The Laboratory Directed Research and Development (LDRD) program at Oak Ridge National Laboratory (ORNL) funds creative and innovative R&D that advances the Laboratory’s capabilities and strengthens its scientific and technical leadership.

In accordance with US Department of Energy (DOE) requirements, LDRD projects support the following goals:

- Maintain the scientific and technical vitality of the Laboratory
- Enhance the Laboratory’s ability to address current and future DOE missions
- Foster creativity and stimulate exploration of forefront areas of science and technology
- Serve as a proving ground for new concepts in R&D
- Support high-risk, potentially high-value R&D

**Proving Ground for New Concepts**

*Scaling Up Materials Synthesis for Soft Robotics*

Equipped with LDRD funding and world-class nanoscience capabilities, ORNL researchers developed a scalable new method to produce a film material that can be used as a muscle-like actuator in soft robotics. When an electric field is applied, the material quickly and reversibly contracts at a force comparable to muscular tissue. The team’s method incorporates single-walled carbon nanotubes into a longtime candidate for morphable mechanical devices based on liquid crystal elastomers (LCEs). Current LCE devices require complicated, expensive control systems, but the nano-based LCE is less expensive, scalable, and can be tuned using widely available electrical inputs.

**High-Value R&D**

*Big Milestones in 3D Printing*

Before ORNL and partners 3D-printed a car in 2014, followed by a 200-square-foot house and an advanced nuclear reactor core, researchers used LDRD funds for the initial exploration and development of their Big Area Additive Manufacturing (BAAM) machine—a first in the field of advanced manufacturing. The BAAM was co-created with partner Cincinnati Inc. and secured subsequent funding from DOE’s Advanced Manufacturing Office, contributing to the growth of ORNL’s advanced manufacturing capabilities.

“LDRD investments are enabling us to develop a ‘One ORNL’ ecosystem that will connect computing, scientific instruments, and edge devices across science domains to facilitate new innovations not possible with current technology.”

**Ben Mintz, Initiative Lead for Foundational Computing, Math, and AI at Extreme Scale**
Addressing DOE Missions

Rapid COVID-19 Research

As the coronavirus pandemic and response escalated in the United States in March 2020, ORNL rapidly released LDRD funds for COVID-19 research. Nine projects addressed critical areas of national need, such as epidemic modeling, insight into virus properties and drug interactions, and the manufacture of personal protective equipment. In one project, analyses of lung fluid cells from COVID-19 patients conducted on the nation’s fastest supercomputer at ORNL indicated that bradykinin—the compound that dilates blood vessels and makes them permeable—is overproduced in patients and could explain the runaway symptoms observed in response to the virus.

Funding Opportunities Through LDRD

To meet LDRD goals, ORNL manages four complementary programs within LDRD. Two programs are focused on funding projects of strategic importance with high potential, and two programs are focused on recruiting and funding strategic hires and early-career fellows.

Director’s R&D Fund
Develops new capabilities in support of the Laboratory’s science and technology initiatives.

Seed Fund
Supports innovative ideas that have the potential for enhancing the Laboratory’s core scientific and technical capabilities and addresses emerging sponsor priorities and needs.

Strategic Hire Fund
Adds critical skills to the Laboratory by hiring established researchers who are well qualified for leading research programs with expertise critical for responding to evolving new programs, capable of developing substantial programs, and able to take organizational leadership roles that support ORNL’s primary initiative areas, strengthen Laboratory core capabilities, or develop new program directions.

Distinguished Staff Fellowship Fund
Allows the Laboratory to hire exceptional early-career scientists to refresh and expand its scientific and technical expertise.