Interview: Dr. James L. Matthews

SDI lasers inactivate the AIDS virus!

The director of the Baylor Research Foundation tells how the Strategic Defense Initiative is driving a fundamental area of research in biology.

James L. Matthews, Ph.D. was widely quoted in the news media beginning on Jan. 12 reporting that his research team at the Baylor Research Foundation, using a combination of a non-toxic dye and laser light, had demonstrated in principle the ability to destroy the AIDS virus (HIV) and a number of other viruses in the blood, without harming the blood itself. In addition to HIV, the technique has been successfully tested on herpes, measles, and cytomegalovirus. "We attained a 100% viral kill without seeing any evidence of damage to the normal blood elements," Dr. Matthews said.

The interview below with Dr. Matthews was conducted on Jan. 18 by John Grauerholz, M.D., a member of the EIR Biological Holocaust Task Force who has spoken on the AIDS pandemic to scientific and medical conferences, legislative bodies, and citizens' groups throughout the United States and abroad.

Grauerholz: What is your particular area of interest?
Matthews: My particular area of interest relates to two specific fields that I am personally working in: One is calcium metabolism and connective tissue, and the other area, in recent years, is photobiology. I am a physiologist, and we have a contract from the SDI [Strategic Defense Initiative] program, which enables us to have a large group who are specifically studying the potential medical applications of lasers, where possible, the medical applications of lasers that are being developed under the auspices of the SDI program, which means that we expect to have available to us lasers that are not yet available commercially.

Grauerholz: So the SDI program is in fact driving a fundamental area of biology.
Matthews: Yes, it is. They have a program, for which several institutions around the country at the present moment have funding, to explore potential unique spin-off applications to medicine of some of the lasers that are being developed. Specifically, the free electron laser is one that is of interest to many of us, because it is a laser that is tunable. It has high power and a capability for tuning so that you can select the appropriate labeling that you might use, and also control the various pulse characteristics so that, rather than having to have 200 different dye-lasers and dyes, and 100 different laser set-ups in order to explore which dye, for example, might have specific binding or which might have a unique outcome. For example, a dye might be taken up by a tumor cell, or a dye might be taken up by an infectious agent that could be uniquely activated without being absorbed sufficiently by the adjacent tissue to cause damage.

Grauerholz: This is similar to photodynamic therapy of tumors.
Matthews: That's right, and we are obviously into that, looking at different dyes. We're looking at the treating of autologous marrow, for example. We're looking at photodynamic therapy for tumors and at various other potentials, such as the dyes that might be absorbed by the plaque-material in a blood vessel, and therefore volatilized uniquely. So, what the [SDI] program across the country has done is to provide us a basis for the laser medicine and biology research, plus the fact that it has made available to us, at those installations where those lasers are presently available, access to test these when it seems appropriate to use them.

Grauerholz: Do you think that the current funding cuts of the SDI are going to affect this program?
Matthews: We would hope not! We obviously are looking for and have support for this specific program as has been reported; we're seeking resources other than this, other than

SDI, and we do have some other private support that is behind it from our own basic science foundation gift, and as well, we have just received a grant from the AMFAR [American Foundation for AIDS Research]. We are seeking other support.

Grauerholz: Are you looking for any federal support from the actual AIDS program?
Matthews: We have filed an application collaboratively with the Southwest Foundation for Biomedical Research in San Antonio, Texas, led by Dr. Gordon Driesman. We have just filed an application to NIH [the National Institutes of Health] in response to their recent request for proposals dealing specifically with this problem, namely the problem of infection transmission with blood banking. And we responded collaboratively with the San Antonio group to that, because we think that 1) the fact that the San Antonio group has a wide experience with enveloped viruses, especially AIDS virus, and 2) they represent one of the nation's strong resources in terms of primate colonies, and the use of primates in investigation. So by consolidating our group, which has blood analysis capability, laser background, etc., and virology, with their group, which has virology and primates, we believe that we have an opportunity to accomplish all the requisite tasks to do a full evaluation of the potential for this thing that we now have a feasibility study of.

Grauerholz: Could you briefly summarize the actual data you've gotten so far, in terms of the work which was publicized?
Matthews: Preliminarily, we started off using herpes virus, and adding dye to the herpes virus, and showed that we did indeed kill the herpes virus. We then tested in a small chamber that we added the dye to and exposed to the light, either dye-laser and/or xenon light source (both were used). We also did cytomegalovirus [CMV] and got an effect on it, we then did measles virus and got an effect on it. These were all enveloped viruses. We did a DNA and an RNA non-enveloped virus, what's called a naked virus, and found that it was ineffective. So our preliminary view is that enveloped viruses are susceptible, and that the envelope represents the location of the dye-binding, and that if it is a naked virus, then the dye is not taken up adequately to effect a kill. The viruses that we have interest in testing in the future are Epstein-Barr virus, which is also an enveloped virus, and hepatitis virus.

More specifically, we're looking toward SIV [Simian Immunodeficiency Virus] in the immediate future because through our collaborative effort in San Antonio, we'll have the opportunity to expose the SIV virus in the test chamber with the blood, the dye, and the light, and then to test it directly for its infectivity in the primate. We've done two non-enveloped viruses, and we've done measles, CMV, herpes, and AIDS virus, thus far, with kill. I've tested the herpes virus in full hematocrit whole blood to ask the question, did the presence of the blood interfere either with the light getting to it, or did the presence of whole blood take up so much of the dye itself that it would attenuate, or require a higher dose to kill the virus in terms of dye concentration.

We got comparable viral kill with herpes, in the presence of whole blood, as well as in the cultured medium. So our feeling is that the blood itself per se does not interfere with the system, but we have yet to actually add the AIDS virus itself to whole blood and test it, simply because of our early tests on AIDS, after it had been treated, we wanted to have the absolute, most ideal culture conditions appropriate to make dang sure that we had really knocked off the virus. So it was more important to us to ask the question in a system that was optimal for the growing virus, if it was going to grow, and we did that experiment on the AIDS virus suspension, the AIDS virus culture without blood first.

Our next step will be going through the procedure in the next couple of weeks, as soon as our virus titer reaches a sufficiently high concentration to enable us to do the test. We'll be back doing it in spiked and whole blood just to prove the point that the AIDS virus is not different from the other viruses in terms of being susceptible in the presence of whole blood. Since the earlier study showed no effect of blood on the system, we don't anticipate any problems.

Grauerholz: From the theoretical point of view, it's interesting. A colleague of mine has put forward a hypothesis that the spikes on the envelope of the AIDS virus could act as an antenna to focus electromagnetic energy, and I would think that what you have here is certainly an indication of that, where you don't get interference from the blood, and the thing focuses very specifically on the dye molecule.
Matthews: The dye molecule is very likely the way to achieve concentrated absorption of the light energy necessary to reach the energy state for the successive photochemical reactions.

Grauerholz: What power levels were you operating at?
Matthews: Let me get a definitive answer from my laser man who is sitting right next to me, and let me just be sure that I give you the exact thing, because I don't have the papers before me, and we've used so many different ones, I just want to give you the exact one that he will report. Just a second. It is 5 joules/cm^2.

Grauerholz: So we're looking at a non-thermal effect.
Matthews: That's right.

Grauerholz: What are your hypotheses?
Matthews: Using this kind of activation on tumor cells previously various investigators have reported that, as a consequence of activation of dyes of this class, that singlet oxygen

is produced. One would predict that the singlet oxygen species causes envelope disruption, but we don't know yet whether or not that is, in fact, what's happening with the viral envelope. The work on singlet oxygen has been done on tumor cells. Very likely we're reaching a different energy state, or we're oxidizing the membrane or the envelope. Our work ongoing at the present moment is exploring the various approaches to studying what the actual mechanism of kill is. Earlier studies on viruses that have envelopes, had suggested that if the envelope is disrupted, the virus loses its infectivity. So our premise at the present moment, unproven, is that very likely what we're doing is at least some micro-damage points on the envelope that perturbs its infectivity.

Grauerholz: But basically, what you're getting is a non-thermal effect of the interaction of electromagnetic energy with the dye.
Matthews: That's correct.

Grauerholz: So it's a sort of a specific focusing on some process yet to be identified.
Matthews: That is correct. Obviously what we're also looking for and exploring is the potential use of other dyes that also we have shown have a binding affinity, and that show potential for binding. This is where, I think, the SDI-related laser activity will be of more use to us because, if we have dyes whose absorption spectra are different than the available fixed-lasers that we have at hand, we propose to use the free electron laser. Not only to obtain these appropriate and desirable wavelengths, but also to get at their very uniquely controlled pulse characteristics, so that we can deliver a short, quick pulse, minimizing potential for thermal damage. What we want to do, if we can, is to develop the system at hand, but also to explore others for that possibility, because, if you could find a dye that would behave the same way, whose absorption spectra were further away from that of hemoglobin, which is in the red, we would, hopefully, be able to deliver higher powers, achieve faster flow rates, and therefore have a more efficient system. Nevertheless we're going ahead and developing the one that we have at hand, because we have yet to demonstrate any red cell damage.

Grauerholz: One thing I would be interested in pursuing is the question of whether the virus might have an intrinsic absorption of its own, even without dye.
Matthews: I don't think so, because we did the experiments with and without dye, with and without light, and various permutations of those variables: virus, no virus; virus without light, no dye; virus with dye, kept in the dark. Virus, no dye and no light, [keeps] growing [and] flourishing. Virus plus dye plus light, [means] no viral growth. So we had four groups at different doses, different concentrations, both variation in light intensity, running a gradient of various lights, and also against a variation in concentration of dye.

Grauerholz: Interestingly, you get your result even with a non-coherent light source, if you said you used a xenon light, or was that a laser?
Matthews: It was filtered to deliver about the same wavelength, ± 5 nanometers.

Grauerholz: But it's not the same coherence as a laser?
Matthews: No, it is not the same coherence, that's correct.

Grauerholz: But, nonetheless, you got an effect.
Matthews: That is correct. Of course, one of the reasons we went to the xenon was for 1) portability, ease of the system, in order to go in and out of a P-3 environment, and 2) to minimize the hazard of technology, where possible just to run the small test chamber feasibility, because we were using a relatively small test chamber to keep from having to handle large concentrations, large volumes, and large amounts of virus. So, what we've run is a small test module that we now are preparing to scale up.

Grauerholz: If you listen to the best people in the molecular biology area per se, such as Drs. David Baltimore and William Haseltine, they are very pessimistic about getting a cure that way, and our position has been that the research on this disease has to expand into new areas, such as this.
Matthews: Oh, there's no question of that. I'm absolutely certain of that, and I would say that it's the kind of research that has to be done in a controlled environment, very carefully.

Grauerholz: Right, it has to be funded, and the facilities have to be adequate to the job.
Matthews: Absolutely. I'm confident that that will occur. But it's not the sort of thing that you just put into the media.

Grauerholz: No, I understand that, and I think that part of the problem, in a certain sense, has been that the research on this thing has been conducted piecemeal. Somebody finds an interesting finding; it gets publicized; everybody gets their hopes up, and then nothing goes anywhere because, absent the sufficient commitment of funds and manpower, and so forth, none of these things will go anywhere.
Matthews: There's no question about that. If it's not pursued vigorously by the group working in the area with a definitive approach, then, if some other group doesn't pick it up, then sometimes a really good idea goes wanting. But I fully expect that this will be investigated.

Grauerholz: Oh, I expect that it will be investigated. Our position has been that we really should approach this thing as a crash program, as what we would call a BSDI, or Biological

Strategic Defense Initiative, and really ought to have interdisciplinary research of this sort.

Matthews: Exactly. One of the things that our group has benefited from, is just what you've said. Namely, it was my good fortune to be in a position as the director of the Research Foundation, to have knowledge of the capability of investigators across campus, and the team that has been working includes our chief of the blood bank, a Ph.D. biochemist whose specialty is coagulopathy and blood protein chemistry and hematology, and a pathologist-hematologist, and a laser-physicist, and three virologists.

Also, I think the unique collaboration of the virology group in San Antonio with their primate colony will, in fact, build, essentially, what you are talking about. Plus the fact that we have AIDS patients under care in the facility, and we ran two units of AIDS patients' blood through the present system. Not in order to ask the question of viral kill (because we didn't know what the viremia level was, so we didn't have a starting number to work with) but we ran two samples of AIDS patients' blood through the system, in order to establish that the blood of the patient with viremia, or with, at least, manifested disease, had not been so compromised in its integrity, red cell fragility and so forth, that it would have been more susceptible to the technique than the normal blood possibly was.

So we have run AIDS patients' blood through the system, not for viral kill yet, but to establish that the characteristics allowed us to perform it without damaging the blood. That's reported in the paper on those two patients, and the findings were good. When you get down to the point that you're going to test for infectivity in AIDS blood, per se, the ultimate long-term tests have to relate to treating it, and putting it into a chimp, because the chimp is the model for the AIDS virus per se. So that is essentially where we are.

Grauerholz: Could you briefly describe the functions of the Baylor Research Foundation?

Matthews: The Baylor Research Foundation is an incorporated, not-for-profit, research wing of the Baylor University Medical Center. We inaugurated the activities of the Research Foundation in January 1984, after a task force evaluated the overall activities of the center in terms of the missions we had initially stated. These included primary medical care, medical education, and research. Up until that time, we had had various persons of our staff with grants, contracts, and some donated money, supported by a very small grants office, with the IRB [Institutional Review Board] for human protection activities, with an animal committee, and so forth.

But we wanted to focus more of the institutional strength and effort toward developing further the medical research unit with the particular idea that the medical center per se was one of the larger hospitals in the country, being especially suited for looking at medical applications of clinically based research.

We had, at the time we started, a research foundation already going, various specific clinical centers, the Sammons Cancer Center, a Hunt Heart Center, a psoriasis center, an arthritis center, and a diabetes center, which focused on emphasizing excellence in certain clinical areas. So the Research Foundation was developed to help foster research, to provide office support, graphics support, researchers, laboratories, core laboratories, and so forth. We're now researching several areas, with 130 funded projects of one sort or another, including clinical trials.

We have six major areas of focused research: 1) laser medicine; 2) cell and molecular biology, which serves as a support focus group for all of the clinics because it provides a basis for study in numerous different areas; 3) a radiation biology group, particularly working on radiation oncology studies; 4) a group in transplantation biology, having the second most active liver transplant group in the country; 5) an oncology-immunology research unit; and lastly, a developing clinical center for inborn metabolic errors and genetic disease, with the attendant basic science molecular biology laboratory to support their research. The idea is that we have already several outstanding clinical activities, and we're trying to develop focused basic laboratories to support those.