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If You Build It: Ultrafast, Ultra-rare Instrument Will Probe Building Blocks of Life

MOSCOW, Idaho – The University of Idaho soon will build – from scratch – a piece of research equipment so rare that only a few dozen exist in the entire world.

Thanks to a National Science Foundation equipment grant totaling $710,000, scientists are purchasing components to build an ultrafast infrared spectrometer. At the heart of the machine is a laser that creates bursts of light pulses one-ten-trillionth of a second long capable of probing the most fundamental characteristics of molecules.

“The individual components of the spectrometer are commercially available, but the assembled machine is not,” said Eric Brauns, professor of chemistry at the University of Idaho, who acquired the grant and will build the device over the next few years. “Putting the pieces together and making them do what we want is unique enough that there are probably less than 50 research groups using a piece of equipment like this.”

Though other scientists have constructed similar instruments, the blueprints are not set in stone, and that leaves plenty of room for improvement by incorporating new ideas and features.

The innovation comes in during a series of optical components that the laser must pass through to create high-powered pulses one-ten-trillionth of a second long; a time period so short that light travels only the width of a human hair within it. Researchers will take laser pulses from different points in this process to allow several variations of the laser to be used for a multitude of different experiments. In effect, the instrument will produce ultrafast pulses tunable from ultraviolet to mid-infrared wavelengths.

“It makes the instrument very versatile,” said Brauns, who is one of several chemistry professors at the University of Idaho already planning on using the instrument.

Tom Bitterwolf will study the ultrafast photochemistry of inorganic compounds, Peter Griffiths plans to study the interaction of mid-infrared photons with diffusely scattering media and Richard Williams will investigate homoaromatic organic compounds.

But first, Brauns must build the instrument and take the first crack at using it. Brauns plans to study the structure of RNA, the cousin of DNA responsible for making proteins.

To do this, he will heat an RNA solution with a short laser pulse – in much the same way that a microwave oven heats food but in an ultra short time frame – to cause the RNA to unfold. As the RNA returns to its original state, the new spectrometer will zap it with a series of infrared laser pulses in a matter of ten-trillionths of a second. The interactions of these pulses will generate a fourth pulse that, when observed, will reveal information about the RNA’s structure.

“Nobody has studied RNA and nucleic acids with this technique yet,” said Brauns. “It allows you to begin to characterize intermediates in the RNA folding process; something that we currently don’t have a way to do. But this is a technique that opens up that possibility.”

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About the University of Idaho

Founded in 1889, the University of Idaho is the state’s flagship higher-education institution and its principal graduate education and research university, bringing insight and innovation to the state, the nation and the world. University researchers attract nearly $100 million in research grants and contracts each year; the University of Idaho is the only institution in the state to earn the prestigious Carnegie Foundation ranking for high research activity. The university’s student population includes first-generation college students and ethnically diverse scholars. Offering more than 150 degree options in 10 colleges, the university combines the strengths of a large university with the intimacy of small learning communities. For information, visit *www.uidaho.edu*.