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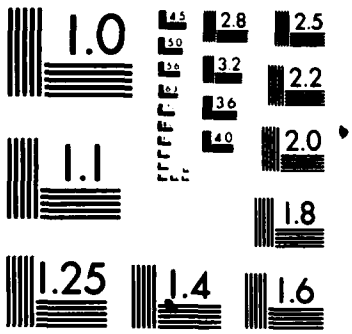

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19. ABSTRACT (Continue on reverse if necessary and identify by block number)

This, fifth conference in the series, was attended by approximately 100 scientists. The focus of the conference was on mechanisms of neural plasticity. The scope of the conference was deliberately broad, so that a range of neuroscientists could be exposed to ongoing work in areas that they might not otherwise be aware of, but which might have import for their own studies. Thus anatomists, may benefit from principles used in biochemical or neurophysiological studies, and vice versa. In the spirit of the Gordon Research Conferences, the sessions were informal and concentrated on the very newest data, and fundamental issues, rather than technical points.



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Report on the Gordon Research Conference on Molecular and Cellular Aspects of Neural Plasticity



Brewster Academy, Wolfeboro, NH July 21-26, 1985

The fifth conference in this series was attended by approximately 100 scientists. The focus of the conference was on mechanisms of neural plasticity. The scope of the conference was deliberately broad, so that a range of neuroscientists could be exposed to ongoing work in areas that they might not otherwise be aware of, but which might have import for their own studies. Thus anatomists, may benefit from principles used in biochemical or neurophysiological studies, and vice versa. In the spirit of the Gordon Research Conferences, the sessions were informal and concentrated on the very newest data, and fundamental issues, rather than technical points.

Session I examined in depth the forms of developmental plasticity observed in the mammalian visual system. Kasamatsu presented data on the potential role of norepinephrine (NE) in this plasticity. From Daw's presentation, it became apparent that important methodological differences might underlie some of the failures to replicate the work, but also that the highly cited experiments using the NE neurotoxin, 6-hydroxydopamine, are flawed, and should not be taken at face value, because of the high toxicity of the drug, the failures to replicate the results, and because other techniques that deplete NE do not always produce consistent results. Thus the hypothesis that NE is critical for plasticity in this system may be an oversimplification. Nevertheless, Kasamatsu described experiments using beta-receptor blockers that give interesting results and need to be explored further before definitive conclusions can be drawn.

Monday evening, Michael Berridge gave a masterful overview of the state of the art of phosphoinositides as second messengers. It is apparent that these membrane-associated compounds form the basis of a second messenger system, comparable in importance to the cyclic AMP system. The uniqueness of the phosphoinositide system is that not one but two second messengers can be produced: inositol diphosphate and diacylglycerol (diglyceride). These can interact synergistically or antagonistically in the cell to produce a range of postsynaptic phenomena. This lecture was followed by a poster session which enabled scientists not scheduled to give formal presentations, especially junior investigators, a chance to display their work.

In the session on neural transplants, Zigmond discussed elegant work on reinnervation in the sympathetic nervous system, where ganglionic neurons appear not to be predestined for a particular target. Then, Aguayo and Gage discussed their fascinating work on transplantation and regrowth of neural tissue, which in some cases can result in restoration of behavioral function. Finally, Nottebohm showed that in songbirds the nucleus which regulates the song repertoire generates new neurons each season.

In the anatomical session, Purves, Lichtman and Westerfield showed some truly elegant anatomical techniques that are capable of revealing long-term plastic changes.

Receptors for neurotransmitters and hormones were discussed by McEwen, de Kloet, Katt, Kellar, and Handelman. It is clear that receptors for steroids, peptides and amines not only display the capacity for up- and down-regulation, but that these capacities are themselves regulated by other agents. Thus the complexity of the process is sufficient to account for more complex examples of

neuroplasticity.

In the session on invertebrates, Truman gave us some insight into mechanisms of insect hormone actions on behavior. Selverston showed dramatic films indicating how the lobster stomatogastric ganglion, consisting of only ten neurons, can produce a variety of behaviors, and that the particular behavior can be determined by infusing neuroactive substances over the whole ganglion. This was a striking example of how complex behavior can emanate from a simple system, and how the behavior can be regulated at a distance in a hormone-like manner. Kravitz gave us some interesting insight into peptide-amine interactions.

The combined efforts of Livingstone, Acosta-Urquidi, Abrams and Baudry, showed that simple examples of neuroplasticity can be accounted for by modulation of ion channels, in some cases by receptors, and in others by cyclic nucleotides and $Ca^{2+}$ It was apparent that rather diverse mechanisms can be used, but that there is a generality in the principle from Aplysia, to Drosophila to the hippocampus.

Dunn and McGaugh reviewed opiate-catecholamine interactions from anatomical, biochemical, electrophysiological and behavioral points of view. They, together with Stone, discussed the idea that the two systems might play a coordinate action in stress.

A remarkable consensus on the specific protein changes that occur in neural growth and regeneration was achieved in the Friday morning session by Willard, Skene, Benowitz, and Wilson. It became clear that Routtenberg's protein F1, Gispen's B-50, Willard's GAP-43, and Growth-Cone Protein were one and the same, although its biological function is as yet unknown. Ingoglia presented interesting data on protein processing in axons, involving nonribosomal amino acid polymerisation and transfer RNA.

The conferees agreed unanimously, that they learned much from the conference and in many cases expressed their intention to go back to their laboratories and do some experiments they would not otherwise have done.

Gordon Research Conference on Molecular and Cellular Aspects of Neural Plasticity

Brewster Academy, Wolfeboro, N.H. July 22-26, 1985

MONDAY AM — Factors Affecting the Duration of the Critical Period in the Visual System

Discussion Leader: Carla Shatz (Dept Physiology, Stanford University)

Takuji Kasamatsu (Smith-Kettlewell Institute of Visual Science, San Francisco)
Background review of the role of biogenic amines in developmental plasticity.
Nigel Daw (Dept Physiology, Washington University)
Effects of deprivation and the role of catecholamines.
Max Cynader (Dept Psychology, Dalhousie University)
Extension of the critical period by dark rearing.
Michael Stryker (Dept Physiology, University of California San Francisco)
The role of activity in the formation of ocular dominance columns.

MONDAY PM — Phosphoinositides as Second Messengers

Michael Berridge (Dept Zoology, University of Cambridge)
Inositol triphosphate: a uniquely flexible second messenger.

POSTER SESSION

TUESDAY AM — Formation of New Functional Circuits

Discussion Leader: Richard Zigmond (Dept Pharmacology, Harvard Medical School)
Formation of new neural connections by peripheral sympathetic neurons via collateral and regenerative sprouting.
Albert Aguayo (Dept Neuroscience, McGill University, Montreal)
Regenerative growth in the mammalian CNS.
Fred Gage (Dept Histology, University of Lund, Sweden)
Formation of new neural connections by CNS tissue transplants.
Fernando Nottebohm (Rockefeller University)
Formation of new neural connections by new neurons generated in adult CNS.

TUESDAY PM — Methods of Assessing Changes of Neural Connectivity

Discussion Leader: Dale Purves (Dept Physiol. & Biophysics, Washington University, St. Louis)
Monitoring changes of mammalian dendrites by repeated imaging of the same neuron in situ.
Monte Westerfield (Institute of Neuroscience, University of Oregon)
Monitoring the outgrowth of motor neurons with long-lived fluorescent dyes in Zebra fish.
Jeff Lichtman (Dept Physiology and Biophysics, Washington University, St. Louis)
Monitoring changes in presynaptic motor terminals by stimulus-induced uptake of fluorescent probes.

WEDNESDAY AM — Regulation of Neurotransmitter and Hormone Receptors

Discussion Leader: Bruce S. McEwen (Lab Neuroendocrinology, Rockefeller University)

Kevin Catt (National Institutes of Health)
Up and down regulation of receptors in CNS and pituitary.
Ken Kellar (Dept Pharmacology, Georgetown University School of Medicine)
Regulation of CNS monoamine receptors.
Gail Handelmann (NICHD, National Institutes of Health)
Peptide receptor regulation by peptides in ontogeny.
Ron de Kloet (Rudolf Magnus Institute for Pharmacology, University of Utrecht)
Peptide regulation of CNS glucocorticoid receptors.

WEDNESDAY PM Modulators of Simple Neuronal Systems

Discussion Leader: James Truman (Dept Zoology University of Washington)
Modulation of peptide responses in the CNS of an insect.
Allen Selverston (Dept Biology University of California San Diego)
Modulation of rhythmic motor output in the lobster stomatogastric system.
Edward Kravitz (Dept Neurobiology, Harvard Medical School)
Roles of peptides and amines in the modulation of behavior in the lobster.

THURSDAY AM Molecular Models of Learning

Discussion Leader: Tom Carew (Dept Psychology, Yale University)

Tom Abrams (Dept Neurobiology and Behavior, Columbia University, New York)
Roles of $Ca^{2+}$ and adenylate cyclase in a mechanism for associative learning in Aplysia.
Michel Baudry (Dept Psychobiology, University of California Irvine)
Modulation of neurotransmitter receptors as a molecular mechanism of LTP and learning in the hippocampus.
Juan Acosta-Urquidi (Friday Harbor Labs, Univeristy of Washington)
Modulation of K+-channels via Ca2+-calmodulin-dependent phosphorylation as a mechanism of memory.
Marge Livingstone (Dept Neurobiology, Harvard Medical School)
Why some flies can't learn: the biochemistry of Drosophila learning mutants.

THURSDAY PM Role of Biogenic Amines and Endorphins in Neuroplasticity

Discussion Leader: Eric Stone (Dept Psychiatry, New York University Medical Center)

Adrian Dunn (Dept Neuroscience, University of Florida)
Interactions between catecholamines and opiates in the CNS.
Jim McGaugh (Inst. Neurobiology of Learning and Memory, University of California, Irvine)
Interaction of adrenergic and opioid systems in behavioral plasticity.
Bruce Pappas (Dept Psychology, Carleton University, Ottawa, Canada)
Effects of early lesions of the noradrenergic system on neuroplasticity.
Discussant: Aryeh Routtenberg (Cresap Neuroscience Lab, Northwestern University)
Protein phosphorylation and opioid effects on synaptic/behavioral plasticity

FRIDAY AM Molecular Aspects of Nerve Growth

Discussion Leader: Bernard Agranoff (Neuroscience Lab, University of Michigan)

Mark Willard (Dept Anatomy and Neurobiology, Washington University, St. Louis)
Changes in the molecular state of neurons during development and regeneration.
Pate Skene (Dept Neurobiology, Stanford University)
Phylogenetic conservation and developmental regulation of growth-associated proteins.
Larry Benowitz (Mailman Research Center, Harvard Medical School)
The expression of membrane proteins during regeneration of the goldfish optic nerve.
Discussants: Nick Ingoglia (New Jersey Medical School)
David Wilson (University of Miami)

Chairman: Adrian J. Dunn (Dept Neuroscience, University of Florida)

Vice-Chairman: James W. Truman (Dept Zoology, University of Washington)

POSTERS FOR THE NEUROPLASTICITY GORDON CONFERENCE

1. MECHANISMS OF HYPOTHALAMIC SEROTONIN SECRETION. Aloyo, V.J., H.A.F. Navarro, & R.F.Walker Sanders-Brown Res. Cntr. on Aging, Univ. of Kentucky, Lexington, KT 40536.

2. A ROLE FOR cAMP IN VISUAL CORTICAL PLASTICITY: PHOSPHORYLATION OF MAP2. Aoki, Chiye, & P. Siekevitz Rockefeller Univ., New York, NY 10021.

3. STRESS AND MORPHINE SIMILARLY AFFECT EXPLORATORY BEHAVIOR IN MICE. Berridge, Craig W., & Adrian J. Dunn Dept. of Neuroscience, Univ. of Florida College of Medicine, Gainsville, Fla.

4. INTRACELLULAR CURRENT STIMULATION PRODUCES PROLONGED CHANGES IN EXCITABILITY AND INPUT RESISTANCE IN RAT CORTICAL NEURONS. Bindman, L.J., T. Meyer, & C.A. Prince Dept. of Physiology, University College London, Gower St., London WC1E 6BT, U.K.

5. ORGANIZATIONAL AND ACTIVATIONAL PROPERTIES OF VASOPRESSIN IN BRAIN. Brinton, Roberta E.[1], Henry I.Yamamura[2], Ralph Gruener[3], & Bruce S.McEwen[1] (1) Lab. of Neuroendocrinology, Rockefeller Univ., New York, NY, (2) Dept. of Pharmacology and (3) Dept. of Physiology, Arizona Health Sciences Center, Univ. of Arizona, Tucson, AZ.

6. CRF ADMINISTRATION (ICV AND SC) CAUSES A STRESS-LIKE ACTIVATION OF CEREBRAL CATECHOLAMINE SYSTEMS. Dunn, Adrian J., & Craig W. Berridge. Dept. of Neuroscience, Univ. of Florida College of Medicine, Gainesville, Fla.

7. PATHWAY SELECTION AND DEVELOPMENT OF FUNCTIONAL INTERACTIONS OF IDENTIFIED MOTOR GROWTH CONES IN ZEBRAFISH. Eisen, Judith S., Paul Z. Myers, & Monte Westerfield Inst. of Neurosciences, Univ. of Oregon, Eugene OR 97403.

8. INDUCTION OF FUNCTIONAL RETINAL PROJECTIONS TO THE SOMATOSENSORY SYSTEM. Frost, Douglas Section of Neuroanatomy, Yale Medical School, New Haven, CT.

9. EXPRESSION OF A SYNAPTIC VESICLE ANTIGEN IN THE DEVELOPING AND ADULT RAT SUPERIOR CERVICAL GANGLION. Grier, K.F., & H.L.Trenchard Dept. of Biology, Bryn Mawr College, Bryn Mawr, PA.

10. ELECTROMORPHOLOGY - A FUNCTIONAL DESCRIPTION OF NEURONAL STRUCTURE. Gutherie, Peter. Lab. of Developmental Neurobiology, NICHD, NIH, Bethesda, MD.

11. TRANSNEURONAL PLASTICITY IN THE ADULT RAT HIPPOCAMPUS. Hoff, Steven F. Dept. of Pharmacology, Chicago Medical Sch., North Chicago, IL 60064.

12. PLASTIC CHANGES IN MOUSE CEREBRAL CORTEX AFTER BASAL FOREBRAIN LESIONS: A CONSEQUENCE OF ACETYLCHOLINE DEPLETION IN CORTEX? Hohmann, Christine. Dept. of Pharmacology, Johns Hopkins University, 600 N. Wolf St., Baltimore, Md 21205.

13. DEVELOPMENT OF PRIMARY VISUAL PROJECTIONS IN A MARSUPIAL MAMMAL AFTER EYE REMOVAL OR ROTATION PRIOR TO OPTIC INNERVATION OF THE BRAIN. Marotte, L.R., & R.F.Mark. Dept. of Behavioural Biology, Research School of Biol. Sci., Australian Natl. Univ., Canberra ACT 2600 Australia.

14. ENHANCED INCORPORATION OF $^{3}$H-FUCOSE IN DENDRITIC STRUCTURES OF THE RAT HIPPOCAMPUS ACCOMPANIES POST-CONDITIONING LTP. Matthies, H., W.Pehle, L.Acosta, & H.Ruethrich. Inst. Neurobiology & Brain Res., Acad. Sci. of GDR; Inst. of Pharmacology, Med. Acad., 3090 Magdeburg, Leipziger Str. 44, GDR.

15. CPG METAMORPHOSIS: MODULATION OF A PRE-EXISTING, LARVAL ECDYSIS MOTOR PROGRAM GENERATES ADULT-SPECIFIC ECLOSION BEHAVIOR. Mesce, Karen, & J.W. Truman Dept. of Zoology, Univ. of Washington, Seattle WA.

16. DEVELOPMENT OF BEHAVIORAL SENSITIVITY TO A PEPTIDE HORMONE IN MANDUCA SEXTA: ROLE OF CYCLIC NUCLEOTIDE-DEPENDENT PROTEIN PHOSPHORYLATION. Morton, David B., & J.W.Truman. Dept. of Zoology, University of Washington, Seattle, WA.

17. PHOSPHOPROTEIN F1, WHICH IS DIRECTLY RELATED TO NEURAL PLASTICITY IN ADULT RAT BRAIN, MAY BE IDENTICAL TO A MAJOR GROWTH CONE MEMBRANE PROTEIN (pp46). Nelson, R.B., & A. Routtenberg Cresap Neurosci. Lab., Northwestern Univ., Evanston, IL.

18. GROWTH ASSOCIATED PROTEINS IN CULTURED MAMMALIAN CNS NEURONS. Perrone-Bizzozero, N., Seth Finklestein, & Larry I. Benowitz. Dept. of Psychiatry, Harvard Medical Sch., McLean Hosp., Belmont MA.

19. LESION-INDUCED STIMULATION OF A 25KD PHOSPHOPROTEIN IN FROG BRAIN HOMOGENATES. Richter-Landsberg, Christiane, & Hans Flohr. Fachbereich Biologie, Universitat Bremen, 2800 Bremen 33.

20. PASSIVE AVOIDANCE TRAINING RESULTS IN LASTING CHANGES IN DEOXYGLUCOSE METABOLISM IN LEFT HEMISPHERE REGIONS OF CHICK BRAIN. Rose, Stephen P.R., & Andras Csillag. Brain Research Group, The Open University, Milton Keynes MK7 6AA U.K.

21. INVOLVEMENT OF GOLDFISH BRAIN EPENDYMINS IN MEMORY CONSOLIDATION AFTER TWO DIFFERENT LEARNING PARADIGMS: A BIOCHEMICAL ANALYSIS OF THEIR FUNCTION. Schmidt, Rupert. Dept. Zoology, J.W.Goethe Universitat, Siesmayerstrasse 70, D-6000 Frankfurt, F.D.R.

22. RECOVERY OF NEURONAL PLASTICITY IN KITTEN VISUAL CORTEX PERFUSED WITH A B ADRENORECEPTOR ANTAGONIST: EFFECTS OF NORADRENALIN AND TUNICAMYCIN. Shirokawa, T., & T.Kasamatsu. Smith Kettlewell Inst. of Visual Sci., 2232 Webster St., San Francisco, CA 94115.

23. PASSIVE AVOIDANCE TRAINING CAUSES ALTERATIONS IN SYNAPTIC MORPHOLOGY IN BOTH HEMISPHERES OF A REGION OF THE CHICK FOREBRAIN, THE LOBUS PAROLFACTORIUS. Stewart, Michael G., & Steven P.R. Rose Brain Res. Group, The Open University, Milton Keynes MK7 6AA U.K.

24. MAMMALIAN CEREBRAL CORTICAL TISSUE RESPONDS TO LOW INTENSITY VISIBLE LIGHT. Wade, Patricia D. Rockefeller University, New York, NY 10021.

25. AMINO ACID SEQUENCE OF A NEUROTOXIN THAT BLOCKS NICOTINIC RECEPTORS, AND THE LOCALIZATION OF ITS BINDING SITES IN CHICK CILIARY GANGLION. Loring, R.H. & Zigmond, R.E. Dept. Pharmacology, Harvard Medical School, Cambridge, Mass.

26. A PROTEASE INHIBITOR, L-LEUCYL-L-LEUCYL-ARGININE, BLOCKS PASSIVE AVOIDANCE CONDITIONING. Pico, R.M. & Davis, J.L. Department of Anatomy, University of California, Irvine, Ca.

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