

<<细胞和分子神经生理学>>

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## <<细胞和分子神经生理学>>

### 前言

人脑或神经系统是我们已知的宇宙中最复杂的物质结构，神经科学是探索脑的奥秘的科学，是21世纪迅猛发展的生命科学中最为突出的领域之一。

过去的十多年中，分子生物学和计算机科学技术的快速发展，极大地推动了神经科学的发展，人类基因组DNA序列的阐明及其对神经科学的推动、脑功能成像技术研究人脑和心理活动的巨大进展便是最突出的代表。

对许多神经元活动的基本过程，神经科学家已经可以通过基因操作，在基因及其编码的蛋白分子的结构和功能水平上进行描述和分析，从而精细地研究其复杂的细胞膜上和胞内信号的调控分子机制。

脑功能成像技术使得过去只能停留在人脑这个“黑箱”外、对心理现象的脑机制进行各种猜测和假说的时代成为过去，人脑的认知和思维活动变得“看得见”了。

神经科学不仅吸引着各类神经生物学家、化学家和物理学家，而且吸引分子生物学家、计算机科学家和心理学家纷纷加入其中，成为真正意义上的多种学科交叉的科学。

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### 内容概要

这本《细胞分子神经生理学》描述了神经细胞生理活动过程的基本概念、基本原理和主要的实验依据，包括神经细胞和胶质细胞的结构与功能、电压门控性离子通道与神经元的兴奋性、受体门控性离子通道与突触传递、神经电信号在树突-胞体的整合、神经元发放模式、突触可塑性以及神经网络等。尽管该书没有探讨多突触信号的汇聚整合原理、整合信号驱动神经细胞编程的机理、神经信号编程的内涵、神经信号编程的稳态以及网络内神经元的时空编程等神经科学的基本问题，但对于神经生理学领域教学研究人员仍然是一本应选用的好教科书，尤其是对于神经科学的初学者来说，这本书是建立神经生理学基本概念和知识的精品读物。

为了使初学者能够尽快地把握该书的内容，导读作者用中文给出了各个章节的核心要点。

## &lt;&lt;细胞和分子神经生理学&gt;&gt;

## 作者简介

作者：(美国)Constance Hammond Larry R. Squire is Distinguished Professor of Psy-chiatry, Neurosciences, and Psychology at the Univer-sity of California School of Medicine, San Diego, and Research Career Scientist at the Veterans Affairs Medical Center, San Diego. He investigates the organi-zation and neurological foundations of memory. He isa former President of the Society for Neuroscience andis a member of the National Academy of Sciences andthe Institute of Medicine. Darwin K. Berg is Distinguished Professor in the Division of Biological Sciences at the University of California, San Diego. He has been chairman of the Biology Department and currently serves as Councilor of the Society for Neuroscience and as a Board member of the Kavli Institute for Brain and Mind. His research is focused on the roles of nicotinic cholinergic signal-ing in the vertebrate nervous system. Floyd Bloom is Professor Emeritus in the Molecular and Integrative Neuroscience Department ( MIND ) at The Scripps Research Institute. His recent awards include the Sarnat Award from the Institute of Medi-cine and the Salmon Medal of the New York Academy of Medicine. He is a former President of the Society for Neuroscience and is a member of the National Academy of Sciences and the Institute of Medicine. Sascha du Lac is an Investigator of the Howard Hughes Medical Institute and an Associate Professor of Systems Neurobiology at the Salk Institute for Bio-logical Studies. Her research interests are in the neu-robiology of resilience and learning, and her laboratory investigates behavioral, circuit, cellular, and molecular mechanisms in the sense of balance. Anirvan Ghosh is Stephen Kuffler Professor in the Division of Biological Sciences at the University of California, San Diego and Director of the graduate program in Neurosciences. His research interests include the development of synaptic connections in the central nervous system and the role of activity-dependent gene expression in the cortical develop-ment. He is recipient of the Presidential Early Career Award for Scientists and Engineers and the Society for Neuroscience Young Investigator Award. Nicholas C. Spitzer is Distinguished Professor in the Division of Biological Sciences at the University of California, San Diego. His research is focused on neuronal differentiation and the role of electrical activity and calcium signaling in the assembly of the nervous system. He has been chairman of the Biology Department and the Neurobiology Section, a trustee of the Grass Foundation, and served as Councilor of the Society for Neuroscience. He is a member of the American Academy of Arts and Sci-ences and Co-Director of the Kavli Institute for Brain and Mind.

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## 章节摘录

插图：Acetylcholinesterases are glycoproteins synthesized in the soma and carried to the terminals via antero-grade axonal transport. They are inserted into the presynaptic membrane and the basal lamina. They display an important structural polymorphism ( Figure 6.12b ) : they have a globular form ( G ) or an asymmetric form ( A ) . These different forms have distinct localizations. Globular forms ( G ) are anchored in the pre- or postsynaptic membrane ( these are ectoenzymes ) and are secreted as a soluble protein into the synaptic cleft. Asymmetric forms ( A ) are anchored in the basal lamina ( Figure 6.12c ) . The molecules of acetylcholine, released in the synaptic cleft when the neuromuscular junction is activated, cross the basal lamina through its loose stitches. But a part of the acetylcholine molecules is also degraded before being fixed to postsynaptic receptors, by the acetylcholinesterase inserted in the basal lamina. The other part is quickly degraded after its fixation. Acetylcholinesterases hydrolyze acetylcholine into acetic acid and choline. Choline is taken up by presynaptic terminals for the synthesis of new molecules of acetylcholine. This degradation system of acetylcholine is a very efficient system for inactivation of a neurotransmitter.

6.3.3 Nicotinic receptors for acetylcholine are abundant in the crests of the folds in the postsynaptic membrane. The plasma membrane of muscle cells, the sarcolemma, presents numerous folds in mammalian neuromuscular junctions. By using a radioactive ligand for a type of acetylcholine nicotinic receptor, *c*-bungarotoxin labelled with a radioactive isotope or a fluorescent molecule, it has been shown that the radioactive material accumulates predominantly in the crests of the folds in the sarcolemma. Immunocytochemical techniques produce similar results. Other studies have shown that they are anchored to the underlying cytoskeleton ( see the following section ) . The nicotinic receptor is a transmembrane glycoprotein comprising four homologous subunits assembled into a heterologous 2B8 pentamer. It is a receptor channel permeable to cations whose activation results in the net entry of positively charged ions and in depolarization of the postsynaptic membrane. The structure and functional characteristics of the muscular nicotinic receptors are given in Chapter 8.

6.3.4 Mechanisms involved in the accumulation of postsynaptic receptors in the folds of the postsynaptic muscular membrane. The acetylcholine nicotinic receptors are, in the adult neuromuscular junction, present in high density ( about 10,000 molecules per  $\mu\text{m}^2$  ) in the postsynaptic regions and occur in a much lower density in the nonsynaptic membrane ( extrajunctional membrane ) . Under the nerve terminal, the muscle cell is free of the myofibrils actin and myosin. At this level, four to eight cell nuclei are found, the fundamental nuclei ( Ranvier 1875 ) . The myonuclei located outside the post-synaptic region ( extrasynaptic ) are the sarcoplasmic nuclei. The formation of this well organized subsynaptic domain - which concerns not only the nicotinic receptors but also the Golgi apparatus and the cytoskeleton ( it also comprises the organization of the basal lamina and the distribution of the asymmetric form of acetylcholinesterase in the synaptic cleft ) - occurs in numerous steps during maturation of the neuromuscular junction ( Figure 6.13a ) : There is an increase in the number of nicotinic receptors ( 1 and 2 ) during fusion of the myoblasts to form myotubes, owing to the neosynthesis of these receptors. They have an even distribution over the membrane surface. This phenomenon is independent of the neuromuscular activity since it is not affected by the injection in ovo of nicotinic antagonists such as curare. ~ There is formation of aggregates of nicotinic receptors under the nerve terminal ( 3-5 ) and disappearance of extrajunctional receptors ( 5 ) .

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### 编辑推荐

《细胞和分子神经生理学(第3版)(导读版·原版引进)》是建立神经生理学基本概念和知识的精品读物。为了使初学者能够尽快地把握该书的内容，导读作者用中文给出了各个章节的核心要点。

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