The Lasker Awards, among the most respected prizes in medicine, will go to six researchers who made major discoveries in physiology and virology, and to a scientist who has tirelessly promoted science education, the Albert and Mary Lasker Foundation announced on Tuesday.

The awards, honoring basic medical research, clinical research and special achievement, each come with a $250,000 prize and a nice omen: 87 Lasker laureates have also won Nobel Prizes.

This year’s awards speak to the additive nature of scientific research, with both the basic and clinical research prizes recognizing scientists who worked independently of one another but who built on one another’s findings, said Joseph L. Goldstein, chairman of the awards jury.

Three physician-scientists — William G. Kaelin Jr., Peter J. Ratcliffe and Gregg L. Semenza — shared the Albert Lasker Basic Medical Research Award for elucidating the cellular path by which almost all animals respond to variations in oxygen.

In the late 1980s, Dr. Semenza, a pediatric geneticist at Johns Hopkins, and Dr. Ratcliffe, a kidney specialist at Oxford, began independently researching how oxygen
deprivation, or hypoxia, prompts the production of a hormone that elicits red blood cell production to combat it.

Their work eventually led to the discovery of a protein, HIF-1, that showed up only when oxygen was scarce and that activated many genes as part of a large, interwoven physiological response to oxygen.

Nobody understood what caused the HIF-1 protein to change with oxygen availability until Dr. Kaelin, a cancer specialist at the Dana-Farber/Harvard Cancer Center in Boston, started studying a rare genetic syndrome.

The syndrome, Von Hippel-Lindau disease, or VHL, is characterized by tumors made of newly formed blood vessels. Those tumors “were behaving like they were constantly starved of oxygen,” Dr. Kaelin said.

In the mid-1990s, Dr. Kaelin found that the VHL protein helps remove hypoxia-related compounds from cells when oxygen is abundant. Dr. Ratcliffe then linked VHL to the disappearance of HIF-1 in rich oxygen conditions.

Researchers have since found that HIF-1 and related proteins factor into many biological processes and medical conditions. “When we started, we were focused on one gene,” Dr. Semenza said. “Now, there are thousands.”

Several companies are conducting late-phase trials on anemia treatments that activate HIF to produce red blood cells. Other researchers are looking into treatments for cardiovascular disease and certain cancers.

“I don’t think any of us ever thought the system might be a ‘classical’ drug target,” Dr. Ratcliffe said. “So it was really exciting to discover the potential consequences.”

The Lasker-DeBakey Clinical Medical Research Award went to Ralf F. W. Bartenschlager and Charles M. Rice for creating a system to replicate the hepatitis C virus, or HCV, in the laboratory, and to Michael J. Sofia for using this system to develop a potent and safe new drug to treat the debilitating disease.
Hepatitis C causes chronic liver infection in as many as 170 million people worldwide and results in more than 350,000 deaths each year. Untreated, the virus leads to liver failure or cancer in 15 percent to 30 percent of cases.

Dr. Bartenschlager, a virologist at the University of Heidelberg in Germany, and Dr. Rice, a virologist at Rockefeller University in New York, started researching hepatitis C in 1989, after scientists first sequenced the genome of the virus.

At the time, researchers thought the work might be as simple as inserting that newly sequenced RNA into cultured cells and watching it replicate. But in experiment after experiment, this approach failed.

“If you don’t have a virus that replicates in culture, it becomes very difficult to study,” Dr. Rice said. He and his colleagues, then at Washington University in St. Louis, wondered if the original genome sequence lacked some pieces.

Dr. Rice and a team of Japanese scientists independently discovered that it did. But it took Dr. Bartenschlager, working at the University of Mainz in Germany, to find a way to efficiently replicate the virus in cells in the lab.

This allowed pharmaceutical researchers to test their theories in the drug discovery process. One such researcher was Dr. Sofia, chief scientific officer at the pharmaceutical company Arbutus Biopharma.

In 2005, Dr. Sofia had just joined another company, called Pharmasset, which wanted to create a new hepatitis C drug. Previous investigators had developed a chemical that blocked the virus’s RNA-copying machinery, but their compound was not very potent.

Dr. Sofia found a creative solution to this problem. He created a “slippery” coat for the compound that allowed it to easily enter liver cells. Once in the liver, metabolic enzymes converted the compound into an active drug. In this process, the enzymes also stripped off the compound’s coat, preventing it from traveling back out of the liver and into other cells.

“This allowed us to provide very high concentrations of the drug in the liver, where it needed to be,” Dr. Sofia said, “and also reduced the chance of side effects on
other organs.”

His work led to the development of a new oral drug, sofosbuvir, capable of long-term HCV eradication without severe side effects. The first sofosbuvir regimen, Sovaldi, was approved by the Food and Drug Administration in 2013. Since then, several others have come out. One, Harvoni, has cure rates of 94 percent to 99 percent in only eight to 12 weeks of therapy, even for recalcitrant HCV cases.

“I think this is probably the biggest success we’ve ever had in the antiviral therapy area,” Dr. Bartenschlager said, though he noted that the high cost of the drugs prevent them from having a global impact.

Bruce M. Alberts, a biochemist at the University of California, San Francisco, received the Lasker-Koshland Award for Special Achievement in Medical Science for his contributions to molecular biology and his indefatigable advocacy for public science education.

Throughout the 1970s, Dr. Alberts investigated DNA synthesis and made fundamental discoveries about the machinery that cells use to carry out physiological processes.

In 1983, he and several co-authors published a groundbreaking textbook, “Molecular Biology of the Cell,” which is in its sixth edition and has been translated into 11 languages. The team took an unconventional approach to textbook writing by having experts and novices in different specialties work together to produce chapters.

Dr. Alberts has long championed science education that trains students to use evidence and logic, and that teaches them how to work through issues with more than one right answer, as opposed to memorizing facts for a test.

“The fundamental purpose of science education is not to produce more scientists — that’s one function — but to foster scientific thinking skills and values in everyone,” he said.

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