The Pimentels

Holism and science

by Guest Editor Lindsey Grant

Perhaps, years hence, the principal failure of twentieth century science will be recognized as its general failure to reconcile holism – the recognition that everything is connected, but frequently in vague and arcane ways – with the demand of the scientific method that lines of inquiry be sharply delimited and defined so as to permit scientific challenge

For the scientist, the path of caution (if not of enlightenment) is to stay within the narrow edges of his discipline. One can keep up with the literature and avoid the ultimate humiliation of publishing a paper that colleagues can attack for failing to take note of some recent development in his or her field. And, because the scientific literature is expanding fast, disciplines tend to become more and more narrowly defined.

The same process leads the cautious to offer solutions only within their discipline. Human population growth (my area of interest) is the most vivid illustration of the point I am making. Since its effects have been so pervasive, one might reasonably expect that it would be recognized as a cause of many of the problems scientists are investigating. And an effort to influence population growth might often be the solution to the problem, or part of it. Does it happen that way in most scientific research? Hardly. For some years, I kept an informal tally of scientific articles (mostly from *Science*) in which human population change was prima facie a source of the problem. I marked those articles "zip re pop" that either (a) failed to identify it as a cause or (b) having identified it, failed to suggest that action on population growth could be part of the solution. My plan was to write "pop!" on articles that made both connections, but I literally almost never had the chance to bestow that accolade. Scientists, like many others, seem compelled to treat population growth as an independent variable to which they must adjust rather than as a human activity that can be addressed.

The price for this insularity is irrelevance. Reality does not observe disciplinary boundaries. Timidity has sidelined scientists when governments, in their rare moments of lucidity, have undertaken to deal with the real problems they face. Under President Nixon's leadership, the U.S. Government addressed the implications of population growth in the United States and in the less developed countries (LDCs). The domestic effort fizzled out, but in the following decades (with setbacks in the Reagan years and the 1990s), the United States played a major role in educating others about the problem, convincing them of its importance, and helping them to promote family planning. Human fertility has indeed declined in much of the third world, and with that decline comes the beginning of hope. The United States can claim some of the credit for the progress. But U.S. scientists were not leading that charge. A review of U.S. scientific demographic literature in the past forty years would lead us through mind-numbing mountains of detailed and inconclusive studies of the reasons women have children, and very little about the ramifications of population growth itself.

The general insularity of scientific research defies the advice of scientific leaders. Several leading scientists, including at least two Presidents of the American Association for the Advancement of Science (AAAS), have pleaded for more inter-disciplinary research, and specifically for a willingness to take on population growth. All the major national and regional multi-disciplinary research organizations in the world have identified population growth as a central danger to human welfare. I think that the

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unwillingness of researchers at the bench level to heed that advice is a product of the structural organization of academia; but that is another topic, and I am not the one to address it.

There is a short honor role of scientists who defy my generalization. From memory, let me mention just a few: Kingsley Davis, Al Bartlett, Garrett Hardin, Henry Kendall, Paul and Anne Ehrlich – and an entire generation of young scientists whom they trained – Lester Brown and the Worldwatch Institute, Lincoln Day, Norman Myers, E.O. Wilson, Leon Bouvier.

Engaging Other Disciplines

Agriculture is the central point where expanding human populations encounter the limits of natural systems. It has reshaped more of the earth's surface more profoundly than any other human activity. The primary goal of agronomy is regularly described as promoting crop yields so as to make it possible to feed a growing population on a land base that has nowhere to grow. Agronomists almost never see it within their purview to suggest that the problem is not simply one of yields; it is the twofold one of bringing demand – population growth and eating habits – into balance with ecologically sustainable yields. And rare indeed is the demographer who, having described population growth, is willing to suggest that it may have consequences for human nutrition.

Poets and writers have described an idealized agriculture in balance with nature at least since Roman times. In the United States, names like Louis Bromfield and Aldo Leopold come to mind. But scientists feel free to ignore them because they are not speaking the language of science.

Geographer Vaclav Smil, in Canada, called attention to what should have been obvious to all of us: that because of commercial agricultural fertilizers, human activity is introducing more nitrogen compounds into the biosphere every year than all natural processes. He thus set in motion an endless series of questions: what would happen to the biosphere if that nitrogen all piled up rather than being recycled by microbes into the atmosphere? How much can the microbes handle? Are we changing their environment in ways that might lead them to recycle too much? Or too little?

And Smil has opened only one of many doors. What does agriculture do to the land itself? To the living systems that support it? How do energy and agriculture interact? What does the future of one mean for the future of the other?

There is remarkably little of this cross-disciplinary thinking. I find it remarkable that all the fierce debates about Thomas Malthus have revolved about the secondary question: Can food production stay ahead of population growth? Almost nobody (including Malthus himself) has asked, how might the effort to keep expanding food yields itself affect the natural systems that support us?

And that brings me to David and Marcia Pimentel. They have regularly suggested the unthinkable: that the solution to a given problem may lie outside the boundaries of that particular discipline. More systematically than any other scientific writers I know, they have regularly crossed scientific boundaries to explore the interactions of modern agriculture with other issues. For example: the role of pesticides in developing more virulent pests; the interaction between the tightening supplies of fossil fuels and future agricultural output; water shortages and the future of food production; the effects of modern agriculture on soil productivity; the ramifications of chemical-intensive agriculture; dietary habits and the ability of the world to support human numbers; and – above all – the size population that world and U.S. agriculture can sustainably support without damage to other systems.

The Pimentels and a few like them have ventured into inter-disciplinary studies at the level of research itself, and therein lies their importance. They are leading the way in bringing the boundaries of research into better correspondence with the nature of reality. I hope they will be followed in the twenty-first century by rising numbers of interdisciplinary researchers who may teach us the true ramifications of human activities. That in turn could be the beginning of a willingness to deal with the imbalances we have generated – starting with the extraordinary growth of human numbers and activity in the past two generations.

Enough. The reader is interested in hearing the Pimentels' viewpoint, not mine. I hope you will find the following excerpts as stimulating as I did.

LINDSEY GRANT

Pests, Pesticides, and Growing Populations

An interview with David Pimentel

by John F. Rohe

As an important part of this issue's feature section, *The Social Contract* asked author and environmental activist John Rohe to interview David Pimentel. The interview was conducted on Memorial Day, 2002.

JOHN ROHE: *Thank you, Dr. Pimentel, for taking the time for this interview for* The Social Contract.

DAVID PIMENTEL: My pleasure.

JR: Can I ask when you were born?

DP: May 24, 1925. I just had a birthday.

JR: Happy Birthday. Where were you born?

DP: Fresno, California. I spent my first six years there on a farm.

JR: And from there?

DP: From there we moved to Massachusetts, to another small farm in Middleboro.

JR: When you turned eighteen we were midway through World War II.

DP: I was a teenager. I volunteered. Yes, the war was on, and we all had a patriotic spirit. Everybody was going in. So, I decided it was a good time to go. I joined the Air Force as soon as I turned eighteen, and trained to be a pilot. I was relatively young for the Second World War. The military gave this farm boy a wonderful experience, meeting a wide variety of people.

JR: When did you start college?

DP: In 1945 when I was about 20. I was only in the Air Force for two years. When I got out, I immediately went to the University of Massachusetts and majored in animal science, and subsequently switched to entomology during my last year in college.

JR: You are still dealing with animals.

DP: Still animals, but insects in this case.

JR: Were there any other influential events in your early life that influenced your love of animals.

DP: Yes, growing up on a farm there were many types of animals, like goats, geese, and chickens. Also there were books. I remember in particular the Thornton Burgess books. He had a book on Blacky, the crow, one on Peter Rabbit, and he really did a super job of introducing these animals and their behavior and ecology to young people in grammar school. He must have had twelve or fifteen books. Each of them dealt with a particular animal, but then he related each animal to all the other animals that existed in the ecosystem.

JR: The web of life?

DP: Yes. Burgess focused on one at a time, but related each to the other animals in that ecosystem.

JR: Well, I notice that along the way you spoke of the interconnectedness. Not just seeing one animal on its own, but the relationship between it and the surroundings. Was that a novel idea at that time?

DP: This interrelationship was a novel idea for most biologists.

JR: Well, it's obviously difficult for many of the readers of The Social Contract *who might not have been around in 1935, when you would have been reading the Burgess books, to know what was going on at that time. Darwin had released his* Origin of Species *in 1859.*

DP: Darwin, in a way, was a systematist, or a taxonomist, and collector. And what he did was carry biology a major step further. That is, he asked: what did all this collection of organisms that he was observing mean? That's when he put together his theory on natural selection, the relatedness of animals and plants. Linneas, in Sweden, was the first one to introduce the taxonomic system of binomial names in

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