Contents

I. INTRODUCTION

Reminiscences and Perspectives about Research on Neurotransmitter Amino Acids
E. Costa

II. BIOCHEMICAL OVERVIEW

Neurochemical Studies on Glutamate-Mediated Neurotransmission
F. Fonnum

III. ANATOMY

Light- and Electron-Microscopic Immunocytochemistry of Excitatory Amino Acids
J. Storm-Mathisen and O. P. Ottersen

Toward the Anatomical Identification of Glutamatergic Neurons and Synapses in the Cerebral Cortex
F. Conti

The Anatomy of Non-N-Methyl-d-aspartate Excitatory Amino Acid Binding Sites in Mammalian Brain

Immunohistochemical Localization of Glutamate and Homocysteate
P. Streit, P. Grandes, P. Morino, P. Tschopp, and M. Cuenod

N-Acetyl-aspartyl Glutamate: Recent Developments
J. T. Coyle, B. Stauch-Slusher, G. Tsai, J. Rothstein, J. L. Meyerhoff, M. Simmons, and R. D. Blakely

Mapping Pathways of Focally Evoked Seizures Using Early Response Gene Expression
P. Lanaud, R. Maggio, K. Gale, and D. Grayson
IV. MOLECULAR BIOLOGY

Biochemical and Molecular Characterization of a Frog Brain Kainate Binding Protein 87
R. J. Wenthold, Y. Nakatani, D. R. Hampson, C. J. Dechesne, R. G. King, and K. Wada

The Chick Cerebellar Kainate Binding Protein: Structure and Function 97
A. Ortega, Y. Lamed, P. Gregor, and V. I. Teichberg

Possible Heterogeneity of Glutamate Receptors Linked to Inositol Phospholipid Metabolism 105
H. Sugiyama, I. Ito, and S. Tanabe

The Glutamate Receptor Gene Family 109

Identification and Properties of a Functional Unitary Non-N-Methyl-d-aspartate Receptor from Xenopus Brain 135

Molecular Biology of Excitatory Amino Acid Receptors 145

Kainate and Quisqualate Activate the Receptor Channel Expressed by GluR-K1: Comparison with Brain Poly(A+ ) RNA 155
L. Prado de Carvalho, B. Lambolez, P. Curutchet, J. Stinnakre, P. Bregestovski, and J. Rossier

V. ELECTROPHYSIOLOGY, PHARMACOLOGY, AND SIGNAL TRANSDUCTION

Electropharmacological Evidence for Glutamate Receptor Subtypes 163

Modulation of Excitatory Synaptic Transmission by Presynaptic GABA_B Receptors in Rat Hippocampal Slices 177

Rapid Activation, Desensitization, and Recovery of Synaptic Channels of Crustaceans after Glutamate Pulses 183
J. Dudel, C. Franke, and H. Hart

N-Methyl-d-aspartate Antagonist Structure-Activity Relationships Revealed by Rapid Perfusion in Voltage-Clamp Experiments 193
M. L. Mayer and M. Benveniste
Agonist- and Antagonist-Preferring N-Methyl-D-aspartate Receptors and Independent Activation of Their Ion Channels  
D. T. Monaghan  
Glycine-Site Ligand Affinity and Efficacy: Consequences for N-Methyl-D-aspartate Receptor Modulation  
J. A. Kemp, T. Priestley, and G. R. Marshall  
Block of the Glycine Recognition Site on N-Methyl-D-aspartate Receptors  
R. Dingledine and N. W. Kleckner  
Role of Arachidonic Acid in Signal Transduction of N-Methyl-D-aspartate-Sensitive Glutamate Receptors  
J. T. Wroblewski, J. W. Lazarewicz, B. Wroblewska, and E. Costa  
Stimulation of N-Methyl-D-aspartate or Metabotropic Quisqualate (Q_p) Receptors when Associated with Depolarization-Triggered Arachidonic Acid Release  
J. Bockaert, J.-P. Pin, K. Oomagari, M. Sebben, and A. Dumuis  
Excitatory Amino Acids and Nitric Oxide Formation  
J. Garthwaite, E. Southam, and S. J. East  
Allosteric Modulators of the N-Methyl-D-aspartate Receptor Affect Excitatory Postsynaptic Currents in a Thin-Slice Preparation of Rat Hippocampus  
S. Vicini, C. T. Livsey, E. Costa, and G. Mereu  
In Rat Cerebellar Granule Cells, Ibotenic Acid Stimulates Phosphoinositide Hydrolysis Via Two Distinct Receptors  
R. Raulli, E. Costa, and J. T. Wroblewski  
Excitatory Amino Acids Induce Calcium/Calpain-I-Dependent Proteolysis of Brain Spectrin in Cultured Central Neurons  
V. Gallo, A. M. M. Di Stasi, M. Ceccarini, and T. C. Petrucci  
L-Glutamate Receptors in the Insect Central Nervous System  
K. A. Wafford, D. Bai, M. I. Sepulveda, and D. B. Sattelle  
Quisqualate-Induced Changes in [Na^+]_o and [Ca^{2+}]_o Persist in the Combined Presence of 2-Amino-5-phosphonovaleric Acid, Ketamine, and 6-Cyano-7-nitroquinoxaline-2,3-dione  
L. A. Mudrick and U. Heinemann  
N-Methyl-D-aspartate-Receptor-Mediated Control of Dopamine Release in Striosomal- and Matrix-Enriched Areas of the Rat Striatum  
M.-O. Krebs, M.-L. Kemel, M. Desban, J. Glowinski, and C. Gauchy  
Streptomycin Blocks Quisqualate and Kainate Effects on the Vestibular System Primary Afferents  
E. Soto, M. E. Pérez, and R. Vega  
Inhibition of N-Methyl-D-aspartate-Induced [^{3}H]Norepinephrine Release from Hippocampal Slices by the Polyamine Antagonists Arcaine and Putrescine  
A. I. Sacaan and K. M. Johnson
Glutamate Receptors in Excitatory Synaptic Inputs to Frog Spinal Motoneurons
S. M. Antonov, L. G. Magazanik, N. I. Kalinina, G. G. Kurchavyj, and N. P. Vesselkin

Properties of N-Methyl-d-aspartate Receptors Expressed in Oocytes
M. V. L. Bennett, J. Lerma, and R. S. Zukin

Role of Nitric Oxide in the Activation of Cerebellar Guanylate Cyclase by Excitatory Amino Acid Agonists In Vivo
P. L. Wood

Spermine Potentiates Responses of N-Methyl-d-aspartate Receptors Expressed in Oocytes
J. F. McGurk, M. V. L. Bennett, and R. S. Zukin

Kinetic Properties of N-Methyl-d-aspartate Receptor Channels: Mechanisms of 3-(2-Carboxypiperazin-4-yl)propyl-1-phosphate and Dibenzocyclohepteneimine Antagonism

VI. KYNURENATE AND QUINOLINATE

In Vivo Studies on the Synthesis of Quinolinic and Kynurenic Acids in the Rat Brain and Other Organs
P. Russi, R. Pellicciari, M. Gallo-Mezo, G. Moneti, and F. Moroni

Quinolinic Acid and Kynurenic Acid: Potential Mediators of Neuronal Dysfunction During Immune Activation
M. P. Heyes

The Endogenous Antagonist Kynurenic Acid: Effects at Kainate Receptors
T. W. Stone

The Neurochemistry of Quinolinate and Kynurenate: Current Concepts

VII. MEDICINAL CHEMISTRY

Natural Toxins and Glutamate Transmission
P. N. R. Usherwood

Structure–Activity Studies with Analogues of MK-801
3,4-Cyclopropylglutamates as N-Methyl-D-aspartate Receptor Ligands
R. Pellicciari, B. Natalini, M. Marinozzi, C. Chiorri, T. H. Lanthorn,
J. B. Monahan, and J. P. Snyder

The Development of Novel Competitive N-Methyl-D-aspartate
Antagonists as Useful Therapeutic Agents: Discovery of LY274614
and LY233536
P. L. Ornstein, D. D. Schoepp, J. D. Leander, and D. Lodge

Synthetic Chemistry, N-Methyl-D-aspartate Receptor Modulators, and
Second Messengers
A. P. Kozikowski and Y.-P. Pang

Novel N-Methyl-D-aspartate (NMDA) Agonists and Non-NMDA
Antagonists
P. Krogsgaard-Larsen, B. Ebert, T. N. Johansen, J. W. Ferkany, and
U. Madsen

Anti-ischemic Potential of the Polyamine Modulatory Site Antagonists
Ifenprodil and SL 82.0715
B. Scatton, C. J. Carter, J. Benavides, C. Dana, and B. Gotti

Quinoxalinediones: Non-N-Methyl-D-aspartate Receptor Antagonists as
Potential Drug Candidates
T. Honoré, M. J. Sheardown, E. B. Nielsen, M. E. Judge, and
P. Jacobsen

VIII. LONG-TERM POTENTIATION AND SYNAPTIC PLASTICITY

Main Features of Hippocampal Synaptic Plasticity
P. Andersen and Ø. Hvalby

Postsynaptic Mechanisms of Hippocampal Long-Term Potentiation: The
Involvement of Glutamate Receptors and Protein Kinases in Its Late
Maintenance
K. G. Reymann

Retrograde Messengers in Long-Term Potentiation: A Role for
Arachidonic Acid?
J. H. Williams, M. P. Clements, M. L. Errington, K. L. Voss,
M. A. Lynch, and T. V. P. Bliss

Mechanisms of Use-Dependent Synaptic Plasticity in Slices of Rat
Visual Cortex
A. Artola, S. Brocher, and W. Singer

Involvement of Excitatory Amino Acid Receptor Mechanisms in Visual
Cortical Plasticity
M. F. Bear
IX. BEHAVIORAL PHARMACOLOGY

The Role of Excitatory Amino Acid Agonists and Antagonists in Complex Behavioral Processes 515
J. M. Moerschbaecher and J. H. Woods

N-Methyl-D-aspartate Receptors and Learning: A Framework for Classifying Some Recent Studies 521
I. C. Reid and R. G. M. Morris

N-Methyl-D-aspartate Receptors and Recognition Memory in the Domestic Chick 533
B. J. McCabe

Intravenous Self-Injection in Rhesus Monkeys: Comparison of CGS 19755 and Phencyclidine-like Compounds 539
G. Winger, C. P. France, and J. H. Woods

Central Mediation of N-Methyl-D-aspartate-Induced Dipsogenesis in Pigeons 547
S. P. Baron and J. H. Woods

X. EXCITOTOXICITY

Fast and Slow Excitotoxicity in Cortical Cell Culture 555
D. W. Choi

Excitotoxic Mechanisms in the Immature Rat Hippocampal Slice: Focus on Calcium 563
A. Lehmann and P. Andine

Acute Toxicity of Acidic Amino Acids in Cultured Cerebellar Granule Cells: Effects of pH and Zn\textsuperscript{2+} and the Intracellular Accumulation of Glutamate 573
S. Eimerl and M. Schramm

Pharmacology of Excitotoxicity in Cultured Hippocampal Pyramidal Neurons 579
R. J. Miller, A. E. Abele, K. P. Scholz, and W. K. Scholz

Excitotoxicity in Cultured Neurons: Role of Second Messenger Systems and Intracellular Ca\textsuperscript{2+} Homeostasis 593
A. Schousboe, A. Frandsen, P. Wahl, J. Drejer, and T. Honoré

Ganglioside Treatment Following Cerebral Ischemia: Relationship with Anti-excitotoxic Effects 601
M. Lipartiti, A. Lazzaro, R. Zanoni, N. Schiavo, S. Mazzari, G. Toffano, and A. Leon

The Pattern and Degree of Selective Vulnerability to Excitotoxic Brain Injury Is Dependent upon Developmental Age 609
J. W. McDonald, W. H. Trescher, and M. V. Johnston
Effect of Glutamate Receptor Agonists on Transmitter Release and Leucine Incorporation in Cultured Mature Hippocampal Slices 615
N. Kleinberger-Doron and M. Schramm

Blockade of Excitatory Transmission Prevents Hippocampal Damage Induced by Tetanus Toxin in Rats 619
G. Bagetta, G. Nistico, and N. G. Bowery

Monoaminergic Activity and Excitotoxicity: An Approach Using Microdialysis 627
B. Arvin, A. G. Chapman, and B. S. Meldrum

Receptor-Abuse-Dependent Antagonism: A New Strategy in Drug Targeting for Excitatory Amino-Acid-Induced Neurotoxicity 635
A. Guidotti, G. de Erausquin, G. Brooker, M. Favaron, H. Manev, and E. Costa

A Serum Protein Complex that Induces Cerebellar Granule Cell Differentiation and Confers Resistance to Excitotoxicity 647
C. Galli, P. Gullà, M. T. Ciotti, M. Liguori, D. Mercanti, and P. Calissano

XI. EPILEPSY, ISCHEMIA, AND RELATED PATHOLOGIES

Excitatory Amino Acid Neurotransmission in Epilepsy and Anticonvulsant Therapy 655
B. S. Meldrum

Anticonvulsant Activity of Competition N-Methyl-D-aspartate Antagonists Following Oral Administration 671
A. G. Chapman

Release of Excitatory Amino Acids: Animal Studies and Epileptic Foci Studies in Humans 677

CGP 37849 Is an Orally Bioavailable Competitive N-Methyl-D-aspartate Receptor Antagonist with Potent Anticonvulsant and Neuroprotective Properties 687

Excitatory Amino Acids and Traumatic Nervous System Injury 695
T. K. McIntosh, R. Vink, D. H. Smith, and R. P. Simon

MK-801 (Dizocilpine): Efficacy and Limitations in Cerebral Ischemia 703
R. N. Auer, M. R. Rod, and I. Q. Whishaw

Role of Excitatory Amino Acid Receptors in Perinatal Hypoxic–Ischemic Brain Injury 711
M. V. Johnston, J. W. McDonald, C.-K. Chen, and W. H. Trescher
Effects of MK-801, Flunarizine, and Nimodipine on the
Methamphetamine- and 3,4-Methylenedioxyamphetamine-Induced
Decline in Tryptophan Hydroxylase Activity 717
M. Johnson, K. Mitros, G. R. Hanson, and J. W. Gibb
Glycine-Enhanced Glutamate Dysfunction May Mediate Motor Neuron
Degeneration in Amyotrophic Lateral Sclerosis 723
A. Plaitakis
The Significance of the Excitatory Input for Ischemia-Induced Damage
in the Rat Hippocampus 731
N. H. Diemer, F. F. Johansen, and M. B. Jørgensen
N-Methyl-D-aspartate Receptors in Temporal Lobe Epilepsy of Rats
Studied In Vitro 741
Excitatory Amino Acid Receptors in Human Temporal Lobe Epilepsy
and in Animal Models 749
J. W. Geddes, J. Ulas, G. Buzsaki, and C. W. Cotman
Subject Index 759