Professor Dr. Masakazu Konishi

Birth Date: February 17, 1933

Place of Birth: Kyoto, Japan

Nationality: U. S. A. (naturalized May, 1983)

Address: Division of Biology 216-76
California Institute of Technology
Pasadena, California 91125
U. S. A.

Position: Bing Professor of Behavioral Biology, California Institute of Technology

Education and Career:

1956	B. S., Hokkaido University, Sapporo, Japan
1958	M. S., Hokkaido University, Sapporo, Japan
1963	Ph. D., University of California, Berkeley
1963－1964	Postdoctoral Fellow, Alexander von Humboldt Fellowship (University of Tübingen, Germany)
1964－1965	Postdoctoral Fellow, International Brain Research Organization (Division of Experimental Neurophysiology, Max-Planck-Institut, Germany)
1965－1966	Assistant Professor of Biology, University of Wisconsin, Madison
1966－1970	Assistant Professor of Biology, Princeton University
1970－1975	Associate Professor of Biology, Princeton University
1975－1980	Professor of Biology, California Institute of Technology
1980－	Bing Professor of Behavioral Biology, California Institute of Technology

Awards and Distictions:

Newcomb Cleaveland Prize, AAAS, 1978
Member, American Academy of Arts and Sciences, 1979
Visiting Lecturer, College de France, 1981
Elliott Coues Award, American Ornithologists' Union, 1983
Grass Foundation Lecture, Society for Neuroscience, 1984
Member, National Academy of Sciences, 1985
President, International Society for Neuroethology, 1986－1989
F. O. Schmitt Prize, 1987

Representative Works:

Konishi, M. (1965). The role of auditory feedback in the control of vocalization in the white-crowned sparrow. *Z. Tierpsychol., 22, 770-783.*

Knudsen, E. and Konishi, M. (1978). A neural map of auditory space in the owl. *Science, 200,* 795-797.

Konishi, M. and Akutagawa, E. (1985). Neuronal growth, atrophy and death in a sexually dimorphic song nucleus in the zebra finch. *Nature, 315,* 145-147.

Konishi, M. (1986). Centrally synthesized maps of sensory space. *Trends in Neurosci., 9,* 163-168.

Konishi, M., Takahashi, T., Wagner, H., Sullivan, W.E. and Carr, C.E. (1988). Neurophysiological and anatomical substrates of sound localization in the owl. In "Auditory Function: Neurobiological Bases of Hearing", ed. Edelman, G., Gall, W.E. and Cowan, W. M., pub. John Wiley & Sons.

Konishi, M. (1989). Birdsong for neurobiologists. *Neuron, 3,* 541-549.

(Many others)

Academic Achievements:

Dr. Konishi has made significant contributions in the field of behavioral biology by combining and integrating high-resolution bahavioral methods with deep sighted neuroanatomical and cellular neurophysiological techniques. His major contributions have been in two fields: 1) the behavioral and neural mechanisms of bird song development and hormonal influences on sexual differentiation in the avian brain of the zebra finch; 2) the brain mechanisms of sound localization in the barn owl in the context of prey-predator interactions.

Dr. Konishi showed that birds must hear themselves sing in order to develop a song pattern. This finding led him to a template hypothesis of bird song development in which he formulated that birds use the memory trace of a tutor song as a template to mold their vocal output. This concept has been central in all subsequent research on bird vocalization and has provided an important focus for research on the plasticity of neural systems.

Song learning typically occurs only during certain critical periods and Dr. Konishi has demonstrated that these periods are partially dependent on

hormonal factors. This implies that the sites of hormone action may overlap with the neuronal sites which include the template, pattern comparator and song motor generator. Dr. Konishi found sites at which sex steroids of the estrogen and testosterones could influence the vocalization system. Dr. Konishi discovered sexual dimorphism in the anatomy of the song control system of HVc (nucleus hyperstriatum ventrale, pars caudale) and RA (nucleus robustus archistriatalis) of the zebra finch. Dr. Konishi went on to demonstrate that the gender differences arise postnatally and that there is cell atrophy and death in the female, but growth of cells in the male. He showed that the administration of estrogen to a female chick prevents cell atrophy and death in her song nuclei, thus masculinizing the bird both anatomically and behaviorally.

The second major area of Dr. Konishi's research is sound localization in the barn owl. Dr. Konishi made the pioneering and highly significant discovery that the owl's midbrain contains a neural map of the external auditory space. A crucial step toward this finding was the development of new methods. Dr. Konishi developed a system that delivered sound from a speaker which could be moved anywhere around the bird's head. Behavioral studies showed that the owl detects the time and intensity differences in both azimuth and elevation of the sound perceived in the right and left ear. An exceptionally elegant series of electrophysiological experiments allowed him to detect neurons that responded only to sound coming from a very precisely defined direction in space. He found that the space-selective neurons are systematically arranged in the brain according to their receptive fields. A combination of these variables uniquely defines a locus in auditory space; space-selective neurons are turned to specific combinations. Two parallel pathways lead to the midbrain area containing space-selective neurons, one for the processing of time differences between each ear and the other for interaural intensity difference. Each of these pathways contains several sequentially connected stations. Thus, space-selective neurons are at the apex of a neural network containing both parallel and hierarchical circuits. Because of its simplicity, beauty and behavioral relevance, the owl example has become a favorite system for further research, analysis and discussion by neuroethologists and computational neuroscientists. Neuroscience, including neurophysiology, sensory physiology and comparative neuroanatomy, has derived benefits from these studies on the owl.

Through this pioneering work Dr. Konishi has become a founding father of the newly emerging interdisciplinary field of neuroethology and has thus contributed greatly to the understanding of the mechanism of animal behavior in the field of behavioral biology.

Dr. Konishi and his coworkers have initiated a major program of molecular biological research of the neural circuits for bird song and the cell biological machanisms for their development and function.