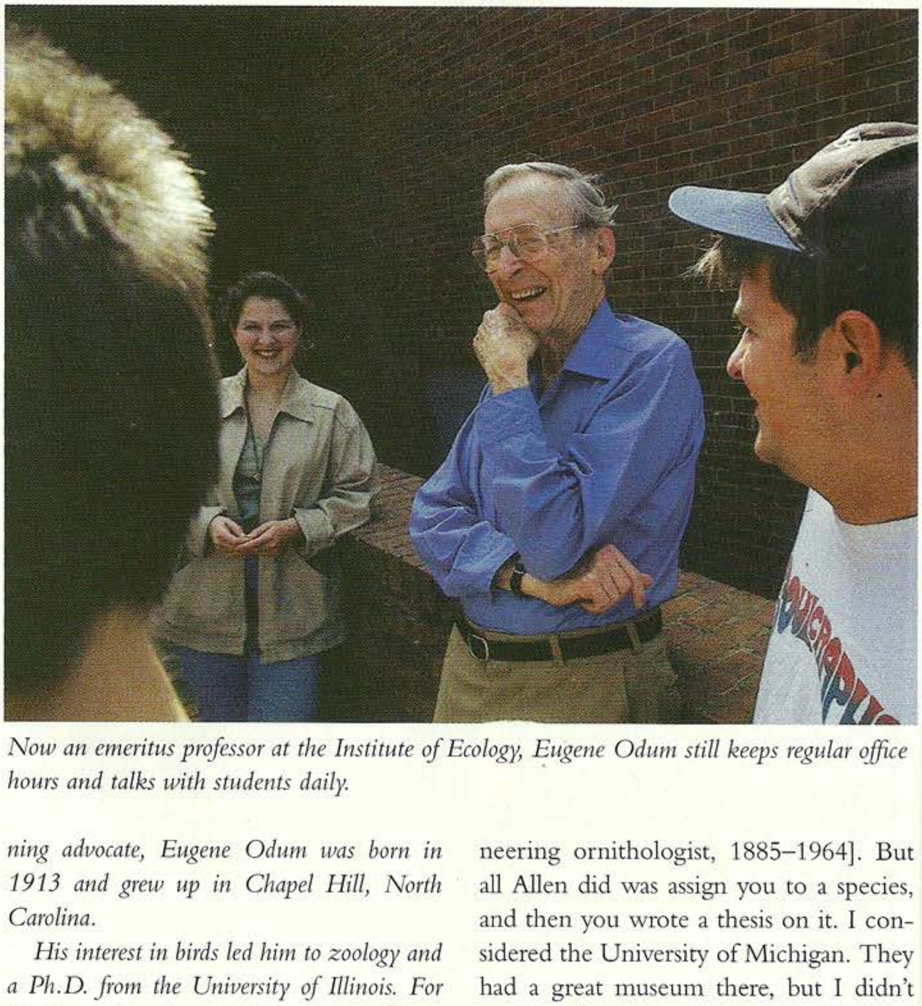
A Conversation with Eugene P. Odum

Whole-Earth Mentor

By Tom Chaffin


Richard Fowlkes, 1998

Now an emeritus professor at the Institute of Ecology, Eugene Odum still keeps regular office hours and talks with students daily.

Eugene P. Odum—often called the father of ecology—didn't exactly invent the discipline. Many of its concepts reach back to ancient times. The word itself was coined by German biologist Ernst Haeckel in 1869. But during the late 1940s, Eugene Odum led the way in drawing various doctrines together into a new science called ecosystem ecology.

Odum and fellow ecologists G. Evelyn Hutchinson and Raymond Lindeman saw nature as shaped more by physics than by biology—nature as a vital flow of energy from recycled chemicals moving through a thermodynamic system. They thought of energy as a currency shared among the earth's various life forms, and they defined ecosystems—including human societies—as living organic communities within their physical settings.

Odum saw the earth—indeed, the entire universe—as a series of interlocking ecosystems. Each one, he wrote, embraced a unique "strategy of development," each "directed toward achieving as large and diverse an organic structure as is possible within the limits set by the available energy input and the prevailing physical conditions of existence." Each ecosystem, Odum argued, was moving toward, or had already achieved, that goal. In 1953, with the help of his brother and fellow ecologist, Howard Odum, he published Fundamentals of Ecology, *the first textbook in the field. The book, which has since appeared in numerous revised editions, secured ecosystem ecology's status as a discipline independent of biology and natural history. As environmentalism began to grab public attention during the late 1960s and the 1970s, the book provided the movement with a vocabulary, as well as a comprehensive vision of nature as a dynamic system.*

The son of a sociologist and regional-planning advocate, Eugene Odum was born in 1913 and grew up in Chapel Hill, North Carolina.

His interest in birds led him to zoology and a Ph.D. from the University of Illinois. For his dissertation, he examined avian cardiovascular systems with a device he invented to measure the heartbeat of small birds. Since 1940, Odum has been at the University of Georgia, in Athens, where in 1967 he was instrumental in founding the university's Institute of Ecology.

Interview *You made a name for yourself by trying to see nature holistically, but your interest began with individual species of birds.*

I considered going off to get a Ph.D. at Cornell under Arthur A. Allen [a pioneering ornithologist, 1885–1964]. But all Allen did was assign you to a species, and then you wrote a thesis on it. I considered the University of Michigan. They had a great museum there, but I didn't want to be a museum person. I didn't want to shoot and stuff birds; I wanted to study live birds. So I ended up at the University of Illinois—one of the few schools with something like ecology—in the zoology department.

My thesis was in physiological ecology. I wanted to get beyond taxonomy—descriptive ecology—into function, into the physiology of birds and how that related to the larger natural environment. How is everything working out there? What's going on? What are the energy flows?

When you first arrived at the University of Georgia, in 1940, you were allowed to teach some ecology courses. But by the end of that decade, you had a confrontation over the inclusion of ecology in the core curriculum.

We had a meeting about what the core curriculum should be and what every major in biology should take. I suggested that ecology ought to be in there, and they looked at me and laughed. They thought that ecology was just going out and finding animals and describing and collecting them. They said, "There are no principles. It is just organized natural history. It's not an important subject."

They were right about what it was then, but I got mad and walked out. Later they said, "We didn't mean to hurt your feelings, but what is ecology?" Then I realized that nobody had written a general book about ecology. So with help from my brother Howard, I started to write it.

Howard was then a graduate student at Yale under the pioneering ecologist G. Evelyn Hutchinson. We were interested in putting together the physical and biological sides of ecology. Unlike other books, which started with the organism and ended with the ecosystem, ours started with the ecosystem and worked down—the top-down approach.

Speaking of trying to see the big picture, you were one of the few major figures to embrace James Lovelock's and Lynn Margulis's Gaia hypothesis, published in 1979, which argues that the biosphere is a self-regulating entity that preserves life on earth by controlling the chemical and physical environment.

The Gaia hypothesis is certainly top-down and holistic, and it's now generally accepted—although there's much discussion as to whether it's self-organized. Organisms have not just adapted to different physical environments; they also modify and improve the environment for their own good—just like people. Evolutionary biologists tend to object to the idea, because they think that the environment is just a stage, and the organisms are up there on it fighting each other—survival of the fittest, and that's all there is to it. The physicists, because they observe the universe and how beautifully it operates, see a plan out there.

Why do you devote so little attention to evolution, natural selection, and to what geologists call deep time?

In ecology today, we say that evolution is not restricted to the organism level. We say that evolution occurs all the way through the spectrum. Earth evolves, populations evolve. In other words, the evolutionary processes are not restricted to the gene. And of course, there is coevolution, which involves two unrelated species and the development of mutualism.

One of our big points now is that as pioneer communities grow large and complex, with all their resources in use, we have increasing mutualism—an evolutionary trend from competition to mutualism. We point out the parallel of the United States and Russia trying for years to kill each other; now it's in their mutual interest to cooperate.

Evolution does not have to involve natural, genetic selection. All this business of cloning and genetic engineering—we're no longer talking about letting natural selection select people. We're talking about us selecting people. We're playing God now. Let's put it this way: evolutionary biology focuses on what happened in the past, but ecology focuses on the present, on what's happening now, and what will happen in the future.

Everything pulses. People are overworried about endangered species. I think it's important, but not the only thing we should study now. But deep time does show us that when there have been mass extinctions, nature is resilient. After each mass extinction, the species left recover their numbers. Diversity is slower. You have a period of wiping out huge numbers of species—and we're doing that—and the questions are: Can we be sure that these species play important roles? Can they be replaced?

You've talked about the need for affluent people *to consume less, but you've resisted the allure of ideas like "small is beautiful."*

Well, "small is beautiful," but big is powerful. As long as big is powerful, "small is beautiful" won't work. As my father [sociologist Howard Odum] said, "Scientists think they can solve problems by being scientific and rational, but not if people don't want to go along with it."

What we ecologists tell students is to think big but work small. We point out to students right away that you can't do a really holistic study as a thesis—a piece study has to be put in a framework.

Do you feel that the fragmentation of ecology into subdisciplines has resulted, in many cases, in a kind of narrow professionalism and a loss of the holistic vision?

Science in general does that. It's perfectly natural. In a new field you have only a broad picture, and as you get involved and learn more, you become reductionist. But you hope you don't stay on that level and [will] come back to the broad picture.

C. P. Snow, in his book The Two Cultures, *articulated the growing dichotomy between the sciences and the humanities. You've said that ecology is the science that's best suited to bridging the two cultures.*

Ecology is the best bridge because it's the only one of the major sciences that's increasing in scale of study. In genetics, you study a gene for cancer but not the bigger idea that cancer won't develop unless the environment and other things are conducive to it.

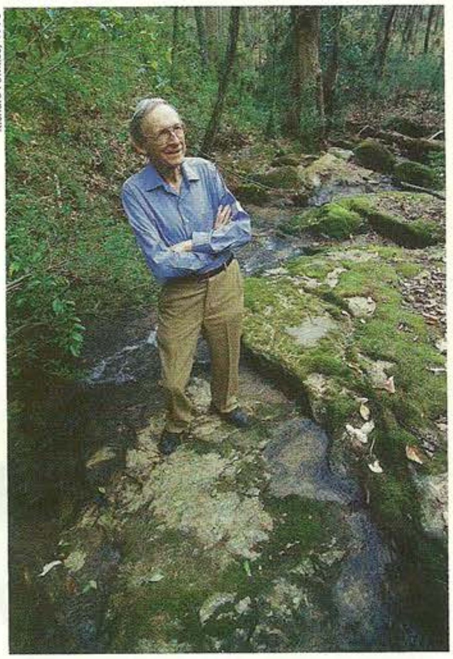
Over the past few years, the so-called nonequilibrium ecologists have charged that your brand of ecology overstates the role of balances and order in nature. Looking at forests, for instance, they see a continually shifting crazy quilt of patch forests, rather than orderly succession.

If you believe that's the way things work, then there's no order, and why bother about conservation? You can't possibly take that viewpoint and then try to do anything about our problems.

The nonequilibrium ecologists argue that the instances of stability—the natural balances—are the exception.

For at least a billion years, we've had a rough balance between oxygen and CO_2. What do you call that? The so-called nonequilibrium ecologist never looks at the big things—the environment to him is a backdrop. There is no steady state, but there sure as hell are a lot of balances.

We say that the control of organisms is at a set point. From the organism on down, everything is tightly controlled.



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Eugene Odum on his twenty-five acre woodland property near the institute.

When you're growing and when you get to be an adolescent, you stop growing automatically because of genes and hormones. And whether you like it or not, you go from youth to maturity. That's called homeostasis, a well-known physiological term. It means that your body functions are highly controlled and maintained. Cancer and obesity happen when things get out of control.

But above the organism, and for society, there's no set-point control. So if society goes from youth to maturity, it's only because the balance of nature is pulsating. We have a Greek word for this—*homeorhesis,* which means "same flow." The balance of nature is like a river; it rises and falls. Nature pulses. That's why it's a little hard to be sure whether global warming is a permanent change or a pulse. El Niño, of course, pulses.

You have written that as an ecosystem moves toward maturity, it gains species diversity and stability increases. But it's been argued that a monoculture, such as a spartina salt marsh or tundra, has very little diversity but is actually more stable than, say, a tropical rainforest with many species.

Salt marshes have just one big plant because very few higher plants can tolerate the salt. But the [salt marsh] system is extraordinarily diverse in microorganisms and algae. You need to measure their activity, rather than count their numbers, in microbial ecology, and this is a field most traditional ecologists don't know about. The marsh is not stabilized by diversity but by pulsing tides. Organisms are adapted to pulsing, and if you stop the pulses, the marsh will become something else. The cornfields of the Midwest are also pulse-stabilized systems, maintained for years and years, not by species diversity but by machines and people.

In the tundra, there's also a tremendous variety in kinds of organisms. It is pulse-stabilized by huge weather changes. Organisms only have a short period in which to grow, so only certain lichens, grasses, sedges, and the hardiest land plants are adapted to that kind of life.

We're about to enter a new millennium. Are you optimistic?

I'm hopeful that we can handle the bust. We're very resourceful. We get knocked down, but we get up quick. Humans are the most resilient organisms that ever appeared on earth.

But you see a bust coming?

Oh, sure. It's already here.

Tom Chaffin teaches American history at Emory University and is director of Emory's Oral History Project. He published Fatal Glory: Narciso Lopez and the First Clandestine U.S. War Against Cuba *in 1996.*