The Future of Orthomolecular Medicine

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Perhaps you could make a good typescript.

L.P.
Thank you.

This has been a great day for me; yesterday too, especially to have so many of my old students, former students and collaborators here saying nice things about me. I wasn't sure that they would, when I heard that they were coming. I can say nice things about them too. I feel that I've been very fortunate in having been associated with them and with the others who aren't here today. Much of the success of the work that we carried out was due to their contributions. Then of course I am pleased with the other participants in this fine program. I dedicated my book Vitamin C and the Common Cold to Irwin Stone and to Albert Stadler. Albert Stadler, having discovered vitamin C, long ago, fifty years ago, when he was trying to find out what it was that kept some fruits and vegetables from turning brown when they were exposed to light. Of course, it was an antioxidant; it turned out to be vitamin C.

Since they have talked, former students of mine and former associates, have talked about my past life, I thought I should talk a bit about my past life. Three days ago I gave two speeches, this week in Italy. One of them, and this now I am able to live up to the pledge that I made that Dr. Catchpool mentioned, that December, 1947, that I would mention the need for world peace in every talk that I gave. One of my talks in Italy was about the need for peace in the world, the path to world peace. I mentioned that it was hard to understand why the American people
I am willing that the government should have the policy of spending 1.6 trillion dollars on militarism in the next five years, beginning this year, and that I thought that the answer was that the American people were misled about the missile crisis, about nuclear vulnerability, the Russians having the Soviet Union having far more missiles than we have or nuclear warheads having greater destructive power, so that we have to catch up. I think that I even quoted the statement that Senator Christopher Dodd and Senator Paul Trojan made last year, which was, "The President of the United States lies". This was unthinkable 20 years ago. Well, it was a shock to me to read this statement by two senators here in the United States. Fortunately, at nearly the same time, I got a letter from a psychologist friend of mine who wrote about reality and fantasy. He said that he had reached the conclusion that President Reagan is unable to distinguish between reality and fantasy, and he quoted President Reagan's fantasy that the Soviet Union has far greater nuclear destructive power than the United States, and then he quoted from the Pentagon Report of the Department of Defense of 1982 that there is an approximate equality of destructive power in the arsenals of the Soviet Union and the United States. Then, fantasy President Reagan says that the campaign for a nuclear freeze is being orchestrated and led by communists. In fact, a few years ago, the State Department (I have forgotten what the name was) stated that there is no evidence that communists are involved in any serious way in the campaign for nuclear disarmament. It's just good sense, good sense to stop wasting so much money on militarism if we're going to solve the problems of the world. We have to cooperate,
all the people and all the nations in the world. The reason
that I spend time thinking about medical problems, and
about vitamin C, for example, is that I believe
that we are going to solve this problem of finding out how to
keep the world from being destroyed in nuclear war, and that
it's worth while to be thinking of making the world a
better place for the coming generations of human beings. One
way in which this can be done is by improving the health
by cutting down on the amount of suffering caused by hypo-
ascorbemia, as Irwin Stone says, from which everybody in the
essential everybody in the world is suffering. Only
a few enlightened persons who take 10 or 12 grams a day of
vitamin C are in the fortunate position of not suffering from
this genetic disease that we learned to control but only
just barely by getting a diet that contains enough ascorbate
to keep us from dying but not enough, it's turned out, to
put us in the best of health.

The other talk that I gave was a scientific talk, this
symposium that I was attending, was involved in, was on the role
of the physical sciences in modern biology. I talked about
one aspect of this, and in fact it's quite pertinent to what
we have all been talking about, about vectors of disease and
about agents that we use to control these vectors of disease,
about the human body and how it functions. I doubted that I thought much about the nature of life until 1929.
I was then carrying on research on structure of minerals
and other inorganic substances up to 1929, and then something
Thomas Hunt Morgan came from Columbia
University, bringing with him Sturtevant and Bridges and Emerson and Tyler. Sturtevant and Bridges were two of the three students who had cooperated with Morgan in developing the theory of the gene, in discovering the gene. It wasn't known, of course, that it consisted of polynucleotides, but they did know what they knew but they knew a lot about it even though they didn't know its chemical composition. Well, they kept talking and talking about the specificity characteristic of life, the specificity. One example of this specificity is that parents have children who resemble them. This resemblance we now know even goes so far as resembling them in terms of amino-acid sequences of polypeptides that constitute the specific proteins in their bodies, and their specificity in the action of enzymes as catalysts is that some of these enzymes are highly specific in that there is only one kind of molecule whose reactions they are able to speed up to their catalytic activity.

Well, Morgan was working on self sterility of the sea squirt, and I can't discuss that, I don't think I have time enough to present it as an example. In 1935 and '36 I was working on magnetic oxygen as well as triplet oxygen, the normal state with the idea that we could tell something about how oxygen molecules are held by hemoglobin molecules in the red cells of the blood. The idea was that we could distinguish between two kinds of combination; one involving a mainly physical force which would leave the oxygen in the triplet state, leave it paramagnetic, and the other chemical combination, forming of chemical bonds which would make the oxygen
molecule magnetic. So we measured the magnetic susceptibility of venous blood and arterial blood, and found that there was a remarkable change. We found that oxygen molecules were held by forming chemical bonds. They lose their magnetic properties when the hemoglobin in the red cells is oxygenated. I was giving a talk in New York in 1936 at the Rockefeller Institute for Medical Research, a seminar on this subject, and Landsteiner asked me to talk with him. Karl Landsteiner had discovered the A, B and O blood groups in 1900, and the others, L and M and the Rh factor later on. He had been carrying out experiments in the field of immunology, immunochemistry, and he asked if I could explain his observations. I couldn't explain them, but he told me a great deal in several days of discussion. He told me a great deal about immunology. I kept thinking about what he said, and finally I reached a conclusion, a decision as to what I thought was going on. Antibodies to show such remarkable specificity in their interaction with antigens. Landsteiner was making azoproteins, using simple chemical substances such as para-azobenzoic acid taken off the shelf, got out of the stock room, diazotizing these amines, coupling them with proteins, using these azoproteins as antigens, making antibodies then that would combine specifically with the simple chemical substance that had been attached to the original protein. This appealed to me in that I felt that I knew a lot about the simple chemical substances such as benzoic acid or parachlorobenzoic acid, meta-chloro, orthochloro-benzoic acid or toluic acid, and hundreds of
other substituted benzoic acids as well as other substances you could use instead of the benzoic acid.

By 1940, I had reached the conclusion that I knew the answer to the question, the basic answer to the question of the molecular basis of biological specificity, of the molecular basis of life. There were two ideas, had been discussed very clearly, or discussed very much, but there were two reasons very simple ideas. A German physicist named Pasqual Jordan published a paper in 1940, about the time that I published my paper about the structure of antibodies and the nature of serological reactions. He advocated one of these ideas, which is that identical molecules attract one another more strongly than nonidentical molecules because of the phenomenon of quantum mechanical resonance. I brought this paper to my attention, and I said, "I don't believe that the extra energy of attraction that you get from quantum mechanical resonance between identical molecules can possibly be the explanation, because this extra energy is less than the energy of thermal agitation. It just wouldn't work. But if, and this was in my paper on antibodies, if the antibody has a combining region that is complementary in its atomic structure, the arrangement of the atoms, to the antigenic group of the antigen, you get strong and highly selective interaction, so that the antibody is the antibody against benzoic acid and you replace one of the hydroxyl atoms on the benzene ring with a chlorine atom, if the fit is tight enough then this substituted benzoate ion will not be able to fit in the cavity. Well, so we wrote a paper in 1940 saying that biological specificity in general results from the detailed molecular complementariness.
of the interacting groups, and that Jordan was wrong about his idea of quantum mechanical resonance. We also said the gene consists of two mutually complementary molecules, each of which when they are separated, can produce a template for the synthesis of a replica of the other one, so that gene duplication occurs that way, the gene using one half of the gene for the template for the other because of its complementariness. Well, of course, some years later examples of complementariness began to show up. The alpha helix and the pleated sheet are arrangements of polypeptide chains in which there are two complementary groups which interact, the group of peptide interacting with the oxygen atom of the carbonyl group of another peptide, and that is a highly directed interaction. You can achieve these hydrogen bonds by coiling the polypeptide chain in the helix or by arranging it in a somewhat staggered linear arrangement coming back on itself to make the pleated sheet where the hydrogen bonds are formed laterally. And then, of course, Watson and Crick discovered the double helix 13 years later, in 1953, in which they were able to show that two nucleotides appearing and form hydrogen bonds with another and two other nucleotides in this specific way, purine and pyrimidine form three hydrogen bonds with one another, and that the gene consists of two polynucleotides which are mutually complementary, adenine combining with thymine and guanine combining with cytosine.

So now by 1948, my students, I don't think any of those of that period are here, and my associates Campbell who came from Chicago, 1948 and David Pressman who worked for several years
on this project, may be carrying out studies of interaction
of antibodies with haptenic groups, hundreds of experiments, a
thousand perhaps, we made determining equilibrium
constants. By 1958 we had tied down these ideas, so far as
they are concerned with antibodies and antigens, so tidily that
there was no possibility of saying we were wrong.

So, molecular complementariness, this tight fit of
the complex of atoms of one molecule onto the complex of atoms
of another molecule is the basis of life. Biology now is
developing, molecular biology is going along strongly, genetic
engineering, we are going to get more control of ourselves, with
a better understanding of the nature of our own bodies and the
way in which these bodies function. I'm not going to make an
effort to predict in detail what the future of orthomolecular
medicine will be. I think that it's been done already, by the
participants in this seminar but I might make a quantitative
statement. Someone sent to me a clipping saying that Dr. Pauling
says that we can live to be 100 years old, and I in fact had
said that, that by proper use of supplementary nutrients and
other health practices, people in general could live 25 years
longer than they do now, live to be a hundred years old, and
lead good lives too, not have a long period of debility as the
body, the beginning of the period of degeneration.

Well, Irwin Stone said that he hoped that, well he
said something stronger than that, that he believed that I could
live 50 years; that was 15 years ago when he made that
statement, so he would say that he thinks 35 years more than
presently accepted. It may well be that in a generation or two
we shall have enough knowledge, especially in the orthomole-
lar field, that people in general will live to be 110 years old. I think that this is worthwhile; if you can extend the period of wellbeing, the period in life when you haven't yet learned how to enjoy yourself, especially in the teens and the period toward the one of life when death is approaching are not included in this period of well being. If we can extend the period of well being, then we shall have extended the ratio of well being to suffering, and I think that that would be worthwhile.

I've enjoyed myself for many years after I got through the initial period of not understanding the world very well. I've enjoyed myself, and it's been a special pleasure for me to have been here today and yesterday. Thank you.