BROOKHAVEN NATIONAL LABORATORY

Laboratory Link

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Two Prestigious Awards

- The Laboratory takes great pleasure in announcing the following honor awarded to two very talented members of our staff:
- Dr. Praveen Chaudhari, our new Laboratory Director, and Dr. Joanna Fowler, Senior Chemist, were chosen to become members of the National Academy of Sciences. Their election to the Academy recognizes their distinguished and continuing work in science.
- Membership of this august body is considered one of the highest honors that can be given to a U.S. scientist or engineer. Abraham Lincoln established the Academy in 1863 by a congressional act of incorporation; he called on them to act as an official adviser to the federal government, when requested, in any matter of science or technology.

Microbeam Radiation Therapy

- Despite considerable recent progress in radiation therapy, treating brain tumors with radiation often causes painful and dangerous side effects due to the damage done to normal brain tissue. But scientists working at the National Synchrotron Light Source at Brookhaven Lab are developing a promising radiation technique that destroys tumors in animals, while leaving normal tissues uninjured.
- This method, called microbeam radiation therapy (MRT), preferentially kills tumors, partly by damaging the unusual type of blood vessels in the tumor.
- The therapy has not yet been tested in humans and it is some years away from being used for treatment, but the results are encouraging. MRT has been proven very effective in treating certain kinds of tumors in the brains of rats, but caused very little harm to nearby normal brain tissue. Results support the idea that MRT could control a brain cancer while having few unwanted side effects.

Two Steps Are Better Than One

- Brookhaven chemist Hua-Gen Yu thought up a new way to speed up computer calculations of how molecules rotate and vibrate. His work promises to give us new insights into the composition of greenhouse gases and the inner workings of the process of burning.
- He worked out the method, called the two-layer Lanczos algorithm, by ingeniously altering a well-known method introduced in 1956. He then successfully used it to study methane and formaldehyde.
- "This new set of rules (algorithm) is not only faster than other methods, but it also reduces the amount of memory required in the computer, " Yu says. "So these features allow us to accurately and precisely study molecules with five or more atoms."
- The scientists have applied the method to formaldehyde, confirming previous results, but their calculations were performed in 2.5 hours, or ten times faster than by using standard methods.

Hua-Gen Yu

(over)

Running as Fast as Radicals

- A team of scientists led by Brookhaven Lab's chemist Christopher Fockenberg built an apparatus that can detect the products of chemical reactions as they are formed. These reactions involve radicals that are highly reactive molecules present when fossil fuels are burnt.
- "Studying the reactions between radicals is challenging," Fockenberg says, "because more reactions occur, and products are formed than expected from the first reaction. Now, we can detect even 'unexpected' products with a speed never achieved before."
- With their apparatus, Fockenberg and his colleagues identified the reactants and products when methyl radicals were exposed to oxygen atoms. To their surprise, the scientists noticed that not only formaldehyde and hydrogen atoms were formed, but also there was a notable amount of carbon monoxide with hydrogen molecules and atoms.
- The researchers next plan to investigate reactions with other radicals, which may help them to invent ways to lower atmospheric pollutants.

Probing Electron Transfer Between Molecules

Marshall Newton

- To build electronic devices- such as switches and transistors - out of molecular materials, scientists need to know how electrons are transferred between molecules. "Scientists have long realized that single molecules might very well be made to perform the basic functions of electronic-circuit elements," says theoretical chemist Marshall Newton. "So we need to know how to control the flow of electrons between molecules."
- Newton and his co-workers, John Smalley and Stephen Feldberg, created small devices, each composed of a gold electrode, a bridge, and acceptor molecules made of either ferrocene or ruthenium.
- By looking at how electrons are transferred between the electrode and the molecular acceptors, the scientists were surprised to notice that, for small bridges, the speed of movement of the electrons inside the bridge reached a limit.
- "Very small (nanometer-sized) molecular structures are made of 'bundles' of molecules, so it is challenging to understand how electrons move around them," Newton says. "What we found shows that we still need a better understanding of electron flow before we can build the basic circuit elements needed for a molecular electronic device."

Upcoming Events Open to the Public

Oliver Sacks to speak on "Creativity and the Brain," at 4 p.m. on June 4, Berkner Hall. World-renowned neurologist, humanist, and best-selling author, Oliver Sacks received his medical degree from the Oxford University in 1958. In the early 1960's, he moved to the U.S. He will sign his books, which include *Awakenings*, *The Man Who Mistook His Wife for a Hat,* and *Uncle Tungsten: Memories of a Chemical Boyhood*, after his talk. Free.

Due to heightened security, everyone16 and older who enters the Laboratory site must have a photo ID.