

APPLIED //

REDISCOVERING HEMP

New Materials, Manufactured Products
and Therapeutics

THROUGH MUCH OF RECORDED HISTORY, THE HEMP PLANT

was recognized as a sustainable, renewable resource with myriad practical applications. Its fibers are strong, resilient and possess unique chemical properties; its seeds and leaves are nutritious; and parts of the plant have medicinal benefits. However, for more than 50 years, its use in the United States was severely restricted by policymakers who equated all hemp products with just one: marijuana.

That situation has changed over the past decade. Today, most restrictions on hemp have been lifted, and states are legalizing marijuana and its by-products for medicinal or recreational purposes. That evolution has been driven by three factors: growing consumer demand for products created from renewable resources; better understanding of the hemp plant's complete physical and chemical composition; and expanding awareness of the known and potential medical uses of cannabinoids (including the fact that the human body not only uses cannabinoids but also manufactures its own).





Ron Kander, PhD, and student Natalie Burgos combine hemp hurd with biodegradable polymers in a laboratory-scale ejection molding machine to make hemp-reinforced polymer composites.



Mark Sunderland '84, M'06, and Michael Savarie '19 are evaluating material properties of Nano-film made from hemp flower extract to determine bio-test sequencing.



The basic and applied research associated with the engineered industrial and consumer products of the hemp initiative has been strategically guided by **Ronald Kander, PhD**, Executive Dean of Kanbar College of Design, Engineering and Commerce, whose research focuses include composite materials and sustainable manufacturing processes. "Since 2017," explains Dr. Kander, "Jefferson researchers have been pursuing four integrated goals: advancing basic scientific knowledge about hemp and its components; exploring where hemp could be a cheaper or more effective raw

material for existing products; conceiving and creating wholly new biomedical and manufactured products; and defining markets and sustainable supply chains for those products."

Toward those goals, Jefferson's hemp-focused research ranges from basic and translational science and clinical trials to industry-sponsored ideation and product development. It engages dozens of departments across the University, from engineering and textile design to chemistry and surgery. Here we highlight two facets of the growing program.

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Manufactured Hemp

A collaborative research and development team—including Dr. Kander; **Mark Sunderland, MS**, Robert J. Reichlin High-Performance Apparel Chair; **Brian George, PhD**, associate professor of engineering and textile; and several colleagues—have been exploring and applying many of hemp’s absorptive, antimicrobial, electrical and mechanical characteristics. The team’s efforts have led to the development of a unique, environmentally sustainable method for processing hemp—one that creates new fibers and textiles using the whole plant—that could soon be the basis for an array of high-performance manufactured products with unique characteristics. Those products could include, for example, hospital gowns and working surfaces that are resistant to staph infection and the MRSA virus, and lighter, more durable yoga mats and blocks. One line of products is now being commercialized under the name Hemp Black.

Michael Leonard, MS Ed, MA Ed, Academic Dean of the School of Design and Engineering, is a scholar and practitioner of Industrial Design. He and his colleagues are guiding a broad array of student-driven research and development projects focused on hemp. Some concentrate on the development of consumer products, such as kitchen surfacing that leverages hemp’s antimicrobial qualities, dog-calming chew toys made of CBD oil-infused hemp hurd (what remains after the fibers are removed from a stalk) or biodegradable 3D-printed seed starters. Dean Leonard and his colleagues are collaborating with a team led by non-woven materials expert Brian George. But they also explore the other end of the spectrum, asking questions such as, “Can we design equipment that reduces the steps involved in harvesting the plants and collecting their oils?”

Medicinal Cannabis

Jefferson’s Lambert Center for the Study of Medicinal Cannabis and Hemp is a nexus for cross-disciplinary, multicenter and multinational research on the use of cannabinoid-based therapies. It also provides evidence-based information on medical uses of cannabinoid-based products to clinicians and patients. The Lambert Center provided support to Jefferson’s hemp initiatives and is currently supporting several ongoing internal and external observational and pre-clinical research projects. Future plans include supporting more extensive research projects, with several already under development.

The Lambert Center and the **Institute for Emerging Health Professions** (IEHP, which is housed in the Jefferson College of Health Professions) launched three online graduate certificate programs in Cannabis Medicine, Cannabinoid Pharmacology and Cannabinoid Chemistry and Toxicology. IEHP plans to develop one of the nation’s first master’s degrees in medicinal cannabis. In addition, the Center is working with researchers and clinicians across Jefferson on research projects addressing multiple areas, ranging from study design and development of clinical data to the impact of medicinal cannabis on key patient populations.

In parallel with those projects, the **Department of Rehabilitation Medicine** is pursuing two current studies. One project begins to address the dearth of evidence on the long-term effects of marijuana use by identifying health and functional variables that are most (and least) influenced. It will monitor physical health, cognitive function, quality of life and day-to-day function of three study groups: persons who currently use cannabis, those who used it previously but not currently, and those who never used it. Beyond the basic knowledge it will produce, the project will also provide a basis for outcome metrics that can be applied to clinical trials on cannabis-based therapeutics.

The second project addresses patients’ perspectives, experiences and knowledge of cannabis. Among many uses, its findings will support development of patient and caregiver educational programs that counter broadly held inaccuracies. ■