July 29, 2003
Senate Subcommittee on Energy

Testimony by Secretary of Energy Spencer Abraham

Mr. Chairman, members of the Subcommittee, thank you for asking me to testify today on the Department of Energy's Office of Science. I am joined by Dr. Raymond Orbach, who leads that office.

This Committee understands the central role DOE plays in fostering basic scientific research, which is the foundation for economic growth and national security in this country. In fact, just over a week ago the Chairman and I were at Oak Ridge National Lab to celebrate a ground breaking for one of our new nanoscience centers and to tour the Spallation Neutron Source. I know the Chairman shares my enthusiasm and excitement over these projects. They are truly the future of science in America.

So, I commend this Committee for its support of these labs and for its support of our Office of Science, which is charged with stewardship for 10 of our civilian laboratories.

When I was a member of the Senate, I was a strong proponent of federal support of science. I backed legislation doubling the budget for NIH and NSF.

We must, however, also pay greater attention to DOE's Office of Science, which has broad responsibility for the future of much of the physical sciences in America. I don't think there is a full appreciation of how the achievements and the public benefits in public health, telecommunications, supercomputing, to name just a few examples, are dependent upon progress in the physical sciences.

Mr. Chairman, no one has made this connection any clearer than former NIH Director Harold Varmus: "Medical advances," he wrote, "may seem like wizardry. But pull back the curtain, and sitting at the lever is a high-energy physicist, a combinational chemist or an engineer. Magnetic resonance imaging is an excellent example. Perhaps the last century's greatest advance in diagnosis, MRI is the product of atomic, nuclear and high-energy physics, quantum chemistry, computer science, cryogenics, solid state physics and applied medicine."

Particle accelerators, like those at Fermi, Brookhaven, and Stanford Labs have given us technologies to develop MRIs, and PET scans, as well as insights into the fundamental properties of matter and energy.

Fundamental research is going to help us move successfully toward a hydrogen economy, to effect carbon sequestration, and to the Generation IV nuclear reactor. Each of these Presidential initiatives will require that we solve some important challenges, particularly in the area of materials. Again, we will need to look to the physical sciences.

So, there is no question that the evolution of technology requires a robust basic research program in the physical sciences … that basic research program is my responsibility as Secretary of Energy and I want to ensure this committee that I take that responsibility seriously.

We have established a special subcommittee of my advisory board under MIT President Chuck Vest to recommend how we can make our science program at DOE more effective. We are looking at a 20-year roadmap for future scientific facilities to answer the question of which facilities should be built and in what sequence to maintain U.S. primacy in science and technology. We have made a major commitment to the future of fusion energy by joining in negotiations to construct ITER, and we are funding construction of all five nanoscience centers like the one you and I broke ground on at Oak Ridge.

There needs to be a broader appreciation of the critical role basic scientific research plays in future economic growth and national security, and quite frankly there needs to be a greater appreciation of what DOE has done in the past and can do in the future for science, technology, and future prosperity.

The Office of Science is one of America's best kept secrets in government. With this Committee's help, I hope to change that.

Let me give you some examples how we are making a difference in people's lives.

DOE science has helped to create an artificial retina that can restore sight to the blind. Why, some may ask, is the Department of Energy working on blindness? Because we are the primary home of the physical sciences in the United States, and you need chemists, material scientists, physicists, electrical engineers, and many other disciplines working together to make a device small enough and tough enough to live in a human retina and replace its functions. Five national labs with Oak Ridge as the lead, Mr. Chairman, joined together with private institutes to build this retina, which in early tests has allowed formerly sightless individuals to see light and dark, to identify common objects by sight, and even to read large letters. And this is just the beginning.

We began the program to map the human genome when others felt it would be impossible, and we used our expertise in the physical sciences and computing to develop the techniques that allowed its completion two years ahead of schedule. We can now map 2 billion base pairs a month, or two human genomes a year.

I hardly need remind this committee of the impact DNA mapping has had. Gene therapies for cystic fibrosis, sickle cell anemia, diabetes and cancer are something we read about often now. Great advances are certainly on the way.

This knowledge is now being applied in novel ways by DOE science. We are going to attempt to use genetic techniques to harness microbes to eat pollution, create hydrogen, and absorb carbon dioxide. The possibilities here are tremendous. In the future, we may see communities of microbes absorbing the pollutants from coal fired power plants - including CO2 – making coal as clean a fuel source as hydropower.

I mentioned our five nanoscience centers. When they are all up and running by 2008, we'll have a suite of discovery centers unmatched by anything in the world. Each is connected to a major light or neutron source, allowing researches to literally see, move, and create at the atomic level. This is allowing design of nanoparticles that deliver medicines to specific cellular sites, such as cancer cells. I'm told they hope to develop materials that will self-repair stress cracks and other results of fatigue that can be used in aircraft and automobiles.

Our basic research has, of course, touched virtually every aspect of energy resources, production, waste, and storage. Examples include: High-energy lithium batteries, now in common use; non-brittle ceramics now used in engine turbines; and catalysts for more energy efficient processes in the chemical industry.

We are also exploring the most basic questions about the nature of our universe. Office of Science researchers from Lawrence Berkeley National Laboratory found that the expansion of the universe is being accelerated by a previously undiscovered force we are calling "Dark Energy", and at Brookhaven we recently re-created a state of matter comparable to that which existed a microsecond after the big bang nearly14 billion years ago in order to study the early evolution of the universe.

There is much more, of course. Our computers have given us greater technical confidence that fusion power could work; our combustion researchers are running diesel engines in their labs to boost efficiency and reduce emissions; and our labs are looking at revolutionary ways to store and move electricity.

In all these areas, and many others, the physical sciences are delivering clear and broad benefits to the nation. Still, the fruits of basic research are often hard to quantify because they are only realized over many years, sometimes decades. So all of us have to continue to make the case for fundamental research.

If we do that, perhaps in 20 to 30 years my successor can come before this Committee and explain how the investments we made today have ultimately paid off. What might that Secretary of Energy say?

I would hope he or she could say that after successful completion of the ITER experiment, we are now ready to consider construction of a demonstration fusion power plant to deliver electric power to the grid; that the materials discovered by our nanoscience centers have made hydrogen storage a breeze, automobiles extraordinarily light, yet incredibly stronger, and engines with virtually no friction.

The Secretary might report that the end of our environmental clean-up program is in sight due to the appetite for waste of genetically modified microbes at work at contaminated sites around the nation. And this Committee might hear of climate modeling on incredibly advanced supercomputers that has resolved a host of climate mysteries and now let us predict hurricanes weeks in advance.

This is just speculation of course. But given what DOE science has accomplished over the last decades, it may even be a conservative look at our future.
Thank you again Mr. Chairman for inviting me to testify today. I would be pleased to take your questions.