (1961) The feedback control mechanism of biosynthetic L-threonine deaminase by Lisoleucine. *Cold Spring Harbor Symp. Quant. Biol.* 26:313-318.
- Changeux J.P. (1962) [Effect of L-threonine and L-isoleucine analogs on L-threonine desaminase.] *J Mol Biol.* 4:220-5.
- Monod J., Changeux J.P. and Jacob. F. (1963) Allosteric proteins and cellular control systems. *J. Mol. Biol.* 6:306.
- Changeux J.P. (1963) Allosteric interactions on biosynthetic L-threonine deaminase from E. coli K12 *Cold Spring Harbor Symp. Quant. Biol.* 28 497-504.
- Changeux J.P. (1964) Sur les propriétés allostériques de la L-thréonine désaminase de biosynthèse, *Bull Soc. Chim. Biol.*, 46, 927-946 ; 947-961 ; 1151-1173 ; (1965) 47, 115-139 ; 267-280 ; 281-300
- Monod J., Wyman J. & Changeux J.P. (1965) On the nature of allosteric transitions : a plausible model. *J. Mol. Biol.* 12:88-118.
- Rubin, M.M. and Changeux, J.P. (1966) On the nature of allosteric transitions : implications of non exclusive ligand binding. *J. Mol. Biol.* 21, 265-274.
- Changeux J.P. & Edelstein S.J. (2005) Allosteric mechanisms of signal transduction. *Science* 308 :1424-1428.
- Changeux J.P., Thiéry J.P., Tung Y. & Kittel C. (1967). On the cooperativity of biological membranes. *Proc. Natl. Acad. Sci. USA.* 57, 335-341.
- Changeux J.P. (1969). Remarks on the symmetry and cooperative properties of biological membranes. In *Nobel Symposium II Symmetry and functions in Biological Systems at the Macromolecular level.*, A. Engström and B. Strandberg, eds. (New York.: John Wiley and Sons Inc. New York) 235-256.

### **B. Discovery of the nicotinic receptor**

- Changeux J.P., Gautron J, Israël M, Podleski T. [Separation of excitable membranes from the electric organ of *Electrophorus electricus*] *C R Acad Sci Hebd Seances Acad Sci D.* 1969 269:1788-91.
- Kasai M, Changeux J.P. (1970) [Demonstration of the excitation by cholinergic agonists from fractions of purified membranes, in vitro] *C R Acad Sci Hebd Seances Acad Sci D.*270:1400-3 ; Kasai M. & Changeux J.P. (1971) *In vitro* excitation of purified membrane fragments by cholinergic agonists. *J. Memb. Biol.* 6:1-23 ; 4-57 ; 58-80 ; 81-88.

- Changeux JP, Kasai M, Huchet M, Meunier JC. (1970) [Extraction from electric tissue of *Electrophorus* of a protein presenting several typical properties characteristic of the physiological receptor of acetylcholine] C R Acad Sci Hebd Seances Acad Sci D. 1970 Jun 8;270(23):2864-7.
- Changeux J.P., Kasai M. & Lee C.Y. (1970) The use of a snake venom toxin to characterize the cholinergic receptor protein. *Proc. Natl. Acad. Sci. USA.* 67:1241-1247.
- Meunier JC, Huchet M, Boquet P, Changeux JP. (1971) [Separation of the receptor protein of acetylcholine and acetylcholinesterase] C R Acad Sci Hebd Seances Acad Sci D. 1971 Jan 4;272(1):117-20.
- Olsen R., Meunier J.C. & Changeux J.P. (1972) Progress in purification of the cholinergic receptor protein from *Electrophorus electricus* by affinity chromatography. *FEBS Lett.* 28:96-100.
- Meunier J.C., Sealock R., Olsen R. & Changeux J.P. (1974) Purification and properties of the cholinergic receptor protein from *Electrophorus electricus* electroplax. *Europ. J. Biochem.* 45 :371-394.
- Cartaud J., Benedetti L., Cohen J.B., Meunier J.C. & Changeux J.P. (1972) Presence of a lattice structure in membrane fragments rich in nicotinic receptor protein from the electric organ of *Torpedo marmorata*. *FEBS Lett.* 33 :109-113.
- Bon F., Lebrun E., Gomel J., Van Rapenbusch R., Cartaud J., Popot J.L. & Changeux J.P. (1984) Image analysis of the acetylcholine receptor heavy form. *J. Mol. Biol.* 176 :205-237. 2

### **C. Chemical and molecular properties of the nicotinic receptor**

- Devillers-Thiery A., Changeux J.P., Paroutaud P. & Strosberg A.D. (1979) The amino-terminal sequence of the 40.000 molecular weight subunit of the acetylcholine receptor protein from *Torpedo marmorata*. *FEBS Lett.* 104:99-105.
- Giraudat, J, Devillers-Thiery, A., Auffray, C., Rougeon, F., Changeux, J.P. Identification of a cDNA clone coding for the acetylcholine binding subunit of *Torpedo marmorata* acetylcholine receptor. *EMBO J.* 1:713- 7, 1982.
- Devillers-Thiery A., Giraudat J., Bentaboulet M. & Changeux J.P. (1983) Complete mRNA coding sequence of the acetylcholine binding  $\alpha$ -subunit of *Torpedo marmorata* acetylcholine receptor : a model for the transmembrane organization of the polypeptide chain. *Proc. Natl. Acad. Sci. USA.* 80:2067-2071.
- Oswald R.E. & Changeux J.P. (1982) Crosslinking of  $\alpha$ -bungarotoxin to the acetylcholine receptor from *Torpedo marmorata* by ultraviolet light irradiation. *FEBS Lett.* 139:225-229.
- Dennis M., Giraudat J., Kotzyba-Hibert F., Goeldner M., Hirth C., Chang J.Y., Lazure C., Chrétien M. & Changeux J.P. (1988) Amino acids of the *Torpedo marmorata* acetylcholine receptor subunit labeled by a photoaffinity ligand for the acetylcholine binding site. *Biochemistry* 27:2346-2357.
- Galzi, J.L., Revah, F., Black, D., Goeldner, M., Hirth, C., Changeux, J.P. (1990) Identification of a novel amino acid alpha-tyrosine 93 within the cholinergic ligands-binding sites of the acetylcholine receptor by photoaffinity labeling. Additional evidence for a three-loop model of the cholinergic ligands-binding sites. *J. Biol. Chem.* 265:10430-7.
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- Martinez KL, Corringer PJ, Edelstein SJ, Changeux JP, Mérola F. (2000) Structural differences in the two agonist binding sites of the *Torpedo* nicotinic acetylcholine receptor revealed by time-resolved fluorescence spectroscopy. *Biochemistry.* 39 :6979-90.
- Giraudat J., Dennis M., Heidmann T., Chang J.Y. & Changeux J.P. (1986) Structure of the high affinity site for noncompetitive blockers of the acetylcholine receptor : serine-262 of the delta subunit is labeled by [3H]-chlorpromazine. *Proc. Natl. Acad. Sci. USA.* 83:2719-2723.
- Giraudat J., Dennis M., Heidmann T., Haumont P.Y., Lederer F. & Changeux J.P. (1987) Structure of the high-affinity binding site for noncompetitive blockers of the acetylcholine receptor: [3H] chlorpromazine labels homologous residues in the  $\alpha$  and  $\beta$  chains. *Biochemistry*, 26:2410-2418.
- Galzi J.L., Devillers-Thiery A., Hussy N., Bertrand S., Changeux J.P. & Bertrand D. (1992) Mutations in the ion channel domain of a neuronal nicotinic receptor convert ion selectivity from cationic to anionic. *Nature.* 359:500-505.

- Mulle C, Choquet D, Korn H, Changeux JP. Calcium influx through nicotinic receptor in rat central neurons: its relevance to cellular regulation. *Neuron*. 1992 8:135-43.
- Bertrand D, Galzi JL, Devillers-Thiéry A, Bertrand S, Changeux JP. (1993) Mutations at two distinct sites within the channel domain M2 alter calcium permeability of neuronal alpha 7 nicotinic receptor. *Proc Natl Acad Sci U S A*. 90:6971-5.
- Corringer P.J., Bertrand S., Galzi J.L., Devillers-Thiéry A., Changeux J.P. & Bertrand D. (1999) Mutational analysis of the charge selectivity filter of the  $\alpha 7$  nicotinic acetylcholine receptor. *Neuron*, 22 :831-843.
- Eiselé J.L., Bertrand S., Galzi J.L., Devillers-Thiéry A., Changeux J.P. & Bertrand D. (1993) Chimaeric nicotinic-serotonergic receptor combines distinct ligand binding and channel specificities. *Nature*, 366 :479-483.

#### **D. Allosteric modulators and allosteric properties of the nicotinic receptor**

- Mulle C, Léna C, Changeux JP. Potentiation of nicotinic receptor response by external calcium in rat central neurons. *Neuron*. 1992 8:937-45
- Galzi JL, Bertrand S, Corringer PJ, Changeux JP, Bertrand D. (1996) Identification of calcium binding sites that regulate potentiation of a neuronal nicotinic acetylcholine receptor. *EMBO J*. 15:5824-32.
- Le Novère N, Grutter T, Changeux JP. (2002) Models of the extracellular domain of the nicotinic receptors and of agonist- and Ca<sup>2+</sup>-binding sites. *Proc Natl Acad Sci U S A*. 99:3210-5.
- Krause RM, Buisson B, Bertrand S, Corringer PJ, Galzi JL, Changeux JP, Bertrand D. Ivermectin (1998) A positive allosteric effector of the  $\alpha 7$  neuronal nicotinic acetylcholine receptor. *Mol Pharmacol*. 53:283-94.
- Teichberg VI, Sobel A, Changeux JP. (1977) In vitro phosphorylation of the acetylcholine receptor. *Nature*. 267:540-2.
- Heidmann T. & Changeux J.P. (1979) Fast kinetic studies on the interaction of a fluorescent agonist with the membrane-bound acetylcholine receptor from *T. marmorata*. *Eur. J. Biochem*. 94:255-279; & Fast kinetic studies on the allosteric interactions between acetylcholine receptor and local anesthetic binding sites. *Eur. J. Biochem*. 94:281-296.
- Heidmann T., Bernhardt J., Neumann E. & Changeux J.P. (1983) Rapid kinetics of agonist binding and permeability response analyzed in parallel on acetylcholine receptor-rich membranes from *Torpedo marmorata*. *Biochemistry* 22:5452-5459.
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- Edelstein SJ, Schaad O, Changeux JP. (1997) Single binding versus single channel recordings: a new approach to study ionotropic receptors. *Biochemistry*. 36 :13755-60.
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- Le Novère N, Grutter T, Changeux JP. (2002) Models of the extracellular domain of the nicotinic receptors and of agonist- and Ca<sup>2+</sup>-binding sites. *Proc Natl Acad Sci U S A*. 99:3210-5.
- Fruchart-Gaillard C, Gilquin B, Antil-Delbeke S, Le Novère N, Tamiya T, Corringer PJ, Changeux JP, Ménez A, Servent D. (2002) Experimentally based model of a complex between a snake toxin and the alpha 7 nicotinic receptor. *Proc Natl Acad Sci U S A*. 99:3216-21
- Grutter T, Prado de Carvalho L, Le Novère N, Corringer PJ, Edelstein S, Changeux JP. (2003) An H-bond between two residues from different loops of the acetylcholine binding site contributes to the activation mechanism of nicotinic receptors. *EMBO J*. 22:1990-2003
- Grutter T, de Carvalho LP, Dufresne V, Taly A, Edelstein SJ, Changeux JP. (2005) Molecular tuning of fast gating in pentameric ligand-gated ion channels. *Proc Natl Acad Sci U S A*. 13 102 :18207-12.
- Taly A., Delarue M., Grutter T., Nilges M., Le Novère N., Corringer P.J. & Changeux J.P. (2005) Normal mode analysis suggest a quaternary twist model for the nicotinic receptor gating mechanism. *Biophysics J*. 88 :3954-3965.

- Bocquet N, Prado de Carvalho L, Cartaud J, Neyton J, Le Poupon C, Taly A, Grutter T, Changeux JP, Corringer PJ. (2007) A prokaryotic proton-gated ion channel from the nicotinic acetylcholine receptor family. *Nature*. 445:116-9.
- Bocquet N., Nury H, Baaden M., Le Poupon C., Changeux J.P., Delarue M.,Corringer PJ. (2009) X-ray structure of a pentameric ligand-gated ion channel in an apparently open conformation *Nature*. 457:111- 114.

### **E. Gain of function allosteric mutations of the nicotinic receptor**

- Revah F., Bertrand D., Galzi J.L., Devillers-Thiéry A., Mulle C., Hussy N., Bertrand S., Ballivet M. & Changeux J.P. (1991) Mutations in the channel domain alter desensitization of a neuronal nicotinic receptor. *Nature*, 353:846-849.
- Bertrand D., Devillers-Thiéry A., Revah F., Galzi J.L., Hussy N., Mulle C., Bertrand S., Ballivet M. & Changeux J.P. (1992) Unconventional pharmacology of a neuronal nicotinic receptor mutated in the channel domain. *Proc. Natl. Acad. Sci. USA*. 89 :1261-1265.
- Bertrand S, Devillers-Thiéry A, Palma E, Buisson B, Edelstein SJ, Corringer PJ, Changeux JP, Bertrand D. (1997) Paradoxical allosteric effects of competitive inhibitors on neuronal alpha7 nicotinic receptor mutants. *Neuroreport*. 8 :3591-6.
- Galzi JL, Edelstein SJ, Changeux J. (1996) The multiple phenotypes of allosteric receptor mutants. *Proc Natl Acad Sci U S A*. 93:1853-8.
- Edelstein SJ, Schaad O, Changeux JP. (1997) Myasthenic nicotinic receptor mutant interpreted in terms of the allosteric model. *C R Acad Sci III*. 320:953-61.
- Taly A, Corringer PJ, Grutter T, Prado de Carvalho L, Karplus M, Changeux JP. (2006) Implications of the quaternary twist allosteric model for the physiology and pathology of nicotinic acetylcholine receptors. *Proc Natl Acad Sci U S A*. 103:16965-70.

### **F. molecular mechanism of receptor up-regulation**

- Sallette J., Bohler S., Benoit P., Soudant M., Pons S., Le Novère N., Changeux J.P. & Corringer P.J. (2004) An extracellular protein microdomain controls up-regulation of neuronal nicotinic acetylcholine receptors by nicotine. *J.Biol Chem*.279:18767-75.
- Sallette J., Pons S., Devillers-Thiéry A., Soudant M., Prado de Carvalho L., Changeux J.P. & Corringer P.J. (2005) Nicotine up-regulates its own receptors through enhanced intracellular maturation. *Neuron* 46 :595-607.

## **II EPIGENESIS OF NEURONAL NETWORKS**

### **A. Selective stabilisation of synapses**

- Changeux J.P., Courrège P. & Danchin A. (1973) A theory of the epigenesis of neural networks by selective stabilization of synapses. *Proc. Nat. Acad. Sci. USA*. 70:2974-2978.
- Changeux J.P. & Danchin A. (1976) Selective stabilization of developing synapses as a mechanism for the specification of neuronal networks. *Nature*, 264:705-712.
- Changeux J.P. *Neuronal man* (1985) Pantheon New-York.
- Benoit P, Changeux J.P. (1975) Consequences of tenotomy on the evolution of multiinnervation in developing rat soleus muscle. *Brain Res*.99:354-8.
- Benoit P, Changeux J.P.(1978) Consequences of blocking the nerve with a local anaesthetic on the evolution of multiinnervation at the regenerating neuromuscular junction of the rat. *Brain Res*.149:89-96.
- Bourgeois JP, Toutant M, Gouzé JL, Changeux JP. (1986) Effect of activity on the selective stabilization of the motor innervation of fast muscle posterior latissimus dorsi from chick embryo. *Int J Dev Neurosci*. 4:415-29.
- Crepel F, Mariani J, Korn H, Changeux J.P. (1974) [Electrophysiology of the cerebellar cortex in the staggerer mutant mouse] *C R Acad Sci Hebd Seances Acad Sci D*.277:2761-3.

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### **B. Molecular biology of nicotinic receptor genes expression in the course of synaptic epigenesis**

- Bourgeois J, Ryter A, Menez A, Fromageot P, Boquet P, Changeux J. (1972) Localization of the cholinergic receptor protein in Electrophorus electroplax by high resolution autoradiography. *FEBS Lett.* 25:127-133.
- Bourgeois JP, Popot JL, Ryter A, Changeux JP (1973) Consequences of denervation on the distribution of the cholinergic (nicotinic) receptor sites from Electrophorus electricus revealed by high resolution autoradiography. *Brain Res.* 62:557-63.
- Bourgeois, JP, Popot, JL, Ryter, A, Changeux, JP (1978) Quantitative studies on the localization of the cholinergic receptor protein in the normal and denervated electroplaque from Electrophorus electricus. *J Cell Biol* 79:200-16.
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