resolution of respect

G. EVELYN HUTCHINSON 1903–1991

Sometimes a cliché is the best way to say it: how many times have we heard "It's the end of an era" as word of the death of G. Evelyn Hutchinson passed around? Hutchinson grew up knowing people who had known Darwin—even, as a mischievous boy, playing tricks on a son of Darwin. He participated in the development of modern ecology as a science and of natural selection as an ecological concept. By the time of his passing there had been major reconstructions of the way we think about the organization of life and how it got that way, much of it due directly to his work or affected by his influence on the thinking of others.

Fortunately, many of the details of his career are available and only major points need be recounted here. At the time of his retirement two celebratory publications were issued presenting, among other things, bibliographies and analyses of his career, edited by Y. H. Edmondson (1971) and E. S. Deevey, Jr. (1972). Further, Hutchinson himself helped us by publishing a memoir covering his early years (*The Kindly Fruits of the Earth,* 1979) and by collecting many of his miscellaneous writings in several volumes (1936, 1953, 1962, 1965).

George Evelyn Hutchinson was born on 30 January 1903 in Cambridge, England of an academic, scientifically oriented family. His father was a professor of mineralogy there. After schooling at St. Faith's and Gresham's he studied at Emmanuel College in Cambridge, receiving a B.A. in 1924 and an M.A. *in absentia* in 1928. He worked briefly at the Zoological Station in Naples, then took an academic position at the University of Witwatersrand in South Africa. He left in 1928 (was sacked as he liked to say), applied for a graduate student fellowship at Yale, and through a remarkable series of events, was appointed to the faculty as a Lecturer instead, eventually becoming Sterling Professor of Zoology. At Yale he developed a pioneering program of ecological research and teaching that became widely known as the "Hutchinson School," based not on a limited field of study, but rather on an attitude.

Fig. 1. G. Evelyn Hutchinson at the National Academy of Sciences, just before the presentation of the Cottrell Award, on 22 April 1974.

His marriage to Grace Evelyn Pickford ended by amicable divorce in 1933. He spent the six weeks residence period in Nevada, obligatory for a divorce at that time, in Reno working on the local lakes, and then wrote a major paper on arid region limnology (1937). Later in 1933 he married Margaret Seal, who died in 1983 after a long bout with Alzheimer's disease. During that period Hutchinson did little travelling, spending much of his time caring for her and continuing to write. Two years after Margaret's death, he married Anne Twitty Goldsby, whose presence and help enabled him to travel extensively and to continue work within the limits of his failing health. After Anne's untimely death on 18 December 1990, he returned home to England for what was intended to be a visit. He died in London on 17 May 1991 at age 88. During those months in England he was able to greet many visitors.

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At his request he toured the new ecology exhibit for children at the Museum of Natural History in London, and he made a final visit to his beloved Wicken Fen, in a wheelchair.

Hutchinson regarded himself primarily as a limnologist (*Kindly Fruits,* p. 208). Much of his later work on biogeochemistry, community ecology, and evolutionary concepts can be seen to be derived from his experience with lakes. He started with an early interest in aquatic insects. His first publication, in 1918 at age 15, appeared in a journal devoted to notes on odd observations. In its entirety, it reads:

> *A SWIMMING GRASSHOPPER,—When I was looking for Hemiptera in a pond here, I knocked a grasshopper into the water. It fell about 18 inches from the bank and commenced to struggle, and I then saw it was getting under the water. When it was well under it began to swim, using its hind legs and its front ones, but not its intermediate ones. It swam back to the bank and climbed up a stem out of the water. I put the insect back into the water and let it swim again. The insect was not apparently much exhausted after its swim. I do not know what species of grasshopper it is so I enclose it for examination. Could you return it if possible. I enclose stamps to cover the postage.—G. E. HUTCHINSON, "Woodlands," Holt, Norfolk. June 20th.*
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> [The species is *Tetrix bipunctatus.* Neither Dr. Chapman nor I were aware of the fact that a grasshopper would apparently be so much at home in the water.—H.J.T.]

In this brief note we can see the beginning of his approach to scientific problems: first the recognition of an unusual condition (grasshopper in water), then close observation of details (how the grasshopper used its legs), next the experimental approach (throwing the grasshopper back to replicate the observation), and finally the realization of the importance of the taxonomic position of the material and the need to keep it. This way of thinking is well exemplified by his *Treatise on Limnology.* The procedure was to assemble an enormous store of factual information, to notice within it distinct patterns or curious conditions, and to look for explanations or connected phenomena. An example is his realization that freshwater aquatic plants as a group have a much higher sodium content than terrestrial plants, a fact that turns out to be of enormous importance to large terrestrial herbivores living in tundra landscapes (Botkin et al. 1973, Hutchinson 1975). Of course his research papers did not use this compilative procedure; however, they were based on large amounts of original data collected according to definite questions, for example his pioneering paper on phosphorus dynamics (1941). Some of his most influential papers had a theoretical orientation with a major component of imaginative speculation. But in every case, he made connections between his results and existing knowledge. An original investigation was always preceded by a period of speculation and evaluation of the possibilities.

He early developed, as all real ecologists must, a deep knowledge of a group of organisms, in his case the Corixidae. In South Africa he extended this to all kinds of freshwater organisms, and included physical and chemical environmental factors known to be important in determining the kind and quantities of various species. One can imagine here the seeds of an appreciation of the concepts of community structure and ecosystem. The influence of Charles Elton was critical.

In New Haven Hutchinson launched a program of research on limnology that neatly combined his interests in general ecology and biogeochemistry. He did experiments on the effect of magnesium on *Daphnia,* stimulated by information about its occurrence in the great African lakes (1932), and he wrote papers on such topics as the aluminum content of *Lycopodium,* guano islands, and many others. Much of his chemical work in aquatic systems was closely connected to the reciprocal relations between organisms and environment.

In 1932 he served as biologist on the Yale North India Expedition, which resulted in a vast collection of organisms, protozoa to fish, from high-altitude lakes, expanding his experience in biogeography. His interest in evolutionary matters, starting from a boyhood love of dinosaurs, was manifested by an early paper on the Burgess shales (1930). Evolution and natural selection became prominent in his thinking later in his life. A large part of his production, with collaborators, was in paleolimnology, culminating in a magnificent report on Lago di Monterosi (1970).

Much of his influence was exerted by publication of scientific papers. Alan Kohn, just arrived at Yale as a graduate student with a

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desire to study oceanography, saw a copy of "Copepodology for the ornithologist" (1951), and instantly found himself converted to evolutionary ecology. Hutchinson's occasionally convoluted style sometimes required study to determine what a sentence meant, but what he wrote repaid that study. His lectures and personal conversation also had an impact that could change careers. Gordon Riley went to the Yale Zoology Department as the best place to fulfil his intention of becoming an experimental embryologist, but the first week of Hutchinson's course in limnology changed all that. He immediately started his Ph.D. study of Linsley Pond, later becoming one of the world's leading biological oceanographers.

There is no better example of the ripple effect of Hutchinson's imagination than the innocuously titled *Concluding Remarks* (1957*b*) that proposed a concept of the niche, presented with just enough holes to keep people busy thinking and working for decades. In fact, it was reprinted in 1991 in a collection of *Classics in Theoretical Biology,* one of only three in the field of ecology.

He took his teaching seriously. His earliest undergraduate assignments covered a wide range, including beginning Biology, Invertebrate Zoology, Entomology and Vertebrate Embryology. The last included the obligatory frog eggs and slices of chicks, but the field was presented as a dynamic, experimental science, as indeed it was in the department led by Ross G. Harrison. Later he added courses closer to his own interests, Natural History of Animals and Animal Ecology of Inland Waters (remember that Yale had a Zoology Department then). In 1942 he started a graduate course in Limnology. He provided the class with elaborate lecture notes, richly illustrated with photographic reproductions of figures from the literature, so that we could listen to the lectures without being distracted by taking our own notes. He was quite critical of the educational attitudes that he found at Yale and most other places in North America. He felt considerable satisfaction in the improvement in the character of both undergraduate and graduate teaching that took place at Yale during his time there.

Although his reputation for innovative thinking spread rapidly, he did not gain universal approval, particularly in the centers of limnology in the Midwestern U.S. (Beckel 1987). Nor did he approve of some of the native customs. It is said that on a visit to the Trout Lake station in Wisconsin he created a sensation by appearing at breakfast wearing shorts. He was quite disappointed to find neither tea nor coffee available, a fact that led to some typically speculative generalization (*Kindly Fruits,* p. 248).

Hutchinson had a strong appreciation of the arts and humanities. He made some novel connections, as in his use of medieval manuscript illuminations as a source of zoogeographic data (1974). He had friendly and professional relations with writers, artists and musicians. He was a literary executor of the estate of Rebecca West. Willie Ruff, who led the interdisciplinary seminar on rhythm in the Yale School of Music, invited Hutchinson many times to lecture; the topic was seiches and their biological implications (W. Ruff 1991 and *personal communication*).

The value of Hutchinson's work was recognized around the world. His awards include:

- Leidy Medal, Philadelphia Academy of Natural Sciences (1955)
- Naumann Medal, International Association of Theoretical and Applied Limnology (1959)
- Eminent Ecologist Award, Ecological Society of America (1962)
- Tyler Award (1974)
- Frederick Garner Cottrell Award for Environmental Quality, National Academy of Sciences, USA (1974)
- Franklin Medal, Franklin Institute (1979)
- Daniel Giraud Elliot Medal, National Academy of Sciences (1984)
- Kyoto Prize in Basic Science, Japan (1986)
- National Medal of Science (1991, posthumous)

For many years people were puzzled by the absence of his name from the annual lists of awardees of the National Medal of Science. He had been nominated repeatedly by individuals and societies, including ESA, but without discernable effect. It turned out that he had not been receptive because he did not want to accept an honor from the hands of then President Nixon. The medal was awarded posthumously on 16 September 1991.

He was a fellow of Saybrook College, Yale University, an honorary fellow of Emmanuel College, Cambridge University. He was honored with degrees from Cambridge, Duke, Harvard, Niagara and Princeton Universities,

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University of Pennsylvania, Washington University, and Lawrence College. He was belatedly recognized at the University of Witwatersrand by the establishment of the G. Evelyn Hutchinson Research Laboratory in 1977. He was an active member of:

American Academy of Arts and Sciences
American Philosophical Society
American Society of Limnology and Oceanography (President in 1947)
American Society of Naturalists (President in 1958)
British Ecological Society
Ecological Society of America (Eminent Ecologist in 1962)
International Association for Theoretical and Applied Limnology (President 1962–1968)
Linnean Society of London
National Academy of Sciences, USA
Royal Entomological Society
The Royal Society

Hutchinson's influence was not limited to the development of ecological theory. My statement about the Cottrell Award at the presentation ceremony summarized his influence on the thinking of ecologists about environmental problems:

> *Effective management of the environment has to depend on an understanding of what it is. Professor Hutchinson has been quietly promoting a real understanding of how the world works for many years. We nominate him not for any specific action to improve the quality of the environment, but in recognition of a whole lifetime of fundamental studies in limnology and ecological theory that have helped us understand our environment and therefore have helped us in our efforts to keep it in viable condition. We recognize further his pervasive influence in focussing that understanding on the protection and preservation of the natural system of which we are part, and on the values of the special features of the human species.*
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> *Evelyn Hutchinson is well known for the immense breadth of his interests in science and beyond it. Tonight we emphasize how he has furthered the rational use of knowledge by lecturing, by writing, and by working with groups such as the Academy's Committee on Science and Public Policy. All of his writing has the characteristic of stimulating thought and work by others, but especially noteworthy is the remarkable series of essays known as* "Marginalia" *that appeared for many years in the* American Scientist. *In the first of these, over 30 years ago, he wrote,*
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> > *"The writer believes that the most practical lasting benefit science can now offer is to teach many how to avoid destruction of his own environment, and how, by understanding himself with true humility and pride, to find ways to avoid injuries that at present he inflicts on himself with such devastating energy." [1943]*
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> *In all his activities, Evelyn Hutchinson has exemplified this belief, and in so doing has greatly influenced the thought of three generations of scientists. Without his contributions, our concern for the environment would be notably less effective than it is today.*

The end of one era is the beginning of another. Evelyn Hutchinson had not regularly attended meetings of scientific societies for many years, but he knew what was going on. He read the journals. He recognized the names of the players and knew what they were doing. He appreciated the fact that new, young limnologists were coming along with their own ideas. We should not be looking for a new GEH. We should just continue to do what catches our interest, with gratitude for the example we have had.

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