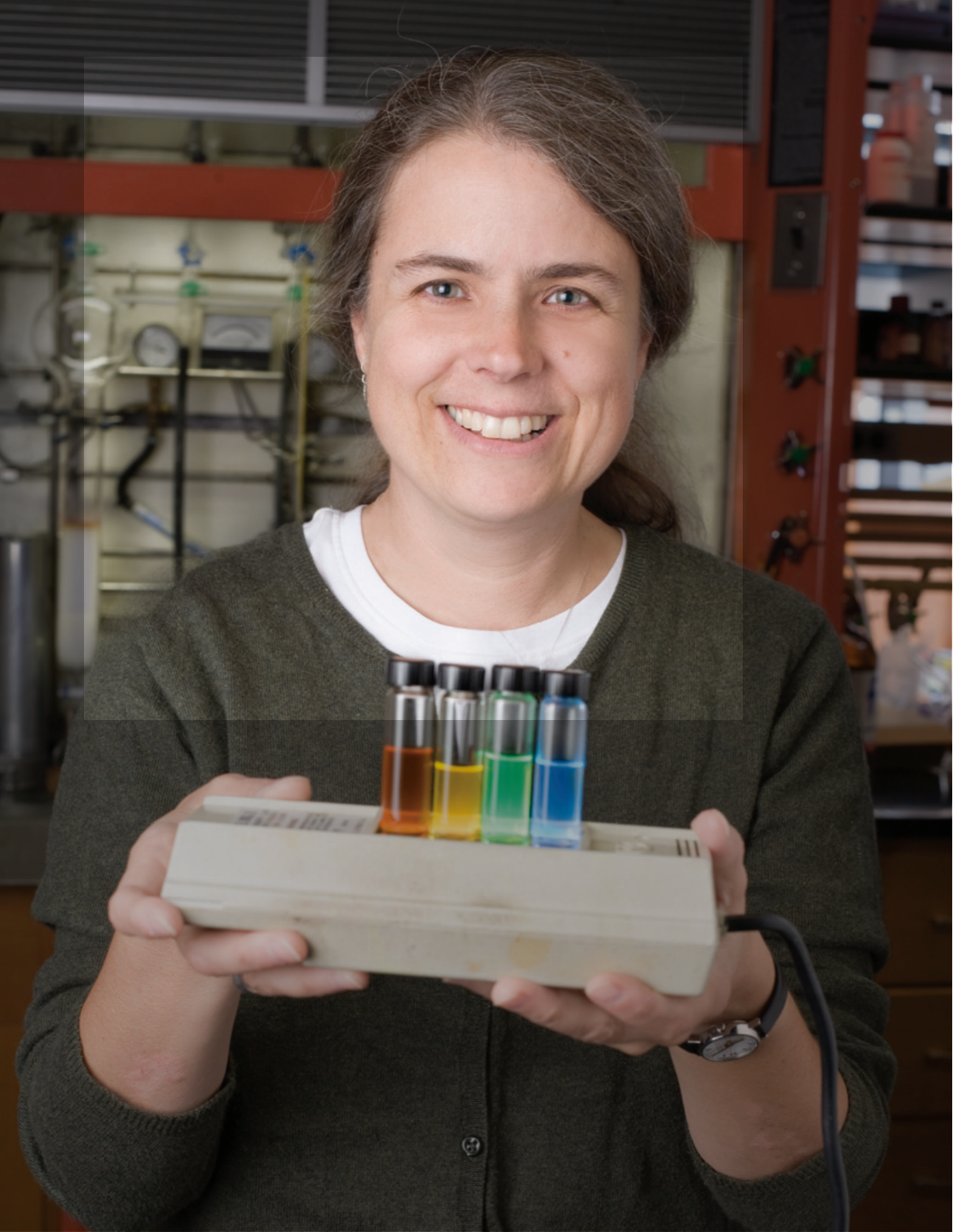

Photo by Jackson Smith

MY BREAKTHROUGH IS

ENHANCING BIOMEDICAL IMAGING THROUGH SUSTAINABLE DESIGN

CASSANDRA L. FRASER, PH.D.

CHEMISTRY

"When you think of metal, you probably think of a hunk of metal," says Cassandra L. Fraser, Ph.D. "But there are metal compounds everywhere in nature — giving color and luminescence and serving as catalysts for enzymes throughout the natural world."

A professor of chemistry at U.Va., Fraser is now harnessing these properties and many others through the controlled synthesis of what she calls "polymeric metal complexes." Bio-inspired and often composed of sustainable materials, many of these metallopolymers are designed to be "greener" and more biocompatible than existing materials with similar properties.

Together with graduate students Guoqing Zhang and Jianbin Chen, Fraser has developed one class of biomaterials with the potential to impact imaging techniques useful in many areas of biomedical research, including cancer, diabetes and cardiovascular research. The U.Va. Patent Foundation has filed a U.S. patent application on these new materials — which combine a boron dye with poly(lactic acid), a polymer derived from corn that is common in medical and sustainable packaging applications.

The novel materials exhibit several visually stunning and useful optical properties, including phosphorescence — visualized as an afterglow following exposure to ultraviolet (UV) light — that exists at room temperature and is extinguished in the presence of oxygen. Fraser's team is also able to fine-tune the polymers' colorful displays across the spectrum. Together, these properties enable the polymers to serve as powerful optical imaging agents that could aid scientists in visualizing cellular and physiological processes and identifying tissues with low levels of oxygen, as in tumors and vascular blockages. In addition, while traditional dyes can degrade after being exposed to a microscope's UV light, this class of polymers retains its brightness and therefore utility. It has served as a successful imaging agent in cells, in tissues and *in vivo*.

"There is a lot of potential for biomaterials that exist at the interface of biomedicine and sustainable design," Fraser says. "If we continue to explore areas that are fertile for new discoveries and technologies, sometimes things come together in exciting and surprising ways."