VOLUME XXXVII, NO. 44
OCTOBER 31, 1984

WHAT MAKES A SCIENTIST?

WRITING for the *New Yorker* (of Nov. 20, 1947), Niccolo Tucci told of his discovery, during a talk with Albert Einstein, of the great physicist's devotion to ancient Greek thinkers. He learned that the world's most eminent scientist spent an hour each evening—tired out or not—reading aloud in Sophocles, Thucydides, and Aeschylus. Tucci said: "So you too, Herr Professor, have gone back to the Greeks." Einstein replied:

> "But I have never gone away from them. How can an educated person stay away from the Greeks? I have always been far more interested in them than in science."

Science is an expression of the human determination "to know," and it was for centuries represented by the vision, inventiveness, and capacity for concentration of men like Einstein. Today it has become something else—a powerful social institution exercising great if fading authority. Dozens of books critical of science come out every year, in which some of the authors distinguish between good science and bad science, calling the latter "scientific" instead of scientific, the term standing for the unwarranted materialistic and mechanistic assumptions on which the popular, institutionalized conception of science is based.

How do these perversions gain a hold on the popular mind? Human beings are apparently so constituted that they long for easy finality, simple explanation, painless reassurance. It is a weakness of human nature that seeks an outside authority in which to trust, whether in some "divine revelation" which rejects all analysis, or in the claim of the scientific (scientistic) fraternity which declares that science will some day solve all problems. It seems a pleasant thought that either the interpreters of the Will of God or those who have mastered the Laws of Nature are here in the world, ready to tell us what to do. This is the thought by means of which the vulgar communicators—the press, the politicians, often the schools—gain their power and authority. These manipulators of opinion, with a great many of the rest of us to help them, are able to shape the popular mind and so become responsible for the course of history.

Yet there are other forces to take into account. History also reveals brief Golden Ages of cultural heights, wonderful new beginnings, and stormy intervals of what seems sudden change when some fundamental truth dawns on a remarkable handful of leaders—or sometimes only one man or woman—leading to social or moral awakening. These periods don't last but during the days of their flourishing some limited but timely recognition of the Good, the True, and the Beautiful is printed on human hearts and is later remembered and echoed as inspiration to succeeding generations. Einstein's devotion to the ancient Greeks is an example.

When we talk about science, then, it becomes important to distinguish between the true scientists, who represent the spirit of a Golden Age, no matter when or where they live and work, and the institutionalized individuals who, like bureaucrats, proceed under the delusion that their discipline has achieved some kind of finality. The books that dramatize this distinction are usually biographies. For general education they are much better than even excellent textbooks on, say, the history and achievements of science. Science lives in the hearts of unusual human beings, not in the institutions which organize, use, and exploit what the scientists have found out. The general reader can *understand* the life of another human being, when well told. And he may learn more about the meaning, possibility, and limitations of science from the biography of a real scientist than in any other reading.

The book that provoked this declaration is Erwin Chargaff's *Heraclitean Fire—Sketches from a Life before Nature* (published by the Rockefeller University Press in 1978). Dr. Chargaff is a chemist, a biochemist whose major achievements have been in the analysis of the constitution of the nucleic acids—vital to the study of DNA and RNA. He is not famous (except among colleagues who understand the importance of his work), perhaps because he has always avoided publicity. He wanted only the recognition that would make it possible for him to go on working, and that he obtained (as the list of awards and honors on the jacket of his book makes clear). To the general reader he is unknown, but this obscurity should not continue since so few volumes that we know of convey with such clarity the meaning of the practice of science. His classical education serves him well and reading him may be a delight for even the complete layman. It was for us.

Chargaff was born in 1905 in Czernowitz, then a provincial capital of the Austrian monarchy. Happily, he was too young for the first and too old for the second World War. When he was nine the family moved to Vienna and he went to school past an office with a plaque bearing the name S. Freud. He learned the classical languages in the *gymnasium* and grew up saturated with Goethe, Karl Kraus, and Kierkegaard. When he entered the University of Vienna in 1923, the times were hard. "When an insurance policy my father had taken out in 1902 was redeemed twenty years later it amounted to the price of one trolley ticket." He chose chemistry for a career because he had never studied it before and this was the only field with promise of employment in Vienna. "Looking back," he writes—"and when you get old this is all you can do—I must say that I have not learned much from my teachers." In short, when he received his Ph.D. (in philosophy) in 1928, he was essentially an autodidact, a self-taught man. (For the extraordinary importance of Karl Kraus as an influence see the chapter on him in *Wittgenstein's Vienna*, Janik and Toulmin, 1973.)

His first job was in Copenhagen, and there he learned of a research fellowship open at Yale, which he applied for and obtained. He relates:

> As the time of my departure grew nearer, so grew my fears. I was afraid of going to a country that was younger that most of Vienna's toilets. Others would try to console me, telling me that I should be surprised and that America would turn out much better than I expected. But I remained doubtful, adapting to that promised land an immortal saying of one of Vienna s wits, Anton Kuh: *"Wie der kleine Moritz sich Amerika vorstellt so ist es."* (As little as Maurice imagines America to be, so it is.)

Yet the people at Yale were considerate and kind and he began to feel at home. But the country remained bewildering to him, "the shock of seeing New York and hearing its weird voices and noises was indescribably severe."

> The neurasthenic pulse of a city that never went to sleep because it never was awake; the grotesque ceremonial of Prohibition, when everybody one met seemed to be "sent by Joe"; the primitive sophistication of an uneducated and conceited intelligentsia; the incredible dirtiness of all that was not incredibly shiny and mock-luxurious; the shameless hypocrisy of all institutions and the boyish grin with which the discovery of deception was acknowledged and defused; the bought dithyrambs accompanying political or commercial careers that soon after ended in oblivion or jail; the confusion of language and the devaluation of all grammatical forms, especially the superlative; the gigantic make-believe as the national gospel, rendering all future belief impossible: all this was bound to overwhelm a young man who, believing to have left Europe behind, found a super-Europe. How far it all seemed from James Fenimore Cooper or Chateaubriand! This was of course, naive on my part: Did I expect to find crocodiles swimming in the Hudson or Sioux on the warpath shooting at me in the avenues of Manhattan? It was only much later that everything I had thought I should find did exist, but always in unexpected disguises.

He did, however, find himself at home with our language, "so sturdy in all richness, so concise and flexible." Yet after being married here—to a

young woman he went back to Vienna to get—they felt unhappy and longed for Europe, and he took a job with the University of Berlin. For a while—nearly three years—he enjoyed the happiest time of his life—but at the end of January, 1933, "the Black Plague had assumed the government of Germany," and they left Germany for Paris. Then, at the end of 1934, they came again to America, he to work at Columbia University, where he went from chemistry to biochemistry. His reflections about the profession of science now begin:

> What I liked about chemistry was its clarity surrounded by darkness; what attracted me, slowly and hesitatingly, to biology was its darkness surrounded by the brightness of the givenness of nature, the holiness of life. And so I have always oscillated between the brightness of reality and the darkness of the unknowable. When Pascal speaks of God in hiding, *Deus absconditus,* we hear not only the profound existential thinker, but also the great searcher for the reality of the world. I consider this unquenchable resonance as the greatest gift that can be bestowed on a naturalist.
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> When I look back on my early way in science, on the problems I studied, on the papers I published—and even more, perhaps, on those things that never got into print—I notice a freedom of movement, a lack of guild-imposed narrowness, whose existence in my youth I myself, as I write this, had almost forgotten. The world of science was open before us to a degree that has become inconceivable now, when pages and pages of application papers must justify the plan of investigation, "in depth," the thirty-fifth foot of the centipede; and one is judged by a jury of one's peers who are all centipedists or molecular podiatrists. I would say that most of the great scientists could not have arisen, most sciences could not have been founded, if the present utility-drunk and goal-directed attitude had prevailed.

The sciences, in short, have deserted nature.

> It is clear that to meditate on the whole of nature, or even on the whole of living nature, is not a road that the natural sciences could long have traveled. This is the way of the poet, the philosopher, the seer. A division of labor had to take place. But the overfragmentation of the vision of nature—or actually its complete disappearance among the majority of scientists—has created a Humpty-Dumpty world that must become increasingly unmanageable as more and tinier pieces are broken off, "for closer inspection," from the continuum of nature. The consequence of the excessive specialization, which often brings us news that nobody cares to hear, has been that in revisiting a field with which one has been very familiar, say, ten or twenty years earlier, one feels like an intruder in one's own bathroom, with twenty-four grim experts sharing the tub. . . .
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> In our time, so-called laws of nature are being fabricated on the assembly line. But how often is the regularity of these "laws of nature" only the reflection of the regularity of the method employed in their formulation! Lately, many tricks have been discovered about nature; but these tricks seem to have been specially produced for the imbeciles to find out; and there is no Maimonides to guide them out of their confusion. In other words, science is still faced with the age-old predicament, the lack of ultimate verification. It is written in the Analects of Confucius (XII, 19): "The Master said, Heaven does not speak."

Well, though heaven may not speak, occasionally a prophet is heard, and Isaiah (I, 9) spoke of "a very small remnant," sometimes referred to as the saving remnant, and we think that Erwin Chargaff is a member of the saving remnant among scientists. Here are some of his recollections:

> What I remember of my beginnings is the truly lyrical shudder with which I contemplated nature. It was the blood and bones of the universe, its dawn and dusk, flowering and decay, firmament and graveyard. The alternations of the spiritual and material tides, the oscillations between future and past, the mysterious fates of everlasting stone and short-lived fly: they filled me with admiration and reverence. Nature, it seemed to me, was almost the entire non-I, the entire non-small-boy. If anybody had asked me then whether I did not wish to go out and do away with some of the riddles of nature, I do not believe I should have understood him. Was I not born and sustained by the darkness that enveloped equally my past and my future? A small boy begins by being unable to explain the explainable, but when he grows old he often looks away from what cannot be explained. I am grateful that fate has preserved me from this form of blindness. Surrounded by a surfeit of solved riddles, I am still struck by how little we understand I would not go so far as to claim that knowledge and wisdom are mutually exclusive, but they are far from communicating vessels, and the

level of one has no bearing on that of the other. More people have gained wisdom from unknowledge, which is not the same as ignorance, than from knowledge.

Another passage:

When I received my doctor's degree from the University the diploma stated that I had studied chemistry. This seemed to confer on me the right, and at that time also, the ability, to practice the science in all its subdivisions. . . . I had a diploma. Did this make me a scientist? Of course not. How does one become a scientist? I wish I could describe the stages; they are obscure. Furthermore, the steps are not the same in the different branches of the natural sciences. The confined reserves of physics or chemistry are one thing, the giant and seemingly shoreless ocean of biology an entirely different one. The geologist knows what is meant by the earth that he carries in his very name; but does the biologist know what life is? . . .

A scientist attempting a dialectical meditation on science is faced immediately with a dilemma: on the one side, the harmonious beauty of a science, its orderliness, its openness, its attraction for the acute and searching mind; on the other side, the dehumanizing and cruel uses to which it has been put, the brutality of thinking and imagination to which it has given rise, the increasing arrogance of its practitioners. No other mental activity offers such contrasting aspects. Art, poetry, music wield no power, they cannot be exploited or misused. If oratorios could kill, the Pentagon would long ago have supported musical research. . . .

From an undertaking designed to understand nature, it [science] has changed into one attempting to explain, and then to improve on, nature. This has brought about an overemphasis of the mechanical side. . . . I am not sure whether the analogy is correct, but I cannot help thinking of the deplorable fact that when the child has found out how its mechanical toy operates, there is no mechanical toy left. . . . The stress on mechanisms has given rise to one of the curses of our time: the expert. It has made body mechanics out of physicians and cell mechanics out of biologists; and if the philosopher cannot be called a brain mechanic, this is only a sign of his backwardness.

I see only one salvation: the return to what I should call "little science." . . . The wish for a return to another kind of science is based on esthetic and ethical considerations—two branches of philosophy that the philosophy of science seems to have slighted. Just as the great scientists were moved by a vision of the harmony of the universe, everything that is beautiful in the world is beautiful by virtue of its shape. In his *Ennzeads* Plotinus writes:

"We maintain that the things in this world are beautiful by participating in Form; for every shapeless thing which is naturally capable of receiving shape and form is ugly and outside the divine *logos* as long as it has no share in *logos* and form. This is absolute ugliness."

I should claim that precisely this has happened to our scientific endeavor: it has gotten out of shape.

Back in the early sixties, Gerald Sykes, in his book, *The Hidden Remnant*, said some things that seem to parallel Dr. Chargaff's reflections. "The technical revolution," Sykes wrote, "demands in time that man be equal to his own creations." Today, as Chargaff shows, our creations are ruling us. They have pulled us out of shape because we no longer even try to control them but allow their built-in tendencies to be called necessities. Man, Sykes went on, "cannot merely run his airplane well. His consciousness must go as high as his body does. He must not be merely a flyer but a Saint-Exupéry." Sykes then recalls that "the great innovators of the Renaissance called a halt to their inventions; they sensed that men would not be worthy of them. But we have gone ahead with ours, and now we must equal them or perish." This is a way of saying that we are now acting out the self-destructive role of the Sorcerer's Apprentice. The scientists who belong to the Hidden Remnant are those who know when to stop or change direction—as Leonardo did, and as Otto Hahn did in our own time. Erwin Chargaff is that sort of scientist. He declares for "small science, one for which an individual can stand up, in which a human voice can still be heard. This also means a science that is governed by human conscience, and not merely by scientific conscience." Toward the end of his book Dr. Chargaff says:

My life has been marked by two immense and fateful scientific discoveries: the splitting of the atom, the recognition of the chemistry of heredity and its

> subsequent manipulation. It is the mistreatment of a nucleus that, in both instances lies at the basis: the nucleus of the atom, the nucleus of the cell. In both instances do I have the feeling that science has transgressed a barrier that should have remained inviolate. As happens often in science, the first discoveries were made by thoroughly admirable men, but the crowd that came right after had a more mephitic smell. "God cannot have wanted that!" Otto Hahn is reported to have exclaimed. Did he ask him beforehand, did He remain silent? I have the impression that God prefers to be left out of these discussions.
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> The impact that the discovery, the bloodstained discovery, of nuclear energy had on me I tried to describe in the first pages of this account. From that time the Devil's carnival was on, for me at any rate. As the dances became more frenetic the air turned thinner and harder to breathe. That science, the profession to which I had devoted my life—and a life is the heaviest investment a man can make—that science should engage in such misdeeds was more than I could bear. I had to speak out, for I was bound to ask myself: Is this still the same kind of science that I thought I was getting into more than fifty years ago? And I had to reply: it is not.

When we look around for scientists to quote or to learn from, it seems clear that we should seek out individuals of this character and vision. Our technical and a part of our cultural future—if we have a future—lies with them.

REVIEW
FIFTEEN INVENTIVE YEARS

WE have for review a book that might have been called "The Resilience of the Earth," or "The Calling of Man," both ideas to which insufficient attention has been paid. Yet the title its authors, Nancy and John Todd, have given it is probably more appealing: *Bioshelters, Ocean Arks, City Farming* (Sierra Club, 1984, $10.95). It is the story of the lifework of the Todds, who are co-founders of the New Alchemy Institute on Cape Cod, practitioners and communicators of a mode of life which is both scientific and religious—scientific in the sense that it establishes appropriate relations with the earth through acts of informed decisions, religious by reason of its recognition of the sacred as that which reveals the meaning of human life and life in general.

The book is a response to the present plight of the modern world and an effort to point to the healing processes to which the natural world will respond, and by which, at the same time, humans may save themselves from the ruin that stares at them from an imminent future.

How and by what means has the earth been wounded? What is its condition and who is responsible? Some reading we have been doing lately gives the answers to these questions, making excellent preparation for reading the Todds. This preparatory reading is brief, in two sources: first, a pamphlet issued by the Soil Conservation Service of the U.S. Department of Agriculture, Information Bulletin No. 99, of thirty pages, by W. C. Lowdermilk. This former Assistant Chief of the Soil Conservation Service provides a personal report of a two-year study he made of the visible record of agriculture around the world. The title is *Conquest of the Land through 7,000 Years.* The content is given in the Preface:

> Dr. Lowdermilk studied the record of agriculture in countries where the land had been under cultivation for hundreds, even thousands, of years. His immediate mission was to find out if the experience of these older civilizations could help in solving the serious soil erosion and land use problems in the United States, then struggling with repair of the Dust Bowl and the gullied South.
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> He discovered that soil erosion, deforestation, overgrazing, neglect, and conflicts between cultivators and herdsmen have helped topple empires and wipe out entire civilizations. At the same time he learned that careful stewardship of the earth's resources, through terracing, crop rotation, and other soil conservation measures, has enabled other societies to flourish for centuries.

The figures he gives on soil erosion in the United States, the reliability of which he explains, are now, if anything, worse. The concluding idea of his paper is that land must not be regarded as "an economic commodity," but an integral part of our lives, requiring the same care and respect. This is an ancient but for us new way of looking at the earth. It has been adopted by the Todds.

The other preparatory reading needs only brief reference. It is an article by Herbert D. Grover in *Environment* for last May. The author teaches biology at the University of New Mexico. His subject is "The Climatic and Biological Consequences of Nuclear War." The article occupies eleven of the magazine's large pages, covering what scientists have found out from studies made over a period of nearly forty years. These anticipations are also a part of our condition, whether we know it or not. "What," Grover asks, "would be the long-term implications of changes that might occur in the character and degree of human reliance on natural ecosystems?" and sets out to say what can now be said in reply. This part of his paper attempts an answer to the question: "Can the survivors survive?"

The Todds are familiar with such material, but horror stories are not their forte. Their work is to establish oases of sanity in a world that on several counts seems to be going insane. They say at the beginning:

> This is a book about ecological design. By this term we mean design for human settlements that incorporate principles inherent in the natural world in

> order to sustain human populations over a long span of time. This design adapts the wisdom and strategies of the natural world to human problems. Implicit in this study there is a larger question—what is the role of humanity in the greater destiny of the Earth? As scientific research continues to discover, all of us who inhabit this planet share the same kind of genetic material. In terms of big-chemical makeup and genetic structures, the similarities between the human being and the bacteria, for example, are greater than the differences. The illusive and pervasive issues of how human beings, as the only self-conscious species, are to live in the world is a logical outgrowth of our new biological knowledge. Even if the present path of industrial society held much promise of survival, which we feel it does not, it is a violent and unhappy world. A reevaluation of the way humans place themselves in the larger world seems timely, if not overdue.

How, in short, should we live in order so much trouble? This question, along with some more positive ones, began to haunt the Todds about fifteen years ago. Their reflections (along with their experiences, neither pleasant nor encouraging) led them to found the New Alchemy Institute on Cape Cod, with the declared intention: "To restore the land, protect the seas, and inform the Earth's stewards." At the beginning in 1971 they had twelve acres of sandy, unproductive soil, which they set about restoring with massive quantities of compost. After a few years they grew good crops of vegetables and added productive fish ponds for protein food. Then they gave attention to architecture, learning how to build dwellings which were humanly devised biological organisms—shelters for living that would "incorporate renewable energies and biological systems in the form of growing areas for plants and fish." After completion and testing they called these dwellings "arks" since they "were independent of outside energy sources for heating and cooling and yielded well throughout the year."

Only a reading of this book can convey the rich harvest of knowledge and inspiration which grew out of the undertaking. A paragraph in an early chapter puts this well:

> From the kinds of work, from the experimentation and the observation of our years at New Alchemy, we began to evolve a way of looking at and thinking about the world, an epistemology, to use one of Gregory Bateson's favorite words. As we began to apply this type of mindset, initially to the problems at the Institute and subsequently on a broader scale in many parts of the world, it became evident to us that we were creating a series of precepts for biological design that could serve to teach such concepts and to make them replicable in different settings. The articulation of these guidelines for design grew from the confluence of New Alchemy's work with that of a number of people who had been thinking along similar lines. The formulation of these early precepts as they are applied and tested will contribute, in time, to the creation of a science of applied biotechnology which will serve in turn as a foundation for future design.

We take these precepts as given in the table of contents: (1) The Living World is the matrix for All Design; (2) Design should Follow, not Oppose, the Laws of Life; (3) Biological Equity Must Determine Design; (4) Design Must Reflect Bioregionality; (5) Projects Should Be Based on Renewable Energy Sources; (6) Design Should Be Sustainable through the Integration of Living Systems; (7) Design Should Be Coevolutionary with the Natural World; (8) Building and Design Should Help Heal the Planet; (9) Design Should Follow a Sacred Ecology. The term Equity in the third precept means concern for the poorest third of humanity.

A long section of explanation and illustration follows each precept. For example, elaborating on the sixth precept, the Todds tell how the elements of the interior of the ark work together:

> Inside the dome, the biological components were installed to maximize the advantage of what we had learned over the years in experimenting with semi-closed ecosystems in bioshelters. A bank of solar-algae ponds, representing the aquaculture irrigation supply, and heat storage unit, were placed along the northern periphery of the dome, surrounding a good-sized and productive fig tree, a tenant of an earlier dome. It had been plastic wrapped to protect it during the months of construction and was the reason for resurrecting the new dome on the site of the old. It is apparently undisturbed by the arbitrary

> intervention in its accommodation and continues to bear prolific quantities of figs. A small central pond was installed to give visitors a chance to look at fish without peering through a layer of solar pond fiberglass and the murk of algae laden water. The central pond contains water hyacinths to demonstrate their water purifying capacity. The southern half of the dome is given over to the same kind of organic agriculture as practiced in the Ark. It has been innoculated with living soils, unlike the sterile soils of standard greenhouses. With some seasonal fluctuations it produces crops of vegetables, herbs, and flowers the year round. It is used to start seedlings in the spring and as a season extender for heat loving crops. A further integration of function is represented by the use of computers, not only in the design phase, but . . . with sensors connected to a central computer which monitor the ongoing state of the building, much as the vital functions of a patient in the hospital are monitored.

It should be remembered that such refinements as the use of computers are built into the New Alchemy Ark because research is an essential part of the activity there. Copies of the ark for individual and community living on the basis of subsistence agriculture would be simpler, yet essentially the same.

The book stands for a new way of looking at both the world and ourselves.

COMMENTARY
THE GREAT QUESTION

WAS Jeanette Rankin's vote against the war with Japan—the only one in Congress—an expression of moral vision, or was it unrealistic and impractical sentiment? (See Frontiers.) Could William Allen White's supposition that a hundred other members of Congress would have liked to have done the same, but didn't dare, have been correct?

Without answering these questions, let us note that the moral power of her integrity—and her courage—has had a great but indefinable effect, evident in the way this remarkable woman is now admired and written about. Another question: What are the hallmarks of motel vision? While it may not persuade us against our will, if it is genuine it commands respect—and more and more as the years go by.

Moral vision has for its foundation the conviction that moral law is a reality. This idea is slowly creeping into the thought of our time. What if the moral law is as inviolable as gravity, as Wendell Berry recently suggested, and only the lapse in time between moral cause and effect prevents us from seeing that it works, and how it works? If we are indeed parts of one another—one another meaning all humanity—then to harm another is to harm ourselves, and to lie to another is to make ourselves future victims of deception, perhaps, worst of all, self-deception. Could this idea untangle some of the darker skeins of human history and biography? Are we indeed, as a great founder of Humanism declared, self-created?

Is there a non-physical kind of evolution, a moral evolution, now going on? One must hope so, for if no such development is possible, one can see absolutely no way out of our present mess.

How is moral vision recorded? In great scriptures such as the *Bhagavad-Gita* and the Sermon on the Mount. It is also found in great drama, such as Eschylus' *Prometheus Bound* and Sophocles' *Antigone.* Such vision reverberates through time in literature. Its echoes do not die, but are continually reborn in the thoughts of humans. We are essentially moral beings and long for realization of the primacy of doing right instead of wrong.

In addition to this self-defining longing, what other acceptable evidence is there of the reality of moral law`? Surely the time has come to focus on this question.

CHILDREN
. . . and Ourselves

WHAT IS CREATIVITY?

A DIRECT inquiry into the nature and occurrence of "creativity" can be a bit embarrassing to the reader of its report. By "direct" we mean asking people when and how they have been creative, or most creative. First of all, are they able to say? One becomes suspicious of those who speak much about their own creative achievements. It is as though they were saying, "Look at me!" And yet, there was certainly a general usefulness in Newton's account of what watching the fall of an apple suggested to him. The matter of taste is involved. A person can be "objective" about himself, and use his experiences and efforts as illustrations that are instructive to others, but can he be objective about the importance of what he does? In Newton's case there was little to debate. His discovery and formulation of the law of attraction and repulsion (known as "gravitation") altered for us the nature of the world, with an importance hardly to be exaggerated; yet, on the other hand, the discovery of the nature of mankind—if that is really possible—would probably bring more lasting benefit. (Of course, knowing the nature of the world would be part of our understanding of ourselves—as Ortega put it, "I am myself and my circumstances.")

The attempt at definitions of the ultimate nature of things does not really add to our knowledge; it identifies the character and perhaps the limit of projects for the acquisition of knowledge. Orientation and direction are essential in relation to what is to be understood.

In short, we have for review a modest book which seeks orientation and direction with respect to "creativity." It is *Creativity and Context,* a seminar report edited by Anne Buttimer, published in 1983 by the Royal University of Lund, Department of Geography, Solvegatan 13, S-223 62 Lund, Sweden. The participants, mostly geographers (Anne Buttimer is a geographer), gathered in Sigtuna, a town about halfway between Stockholm and Uppsala, in June, 1978. Forty-five persons came; the contributors to the book number twelve. The focus as well as the spread of the subject is indicated by Anne Buttimer in her Introduction:

> One common opinion in the West is that creativity begins with the recognition of a problem. But there are many varieties and species of problems: take for example the celebrated distinction between "convergent" and "divergent" (Schumacher, in *Guide for the Perplexed*). Convergent problems are those which may be analyzed, unravelled, and solved by technical ingenuity, e.g., repairing a car or a plumbing system, designing price and rate-scheduling for a transport system in order to maximize convenience or use, electrifying a railroad, or arranging a filing system. Divergent problems, however, are not nearly as amenable to reductionist analysis or "objective" solutions, e.g., the education of one's children, or the choice of a vocation in life, the management of a business or protecting the environment. In the former case, one may stand outside the problem, as it were, rally one's analytical and technical skills toward mastering it. In the latter case one is in the problem, a participant rather than an observer, and more likely than not, the solution may lie in fundamental changes of attitude and behavior, one may have to learn how to live with the problem rather than resolve it once and for all. Now when creativity becomes a problem, does this distinction help? Clearly aspects of divergent and convergent situations are involved, for creativity is part of life itself. . . .
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> Modern day conceptions of creativity, it has been claimed, derive from the Enlightenment dream of human ability to match that of the Creator. Discernible connections could probably be traced between Western definitions of creativity and Judaeo-Christian accounts of creation. Guiding myths of Promethean, Socratic, and Quixotic vein, too, have probably steered attention toward visionary action, even martyrdom, as being more creative than compromise. One has rarely canonized saints (or scholars) until long after their deaths. To what extent, then, are definitions of creativity to be regarded as indices of Western mythology (or pathology) and to what extent are they credible indications of what it might mean to be a creative person in the twentieth century?

What, then, *is* creativity? One account would be that it is the fruitful discovery and use of analogy, the putting together of things previously unrelated which results in making something new or knowing something we didn't know before. It marks some actual advance, personal or cultural. We live, let us say, in a world of known and unknown correspondences. The act of creation puts elements of the unknown in terms of the known, which gives

something new—new for us. Again, this may be personal or cultural. The discoveries of a child through the development of metaphor are creative; the images of a great writer do the same thing for the world. Gandhi picked the invention of the sewing machine as his idea of the right sort of technological invention. If you look at that machine, and how it works, it seems the epitome of one sort of creativity. It lightened the load of women's lives, but it also made possible the sweat shops of the East Side of New York early in this century, and perhaps of today. No object which is the result of human inventiveness is without moral ambiguity—not even cathedrals, ikons, or wafers for communion.

If "there is nothing new under the sun," how can we say that novelty is an aspect of creativity? Well, the creative person, like Blake's poet, is "forever piping songs forever new." There is endless novelty in the world of time, in which we live and grow. One could say that time itself is marked off by creative acts. When nothing creative happens no real time has passed.

Getting about and seeing the world seems essential to creativity for some who attended the conference. One participant, Wolfgang Hartke, of Munich, said:

> To be alone is sometimes not so important for the beginning of concentration as a certain rather complex environment. When a thought must ripen or a decision must be taken I sometimes go to the busy city, even into a café or restaurant and start a conversation with some person who looks interesting. Even play with children or animals can inspire me. Or a view of attractive landscapes—for example far away over the bank of a busy river to a harbor—excites ideas.

Yes indeed. Yet as Harry Hansen pointed out in a column in the *New York World* about sixty years ago, "Many people go to China every year and notice only that the natives are dirty and eat a lot of rice."

If creativity is a function or climax of thought, how do we think? Thinking requires two things: a focus of attention and things to experience and explain. The mind is mostly swinging from one thing to another, unable to focus and generate a field of meaning. But when we do focus the mind narrows its object to a single thing—or idea—and holds that position. Then a pattern may emerge, a sense of meaning dawn, the germ become a nuclear organism, and then, from this pregnancy, after an appropriate interval, there comes a birth.

Minds deliberately schooled in noticing and making use of analogies are almost bound to be creative.

Communication, too, may or may not be creative. As Anne Buttimer says in her closing chapter:

> The actual writing phase may be the most challenging of all to personal creativity. Many expressed difficulties at this phase and some even welcomed an externally-imposed deadline in order to complete a report. To "get the idea across" . . . demands a certain grasp of the rules of form and style.
>
> . . . A poem written in blank verse can communicate quite a different message from that of a sonnet. For a social scientist, graphic and cartographic modes of representing reality have a special appeal within an audience of peers, but they may be quite opaque and uninteresting to a literary audience. . . . One recalls also Niels Bohr's distinction between *Klarheit* and *Wahrheit*, and the challenge of seeing the complementarity of alternative forms. This task of finding a language—symbolically transforming one's experience and understanding-—may be the one which demands most creativity. It demands the ability to shift gear, as it were, between the abstract and the intuitive, the calculative and reflective modes of knowing. Yukawa, writing mainly about physicists, bemoans the one-sided trend toward abstraction which has characterized his own field: "abstraction cannot work by itself, but has to be accompanied by intuition and imagination."

We live in the shadows, under the arches, and in the environs, of all the acts of creation of past human beings, and we are nourished by their fire. The creative act is indeed the Promethean act—but who will define and explain that, except in the creation of another myth?

FRONTIERS

A Better Way

TWO years ago (Sept. 15, 1982) we reviewed here an article (in *democracy*) by Jean Elshtain titled "Antigone's Daughters," by which she meant women in general, but especially those who accept and fulfill the obligation of women to defend and preserve the higher laws of life against the intrusion of state or kingly decrees. Antigone refused to obey Creon, the king of Thebes, who had ordered that her brother, killed in a war of invasion, be left unburied for dogs and vultures to consume. Defying Creon, Antigone buried her brother and suffered death in punishment at the hands of the king.

One of Antigone's daughters, living in our own time, was honored by a brief article in the *Friends Journal* for last June. It begins with quotation from an editorial by William Allen White on the courageous stand of Jeannette Rankin, who in December of 1941 cast the only vote in Congress against war with Japan.

White, a respected journalist, wrote in his *Emporia Gazette* for Dec. 10, 1941:

> Probably 100 men in Congress would have liked to do what she did. Not one of them had the courage to do it. The *Gazette* entirely disagrees with the wisdom of her position. But, Lord, it was a brave thing!
>
> When in 100 years from now, courage, sheer courage based on moral indignation, is celebrated in this country, the name of Jeannette Rankin, who stood firm for her faith, will be written in monumental bronze, not for what she did but for the way she did it.

The writer suggests that she has been honored by something better than monumental bronze, saying: "It took not 100 years but only 30 to establish her name as a symbol of millions of Americans' thinking." She had been elected in 1916 as a representative in the House from Montana, with a campaign fund of less than $700. After voting against war with Germany in 1917 she lost her seat (later regaining it). She said:

> Friends hoped I would vote for war in 1917. They were confused by all the propaganda. I was told that if I voted against war would harm the suffrage movement in other states where women were still struggling for their rights. But I knew that if I voted for war I would violate my intellectual integrity. As the first woman ever elected to Congress I felt a deep obligation to vote right as a woman. It was important that I take this first opportunity to protest. War had always seemed to me the worst way ever devised for settling disputes.

Her vote against war in 1941 brought her political career to an end, but not her commitment. "In 1968, at age 87, she led 5,000 women to the foot of Capitol Hill to protest hostilities in Indochina. She died in 1973 in Carmel, California."

She said to one audience:

> Women have so much to contribute. I don't know whether they would do any better than men, but surely they couldn't do any worse. They seem to have a stronger instinct for preservation of life.

A single person, when so placed, exercises much influence by example. In 1958 John F. Kennedy, in an article in *McCall's*, classed her with Anne Hutchinson and the Quaker reformer Prudence Crandall, in a discussion of "Three Women of Courage."

Today the continued application of violence in futile attempts at the solution of political and international disputes is frightening and impoverishing all the world. The intuitive sense behind Jeannette Rankin's stand now appeals to more and more people. After the impact of the atomic destruction of Hiroshima and Nagasaki was widely felt, Albert Einstein said: "We shall require a substantially new manner of thinking if mankind is to survive." Followers of Gandhi, of Tolstoy, and people brought up in the Quaker tradition, as well as those of simple common sense are now trying to think in this new manner. Involved is a change in habits of reaction which have prevailed for many thousands of years. It will take time.

Yet commitment to change is widely expressed and attitudes seem to be gradually altering. A recent development at the institutional level is the formation of the Albert Einstein Institution, with headquarters at 596 Franklin Street, Cambridge, Mass. 02139, Dr. Gene Sharp, who heads the Program on Nonviolent Sanctions in Conflict and Defense at Harvard University, is president; Charles Hamilton, a publisher, is executive director. The Einstein Institution, it is said, "will support basic research into the nature, history and potential of the nonviolent technique," and spread its findings as widely as possible, through "publications, conferences and seminars, educational materials and activities, and a variety of other programs to increase public awareness." Seed money is now being sought to get these activities under way. The introductory announcement of the Einstein Institution says:

> Contrary to what we have all been taught, the history of nonviolent struggle is vast and the outcomes have often been successful. In the twentieth century, the technique has grown enormously in sophistication and use. . . .
>
> Albert Einstein was deeply concerned with the problems of war, dictatorship, genocide and social oppression throughout his life. The old methods of violence were no longer acceptable. He realized that it was necessary to project beyond past experience and to find answers to deal with these overwhelming problems.
>
> As a scientist, Einstein was willing to open his mind to change and to explore new approaches. In his later life he became enormously impressed with the potential of nonviolent struggle, calling the technique of noncooperation the "ultimate weapon." In 1953, he wrote the introduction to Gene Sharp's first book, *Gandhi Wields the Weapon of Moral Power.* The Institution is dedicated to continuing in the spirit of Albert Einstein's commitment to the exploration of nonviolent alternatives.

What is Gene Sharp's thinking like? An article about him by James Tindall in *Commonweal* for April 20 of this year refers to his three-volume monumental work, *The Politics of Nonviolent Action* (Porter Sargent Publishers, in Boston), and describes the temper of his remarks at a Quaker-sponsored seminar on national security at Whittier College, saying:

> Throughout the Whittier College lecture and interview Sharp appeared to take great pains to present an amoral image. For example, when I asked if he thought violence was ever justified, he replied, "I really don't deal with the question of justification . . . it's not one that interests me." I was curious why he did not like being referred to as a pacifist. Pacifism is a personal moral position, he said, and does nothing to offer a practical alternative to war. He described himself as a researcher and writer who has come upon an important idea which is beginning to generate a lot of interest.
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> Yet years ago Sharp also spent nine months in jail as a conscientious objector, and he is personally opposed to war and violence. It seems he is concerned that being characterized as a "peacenik" will hurt his credibility with more mainstream groups, or lead to the impression that nonviolent resistance is for pacifists only. Sharp sincerely believes that civilian-based defense can stand on its own as a practical effective alternative to war. As he put it, we may be able to give up military weapons for the same reason we have given up bows and arrows—not because they are wicked and immoral—but because we have discovered a better weapons system.

From the authentic Gandhian point of view this may sound like an abuse of language—*ahimsa* or harmlessness is not a "weapons system" except in a most remote or abstract sense—yet there may be many who will appreciate Sharp's hardheadedness as a mode of persuasion.