

NATIONAL ACADEMY OF SCIENCES

EUGENE PLEASANTS ODUM
1913–2002

A Biographical Memoir by
GARY W. BARRETT

*Any opinions expressed in this memoir are those of the author
and do not necessarily reflect the views of the
National Academy of Sciences.*

Biographical Memoirs, VOLUME 87

PUBLISHED 2005 BY
THE NATIONAL ACADEMIES PRESS
WASHINGTON, D.C.



Photo by Gittings

Eugene P. O'Donnell

EUGENE PLEASANTS ODUM

September 17, 1913–August 10, 2002

BY GARY W. BARRETT

EUGENE P. ODUM WAS recognized nationally and internationally as a pioneer of ecosystem ecology. It is rare that an individual makes major contributions in each essential component of academic life: education, research, and program development. A brief summary of his accomplishments in these areas is outlined below.

CAREER AS AN EDUCATOR

Odum considered one of his most important contributions, perhaps the one for which he is best known, the book entitled *Fundamentals of Ecology*. Although Sir Arthur C. Tansley first proposed the term “ecosystem” in 1935, and Raymond L. Lindeman called attention to the trophic-dynamic relationships of ecosystem function in 1942, it was Eugene P. Odum who began the education of ecologists when in 1953 he published the first edition of *Fundamentals of Ecology*. The clarity of and enthusiasm for his holistic and ecosystem approach to both terrestrial and aquatic ecosystems in the second edition, published in 1959 in collaboration with his brother Howard T. Odum, helped to educate generations of ecologists throughout the world (Barrett and Likens, 2002). The fifth edition of this book, authored with Gary W. Barrett, Odum Professor of Ecology at the University

of Georgia, was published after Odum's death (at the age of 88). *Fundamentals of Ecology* was ranked first in a survey of the membership of the American Institute of Biological Sciences as the book that had the greatest impact on career training in the biological sciences (Barrett and Mabry, 2002).

In an award-winning video *Eugene Odum: An Ecologist's Life*, Odum is depicted as providing a commensurate education, whether through invited speaking engagements with citizens, discussions with community organizations, or dialogue with individual students walking across a university campus. In later years of his life Odum authored several books and publications that focused attention on Earth as a life-support system. For example, in 1989 he published *Ecology and Our Endangered Life-Support Systems* (second and third editions were published, respectively, in 1993 and 1997) and in 1998 a book entitled *Ecological Vignettes: Ecological Approaches to Dealing with Human Predicaments*. These books were intended to provide a clear understanding of current and future challenges for public consideration in order to move toward sustainable societies. "Great Ideas in Ecology for the 1990s," published in *BioScience* (1992), placed his understanding of and goals for ecology during the last decade of the twentieth century in a public forum.

Odum was the recipient of numerous awards in ecological education, including the Educator-of-the-Year in 1983 awarded by the National Wildlife Federation, the Environmental Educator Award in 1992 from the Society of Environmental Toxicology and Chemistry, and the Distinguished Service Award in 1998 from the United States International Association of Landscape Ecology.

CAREER AS A RESEARCHER

Odum received his Ph.D. from the University of Illinois in 1939 under the mentorship of S. Charles Kendeigh. Odum

focused on the heart rate of birds in his Ph.D. dissertation. This investigation, published in *Ecological Monographs* (1941), attests his early interest in physiological ecology. This curiosity in physiology challenged him not only to study functions within an organism but also to study how organisms function in their environment as a whole. Odum's involvement with holistic science continued to develop under the influence of Victor Shelford, who viewed ecology as the study of biotic communities. Shelford instilled in Odum such concepts as the whole is greater than the sum of its individual parts; that nature tends toward stability in its mature stages; and that ecology is the study of large-scale systems and the interrelationships therein. Odum built his study of ecosystem ecology on this holistic perspective of nature.

Odum's research on structure and function of ecosystems, trophic-level dynamics, and ecosystem development is recognized internationally. For example, H. T. Odum and he were the recipients of the Mercer Award, awarded in 1956 by the Ecological Society of America, for their coral reef paper, "Trophic Structure and Productivity of a Windward Coral Reef Community on Eniwetok Atoll," published in *Ecological Monographs* (1955). He was the founder of the Savannah River Ecology Laboratory in 1951. Personnel at the laboratory focused their early research on secondary succession as described in Odum's classic paper "The Strategy of Ecosystem Development" (1969). In yet another classic paper (1977) he described how ecosystem development served as the central or unifying theme for early research at the Savannah River Ecology Laboratory.

Eugene conducted early groundbreaking research not only on coral reef energetics and old-field community development but also on bird fat metabolism, radiation ecology, and salt marsh dynamics. For example, in addition to the Savannah River Ecology Laboratory, the Marine Biology

Laboratory of the University of Georgia was established on Sapelo Island in 1953 as a result of interactions between Eugene and Richard J. Reynolds Jr., who maintained a plantation on the island. Odum, his students, and a small academic resident staff, including Lawrence R. Pomeroy, Robert A. Ragotzkie, and Theodore J. Starr, initiated an ecosystem-level investigation of the estuaries and extensive salt marshes, probably the first of its kind in that environment. The early work at the Sapelo Island laboratory was influential in raising awareness of ecological interactions between rivers, estuaries, and salt marshes, especially the interactions of the physical, chemical, and biological components.

Odum was a pioneer in the interaction termed “mutualism.” He frequently quipped, “When the going gets tough, it pays to cooperate”—indicative of a philosophy that he applied across levels of organization or when describing attributes of ecosystems during mature seral stages of development. Odum is also recognized for seeing the “big picture” or what later became known as holistic science. Instead of starting research dealing with components of a system, Odum started with the ecosystem as a whole, investigating how interacting parts function to produce unique features of the whole.

Under the bronze bust of Eugene sculpted by William J. Thompson, which was presented on September 17, 1984, on the occasion of his retirement from the University of Georgia, is engraved the statement, “An ecosystem is greater than the sum of its parts.” For his research accomplishments he was elected to membership in the National Academy of Sciences in 1970, the first member of the University of Georgia faculty to be elected to the academy. In 1974 he received the Eminent Ecologist Award from the Ecological Society of America and that same year became an elected honorary member of the British Ecological Society.

SERVICE CAREER

Perhaps Odum's greatest achievement was the establishment of the Institute of Ecology, which today is recognized as one of the leading institutions in the world for training ecologists (Barrett and Barrett, 2001). The institute offers both undergraduate and graduate degree programs in ecology. Graduates of these programs now command positions of leadership throughout the world. Odum was appointed director of the Institute of Ecology in 1961 and served in this capacity until he retired in 1984. He also held appointments as Alumni Foundation Distinguished Professor (in 1957), Callaway Professor of Ecology (in 1973), and director emeritus (in 1985).

His professional service and national and international awards and honors are extensive. He served as president of the Ecological Society of America (1964-1965). In 1975 he and H. T. Odum jointly received the \$80,000 international Prix de l'Institut de la Vie awarded by the French government. In 1975 Odum was the recipient of the prestigious Tyler Prize for Environmental Achievement, accompanied by a \$150,000 cash award, which he contributed to the University of Georgia Foundation as an endowment for the Institute of Ecology. Other endowments in his name support numerous functions (e.g., Odum Lecture Series) in the Institute of Ecology at the University of Georgia. In his will he established an Odum chair in ecology at the University of Georgia; the author of this memoir holds the first Odum Professor of Ecology.

He also established endowments for the University of North Carolina, University of Virginia, University of Illinois, and the E. P. Odum Award for Excellence in Ecology Education for the Ecological Society of America. In 1978 Odum received the Distinguished Service Award from the American

Institute of Biological Sciences. Likely his most prestigious award occurred in 1987 when, with his brother Howard, he received the Royal Swedish Academy's Crafoord Prize, which often is considered to be equivalent to a Nobel Prize, which is not given in the field of ecology.

PERSONAL HISTORY

Eugene Pleasants Odum was born to Anna Louise and Howard Washington Odum on September 17, 1913, while Anna Louise was vacationing on Lake Sunapee in New Hampshire to escape the summer heat in Athens, Georgia. The brother of Eugene, Howard Thomas Odum, was born on September 1, 1924. Composing a tribute to Eugene that Howard Thomas was to make at the University of Georgia during the memorial entitled "A Celebration of the Life of Eugene P. Odum" on October 16, 2002, would be one of the latter acts of his life. Howard Thomas died on September 11, 2002, in Gainesville, Florida. Elizabeth C. Odum delivered the intended words of her husband, H. T., at the celebration. A sister, Mary Frances Schinhan, born on September 17, 1919, presently resides in Chapel Hill, North Carolina, near the gracious Odum family home, which now serves as an affiliated center for the community.

Eugene's father, Howard Washington Odum, was a distinguished scholar and published numerous books on social justice, southern regionalism, and racial equality (see Craige, 2001 for details). In 1920 Howard W. Odum, along with his family, moved to Chapel Hill, North Carolina, after receiving a professorship in sociology at the University of North Carolina. Howard developed the concept of regionalism in his widely read book *Southern Regions of the United States* (Odum, 1936). Likely his holistic approach to problems confronting the southeastern United States at that time was reflected in the later integrative concepts and research

approaches developed by his son Eugene (referred to by his friends and colleagues as Gene).

Gene's studies in zoology began at age 15 at the University of North Carolina (A.B. 1934 and A.M. 1936). Gene developed and maintained throughout his life a keen interest in ornithology and avian ecology (Meyers and Johnston, 2003). Odum's early research centered on avian research, especially the role of fat deposition for protracted migratory flights, and on avian natural history subjects. Gene and Martha Ann Huff Odum, whom he had met as a student at the University of Illinois, moved to the University of Georgia in 1940, where he served his entire career.

In 1946, spurred by colleagues who supported the concept that ecology was not a basic discipline of biology, Gene began writing the first edition of *Fundamentals of Ecology* (1953). Later he acknowledged that one of his most pleasing accomplishments was his contribution to the evolution of ecology from a subdiscipline of biology to a stand-alone discipline (1977).

Gene Odum collaborated with his younger brother, Howard Thomas Odum, on several major projects. For example, H. T. collaborated with Gene on the second edition of *Fundamentals of Ecology*, published in 1959. Their final paper together, entitled "The Energetic Basis for Valuation of Ecosystem Services," published in *Ecosystems* (2000), builds on their earlier classic works on the structure and function of ecological systems to the benefits supplied to human societies by these same ecosystems and landscapes.

Gene and Martha's son, William Eugene Odum, a professor of environmental science at the University of Virginia, died suddenly in 1991 of cancer at the age of 48. This loss took an emotional toll on Martha and Gene and left a mark on them, the depth of which was only revealed to a few. Martha died on June 29, 1995, after a courageous struggle with

cancer, ending 56 years of marriage with Gene. Using her artistic talents, influences afforded to her in her early life, and extensive travel during her life with Gene, she continually crafted their lifetime primary dwelling at Beech Creek in Athens, Georgia. An early study in design and a developed interest in architecture led Martha to the loving restoration of a cabin (reconstructed with one numbered piece at a time). This cabin, along with the watershed property located in Madison County, Georgia, was named Spring Hollow. Gene and she willed Spring Hollow to the University of Georgia Foundation for use by the Institute of Ecology for research and education. The Eugene and Martha Odum Gallery for the decorative arts, situated in the Georgia Museum of Art, stands as a testament to their dedication to preservation and encouragement of regional craft. Through her paintings Martha enriched Gene's perspective of nature (Odum and Odum, 2000). And the influence of her beautifully appointed parties, appreciated by generations of friends, colleagues, and students, led to the creation of several gifts by Gene that emphasized the importance of and support for social activities and gatherings within academic units, among them a special fund at the University of Virginia.

Gene Odum portrayed intellectual and personal growth throughout his life, evolving from an avian ecologist in the 1930s and 1940s to an ecosystem ecologist and a holistic thinker later in his life. From the 1950s through the 1980s he helped establish the Savannah River Ecology Laboratory, the Sapelo Island Marine Institute, and the world-famous Institute of Ecology. It was also during this time that his writing began to emphasize the role of mutualism, mechanisms of ecosystem development, and energetics as a common denominator across levels of organization. In reflection he then became a philanthropist providing monies for his programs, an environmentalist recognizing the need to

protect ecological systems, and a teacher promoting integrative science.

Gene was a vibrant individual until his death, continuing to negotiate the limitations of aging and sharing the wisdom and gifts accrued in his long life. He shifted from an avid tennis player in his youth and middle years, to a worthy opponent on the croquet court in his later years. He was a relentless birdwatcher, a tireless traveler, and an enthusiastic organic gardener until his death. Although encouraged to officially retire in 1984, he continued to devote his time to writing, contributing to research publications and the fifth edition of *Fundamentals of Ecology* (2005). He was devoted to public communications that promoted ecological awareness. In addition to his reputation as a research ecologist, Eugene also became a respected environmentalist during the decade of the environment and was quoted frequently in *Time*, *Newsweek*, and *Life* magazines.

He conducted his life as both an ecologist and an environmentalist. He played a major role in the passing of the Coastal Marshlands Protection Act of 1990 in the State of Georgia. He frequently noted that politicians act when citizens speak in a unified voice. Eugene designated in his will that more than half his 26-acre estate at Beech Creek be placed in permanent conservation protection, thus providing habitat for the wildlife he loved. His legacy of generosity will benefit generations in pursuit of education, research, and service.

HONORS AND AWARDS

- 1945 Fellow, American Ornithologists Union
- 1950 Fellow, American Association for the Advancement of Science
Delegate, first Atoms-for-Peace Conference, Geneva, Switzerland

- 1956 Mercer Award (shared with Howard T. Odum), Ecological Society of America
- 1957 Foundation Distinguished Professor, University of Georgia
National Science Foundation Senior Fellowship
- 1964 President, Ecological Society of America
- 1967 Georgia Scientist of the Year, Georgia Science and Technology Commission
- 1970 Member, National Academy of Sciences
- 1973 President, Ecology Section, American Society of Zoologists
- 1974 Eminent Ecologist Award, Ecological Society of America
Honorary member, British Ecological Society
- 1975 Prix de l'Institut de la Vie, French government (shared with Howard T. Odum)
Member, American Academy of Arts and Sciences
- 1976 Conservationist-of-the-Year Award, Georgia Wildlife Foundation
- 1977 Tyler Prize for Environmental Achievement
- 1978 Distinguished Service Award, American Institute of Biological Sciences
Honorary member, Southeastern Estuarine Research Society
- 1979 Member, Environmental Advisory Committee, U.S. Department of Energy
- 1981 Cynthia Pratt Laughlin Medal, Garden Club of America
- 1983 Educator-of-the-Year, National Wildlife Federation
- 1985 Odum Lecture Series, University of Georgia
- 1987 Crafoord Prize in Ecology, Royal Swedish Academy of Science, Stockholm (shared with Howard T. Odum)
- 1989 Chevron Conservation Award, Washington, D.C.
- 1990 Honored at the seventy-fifth annual meeting of the Ecological Society of America
- 1991 Theodore Roosevelt Distinguished Service Award
- 1992 Environmental Educator Award, Society of Environmental Toxicology and Chemistry
- 1997 Lifetime Achievement Award, Georgia Environmental Council
Estuarine Federation Lifetime Achievement Award, established to honor Eugene P. Odum, Howard T. Odum, and William E. Odum
- 1998 Distinguished Service Award, United States Section, International Association of Landscape Ecology

REFERENCES

- Barrett, G. W., and T. L. Barrett, eds. 2001. *Holistic Science: The Evolution of the Georgia Institute of Ecology (1940-2000)*. New York: Francis and Taylor.
- Barrett, G. W., and G. E. Likens. 2002. Eugene P. Odum: Pioneer of ecosystem ecology. *BioScience* 52:1047-1048.
- Barrett, G. W., and K. E. Mabry. 2002. Twentieth-century classic books and benchmark publications in biology. *BioScience* 52:282-285.
- Craige, B. J. 2001. *Eugene Odum: Ecosystem Ecologist and Environmentalist*. Athens: University of Georgia Press.
- Meyers, J. M., and D. W. Johnston. 2003. In memoriam: Eugene Pleasants Odum, 1913-2002. *Auk* 120:536-538.
- Odum, E. P. 1998. *Ecological Vignettes: Ecological Approaches to Dealing with Human Predicaments*. Amsterdam: Harwood.
- Odum, H. W. 1936. *Southern Regions of the United States*. Chapel Hill: University of North Carolina Press.
- Odum, M., and E. P. Odum. 2000. *Essence of Place*. Athens: Georgia Museum of Art.

SELECTED BIBLIOGRAPHY

1941

Variations in the heart rate of birds: A study in physiological ecology. *Ecol. Monogr.* 11:299-326.

1945

The heart rate of small birds. *Science* 101:153-154.

1953

Fundamentals of Ecology. Philadelphia: W. B. Saunders.

1955

With H. T. Odum. Trophic structure and productivity of a windward coral reef community on Eniwetok atoll. *Ecol. Monogr.* 25:291-320.

1956

With D. W. Johnston. Breeding bird populations in relation to plant succession on the Piedmont of Georgia. *Ecology* 37:50-62.

1959

Fundamentals of Ecology. 2nd ed. Philadelphia: W. B. Saunders.

1960

Organic production and turnover in old-field succession. *Ecology* 41:34-49.

1962

Relationships between structure and function in the ecosystem. *Jpn. J. Ecol.* 12:108-118.

With C. E. Connell and L. B. Davenport. Population energy flow of three primary consumer components of old-field ecosystems. *Ecology* 43:88-96.

1964

With D. T. Rogers Jr. and D. L. Hicks. Homeostasis of the nonfat components of migrating birds. *Science* 143:1037-1039.

1968

Energy flow in ecosystems: A historical review. *Am. Zool.* 8:11-18.

1969

The strategy of ecosystem development. *Science* 164:262-270.

With R. W. Gordon, R. J. Beyers, and R. G. Eagon. Studies of a simple laboratory microecosystem: Bacterial activities in a heterotrophic succession. *Ecology* 50:86-100.

1977

The emergence of ecology as a new integrative discipline. *Science* 195:1289-1293.

1979

With J. T. Finn and E. H. Franz. Perturbation theory and the subsidy-stress gradient. *BioScience* 29:349-352.

1981

With B. C. Patten. The cybernetic nature of ecosystems. *Am. Nat.* 118:886-895.

1984

The mesocosm. *BioScience* 34:558-562.

With L. J. Biever. Resource quality, mutualism, and energy partitioning in food chains. *Am. Nat.* 124:360-376.

1986

With P. F. Hendrix, R. W. Parmelee, D. A. Crossley Jr., D. C. Coleman, and P. Groffman. Detritus food webs in conventional and no-tillage agroecosystems. *BioScience* 36:374-380.

1989

Input management of production systems. *Science* 243:177-182.

Ecology and Our Endangered Life-Support Systems. Sunderland, Mass.: Sinauer.

1992

Great ideas in ecology for the 1990s. *BioScience* 42:542-545.

1995

With W. E. Odum and H. T. Odum. Nature's pulsing paradigm. *Estuaries* 18:547-555.

1997

With G. W. Barrett and J. D. Peles. Transcending processes and the levels-of-organization concept. *BioScience* 47:531-535.

2000

With G. W. Barrett. The twenty-first century: The world at carrying capacity. *BioScience* 50:363-368.

With H. T. Odum. The energetic basis for valuation of ecosystem services. *Ecosystems* 3:21-23.

2005

With G. W. Barrett. *Fundamentals of Ecology*. 5th ed. Belmont, Calif.: Thomson Brooks/Cole.