The New Epoch

Jonas Salk

The human mind may be seen as a form of matter that has become conscious of itself, conscious of evolution, and conscious of its capacity to participate in evolution. We are a product of evolution, and the embodiment of the process as well.

When the success of Jonas Salk's polio vaccine was announced in 1955, there was a national celebration. Salk's research, funded by the March of Dimes, promised to obliterate one of the most treacherous diseases known to man. True to expectation, the incidence of polio in the United States fell by 92 percent within five years. And Salk himself, one of the first to use the vaccine, received a citation from President Eisenhower, as well as a Congressional medal for "great achievement in the field of medicine."

But Salk's grand achievement touched off a bit of controversy within the medical community. Some doctors seemed jealous of the attention heaped on one of their brethren, and, as Salk now explains, "the whole experience gave me much food for thought about people. . . . I realized that something was needed to help people understand each other, and I knew that the problems of man were not all going to be solved only in the laboratory. I saw a wide gap between human knowledge and its use for improving the human condition, for aiding what I call human evolution."

Salk's desire to advance human evolution resulted, in 1963, in the founding of the Salk Institute for Biological Studies in La Jolla, California. The institute, a center for research on cancer, brain science, and genetics, is also concerned with the social consequences of science and technology. And it is this last field in which Jonas Salk has been particularly involved. "The threat that we are to ourselves," he says,

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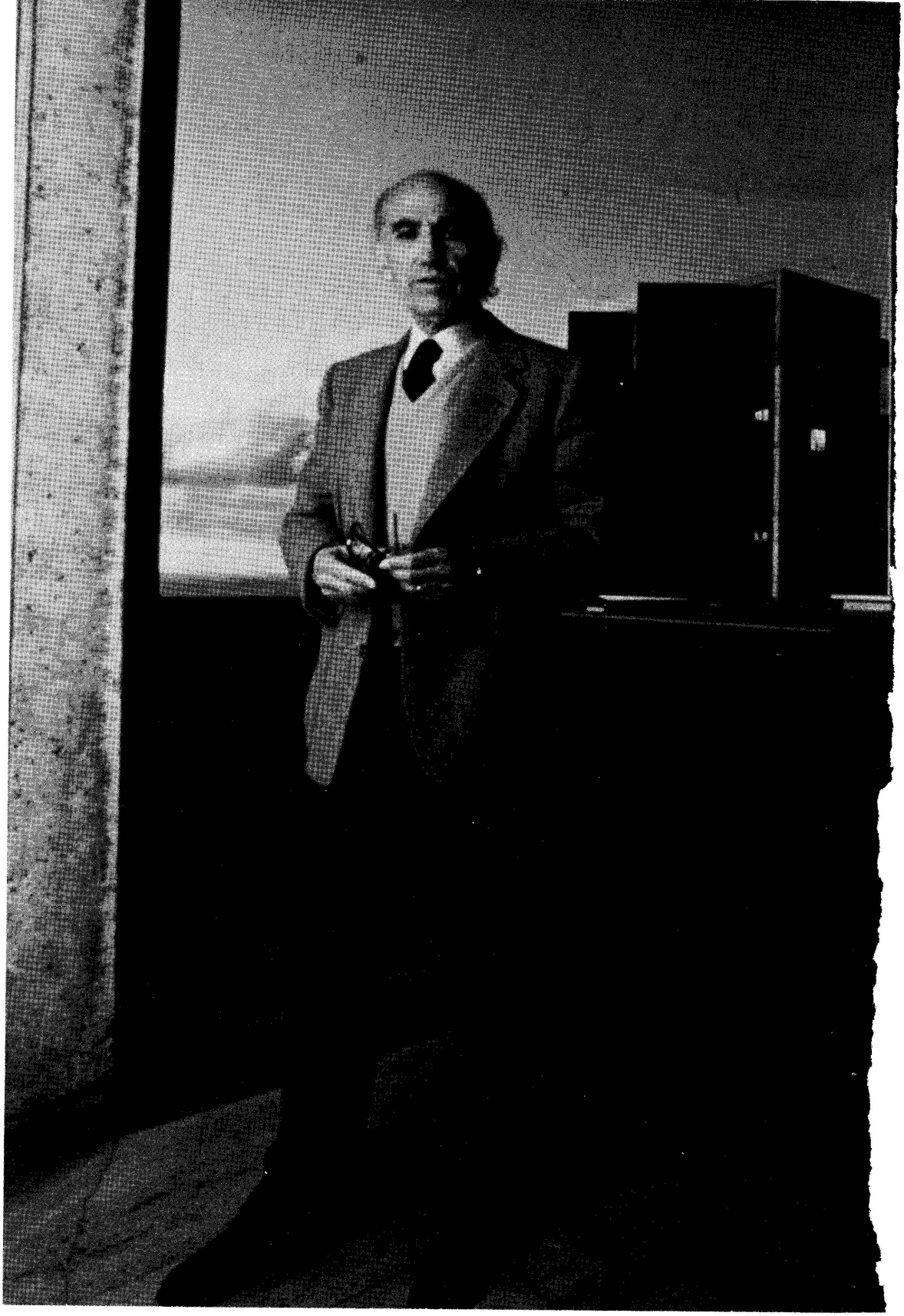

"manifests itself in the form of nuclear weapons, the economic crisis, problems associated with development of the third world, problems associated with resources, with the pollution of the planet."

Jonas Salk believes we must use foresight to correct the problems we've created. Doing just that, he has, over the last two decades, produced four books: Man Unfolding, The Survival of the Wisest, World Population and Human Values *(written with his son Jonathan), and* Anatomy of Reality *(part of the "Convergence" series started by editor/philosopher Ruth Nanda Anshen).*

The writings discuss his latest brainchild, a theory of "metabiological evolution" — cultural evolution that takes place as a result of human consciousness and creativity. His dream is to understand cultural evolution as well as we now comprehend biological evolution. "In a sense," says Salk, "the nature of evolution itself has evolved. In order to survive the dangers created by the evolution of the human brain, we've got to understand evolution in the metabiological realm."

I first met Jonas Salk in 1982 in his spacious La Jolla office, decorated with paintings by his wife, Françoise Gilot. We met on four subsequent occasions in their Manhattan apartment. Our goal: to let our discussion roam wide and evolve.

OMNI: In *Anatomy of Reality,* your latest book, you say that very early in life you started imagining that you actually were those objects you wanted to study. Later, as a scientist, you used this same technique, imagining yourself to be a virus and even the human immune system attacking the virus. Can you explain how you discovered this method, and how it helped you understand science?

SALK: It seems to be a way of thinking that comes naturally to me. I wasn't always aware of my mind working that way. It's only now, as I look back over my life, that I realize what was happening. This helped me understand how things work in nature. For instance, when I was developing the influenza and then the polio vaccines, I had to understand how the immune system worked. How was it that immunity resulted when an individual came into contact with an infectious agent like a virus? I tried to imagine what might be taking place, then design an experiment to test that notion. You might say that I was having a dialogue with nature, a way of bringing together intuitive feelings with reasoned thought.

OMNI: How did this mode of thinking contribute to your biological research?

SALK: To see that in perspective, we should go back to my early orientation as a physician. I was trained as a generalist in medicine, but not as a biologist per se. I wasn't trained academically in any of the fields in which I ultimately worked: immunology, virology, oncology, neurology, and evolution. I've always entered as an outsider and was self-taught, in a way, in order to contribute in the ways I had chosen.

Basically, I entered each of these fields because of the questions and answers that arose as I thought about these areas more and more deeply. It seemed to begin when I decided to study medicine. I wanted to bring the science of chemistry into medicine, which, in those days, was not quite as scientific as medicine is today. As luck would have it, at the end of my first year in medical school, I was given the opportunity to work as a research fellow in chemistry; I could have left medicine at that point to get a Ph.D. in chemistry, but I elected to remain in medicine to get an M.D. degree. I even did a two-year internship in internal medicine. I worked in surgery, pediatrics, and in all the specialties. And it was at the end of this period that I entered the field of research as a career. But my research has had a clinical orientation. I continue to think and function as a physician: if there is something wrong, I must fix it.

OMNI: How did all this lead to your work in immunology?

SALK: My early interest was captured by a paradox in two medical school lectures, each of which presented a different point of view. In one lecture, we were told that it was *not* possible to immunize against a virus disease with viral particles that had been chemically treated so that they did not cause infection. Instead, we were told that immunization against virus disease could be accomplished only by using *live* viral particles. There was a danger to this technique, however, since the administration of live viral particles might still induce the disease. In another lecture, we were told that we *could* immunize against diseases like tetanus and diphtheria with vaccines made of chemically treated toxins that were no longer toxic.

The bell rang and the lights went on! It seemed to me that what was possible for tetanus and diphtheria should similarly be true for virus-caused diseases.

I perceived the situation this way: since successful killed-virus vaccines had not yet been developed, it was simply assumed that it couldn't be done. As we now know, it can be done, but in order to determine why it had not yet been done, it was necessary to think about it first, to construct hypotheses and theories that then guided the experimental research. I didn't begin to pursue this question seriously until three years later, when, quite by chance, I had an opportunity to work in a laboratory that was involved in influenza research. And that was when I learned the skills basic to the development of killed-virus vaccines.

When I worked on the polio vaccine, I had a theory. Experiments were done to determine what might or might not occur. I guided each one by imagining myself in the phenomenon in which I was interested. The intuitive realm is constantly active — the realm of imagination guides my thinking.

OMNI: It was this line of thought, I take it, that led to your current interest in evolution and the human mind.

SALK: Yes. After the effectiveness of the polio vaccine was announced in 1955, I received a lot of public attention — positive from the general population and negative from some colleagues, perhaps due in part to envy for all the public attention. The whole experience gave me much food for thought about people — what we think and why we don't all see things in the same way. I realized that something was needed to help people understand each other, and that the problems of man were not all going to be solved only in the laboratory. I saw a wide gap between human knowledge and its use in advancing the human condition, for aiding what I call human evolution. I had been reflecting on evolution, and a broader concept of the word emerged in the course of my experiences.

OMNI: Can you explain that a bit more?

SALK: I like to compare my experience of evolution to the experience of this interview. We talk about many things at random. This leads to discoveries that would not have been made if we had decided precisely what to say ahead of time. In a sense, that's also how I've come to experience evolution in science, for example. When I think about or conduct experiments, I don't set out to prove anything. I simply pose questions. I accept whatever answer emerges, and, depending on the answer, I then ask another question. If something perplexing invades my mind, then my mind seems to work by itself

on whatever attracts its attention, selecting and discarding in the process. The circumstances of my life helped me to be reflective and meditative — qualities that I see as adaptive and evolutionarily advantageous. I sometimes wonder if the particular kinds of questions to which we are attracted may not be genetically determined! For instance, I was attracted to study medicine and biology for a profession, but not physics. I was not drawn to become a nuclear physicist, nor am I an Oriental scholar.

Over time, I've discovered that I'm not really in control of my own mind. Often, I merely observe it and its machinations. The analytic part of my mind — the observer — and the analogic part of my mind — the accumulator of experience — are in constant dialogue, challenging and testing the fit of concepts and formulations.

In this inner dialogue, I frequently find myself more interesting company than others. And after meetings or activities or events or travel, I need time to be alone to talk to myself about what happened, what it all means. The best time for me to discover what is going on in my life and in my mind is when I awaken. And then, without disturbing anything, I simply watch what's happening, writing down whatever seems to crystallize.

I became interested in the mind as an instrument of evolution when I realized the way in which the content of my own mind was evolving. As a result of that process, the substance of my thoughts is different from what it was one or two or three or four decades ago. My mind seems to be continuous with the process of evolution from the beginning of time.

OMNI: How so?

SALK: For example, we see that during the nine months of human gestation, ontogeny [the development of a single organism] recapitulates phylogeny [the evolutionary development of a species through time]. As the human fetus develops, its changing form seems to retrace the whole of human evolution from the time we were cosmic dust to the time we were single-celled organisms in the primordial sea to the time we were four-legged, land-dwelling reptiles and beyond, to our current status as large-brained, bipedal mammals. Thus, humans seem to be the sum total of experience since the beginning of the cosmos. As I grew older and my consciousness expanded, I developed the capacity to sense and to recognize what had gone before. The human mind may be seen as a form of matter

that has become conscious of itself, conscious of evolution, and conscious of its capacity to participate in evolution. We are a product of evolution, and the embodiment of the process as well.

OMNI: You apparently see the human mind as the pinnacle of the evolutionary spiral. Can you explain how you think the mind might have emerged, and how it relates to other elements of the evolutionary process? You might start by explaining how it all began.

SALK: When I try to imagine how the universe may have started, I envision a shimmering web of energy. Out of this web a few specks of matter coalesced in an orderly arrangement. The quantity of matter increased. Then gravitational forces and the pressures they generated resulted in an explosion — the so-called Big Bang. In time, matter from that explosion formed stars and planets as well as macromolecules, and under the conditions that existed on our own planet, the precursors of life finally emerged. All that happened up to this point I call *prebiological* evolution.

As the organic precursors of life interacted, they formed self-reproducing macromolecules and cell membranes. I think of the cell as the unit of life, just as I think the atom is the unit of matter. The beginning of life marked the beginning of *biological* evolution, sometimes referred to as Darwinian evolution. Increasingly complex organisms evolved until human forms appeared — and with them, the development of the human mind. With the advent of man came the capacity to create new forms that would not otherwise exist.

OMNI: And those forms include?

SALK: Buildings, ideas, computers, radio, television, airplanes, nuclear weapons, physics, chemistry, biology, philosophy. The mind is like a volcanic eruption, and the force behind it exists in that extra layer of the cerebral cortex. The human mind has altered the rate of evolution in a staggering way. If time since the birth of the cosmos were compressed into a single day, the enormous changes brought about by the human mind would have happened in part of a second. I refer to the evolution of human consciousness and creativity as *metabiological* evolution. I'm not trying to coin new words just for the sake of doing so. Rather, I'm trying to unify, to tie it all together. I could call the three phases chemical evolution, biological evolution, and cultural evolution. But then the connection between them may not be clear. When I refer to prebiological, biological, and meta-

biological evolution, then the unifying connection is implicit. The three phases are part of what I call universal evolution — in which we see revealed the evolution of evolution itself. And in all three realms of evolution, I recognize the existence of a fundamental relationship, which I call a binary relationship.

OMNI: Can you explain?

SALK: I see everything in nature, everything in the universe, as composed of networks of two elements, or two parts. This became apparent to me when I realized there were also two parts of my mind — an observer on the one hand, and a thought process on the other. This discovery was hardly new, but somehow it set my imagination free. I began to associate seemingly unrelated observations and events, and patterns began to emerge. I observed that like my mind, a living cell could be divided into two parts: a DNA-packed nucleus and a surrounding cell body, or soma. The DNA forms the genes, which, when decoded, direct the making of proteins for the soma, as well as proteins that catalyze the production of more DNA. The soma, meanwhile, protects, serves, and ensures the survival of the DNA. Now, this is an interesting relationship; without *both* components, life would not exist. I began to see a similar binary relationship at the level of the atom, between the nucleus and the electron, and I recognized that the same thing was evident for species and individuals. You cannot have species without individuals, nor individuals without species. The same relationship can be seen between the environment and the organism. In all of the phenomena of nature, I saw two kinds of functions: the breaking down and the building up, the destructive and the constructive. Also, a part of the mind deals with totality and puts things together, and another part takes things apart. The physiologist sees things in their wholeness, and the anatomist dissects them; both approaches are needed and useful. Finally, I postulated the existence of corresponding mental attributes that I first called being and ego, then intuition and reason. These attributes seem related to brain structure as suggested by Roger Sperry's theory, which talks about intuition seated in the right hemisphere, and the equivalent of reason seated in the left.

OMNI: But is this relationship between the hemispheres of the brain and the qualities of intuition and reason really solid? I can understand, in a tangible way, how the nucleus and electrons are

binary components of the atom, and how gene and soma are binary components of the cell. But when it comes to the brain, I find the analogy troublesome. Every time I pick up a new book or article, I see another explanation of how the brain really works. Part of my problem is understanding the brain as a physiological entity.

SALK: Well, it is my problem, too. We have no difficulty with the cell, because of its material nature. We have no trouble with the atom, because we see the mechanics of this relationship. But when we come to mind, we're dealing with something that Roger Sperry calls mentalism — he sees the mind as an emerging property of the brain. According to his definition, the emergent whole is different from and greater than the sum of its parts. The brain has now become so complex as to evidence the emergent qualities of intuition and reason. These qualities can be experienced subjectively, and we can see their impact objectively in the world.

OMNI: It's all very easy to go from an indecipherable brain to the emergent properties of intuition and reason. But between those two things, don't you think there must be something to explain the connection, a mechanism that's not yet understood? Mentalism just seems a little easy to me.

SALK: It doesn't go as far as we want to go. I would like to go beyond that, by dissecting and understanding these two different properties of mind, if you like, on the assumption that there are two physiological, and therefore structural, elements equivalent to gene and soma. For the moment, I'm calling these elements intuition and reason, merely as a convention.

OMNI: And so you would say that these things, these two properties have a physiological base, though neither you nor anyone else could say what it is, because we simply don't understand the workings of the brain sufficiently.

SALK: That's right. And the concepts of intuition and reason suggest that physiological structures must exist by virtue of the effect they produce, in the same way as, for example, the physical existence of a virus was suspected before a virus was ever seen. I'm simply proposing the existence of two connected sets of phenomena, two related elements that make up the mind. This view provides me with a basis upon which I can think about the mind and its relationship to the human brain.

This is illustrated by the way in which experiences have an effect

upon the nervous system, the brain, the endocrine system, and the immune system. An example is seen in the bereavement syndrome, where, in the year following the death of a spouse or a child, there's a higher frequency of serious illness and mortality amongst grieving spouses and parents. Can we minimize the bereavement effect by putting and maintaining the human mind in a better state of balance? If we could, we might not understand precisely what we were doing at first. But eventually we'd understand the correlates. They would be measurable or detectable in terms of peptides, in terms of endorphins, in terms of brain waves, in terms of other tangible factors. These could be regarded as elements of the mind and its components — intuition and reason. When we deal with the mind, we're dealing with emergence and integration at higher and higher levels of complexity.

OMNI: Then you do believe we must understand biology, at least as it relates to the brain, in order to understand ourselves and control evolution in the metabiological realm.

SALK: Yes and No. During the course of evolution, higher levels of complexity resulted from the synthesis and integration of elements. Most scientists tend to go in the reductionist direction. They dissect things, and as they dissect, they remove the properties of the whole. It's like taking a squirrel apart, separating all its enzymes, proteins, and nucleic acids, then asking how it doesn't climb a tree. Therefore, in order to understand mind we have to study cellular units of the brain that *all together* are responsible for mind phenomena.

OMNI: Then we can understand what's happening in the metabiological realm, even if we don't understand its parts, well enough to alter events on that level — to deal with nuclear bombs, overpopulation, oppression of the poor.

SALK: That's how I see it. And we can influence these things by altering our attitudes, our values, our perceptions. We tend to behave and respond according to how we see things.

Before too long we are going to realize that war, and certainly nuclear war, is not to anyone's advantage. We've reached the limit, and we're beginning to recognize that we need to evolve in order to survive. I see signs that human beings are starting to react to the new reality, to the new context into which they've been born.

OMNI: But the dangers we're discussing may be imminent. How can we evolve that fast?

SALK: Because the mechanism involved in metabiological evolution is different from that of biological, or Darwinian, evolution. In Darwinian evolution, the basic mechanism is genetic mutation, followed by selection of the organisms most likely to survive. After many mutations and over many generations, radically different creatures with divergent behaviors evolve. In metabiological evolution, on the other hand, I see the basic mechanism as the mutation and selection of ideas. As in Lamarckian evolution, metabiological evolution proceeds as individuals pass on traits that already exist.

OMNI: Then genes play no role here?

SALK: I'm not talking about genes. I'm talking about behavior patterns that may or may not be related to particular genes. I see it this way: people have the genetic potential to be either constructive or destructive, cooperative or competitive. Those who are essentially constructive will tend to join forces to perform constructive acts. Those who are destructive will tend to band together for destruction. My hope is that the constructive group will self-select and self-organize and reinforce its behavior through education and training until it grows in size, transmitting its behavior from one generation to the next.

OMNI: In *Anatomy of Reality* you envision small groups of pro-evolutionary people forming "sociometabiological islands of sanity" to fend off destructive forces; eventually, the constructive forces would survive. That sounds rather frightening, almost as if you imagine warring bands of good and evil that may clash. Do you mean it that way?

SALK: No, I don't think in terms of clashing. I'm simply suggesting that people form such islands to protect each other from being destroyed. Those who form such islands would act in a positive, constructive way — their behavior would enhance their chances for survival, and they would try to transmit their ideas and strategies to all others.

OMNI: Until eventually the whole world was one large island of metabiological sanity?

SALK: If we're going to make it, ideally that's what needs to happen. I'm simply suggesting the mechanism whereby this can come to pass. If we understand this, we can help it to happen.

OMNI: But if we can in fact alter the course of metabiological evolution so that we arrive at this sanity, aren't we faced with the

problem of eradicating certain traits from the human population? If, as you suggest, some of these traits have a genetic basis, we're faced with a lot of sticky questions. Some people may refer to such evolution as an insidious form of genocide.

SALK: There's always danger that ideas of this kind will be misunderstood, so I speak about them with some trepidation. But the fact of the matter is that human beings have been exterminating each other for a long time; we must recognize that. It has happened before, and it's happening in the world today; I needn't recount examples with which everyone is familiar. The hope is that this destructive, devolutionary behavior might be contained, ameliorated, reduced, so that evolution will proceed in the most advantageous way possible.

OMNI: But the traits you talk of eradicating are those very characteristics which may have helped us evolve in the first place: aggression, and the competitive spirit, have honed *Homo sapiens* through the millennia.

SALK: I'm not for eradicating such traits. I'm for transformation through *self*-regulation. I'll tell you what I imagine. I imagine that people who are greedy may recognize that it will be to their advantage to be less greedy, or not greedy at all; they may learn to restrain their greed for some other, greater advantage.

OMNI: Do you really believe such cooperation — such control — is possible, given what we do know about the human brain? We not only have a cortex, the seat of thought, but, beneath it, our mammalian and reptilian brains — the centers for all those drives you're hoping to quell. How can we suppress drives rooted in our physiology?

SALK: It may well be that we're still not evolved enough to overcome such drives. But if that's so, then metabiological processes can help us take the next evolutionary step. If there's a need, then the brain may be sufficiently plastic to respond. In the course of evolution, the cortex has developed the capacity to restrain the more primitive brains that are also part of us. More recent additions to the brain may be seen as modulators of those responses which cease to be advantageous. In the course of life's experiences, the brain evolves functionally, but it probably also evolves structurally. It's very likely that the cortex, when stimulated, develops in the same way that muscles get larger when exercised. Eventually, we'll realize that if we destroy the ecosystem, we destroy ourselves.

OMNI: And possibly give rise to another metabiological realm. The biosphere could give rise to one experiment in metabiological evolution after the next.

SALK: Precisely. I think you've got it now.

OMNI: If the experiment doesn't work this time, it may work next time. In all of the vast cosmos, it's bound to work somewhere.

SALK: Don't worry about the cosmos out there; I'm interested in *this* piece of the cosmos right here.

OMNI: Suppose we succeed at metabiological evolution. What's the next evolutionary step?

SALK: The challenge before us is to use the capacities that we possess, to take responsibility for our own evolution. We're all in it together, and if we let others destroy us, we've become the co-authors of our own destruction. Therefore, we may have to change the way we relate to each other and enter into a kind of relationship which I call mutualism, or mutual cooperation.

What I'm thinking of is an ecosystem dominated by mutually advantageous relationships rather than mutually destructive relationships. That's what I mean by managing our competitive instinct — seeing if we can learn to compete to find who could be the most cooperative.

Now, this may evoke the response "That's not what human nature is like." I know that. That's obvious. What is not obvious is that we may have, in our future, another evolutionary phase that may be of this nature. I can project a scenario in which we avoid the catastrophe by having our peace talks *before* rather than after the war. I too know what's going on in the world; I see the same thing that everybody else sees. My imagination, however, suggests that a better solution can be found. By a series of evolutionary approximations, we have our remarkable eyes, an incredible hearing mechanism, and our unbelievable mind. If evolution is an error-making and error-correcting process that we're in the midst of right now, then we need a few more error-correctors to emerge.

OMNI: Dr. Salk, in writing about metabiological evolution you often invoke a powerful symbol called the sigmoid curve. Can you explain the meaning of the curve and its relationship to your work?

SALK: I'll start by explaining the origin of the concept itself. During the sixties I had the sense that the world was coming apart or was, at least, changing rapidly. It was apparent in the rate of

population growth, in the exploitation of natural resources, and in the widespread occurrence of social and political disturbances. And I attributed what was happening to what I analogized would happen in, let us say, a colony of fruit flies. At first the colony is a self-replicating system in which the environment is ideal. All necessary resources are present, and procreation occurs at a rapid rate. But then, as the fruit flies multiply, resources are consumed.

In the case of the fruit fly colony, we see evidence of a feedback effect. Somehow, it seems that the fruit flies would receive a signal to reduce their rate of replication. If we draw a graph, plotting the number of flies in the colony against time, the curve that results is *s*-shaped, or what's known as sigmoid. In the first half of the curve, population increases slowly and then dramatically. In the second half of the curve, population growth decelerates and then levels off as the food supply diminishes. If the reproduction rate didn't level off, the flies would exhaust the system and self-destruct.

OMNI: And these organisms have a mechanism that is not a conscious mechanism; it's a built-in genetic, biological mechanism that tells them to lower their reproduction rate.

SALK: They don't have to hold a town hall meeting. The behavior is built into the system; it's emerged in the course of evolutionary time. Those organisms which behave in this intelligent or wise fashion are the ones that were rewarded by survival and/or evolution. Their behavior, and the sigmoid curve, illustrate a fundamental law of nature.

OMNI: How do you relate what you saw during the sixties to the sigmoid curve?

SALK: The turbulence and population explosion of the sixties convinced me that we were nearing the end of the first phase of the sigmoid curve, in which population increases, and approaching the second part of the curve, in which population growth levels out — what I call the point of inflection. I theorized that the conditions and circumstances prevailing in phase A and phase B must of necessity be different. Thus, population growth is just one parameter measured by the sigmoid curve. The curve reflects changing values as well. During phase A, society values individual power, competition, and independence. During phase B, we will value individual *and* group consensus, collaboration, and interdependence.

Over the past several centuries human population growth and

values have corresponded to what is expected in the first phase of the sigmoid curve. But world population growth is now beginning to decelerate. We're experiencing the turbulent effect of rapidly changing values, and in the future we may see both population growth and values change in accordance with what may be expected in the second half of the curve. We're approaching the point of inflection. But in order to survive, we must learn to facilitate this transformation ourselves. We're in the midst of a crisis, but the fact that population growth has already begun to level off even in the less-developed countries suggests that we are at the point of inflection. A hundred years from now, we will recognize that in the late twentieth century we were going through an enormous evolutionary change. This change seems very much like the punctuated equilibrium referred to by some evolutionary biologists.

OMNI: *Some* biologists, as you say, believe in punctuated, or rapid and sudden, evolution, while others believe that evolution is gradual, taking place at a snail's pace over geologic time. Can you reconcile these two points of view?

SALK: Evolution has been going on in a progressive way ever since the emergence of the cosmos, yet there have been some major events that are clearly punctuational: the emergence of life from matter, and the emergence of consciousness from life. I see punctuation in human population growth, particularly as reflected in the sigmoid curve when population mounts dramatically, then suddenly plateaus. And I see punctuation in the emergence of concepts, scientific discovery, and technology.

It is as if universal evolution, which includes the three phases of evolution, reflects perpetual creation, as when order emerges out of disorder, or cosmos emerged out of chaos. The mathematical language of creation and emergence will come from the relatively new field of nonlinear dynamics [the study of sudden, nonlinear changes], which physicists, chemists, and biologists are using to explain the order that emerges from random, or chaotic, systems.

OMNI: Those who are using nonlinear dynamics to explain the brain say that in some ways the workings of the mind may be compared to a stream going past a rock. When the stream is moving very slowly, it slides smoothly past the rock. If it moves more quickly, it forms vortices; those vortices may seem chaotic, but they actually

take on an organization of their own. Then, if the stream moves even more quickly, the vortices form vortices. Each time the stream reorganizes, you have a punctuation point, also called a phase transition. Do you think this analogy applies to your concept of evolution?

SALK: Yes, it does. It is as if evolution is a process in which matter interacts with itself over the flow of time, resulting in self-organization. For example, I met you as you were moving about in your professional work as a science journalist, and we have now formed a relationship in the dialogue we are having. Something is emerging out of this dialogue, this relationship, that would not have occurred if we had not encountered each other. We, as a result of that something, will have an effect on others, who will encounter the product of our interaction and will be drawn into vortices resulting from that encounter in the stream of time. The interacting entities can be physical, biological, or intellectual. As a result of the interaction the properties change, and they continue to change, because this is an endless process, giving rise to higher and higher orders of complexity.

OMNI: You say that we need to evolve in order to survive. And evolution, your theory goes, is propelled forward by a punctuation — by dynamic interactions resulting in phase transitions. Yet according to nonlinear dynamics, that phase transition will occur only if some powerful force jolts the system. What force will jolt *us* into the awareness required for the next phase in metabiological evolution? How will we overcome the anti-evolutionary forces that seem to be leading us toward extinction?

SALK: The jolt is going to arise internally, causing a reorganization similar to that of the swirling stream. An inner force is generated in much the same way that the internal pressure produced by gravity generated the Big Bang. I see the whole of humankind becoming a single, integrated organism. It's the organism of humankind that will go through a phase change, by virtue of the threat we are to ourselves.

OMNI: Can you be more specific?

SALK: The threat that we are to ourselves manifests itself in the form of nuclear weapons, the economic crisis, problems associated with development of the third world, problems associated with resources, with the pollution of the planet — with all of those things which are threatening to the life of the organism of humankind and

therefore to the individual members of the organism. The threat will affect our perception of ourselves as well as one another, and we will soon recognize that we are *both* the victim *and* perpetrator of the critical state of the world. Now, this state of affairs will be more evident to some than to others; some individuals will have more insight and foresight than others. Some will have greater sensitivity. I look upon each of us as I would an individual cell in the organism, each of us playing his or her respective role.

OMNI: It seems to me that most people, even if they're aware of these problems, have other things on their minds. Don't you think there's going to have to be more of a squeeze before a large enough number of people take action?

SALK: I hope not, but I'm afraid I agree with you. There is a time frame, a dynamic, and it would be useful to understand it. I think a great deal about this. I'm reasonably sure that fifty years from now, we will not be making nuclear weapons. It may be a hundred years from now, it may be a thousand years from now, but it doesn't matter. I try to imagine how the making of nuclear weapons will come to an end, and I ask what we can do to hasten it.

OMNI: What do you come up with?

SALK: In facing such a question, I project myself into the future and look back at myself and my fellow human beings in the present, and I say to myself, What is it that needs to be done now in order to bring about change much sooner? That's what I mean when I talk about conscious metabiological evolution. It means adding consciousness and choice, not allowing things to occur by chance. It means using foresight; it means not only feedback but also feed-forward, defined as a projection of our imagination.

OMNI: Yet if I look back from the future, as you've just suggested, I see a relatively powerless group protesting nuclear armament, and a powerful group building bombs, committing genocide, and deploying the MX, the Pershing, and a spate of other missiles. If I follow the process that you're talking about, I can't really imagine all of this coming to a halt without the insanity of it in some way being emphasized. And that sort of emphasis has to be a horrible thing.

SALK: You can see now why religions were based on implicit threats — the wrath of God, the consequences in this life, or the afterlife, of actions contrary to what was considered ethically and

morally correct. The threat of nuclear war is, in a sense, equivalent to the holy wrath. In order for it to deter us, there needs to be a critical event, a critical mass, a moment of punctuation. Evolution proceeds gradually; then all of a sudden, a critical event of some sort occurs, for whatever the reason. Such an event has occurred.

As science and technology emerged out of the past, they gave rise to our capacity to develop more and more powerful weapons of destruction to gain some advantage over our enemies. What can we do with this weapon in order to gain some advantage? We ask that question in a moment of clarity, and we recognize that this weapon is useless, because its use would also be to our disadvantage.

OMNI: Well, some people realize that; other people say we can win a nuclear war, that we can gain an advantage. And those are the people who control the government now.

SALK: That's correct. Therefore, the rest of us must speak out. What I see manifest here are the pro- and the anti-evolutionary forces in metabiological evolution. I've come to the conclusion that the forces of evolution, both for and against, are poised and locked in this struggle, and the only way to survive is to evolve beyond the point at which we are now.

OMNI: How do we define the members of the two opposing groups, though? In biological evolution, there's a struggle between two species fighting for a niche in an ecosystem. Is there an analogy in the metabiological realm?

SALK: In the biological realm, two sets of genes — two separate species — are struggling to survive in a single ecosystem. In the metabiological realm we have struggling ideologies. One ideology is analogous to one set of genes; another ideology is analogous to another set of genes. And the two ideologies then attempt to dominate each other, to replace each other, to survive, to establish, to spread. Now, I say, Let's take the conflicts that exist and use them constructively to see if we can invent a way to convert the opposition to apposition. Perhaps we can resolve our differences. After all, we have reached a point at which it is to our mutual disadvantage to continue to proceed as we're proceeding. It is to our mutual disadvantage to spend huge sums of money on weapons to destroy ourselves, when that same money could be used constructively to improve the human condition.

OMNI: Yet when you start talking about one ideology being superior, and needing to engulf another in order for the species as a whole to survive, you get into a kind of political problem. How far can you go to perpetuate your ideology? Should you become an evangelist? Should you form a Soviet utilitarian-type state? Should you go to war? What are you paying to spread your ideology? Will everyone perish if you don't spread it?

SALK: I'm convinced that we are impelled by an innate evolutionary force. We have an evolutionary instinct — not merely a survival instinct — to improve the human condition. It's for this reason that we are engaged in biomedical research; this is why we are trying to understand how to manage our lives with the resources available. We have come face to face with competing ways of improving the conditions of life on the planet. We're competing for the minds of people in the developing countries, for resources, and for economic advantage. So this is a continuation of the process of biological evolution in the metabiological realm, using metabiological tools, which are those of the mind.

OMNI: There are two basic ideologies now warring for control of the world: the communist ideology and the capitalist ideology. Yet both groups promote nuclear weapons, and a lot of other anti-evolutionary things. The point may be to evolve totally new ideologies.

SALK: New strategies and new ideologies. We must recognize that we are the victims, and that the process of evolution has pitted us against each other. With our superior knowledge and intellect over and above those of other species, we need to recognize that we are going to have to do something about it. We are coming up against a wall that we're going to have to get over or around, which means a phase change. And we ourselves must influence the outcome. If we don't, then we will go the way of the dinosaurs. But we should try to do otherwise. That makes a more interesting game. Of course the sun will become extinct three to five billion years from now. Of course the cosmos is itself evolving, and this planet is going through a life cycle.

Given all this, we may feel that conscious evolution is futile — it's all going to end for us eventually, anyway. But we're not so constituted; by our very nature we're not allowed to give up. And it's for this reason that I invoke the idea of the evolutionary force acting upon us, in us, through us.

I see more and more people concerned with conflict resolution, more and more people speaking out. I think that we're evolving rapidly in the metabiological realm; being in it, in the process of evolution itself, it's sometimes difficult for us to see. But inasmuch as I have the capacity to get outside myself into what I call outer time and outer space, and take a look down at where we are, I can recognize the existence of these movements and these trends. I'm simply trying to call attention to what I see, saying that these have evolutionary significance, and that the process of metabiological evolution is occurring at an accelerating rate. And I also say that the determinant in natural selection is human choice.

OMNI: Dr. Salk, when we've finally emerged, do you think we'll have the same physical form we do today? For instance, some scientists say that gene-splicing technology, a product of metabiological evolution, will be used to change the species *biologically*. Some researchers even believe recombinant DNA technology will help us increase life span, brain size, and intelligence.

SALK: I believe that if we wish to contribute to human evolution, we can do so more rapidly, more effectively, and more efficiently metabiologically than biologically. Even if a gene could be altered and then transferred to a number of individuals, you would still have to rely on the slow process of biological evolution to transform the species. For instance, scientists at the Salk Institute, in collaboration with others, created a giant mouse by transfer of genes for growth hormone. While this trait is transmissible to succeeding generations, it will be a slow process. We can induce metabiological evolution much more rapidly and efficiently because we can transmit changes via education and early experience. By training infants at birth and soon after, we can evoke different sets of characteristics — ones that are positive, constructive, and creative, rather than their opposites. It's not too different from agriculture, and that's why I use the term homoculture.

OMNI: Yet metabiological evolution does feed back into the biological realm.

SALK: Of course. The discovery of insulin has changed the gene pool with respect to the number of diabetics that survive. Control of malaria has increased the amount of sickle cell anemia in the world. There are many people alive today who would not have lived under conditions that prevailed when infection was rampant and physical

prowess important. Now it's the mind that's important. This is why I talk about the survival of the wisest as distinct from survival of the fittest in the traditional tooth-and-claw sense.

OMNI: Many evolutionary scientists would view this new trend in a negative way. They'd say we're weakening the gene pool, and that the forces of metabiological evolution, which maintain all the defective physical forms, are actually *devolutionary*.

SALK: It's true that all this may be seen as the beginning of the end. But I see it as the beginning of a new beginning. Some individuals with physical impairments have fantastic minds. Take Stephen Hawking, the British physicist with amyotrophic lateral sclerosis. The longer he can be kept alive, the more he'll contribute to the metabiological gene pool, which is the pool of ideas.

I often think that if my own life had been curtailed after my earlier work was done, I would not now be synthesizing my experiences. We still have a great harvest to reap from individuals who will have lived over a longer life span, whose wisdom and experience can still be drawn upon. We have not yet recognized the great potential of the aging superstars. Some people look only at the negative, rather than the positive. The so-called weakening of the gene pool may be a price we are paying for a far greater advantage.

OMNI: You've essentially spawned a new philosophy that needs to be spread if it's to have an impact. Do you have any hope for your writings in this regard?

SALK: I hope they'll provide people with a way of seeing themselves in relation to others and the cosmos. It is in the nature of man to be curious about the so-called eternal questions. Since I've confronted these questions, I'm offering what has become apparent to me. My questions are similar to those that mystics and philosophers have always asked. But I think we may do a better job of answering them in the twentieth century, by merging the epistemology of human experience with the epistemology of science.

I do believe that my ideas will filter out. These things have a way of permeating the atmosphere. An idea gets into space, in one form or another, and reaches the eyes and the ears and eventually the mind. As I now write, my ideas are in a more abstract form, perhaps, than is useful to most people at the moment. I wish I could immediately transpose them from the abstract to the concrete. You're

helping me to do this by teasing out examples of what I see in the abstract.

OMNI: The more we talk, the less abstract it all seems.

SALK: That's what I find happening when I talk to people this way. I've been asked many times how I'm going to communicate my ideas, and I say, through dialogue. They can be best understood when we're in the presence of each other, when we're close enough to make contact in all modalities — eye contact, ear contact, feeling, expression. It's like music or dancing. I *want* to communicate to you; you *want* to receive. And I want to receive from you what it is that you understand or don't understand, because I desire very much to communicate this understanding — not only to you, but to others. It's interesting for me to observe those who respond to my writings with great enthusiasm, those capable of comprehending them on a particular level. They are the ones who have evolved the receptors to recognize and react.

OMNI: What about less educated people around the world? How will you reach them?

SALK: I think it's most necessary to reach those who are active determinants of the evolutionary process — the thinkers, the writers, the artists, the scientists, the intellectuals, the teachers. We need to reach the leaders of the various belief systems, those who can influence others. We need to find an ecumenical way, a common way, of seeing the world. For me, the critical determinant of human evolution is the realm of human values — and that is a matter of education and choice.