C U R R I C U L U M V I T A E

Bruce Sherman McEwen

BORN: January 17, 1938

EDUCATION:

1955 Graduated, University High School, Ann Arbor, MI
1959 A.B. Oberlin College, Summa Cum Laude in chemistry
1964 Ph.D. Rockefeller University, cell biology

PROFESSIONAL EXPERIENCE:

1964-65 USPHS Postdoctoral Fellow, Institute of Neurobiology, Goteborg, Sweden
1966 Assistant Professor, Dept. of Zoology, University of Minnesota (Jan-June)
1966-71 Assistant Professor, The Rockefeller University
1971-73 Associate Professor
1973-81 Associate Professor with Tenure
1981- Professor, Rockefeller University, Head of the Harold & Margaret Milliken Hatch Laboratory of Neuroendocrinology
1985-91 Associate Dean for Graduate and Postgraduate Studies
1991-93 Dean, Graduate and Postgraduate Studies
1992- Faculty Chair, Science Outreach Program
1993-94 Associate Dean for Graduate and Postgraduate Studies
1999- Alfred E. Mirsky Professor

SOCIETY MEMBERSHIPS:

American Academy of Arts and Sciences
American Association for Advancement of Sciences
American Association of Biological Chemists
American Society for Neurochemistry
Endocrine Society
International Brain Research Organization
International Society for Neurochemistry
International Society of Neuroendocrinology
International Society for Psychoneuroendocrinology
Institute of Medicine
National Academy of Sciences
New York Academy of Sciences
Phi Beta Kappa, Sigma Xi
Society for Neuroscience

TEACHING EXPERIENCE

Every 2nd year – organizes and teaches in Behavioral Neuroscience course for Rockefeller students
Yearly lectures in Weill/Cornell Neuroscience Course on neuroendocrinology
Yearly lecture to 2nd year Tri-Institutional M.D./Ph.D. students
Yearly lecture on stress to graduating M.D. students at Weill/Cornell

Over past 40 years, has organized courses in neurochemistry and neuroscience For Rockefeller students every other year.

PROFESSIONAL ACTIVITIES:

Member, Program Committee, Society for Neuroscience, 1973-74
Member, Neuropsychology Study Section, NIMH, 1974-79
Chairman, Neuropsychology Study Section, NIMH, 1975-79
Program Co-Chairman, Winter Conf. on Brain Research, 1975
Councilor, Society for Neuroscience, 1978-1982
Secretary, Society for Neuroscience, 1983-1986
Editorial responsibilities:
Editorial Board, Behav. Neuroscience, 1980- ; Editorial Board, Biological Psychiatry, 1997- Editorial Board, Brain Research, 1972-02 ; Editorial Board, Journal of Neurobiology, 1977-86; Editorial Board, Neuroendocrinology, 1977-83; Editorial Board, Molecular Pharmacology, 1977-81; Editorial Board, Endocrinology, 1977-81; Editorial Board, Journal of Neurochemistry, 1980-88; Editorial Board, Experimental Brain Research, 1981-92; Editorial Board, Neurochemical Research, 1976-80; Editorial Board, Journal of Neuroendocrinology, 1989-95; Associate Editor, Journal of Neuroscience, 1989-1998; Advisory Editor, Journal of Neurochemistry, 1972-80; Associate Editor, Behavioral Biology, 1975-78; Associate Editor, Hormones and Behavior, 1977-87; Senior Editor and Editorial Board, Neuropsychopharmacology, 1997-
Member of NIMH, Board of Scientific Counsellors,1987-91
Chairman, NIMH Board of Scientific Counsellors, 1989-91
Chairman, Public Information Committee, Society for Neuroscience 1990-93
Member, Health and Behavior Network, MacArthur Foundation, 1990-95
Member, MacArthur Fdn Socioeconomic Status and Health Research Network, 1996-
President, International Society for Neuroendocrinology, 1992-1995
President-elect, President, past-President, Society for Neuroscience, 1997-99
Member, IOM Committee to write report on lesbian health, 1997-98
Member, NRC Committee on evaluation of teaching materials, 1998-99
Member, IOM Committee to write report on protection of US Forces in war, 1998-99
Member, IOM Committee to write report on health and behavior, 1998-99
Member, NRC Board of Neuroscience and Behavioral Health, 2001-2006
Member, Board of Governors, New York Academy of Sciences, 2002- 2010
Vice Chair, Board of Governors, New York Academy of Sciences, 2008-2010
Chair, Government and Publlic Affairs Committee, Society for Neuroscience, 2009-

HONORS and AWARDS:

Fellow of AAAS, 1986
Fellow of American Academy of Arts and Sciences, 1994
Fellow of the New York Academy of Sciences, 1998
Member, National Academy of Sciences, 1997
Member, Institute of Medicine, 1998
Jacob Javits Award, NINCDS, 1995
MERIT Award, NIMH, 1994
Phi Beta Kappa, Sigma Xi
Honorary Sc.D. degree: Oberlin College, 2000
President's Award, American Psychosomatic Society, 2001
Dale Medal, British Endocrine Society, 2001
Lifetime Achievement Award, International Soc. Psychoneuroendocrinology, 2001

Archibald Byron Macallum Lectureship, Dept. Physiology, U. Toronto, 2002
Edward J. Sachar Award, Dept. Psychiatry, Columbia University, 2002
Father John O'Sullivan Award, McMaster University, 2003
Award for Distinguished Scientific Contributions, American Psychological Association, 2003
Honorary ScD degree, University of Michigan, 2005
Karl Spencer Lashley Award, American Philosophical Society, 2005
Pat Goldman Rakic Award, NARSAD, 2005
Pasarow Foundation Neuropsychiatry Award 2006
Marius Tausk Visiting Professor, University of Leiden, 2006
Segerfalk Award, University of Lund, Sweden, 2007
Gold Medal, Society of Biological Psychatry, 2009

Overview of research themes and achievements:

As a Ph.D. student of the late Alfred E. Mirsky and Vincent G. Allfrey in the early 1960's, I became fascinated with the notion of environmentally-regulated, variable gene expression and with the possibility that - in brain - circulating steroid and thyroid hormones coordinate neural with body function by regulating the expression of nervous system genes. Moreover, the notion that the brain regulates the endocrine system, and that the endocrine system, in turn, regulates brain function, provides a powerful model to understand how external events influence behavior and the plasticity of the brain over hours, days and even years. It should be remembered that, until fairly recently, study of gene expression in the brain was not fashionable, and that ion movements and neurotransmission were the main focus of neuroscience research.

When I joined the Neal Miller laboratory in 1966, I set out to elucidate, in cellular and molecular terms, the basis for long-term effects of sex and stress hormones on the brain that were inferred from the classical work of Frank Beach, Daniel Lehrman, W.C. Young, among others. I was one of the first investigators to look for, detect and characterize receptors for steroid hormones in brain tissue in the late 1960's, and the work that has arisen from this has become one of the foundations of the growing intersection between neurobiology, endocrinology and behavioral science. I consider that my laboratory has played a major role in this progress.

In a major discovery, in 1968, I found receptors for adrenal steroids in the hippocampus of rats (and later, rhesus monkeys) that are DNA-binding proteins that are now known to be transcription factors. This discovery has triggered an ever-growing number of studies throughout the world on the neural effects of adrenal steroids, secreted in stress and during the diurnal rhythm, on the hippocampal formation, and some of the key figures in this work have trained in my laboratory. The investigations of stress effects on hippocampal function and structure now have included the human hippocampus and have shown that it undergoes atrophy in recurrent depressive illness, post-traumatic stress disorder, Cushing's syndrome and the early stages of dementia. These studies point to a role for the hippocampus in neuroendocrine regulation and for a role of adrenal steroids in regulating neuronal atrophy in stress and the survival and neurogenesis of dentate gyrus granule neurons, with accompanying changes in cognitive function, and they have provided a new view of plasticity and vulnerability of the adult brain, which is now expanding to understanding the actions of estrogens on the hippocampus. For example, my Ph.D. students, Robert Sapolsky (now at Stanford) and Catherine Woolley (Northwestern) and former postdoctoral fellows, Michael Meaney (McGill), E.R. deKloet (Leiden), Victoria Luine (Hunter College), Roberta Brinton (USC) and Elizabeth Gould (Princeton) have each made important contributions – deKloet, having identified two adrenal steroid receptors subtypes in brain and shown the importance of steroid uptake for access of stress hormone to the brain; Sapolsky, having elucidated the destructive role of adrenal steroids in aging, ischemia, excitotoxic damage and stress; Meaney, having shown how early developmental experiences help determine individual differences in the rate at which the hippocampus ages; deKloet, having demonstrated two types of adrenal steroid receptors in hippocampus and elucidated their effects on neuronal excitability; Gould, having demonstrated stress-regulated nerve cell replacement in the dentate gyrus of old and new world primates, as well as rodents and tree shrews; Woolley, having demonstrated

the estrogen-induced synapse formation (see below) is linked specificially to increased NMDA receptors; Luine, having elucidated sex differences in stress effects on cognitive function; Brinton, having provided the cellular basis for estrogen's neuroprotective effects on nerve cells by managing calcium buffering.

My own recent work on adrenal steroids in hippocampus has begun to distinguish between the destructive and the protective effects of adrenal steroids on the brain. One of our recent discoveries is that hippocampal neurons undergo atrophy after repeated psychological, including psychosocial, stress, and that this process most likely involves a reversible depolymerization or proteolysis of the cytoskeleton. Recent clinical studies have begun to show that the human hippocampus is subject to the types of effects first detected in the rat brain, and it may soon be possible to intervene and attempt to reverse human hippocampal atrophy with agents, such as Dilantin, that we find are able to block atrophy in the rat brain. In addition, we have found other types of plasticity within the hippocampus regulated by adrenal steroids, namely, rapid biphasic effects on long-term potentiation and on memory processes and long-term effects that regulate neurogenesis and cell death in the dentate gyrus and which may be related to seasonal changes in dentate gyrus volume. Our discovery of neurogenesis in the dentate gyrus is another prominent example of cellular plasticity in the adult hippocampus that may underlie seasonal changes in hippocampal volume and cognitive function. In many of these types of plasticity, we have also discovered that glutamate and NMDA receptors play a key role along with adrenal steroids and we are currently exploring the mechanisms of these effects. In contrast to the hippocampus, the amygdala shows growth and enhanced function after single and repeated stress, and new studies indicate that this process depends on different mediators from those in hippocampus, such as tissue plasminogen activator (tPA). Enhanced fear and aggression are among the consequences of changes in the amygdala. Now, new studies in my laboratory are revealing stress-induced remodeling of synapse and dendrites in regions of the prefrontal cortex, as well as behavioral effects on attention, executive function and extinciton of learned fear.

Besides adrenal steroids, gonadal hormone action has been a major topic of my research. My first Ph.D. student, Richard Zigmond, and I were the first to characterize brain estrogen receptors, and this led to a series of discoveries in my laboratory in four directions.

- The *first* was to detect estrogen receptors in the developing brain and to demonstrate the role of aromatization of testosterone in rat brain sexual differentiation.
- The *second* was to determine key events in estrogen action on the brain, including induction of progestin receptors, certain neurotransmitter receptors and some key enzymes, such as choline acetyltransferase, and to demonstrate, in the ventromedial nuclei of the hypothalamus, a critical role for protein synthesis, including progestin receptor and oxytocin receptor induction, in the activation of female sexual behavior. This work provided the first substantive details of the molecular events and cellular changes which underlie hormonal activation of a behavior. My studies with Victoria Luine (now at Hunter College), of choline acetyltransferase induction by estrogens in basal forebrain of rats, were the basis of the first trial of estrogens as a treatment for Alzheimer's disease in postmenopausal women at Rockefeller Unversity, by Dr. Howard Fillit in the mid-1980's, a topic that has recently been revived with new epidemiological data that estrogens may protect the brain from dementia.
- The *third* was to discover that estradiol induces structural changes, including synaptogenesis, in the adult ventromedial hypothalamus and in the hippocampus; and that these are cyclic events in the estrous cycle of the female rat. Çyclic synaptogenesis in the hippocampus is perhaps the most dramatic example of synaptic plasticity in the adult brain, and its existence may help explain the protective and cognition enhancing effects of estrogen replacement in post-menopausal and demented women. We have found that, like neurogenesis and dendritic atrophy, estrogen induction of new synapses also requires the participation of NMDA receptors and, therefore, must reflect interactions between circulating hormones and excitatory neuronal activity. This is a novel concept with implications for the mechanisms of hormone action and neural plasticity.
- The *fourth* is to identify estrogen receptors outside of the cell nucleus in hippocampus, where they participate in non-genomic actions of estradiol via second messenger systems such as Akt. A recent demonstration of this is the finding that estradiol stimulated Akt phosphorylation, which in turn, regulates phophorylation of a regulatory subunit of a eukaryotic translation initiation factor, leading to increased de novo synthesis of a post-synaptic anchoring protein, PSD-95, a constituent of dendritic spines.

I have made contributions in five other research areas, spanning almost 40 years. *First*, Bernice Grafstein and I published, in 1968, the first characterization of the rapid axonal transport of newly-synthesized proteins in particulate material in the goldfish optic nerve, and followed this with papers characterizing components of that transported material. *Second*, in the 1970's, David Quartermain and I published several important papers demonstrating the reversibility, by a "reminder" procedure, of retrograde amnesia induced by protein synthesis inhibitors and electroconvulsive shock; this finding cast doubt on the permanence of retrograde amnesia and on the "consolidation" model of passive avoidance learning. This top has been reactivated recently in the work on “reconsolidation” of fear conditioning. *Third*, in 1987, Kelvin Gee, Roberta Brinton and I published a paper showing that A-ring reduced metabolites facilitated opening of the chloride channel of the GABAa receptor at 50 nanomolar concentrations when GABA was included in the incubation buffer. This paper provided the impetus for regarding the A-ring metabolites of progesterone and desoxycorticosterone as endogenous modulators of the GABAa receptor and led Kelvin Gee to form a biotech company, CoCensys, of which I was a founding member and advisor. Neurosteroids related to allopregnanolone are now important in the mechanism of disorders such as PMDD (premenstrual disphoric disorder).

Fourth, over the past 16 years I have worked with two research networks of the MacArthur Foundation Health Program and more recently the National Council on the Developing Child to apply concepts of stress neurobiology to understand how stressful experiences affect health. Together with the late Elliot Stellar, I developed a concept called “allostatic load” which refers to the cost to the body and brain of adaptation to chronic stress. Validation and measurement of “allostatic load” continues as an alternative to more conventional measures of stress, and I am involved in a MacArthur Research Network on Socioeconomic Status and Health in applying the concept to understanding why gradients of health exist across the range of socioeconomic status and not merely at the extreme bottom of the scale. Besides a publication for the public called “Reaching for a Healthier Life” with my Network colleagues, this also resulted in my co-authoring a successful book, The End of Stress as We Know It, published in 2002. *Fifth,* MacArthur support enabled my laboratory to support a project dealing with stress effects on immune function that has shown that acute stress enhances immune function by promoting immune cell movements to locations in the body where they are needed to fight an infection. This work has also provided a vehicle for the training of another outstanding young scientist, Dr. Firdaus Dhabhar, who received his Ph.D. at Rockefeller and then postdoctoral training and is now an Associate Professor at Stanford University. *Sixth,* with the ending of the MacArthur Research Network at the end of 2009, I have joined the National Council on the Developing Child, headed by Dr. Jack Shonkoff, M.D., Harvard Uniiversity, to further apply principles of stress neurobiology to the important area of the lasting effects of adversity early in life on brain and body. Recently, I co-authored a widely cited review in JAMA [Shonkoff, J.P., Boyce, W.T., and McEwen, B.S. Neuroscience, molecular biology, and the childhood roots of health disparities. JAMA 301:2252-2259 (2009]. Moreover, growing out of the MacArthur and National Council activities, I was an organizer and chair of the Science Section of the National Summit on Integrative Medicine at the National Academy in February, 2009, the report of which will be released in Fall, 2009. This effort is providing further scientific substance to the Health Care Reform efforts within Congress.

Publications - BRUCE S. MCEWEN

0. Fritz, E.B. and McEwen, B.S. Effect of carnitine on fatty-acid oxidation by muscle. Science 128:334 (1959).

1. McEwen, B.S., Allfrey, V.G. and Mirsky, A.E. Studies of energy-yielding reactions in thymus nuclei. I. Comparison of nuclear and mitochondrial phosphorylation. J. Biol. Chem. 238:758-766 (1963).

2. McEwen, B.S., Allfrey, V.G. and Mirsky, A.E. Studies on energy-yielding reactions in thymus nuclei. II. Pathways of aerobic carbohydrate catabolism. J. Biol. Chem. 238:2571-2578 (1963).

3. McEwen, B.S., Allfrey, V.G. and Mirsky, A.E. Studies on energy-yielding reactions in thymus nuclei. III. Participation of glycolysis and the citric acid in nuclear adenosine triphosphate synthesis. J. Biol. Chem. 238:2579-2586 (1963).

4. McEwen, B.S., Allfrey, V.G. and Mirsky, A.E. Dependence of RNA synthesis in isolated thymus nuclei on glycolysis, oxidative carbohydrate catabolism and a type of "oxidative phosphorylation." Biochim. Biophys. Acta 91:23-28 (1964).

5. Lovtrup-Rein, H., McEwen, B.S. Isolation and fractionation of rat brain nuclei. J. Cell Biol. 30:405-416 (1966).

6. Hyden, H. and McEwen, B.S. A glial protein specific for the nervous system. Proc. Natl. Acad. Sci. 55:354-358 (1966).

7. McEwen, B.S. and Hyden, H. A study of specific brain proteins on the semi-micro scale. J. Neurochem. 13:823-833 (1966).

8. Hyden, H., Bjurstam, K. and McEwen, B.S. Protein separation at the cellular level by micro disc electrophoresis. Anat. Biochem. 17:1-15 (1966).

9. McEwen, B.S. and Hyden, H. Studies of protein metabolism in brain cells in relation to brain cell RNA and behavior. In: Molecular Basis of Some Aspects of Mental Activity, vol. 1 (O. Walaas, ed.). London & New York, Academic Press, pp. 131-146 (1966).

10. McEwen, B.S. The chemical processes of memory. In: Modern Perspectives in Psychiatry (J. Howells, ed.), Edinburgh, Oliver and Boyd, pp. 87-107 (1968).

11. McEwen, B.S. and Grafstein, B. Fast and slow components in axonal transport of protein. J. Cell Biol. 38:494-508 (1968).

12. McEwen, B.S. Combustion analysis of radioactivity and densitometry of protein in polyacrylamide gels. Analyt. Biochem. 25:172-180 (1968).

13. McEwen, B.S. Cellular dynamics of brain proteins. In: Physiological and Biochemical Aspects of Nervous Integration (F.D. Carlson, ed.), Englewood Cliffs, NJ, Prentice-Hall, pp. 361-381 (1968).

14. McEwen, B.S., Weiss, J.M., Schwartz, L.S. Selective retention of corticosterone by limbic structures in rat brain. Nature 220:911-912 (1968).

15. McEwen, B.S. and Grafstein, B. Rapid transport of labeled material in fish optic nerve. In: Macromolecules and the Function of the Neuron (Z. Lodin and S.P.R. Rose, eds.), Amsterdam, Excerpta Medica Foundation, pp. 246-255 (1968).

16. Weiss, J.M., McEwen, B.S., Silva, M.T. and Kalkut, M. Pituitary-adrenal influences on fear-responding. Science 163:197-199 (1969).

17. McEwen, B.S., Weiss, J.M. and Schwartz, L.S. Uptake of corticosterone by rat brain and its concentration by certain limbic structures. Brain Res 16:227-241 (1969).

18. Azmitia, E. and McEwen, B.S. Corticosterone regulation of tryptophan hydroxylase in rat midbrain. Science 166:1274-1276 (1969).

19. McEwen, B.S., Weiss, J.M. and Schwartz, L.S. Retention of corticosterone by cell nuclei from brain regions of adrenalectomized rats. Brain Res 17:471-482 (1969).

20. Weiss, J.M., McEwen, B.S., Silva, M.T. and Kalkut, M. Pituitary-adrenal alterations and fear responding. Am. J. Physiol. 218:864-868 (1970).

21. Zigmond, R.E. and McEwen, B.S. Selective retention of oestradiol by cell nuclei in specific brain regions of the ovariectomized rats. J. Neurochem. 17:889-899 (1970).

22. McEwen, B.S. and Weiss, J.M. The uptake and action of corticosterone: regional and subcellular studies on rat brain. In: Progress in Brain Research (D. de Wied and J. Weijan, eds.), Amsterdam, Elsevier, pp. 200-212 (1970).

23. McEwen, B.S. and Plapinger, L. Association of corticosterone-1,2, 3H with macromolecules extracted from brain cell nuclei. Nature 226:263-264 (1970).

24. McEwen, B.S. and Pfaff, D.W. Factors influencing sex hormone uptake by rat brain regions: I. Effects of neonatal treatment, hypophysectomy and competing steroid on estradiol uptake. Brain Res 21:1-16 (1970).

25. McEwen, B.S., Pfaff, D.W. and Zigmond, R.E. Factors influencing sex hormone uptake by rat brain regions: II. Effects of neonatal treatment on testosterone uptake. Brain Res 21:17-28 (1970).

26. McEwen, B.S., Pfaff, D.W. and Zigmond, R.E. Factors influencing sex hormone uptake by rat brain regions: III. Effects of competing steriods on testosterone uptake. Brain Res. 21:29-38 (1970).

27. Grafstein, B., McEwen, B.S. and Shelanski, M. Axonal transport of neurotubule protein. Nature 227:289-290 (1970).

28. Quartermain, D. and McEwen, B.S. Temporal characteristics of amnesia induced by inhibition of protein synthesis. Nature 228:677-678 (1970).

29. Quartermain, D., McEwen, B.S. and Azmitia, E. Amnesia produced by electroconvulsive shock or cycloheximide: conditions for recovery. Science 169:683-686 (1970).

30. McEwen, B.S., Zigmond, R.E., Azmitia, E. and Weiss, J.M. Steroid hormone interaction with specific brain regions. In: Biochemistry of Brain and Behavior (R.E. Bowman and S.P. Datta, eds.), Plenum Press, New York, pp. 123-167 (1970).

31. Forman, D., McEwen, B.S. and Grafstein, B. Rapid transport of radioactivity in goldfish optic nerve following injections of labeled glucosamine. Brain Res 28:119-130 (1971).

32. Randt, C.T., Barnett, B.M., Quartermain, D., McEwen, B.S. Amnestic effects of cycloheximide on two strains of mice with different memory characteristics. Exp. Neurol. 30:467-474 (1971).

33. McEwen, B.S., Forman, D.S. and Grafstein, B. Components of a fast and slow axonal transport in goldfish optic nerve. J. Neurobiol. 2:361-377 (1971).

34. McEwen, B.S., Magnus, C. and Wallach, G. Biochemical studies of corticosterone binding to cell nuclei and cytoplasmic macromolecules in specific regions of the rat brain. In: Steroid Hormones and Brain Function (C.H. Sawyer and R.S. Gorski, eds.), University of California Press, Berkeley, pp. 247-258 (1971).

35. McEwen, B.S., Zigmond, R.E. Isolation of brain cell nuclei. In: Research Methods in Neurochemistry (N. Marks and R. Rodnight, eds.), Plenum Press, New York, vol. 1, pp. 140-161 (1972).

36. McEwen, B.S., Zigmond, R.E. Sites of steroid binding and action in the brain. In: Structure and Function of Nervous Tissue (G.H. Bourne, ed.), Academic Press, New York, vol. 5, pp. 205-291 (1972).

37. Quartermain, D., McEwen, B.S. and Azmitia, E. Recovery of memory following amnesia in the rat and mouse. J. Comp. Physiol. Psychol. 79:360-370 (1972).

38. McEwen, B.S., Magnus, C. and Wallach, G. Soluble corticosterone-binding macromolecules extracted from rat brain. Endocrinology 90:217-226 (1972).

39. Zigmond, R.E., Stern, J.M. and McEwen, B.S. Retention of radioactivity by brain cell nuclei in the ring dove after injection of 3H-testosterone. J. Gen. Comp. Endocr. 18:450-453 (1972).

40. Gerlach, J.L. and McEwen, B.S. Rat brain binds adrenal steroid hormone: radioautography of hippocampus with corticosterone. Science 175:1133-1136 (1972).

41. McEwen, B.S. Steroid hormones and the chemistry of behavior. In: The Chemistry of Mood, Motivation and Memory (J.L. McGaugh, ed.), Advances in Behavioral Biology, vol. 4, Plenum Press, New York, pp. 41-59 (1972).

42. McEwen, B.S., Plapinger, L., Wallach, G. and Magnus, C. Properties of cell nuclei isolated from various regions of rat brain: divergent characteristics of cerebellar cell nuclei. J. Neurochem. 19:1159-117 (1972).

43. Grafstein, B., Forman, D.S. and McEwen, B.S. Effects of temperature on axonal transport and turnover of protein in goldfish optic nerve. Exp. Neurol. 34:158-170 (1972).

44. Azmitia, E., McEwen, B.S. and Quartermain, D. Prevention of ECS-induced amnesia by re-establishing continuity with the training situation. Physiol. Behav. 8:853-855 (1972).

45. Forman, D.S., Grafstein, B. and McEwen, B.S. Rapid axonal transport of 3H fucosyl glycoproteins in the goldfish optic system. Brain Res 48:327-342 (1972).

46. McEwen, B.S. and Pfaff, D.W. Chemical and physiological approaches to neuroendocrine mechanisms: attempts and integration. In: Frontiers in Neuroendocrinology (W. Ganong and L. Martini, eds.), Oxford University Press, New York, pp. 267-335 (1973).

47. McEwen, B.S. and Wallach, G. Corticosterone binding to hippocampus: nuclear and cytosol binding in vitro. Brain Res. 57:373-386 (1973).

48. McEwen, B.S. Glucocorticoid binding sites in rat brain: subcellular and anatomical localizations. Prog. Brain Res 39:87-97 (1973).

49. Ingoglia, N.A., Grafstein, B., McEwen, B.S. and McQuarrie, I.G. Axonal transport of radioactivity in the goldfish optic system following intraocular injection of labeled RNA precursors. J. Neurochem. 20:1605-1615 (1973).

50. Plapinger, L. and McEwen, B.S. Ontogeny of estradiol-binding sites in rat brain. I. Appearance of presumptive adult receptors in cytosol and nuclei. Endocrinology 93:1119-1128 (1973).

51. Plapinger, L., McEwen, B.S. and Clemens, L.E. Ontogeny of estradiol-binding sites in rat brain. II. Characteristics of a neonatal binding macromolecule. Endocrinology 93:1129-1139 (1973).

52. Giulian, D., Pohorecky, L.A. and McEwen, B.S. Effects of gonadal steroid upon brain 5-hydroxytryptamine levels in the neonatal rat. Endocrinology 93:1329-1335 (1973).

53. McEwen, B.S. The recognition of proteins by hormone-binding properties. In: Proteins of the Nervous System (D.J. Schneider, R.H. Angeletti, R.A., Bradshaw, A. Grasso and B.W. Moore, eds.), Raven Press, New York, pp. 117-131 (1973).

54. Denef, C., Magnus, C. and McEwen, B.S. Sex differences and hormonal control of testosterone metabolism in rat pituitary and brain. J. Endocr. 59:605-621 (1973).

55. McEwen, B.S., Denef, C.J., Gerlach, J.L. and Plapinger, L. Chemical studies of the brain as a steroid hormone target tissue. In: The Neurosciences: Third Study Program (F.O. Schmitt and F.G. Worden, eds.), MIT Press, Cambridge, pp. 599-620 (1974).

56. McEwen, B.S. Why the brain is truly an endocrine organ. In: Clinician (L. Mastroianni, Jr., ed.), Medcom, New York, pp. 13-21 (1974).

57. McEwen, B.S. Adrenal steroid binding to presumptive receptors in the limbic brain of the rats. In: Neurologie de l'axe Corticotrope, Brain Adrenal Interactions (P. Dell, ed.), INSERM, vol. 22, pp. 79-98 (1974).

58. McEwen, B.S., Wallach, G. and Magnus, C. Corticosterone binding to hippocampus: immediate and delayed influences of the absence of adrenal secretion. Brain Res 70:321-334 (1974).

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61. Azmitia, E. and McEwen, B.S. Adrenocortical influence on rat brain tryptophan hydroxylase activity. Brain Res 78:291-302 (1974).

62. Luine, V.N., Khylchevskaya, R.I. and McEwen, B.S. Oestrogen effects on brain and pituitary enzyme activities. J. Neurochem. 23:925-934 (1974).

63. Ingoglia, N.A., Grafstein, B. and McEwen, B.S. Effect of actinomycin-D on labeled material in the retina and optic tectum of goldfish after intraocular injection of tritiated RNA precursors. J. Neurochem. 23:681-687 (1974).

64. Gutwein, B.M., Quartermain, D. and McEwen, B.S. Dissociation of cycloheximide's effects on activity from its effects on memory. Pharm. Physiol. Biochem. Behav. 2:793-796 (1974).

65. McEwen, B.S., Gerlach, J.L. and Micco, D. Putative glucocorticoid receptors in hippocampus and other regions of the rat brain. In: The Hippocampus, Structure and Development (R.L. Isaacson and K.H. Pribram, eds.), Plenum Press, New York, vol. I., pp. 285-322 (1975).

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