

NEUROTRANSMISSION AND CEREBROVASCULAR FUNCTION VOLUME I

Editors

JACQUES SEYLAZ

Laboratoire de Physiologie et Physiopathologie Cérébrovasculaire
INSERM U 182, CNRS 641 Université Paris VII
Paris, France

ERIC T. MACKENZIE

Cyclotron Biomédical de Caen, CNRS - UPR 16
Caen Cédex, France



1989

EXCERPTA MEDICA, AMSTERDAM - NEW YORK - OXFORD

CONTENTS

Guest Reviews

- Brain aging, Alzheimer's disease and the cholinergic system
Y. Lamour, M.H. Bassant, M.C. Senut and P. Dutar 3
- Cerebral circulation and intracerebral systems in the aging brain
P. Lacombe and R. Sercombe 29

Cerebrovascular Endothelium

- Pressure-induced endothelium-dependent contraction in cat cerebral arteries
K. Kauser, G.M. Rubanyi, R.J. Roman and D.R. Harder 71
- The role of endothelium-derived hyperpolarizing factor (EDHF) and cyclic nucleotides in cerebral vasodilatation
J.E. Brayden 77
- The effect of moderate endothelial damage by air embolism on the reactivity of pial arteries in vivo
C. Haller, R. Sercombe, J. Seylaz and W. Kuschinsky 81
- The glucose transporter of nervous system vascular endothelium
S.I. Harik 85
- Brain blood flow and sucrose space in acute and chronic hyperglycemia
J.C. LaManna, G.E. Kikano and S.J. Harik 89
- Dynamics of capillary perfusion in the brain
W. Kuschinsky, U. Göbel, H. Theilen and H. Schröck 93
- The roles of vascular endothelium, calcium uptake, and cyclic nucleotides in hypoxic cerebral vasodilation
W. Pearce 97
- Muscarinic receptors in the endothelium of peripheral and cerebral vessels
F. Lasbennes, C. Verrecchia, M. Berard, V. Philipson, L. Drouet and J. Seylaz 101
- Cholinergic and histaminergic receptors in cultured endothelium derived from human cerebral microvessels
M. Spatz, F. Bacic, R.M. McCarron, N. Merkel, S. Uematsu, D.M. Long and J. Bemby 105
- Muscarinic cholinergic receptors on the endothelium of human cerebral arteries and atherosclerosis
T. Tsukahara, N.F. Kassell and Y. Yonekawa 109

Cerebrovascular Smooth Muscle

- Myogenicity and spontaneous vasomotion in pressurized neonatal rat cerebral arteries
K. Mackey and W. Halpern 115
- Flow-regulation of cerebrovascular tone: Interaction with neural mechanisms
J.A. Bevan, J.-L. Garcia-Roldan and E.H. Joyce 119
- Modulation of noradrenaline release by purinoceptors and intracellular cAMP levels in cat cerebral arteries
J. Marín, M. Güemes, C. Ibañez, C.F. Sánchez-Ferrer, F. Rivilla and M. Salaices 123
- Vasodilator action of an agonist for histamine H₃-receptors in perfused rabbit middle cerebral arteries
L. Ea-Kim and N. Oudart 127
- Mechanisms of action and interaction of perivascular peptides and non-peptides in cerebral vasoconstriction
L. Edvinsson, B. Fallgren, I. Jansen and K. Horsburgh 131
- Prostacyclin participates in the cerebral vasodilatory effect of dopamine receptor stimulating drugs
J. Callebert, M. Abalo-Abotchi, M. Plotkine and R.G. Boulu 137
- Pharmacological characterization of contraction-mediating cerebrovascular prostanoid receptors
T.K. Uski 141
- Spatial and temporal heterogeneity of cortical cerebral blood flow: A theory and hypothesis of CBF regulation
S.C. Jones, M. Shea, B. Bose, A.J. Furlan and J.R. Little 145

Morphological and Trophic studies on the Innervation of Cerebral Blood Vessels

- Immunohistochemical evidence for the presence of GABAergic nerves in cerebral blood vessels
H. Imai, T. Itakura, N. Komai, J.Y. Wu, T. Okuno and T.J.-F. Lee 151
- Morphological relationship between GABAergic and other autonomic innervation in cerebral arteries
T. Okuno and T.J.-F. Lee 155
- Close relationship between dopaminergic varicosities and small blood vessel walls in rat and monkey retina
C. Favard, A. Simon and J. Nguyen-Legros 159
- Effect of hypoglycemia on autonomic nerve terminals of cerebral arteries
K. Isozumi, F. Gotoh, Y. Fukuuchi, A. Koto, Y. Izumi, Y.M. Tsuzuki and R. Senda 163

Effects of experimental subarachnoid hemorrhage and 6-hydroxydopamine on the ultrastructure of cat cerebral arteries <i>C.F. Sánchez-Ferrer, F. Rivilla, J. Marín, M. Salaiques and P.G. Ramos</i>	167
Effects of high cholesterol diet on the reactivity of rabbit cerebral and peripheral arteries to amines <i>R. Sercombe, C. Verrecchia, M.C. Miller, V. Philipson and J. Seylaz</i>	171
Influence of the sympathetic nervous system (SNS) on morphology and function of the cerebral artery wall <i>V. Dimitriadou, P. Aubineau, K. Kacem and J. Seylaz</i>	177
Does denervation of cerebral vessels increase the risk for cerebrovascular lesions in hypertensive rats? <i>B.B. Johansson, C. Nordborg, and T.-E.O. Sokrab</i>	181
Effect of chronic hypertension on the lower limit of autoregulation of cerebral blood flow in the awake rat <i>P. Janian, I. Lartaud, F. Muller, J. Atkinson and C. Capdeville</i>	185
 Adrenergic and Serotonergic Mechanisms	
Evidence for innervation of cerebral microvessels by locus ceruleus noradrenergic neurons <i>R.N. Kalaria and S.I. Harik</i>	191
Perivascular innervation alters ionic channel conductance in the rat cerebral circulation: An electrophysiological study <i>G.D. Silverberg</i>	195
Modulatory action of histamine on adrenergic neurotransmission in cerebral arteries <i>F.J. Miranda, G. Torregrosa, J.B. Salom, J.A. Alabadi, V. Campos and E. Alborch</i>	201
Cervical sympathetic stimulation: A map of its effects on local cerebral blood flow <i>U.I. Tuor</i>	205
Role of locus ceruleus in hemispheric and vertebral blood flow and their vasomotor responses <i>K. Shimazu, T. Ohkubo, H. Kim, H. Sugimoto, Y. Asano, A. Sudoh, N. Nakazato, M. Sawada, K. Hamaguchi and Y. Ogawa</i>	209
Neurohumoral effects on blood vessels of the cerebrum, brain stem and choroid plexus <i>D.D. Heistad and F.M. Faraci</i>	213
Is the cerebrovascular 5-HT contained in vascular nerve terminals in normal conditions? Complementary cytological and biochemical approaches in rat and rabbit <i>P. Mathiau, D. Riche, G. Behzadi, A.-M. Reynier-Rebuffel, V. Dimitriadou, O. Issertial, J. Callebert, P. Aubineau, L. Wiklund and J. Seylaz</i>	219

Pharmacological characterization of serotonin interactions with cerebral and peripheral vascular smooth muscle <i>T.A. Kent, J.M. Simard and A. Jazayeri</i>	225
Further characterization of the 5-HT _{1-like} receptor present on human isolated basilar artery <i>A.A. Parsons and E.T. Whalley</i>	229
5HT _{1-like} receptors mediate pial venous relaxation <i>T.J.-F. Lee and N. Sunagane</i>	233
Involvement of 5-HT _{1C} -receptors in the production of CSF from the choroid plexus <i>M. Lindvall-Axelsson, C. Nilsson, C. Owman and P. Svensson</i>	237
Effect of muscimol on serotonin turnover rate of rat cerebral arteries <i>E.J. Marco, A.L. Lopez de Pablo, J.C. Soto and M.V. Conde</i>	241
Hypertension-induced amplification of cerebral artery constrictor responses to serotonin <i>G. Osol, S. Knutson and M. Cipolla</i>	245
Experimental paradigms determine the cerebrovascular response to dorsal raphe stimulation <i>G. Bonvento, A. Cudennec, D. Duverger, P. Lacombe, E.T. MacKenzie and J. Seylaz</i>	249
Influence of serotonin on regional blood-brain barrier permeability and cerebral blood flow in the rat <i>H.S. Sharma, Y. Olsson and P.K. Dey</i>	253
Effect of the serotonin antagonist ketanserin on the hemodynamic and morphological consequences of thrombotic infarction <i>W.D. Dietrich, R. Busto and M.D. Ginsberg</i>	257

Peptidergic Mechanisms

Distribution and ultrastructure of peptidergic nerve fibers in the cerebral blood vessels <i>T. Itakura</i>	263
New aspects of cerebrovascular NPY: Co-existence with VIP and acetylcholine in parasympathetic nerves <i>N. Suzuki, J.E. Hardebo, J. Kährström and C. Owman</i>	267
Origins, precise pathways, distribution and co-existence of ChAT-, VIP-, NPY-, CGRP-, SP- and dynorphin B-positive nerves in rat cerebral vessels. Comparison with man, and possible implication for vascular headache <i>J.E. Hardebo, N. Suzuki and C. Owman</i>	271
Cyclic nucleotides and cerebral neurogenic vasodilation <i>T.J.-F. Lee, Y.X. Fang and G.A. Nickols</i>	277
Role of calcitonin gene-related peptide (CGRP) as a vasodilator transmitter in large cerebral arteries of cats <i>A. Saito, T. Mima, T. Shigeno, T.J.-F. Lee and K. Goto</i>	281

Comparison the relaxant effect of human α - and β -calcitonin gene-related peptides (CGRP) with sodium nitroprusside in human pial arteries	
<i>I. Marshall</i>	285
Galanin - A new peptide of trigeminal origin in cerebrovascular nerve fibers	
<i>C. Owman, J.E. Hardebo, J. Kährström and N. Suzuki</i>	289
Endothelin, a potent endothelium-derived constrictor of cerebral vessels. Possible contribution to cerebrovascular disturbances in hypertension	
<i>J.E. Hardebo, J. Kährström, C. Owman and L.G. Salford</i>	293
Effect of endothelin on canine and bovine cerebral vascular smooth muscle in vitro and in vivo	
<i>Y. Suzuki, T. Asano, S.-I. Satoh, I. Ikegaki, M. Shibuya and K. Sugita</i>	297
The cerebrovascular significance of endothelin	
<i>M.J. Robinson</i>	301
Origin, distribution, coexistence and presynaptic mechanisms of neuropeptides in the choroid plexus	
<i>C. Nilsson, R. Ekman, M. Lindvall-Axelsson and C. Owman</i>	305
Stimulation of V ₂ receptors increases blood flow and oxygen consumption in the brain	
<i>E. Kozniewska and E. Szczepanska-Sadowska</i>	309
Postocclusive hyperemia in feline cortical grey matter is mediated by trigeminal sensory axons	
<i>M.A. Moskowitz, D.E. Sakas, E.P. Wei, M. Kano, M.G. Buzzi, C. Ogilvy and H.A. Kontos</i>	313
The cerebrovascular sphenopalatine system: anatomical and functional aspects	
<i>J. Seylaz, H. Hara, E. Pinard, S. Mraovitch, E.T. MacKenzie, L. Edvinsson and R. Uddman</i>	317
Electrical stimulation of postganglionic cerebrovascular parasympathetic fibers enhances cerebral blood flow	
<i>N. Suzuki, J.E. Hardebo, J. Kährström and C. Owman</i>	321
Facial nerve stimulation causes local release of vasoactive intestinal polypeptide in the cat cortex	
<i>P.J. Goadsby</i>	325
Effect of a substance P antagonist on cerebral vasospasm in rats and monkeys	
<i>N.A. Svendgaard, T.J. Delgado, Y. Shiokawa and M.A.-R. Arbab</i>	329
Cholinergic Mechanisms and the Basal Forebrain	
Cholinergic and VIP-ergic innervations in cerebral arteries of the cat	
<i>F.J.-P. Miao and T.J.-F. Lee</i>	335
Choline uptake properties of recently isolated and long term cultured cerebral endothelial cells	
<i>E. Estrada, E. Galea, J. Bready, J. Berliner and P.A. Cancilla</i>	339

Cholinergic markers in isolated bovine cerebral capillaries: Distribution in neuronal and endothelial elements <i>E. Galea and C. Estrada</i>	343
Cholinergic markers as evidence for a functional innervation of the cerebrovascular bed <i>E. Hamel, J. Seylaz and F. Dauphin</i>	347
Pharmacological profile of the muscarinic receptor mediating relaxation in feline middle cerebral artery <i>F. Dauphin and E. Hamel</i>	351
Pre- and postsynaptic muscarinic receptors in cat cerebral arteries <i>M. Salaices, M.J. Alonso, S. Arribas, G. Balfagón, C.F. Sánchez-Ferrer and J. Marín</i>	355
Physostigmine will increase cerebral blood flow and brain metabolism in the rat and reverse the depression produced by midazolam <i>W.E. Hoffman</i>	359
Physiological parameters influencing the cerebral vasodilatory effect of ATP and physostigmine <i>L. Molnár, K. Hegedüs and I. Fekete</i>	365
Role of cholinergic control in heterogeneous arterial responses during increased cortical activity in rabbits <i>Z. Gordeladze, D. Baramidze and G. Mchedlishvili</i>	369
Effects of cholinergic agonists on cerebral blood flow and infarct size following unilateral middle cerebral artery occlusion in rats <i>A. Sauter, M. Rudin and A. Enz</i>	373
Chronic stimulation of nicotinic cholinergic receptors following partial hemitransection of the meso-striatal dopamine system exerts a neuroprotective action reflected in normalization of striatal glucose metabolism and blood flow <i>C. Owman, K. Fuxe, A.M. Janson and J. Kåhrström</i>	377
Cortical cerebral blood flow is modulated by cholinergic basal forebrain neurons: Effect of ibotenic acid lesions and electrical stimulation <i>S.P. Arnerić</i>	381
Cortical blood flow response to stimulation of cholinergic neurons of the substantia innominata in young and senescent rats <i>P. Lacombe, R. Sercombe, F. Dauphin, V. Philipson and J. Seylaz</i>	385
Unilateral lesion of the nucleus basalis magnocellularis does not impair autoregulation of local cerebral blood flow in rats <i>S. Gomi, F. Gotoh, N. Ishihara, K. Tanaka, Y. Ishikawa, S. Takashima and B. Mihara</i>	389
Change of cerebral blood flow in Alzheimer model rat: Effect of transplantation of cholinergic neurons <i>H. Yokote, T. Itakura, S. Yukawa, H. Imai, I. Kamei and N. Komai</i>	393
Cardiovascular and cerebrovascular alterations elicited by cholinergic stimulation of the centromedian-parafascicular complex in the rat <i>S. Mraovitch, J. Feger, Y. Calando and J. Seylaz</i>	397

- Fastigial nucleus stimulation reduces the volume of cerebral infarction produced by occlusion of the middle cerebral artery in rat
D.J. Reis, M.D. Underwood, S.B. Berger, M. Khayata and N. Zaiens III 401
- Effects of electrical stimulation of the brain stem reticular formation on intracranial pressure and cerebral blood flow volume in spinal cats with vagotomy
M. Maeda 405
- Excitatory Amino-Acid and Purinergic Mechanisms: Importance in Ischemia**
- Role of adenosine in the control of cerebral blood flow during seizures
E. Pinard, D. Riche, S. Puiroud, R. Charbonne and J. Seylaz 411
- Effects of R-Phenylisopropyladenosine during global cerebral ischemia studies by in vivo ^{31}P NMR spectroscopy in the rat
P. Roucher, P. Meric, J.L. Corrèze, B. Tiffon, J. Mispelster, J.M. Lhoste and J. Seylaz 415
- Adenosine, prostacyclin and cerebral vasodilatory response to metabolic activation
R. Boulu, M. Plotkine, J. Callebert and M. Abalo-Abotchi 419
- In vivo measurements of brain glutamate/glutamine using ^1H NMR spectroscopy: problems and promises
Y. Cohen, L.-H. Chang, L. Litt and T.L. James 423
- The effect of (S)-emopamil, a novel calcium channel blocker, on the extracellular release of striatal glutamate and dopamine in a rat model of transient global ischemia
M.Y.-T. Globus, R. Busto, E. Martinez, I. Valdes and M.D. Ginsberg 429
- Effects of metabolic stress on the release of glutamate and GABA from hippocampal slices
J.F. Harrington, M. Buczek, T.S. Whittingham, W.D. Lust, A.J. Ricci, H.M. Assaf, L.L. Sternau, J.C. LaManna and R.A. Ratcheson 433
- Age-related differences in aminoacid neurotransmitter levels after bilateral incomplete cerebral ischemia
J.-M. Herb, G. Nemeth, A. Ding and S. Hoyer 437
- NMDA-receptor-mediated phenomena in vivo and their modulation by NMDA antagonists and Mg^{++} - A novel fluorometric approach
D. Uematsu, J.H. Greenberg and M. Reivich 441
- Calcium-dependence of the NMDA-induced changes in cerebral NADH fluorescence
J.-P. Nowicki 445
- Cerebrovascular and metabolic consequences of N-methyl-D-aspartate (NMDA) receptor blockade
J. McCulloch, A. Kurumaji, C.K. Park and D.G. Nehls 449

Kynurenate and R-PIA do not improve the histopathological consequences of MCA-occlusion in spontaneously hypertensive rats <i>R. Roussel, E. Pinard, M. Peres and J. Seylaz</i>	453
Lack of efficacy of MK 801, a non-competitive antagonist of NMDA receptors, on behavioral and neuronal abnormalities induced by transient forebrain ischaemia in the conscious rat <i>M. Beaughard, H. Poignet, M.T. Michelin, G. Lecoin and R. Massingham</i>	457
The protective effect of mild hypothermia on ischemic brain injury: Role of neurotransmitter release <i>M.D. Ginsberg, M.Y.-T. Globus, R. Busto and W.D. Dietrich</i>	461
Remote disinhibition hyperemia after focal cerebral ischemia. Transsynaptic disinhibition mechanism <i>A. Tamura, H. Nakayama, T. Kirino and K. Sano</i>	465
Alterations in neurotransmitter levels in rat brain striatum during forebrain ischemia. Relationship to morphology <i>G. Nemeth, A. Cintra, J.-M. Herb, A. Ding, K. Fuxe, L.F. Agnati and S. Hoyer</i>	469
The role of noradrenaline and serotonin in cerebral cortex, hippocampus and striatum during and after incomplete cerebral ischemia <i>A. Ding, G. Nemeth, J.-M. Herb, S. Hoyer, A. Cintra and K. Fuxe</i>	473
Signal transduction mechanism in cultured adrenal chromaffin cells under hypoxic conditions as a model of cerebral ischemia <i>S. Miwa, K. Lee, K. Koshimura and M. Fujiwara</i>	477
Protein kinase C is translocated to the plasma membrane during cerebral ischemia, but is partially inactivated <i>T. Wieloch, M. Cardell, T. Saitoh and J. Zivin</i>	481
Evidence for free radical production during cerebral reperfusion <i>J.R. Kirsch, R.J. Davis, G.K. Hart, A. Ackerman, T.J. Toung, L.K. Snelling, R.C. Koehler and R.J. Traystman</i>	485
Index of authors	489
Subject index	493