

# Three win Nobel Prize for showing how cells sense low oxygen

October 7 2019, by Malcolm Ritter and Maria Cheng

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Professor Gregg Semenza, accompanied by Johns Hopkins University President Ron Daniels, waves to the crowd during a news conference after he was awarded the 2019 Nobel Prize in Medicine at Johns Hopkins Medicine Hospital in Baltimore, Md., Monday, Oct. 7, 2019. The 2019 Nobel Prize in Medicine has been jointly awarded to William Kaelin Jr., Sir Peter Ratcliffe and Gregg Semenza for their pioneering research into how human cells respond to changing oxygen levels. (AP Photo/Jose Luis Magana)

Two Americans and a British scientist [won a Nobel Prize on Monday](#) for discovering details of how the body's cells sense and react to low oxygen levels, providing a foothold for developing new treatments for anemia, cancer and other diseases.

Drs. William G. Kaelin Jr. of Harvard Medical School and the Dana-Farber Cancer Institute, Gregg L. Semenza of Johns Hopkins University and Peter J. Ratcliffe at the Francis Crick Institute in Britain and Oxford University won the prize for advances in physiology or medicine.

The scientists, who worked largely independently, will share the 9 million kronor (\$918,000) cash award, said the Karolinska Institute in Stockholm.

They "revealed the mechanism for one of life's most essential adaptive processes," the Nobel committee said.

Cells can encounter lowered oxygen not only from situations like living at high altitudes, but also from things like a wound that interferes with local blood supply. Their response triggers reactions that include producing red blood cells, generating new blood vessels and fine-tuning the immune system.

The Nobel committee said scientists are focused on developing drugs that can treat diseases by either activating or suppressing the oxygen-sensing machinery. Such manipulation could help in attacking cancer cells, experts said.



William G. Kaelin Jr. stands with his son, Tripp, at a news conference, Monday, Oct. 7, 2019, in Boston, after he was awarded the Nobel Prize for Physiology or Medicine. Kaelin, who teaches at Harvard Medical School, shares the prize with Peter J. Ratcliffe and Gregg L. Semenza for their discoveries of how cells sense and adapt to oxygen availability, the Nobel Committee announced Monday. (AP Photo/Elise Amendola)

Another payoff is pills to boost production of red blood cells in anemia, which can appear in people with chronic kidney disease. One such drug has been approved in China and Japan and a filing for approval in the U.S. is expected soon, Kaelin said.

Still other potential targets include heart attack and stroke, and a condition of reduced blood flow in the limbs that can lead to amputation,



the researchers said.

Kaelin, 61, said he was half-asleep when the phone rang Monday morning with the news of his award.

"I don't usually get phone calls at 5:00 in the morning, so, naturally, my heart started racing and I could see the call was from Stockholm," he said. "And so I think at that point I almost had an out-of-body type of experience."

Kaelin is paid by the Howard Hughes Medical Institute, which also supports AP's Health and Science department.



William G. Kaelin Jr. holds a model of his work as he speaks at a news conference, Monday, Oct. 7, 2019, in Boston, after he was awarded the Nobel

Prize for Physiology or Medicine. Kaelin, who teaches at Harvard Medical School, shares the prize with Peter J. Ratcliffe and Gregg L. Semenza for their discoveries of how cells sense and adapt to oxygen availability, the Nobel Committee announced Monday. (AP Photo/Elise Amendola)

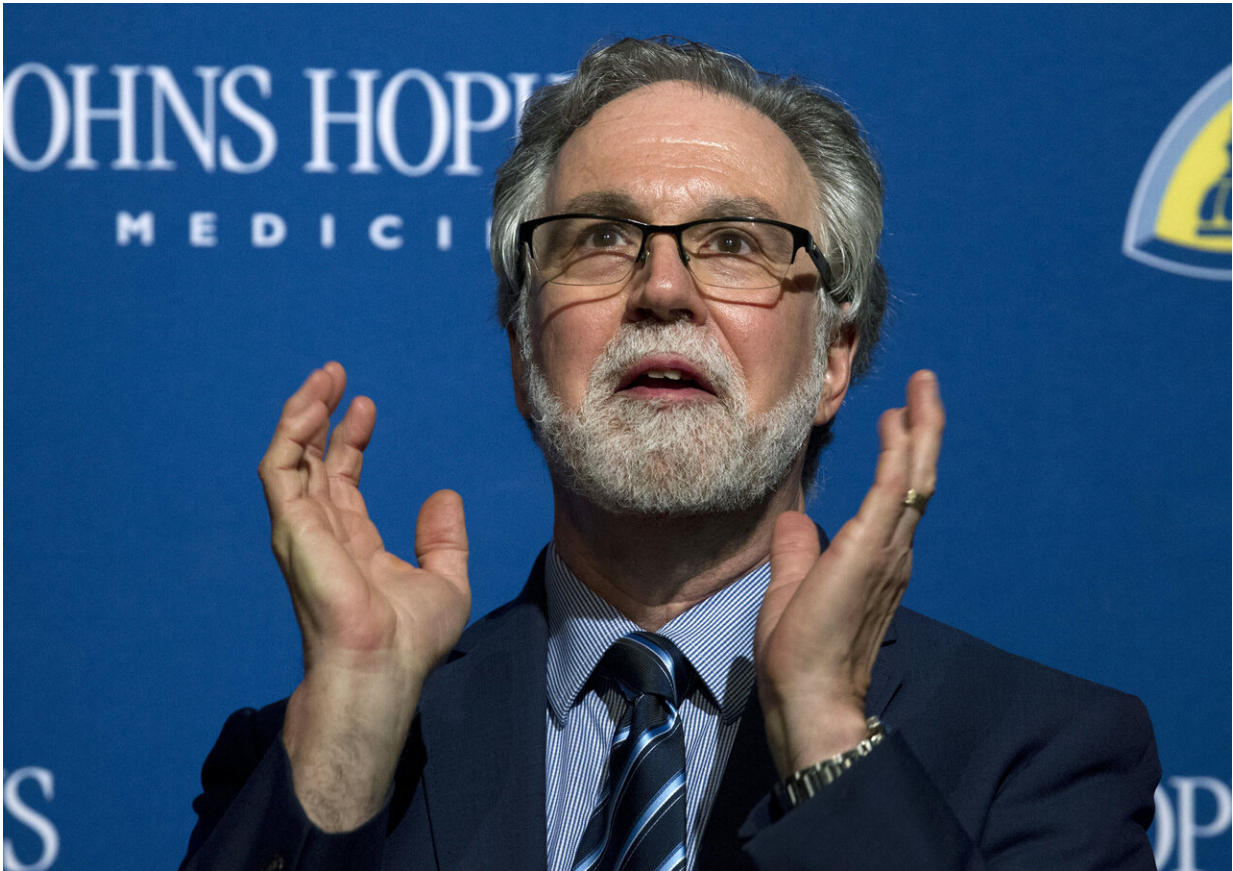
Ratcliffe, 65, said he learned the news after he was summoned out of a meeting this morning by his secretary, who had "a look of urgency."

Trained as a kidney specialist, Ratcliffe said his research began when he and colleagues simply wanted to figure out how cells sense oxygen.

"I thought it was a definable problem and just thought we'd find out how it worked," he said. It was about two years into their research program, which began in 1990, that they realized the discovery had much wider significance, Ratcliffe said.

"We saw that it wasn't just cells in the kidney that know how to sense oxygen, but all cells in the body. ... There are hundreds and thousands of processes the body uses to adapt to and regulate its oxygen levels."

He said while some promising drugs have been developed, it will be years before it's clear whether such discoveries are going to change the lives of tens of thousands.



Professor Gregg Semenza speaks during a news conference after he was awarded the 2019 Nobel Prize for Physiology or Medicine at Johns Hopkins Medicine Hospital in Baltimore, Monday, Oct. 7, 2019. Semenza shares the prize with Drs. William G. Kaelin Jr. and Peter J. Ratcliffe for their discoveries of how cells sense and adapt to oxygen availability, the Nobel Committee announced Monday. (AP Photo/Jose Luis Magana)

In Baltimore, Semenza, 63, said he slept through the Nobel committee's initial phone call. "By the time I got to the phone it was too late," he said. He went back to sleep but was able to answer the second call from Stockholm.

He said kidney cancer may be the first malignancy in which a drug based



on the prize-winning work might make chemotherapy more effective, and that he hopes many other cancers will follow.

Speaking at a news conference at Johns Hopkins University's School of Medicine, Semenza paid tribute to his biology teacher, Rose Nelson, at Sleepy Hollow High School in Sleepy Hollow, N.Y., for inspiring his pursuit of medicine.

"She used to say, 'Now when you win your Nobel Prize, I don't want you to forget that you learned that here,'" he said. "It's my great sadness that she is not still alive to share the moment because I know it would have meant a lot to her. She was my inspiration."



William G. Kaelin Jr. speaks at a news conference, Monday, Oct. 7, 2019, in Boston, after he was awarded the Nobel Prize for Physiology or Medicine.

Kaelin, who teaches at Harvard Medical School, shares the prize with Peter J. Ratcliffe and Gregg L. Semenza for their discoveries of how cells sense and adapt to oxygen availability, the Nobel Committee announced Monday. (AP Photo/Elise Amendola)

"That's the importance of teachers," he added. "To make that kind of spark."

Steven McKnight of the UT Southwestern Medical Center in Dallas noted that the process discovered by the three researchers is widespread in the animal kingdom, found even in the worm. He said the honored work is "of a heroic nature."

Last year, James Allison of the United States and Tasuku Honjo of Japan won the 2018 Nobel Prize for Medicine for their work in immunotherapy, activating the body's natural defense system to fight tumors.

Monday's announcement kicked off this year's Nobel Prizes. The physics prize will be handed out Tuesday, followed by the chemistry prize on Wednesday. This year there is a double-header for the Nobel Literature Prize—one each for 2018 and 2019—which will be awarded Thursday. The Peace Prize will be announced on Friday.





Scientist Peter J. Ratcliffe poses for photos in the laboratory at the University in Oxford, England, Monday, Oct. 7, 2019. Two Americans and a British scientist won the 2019 Nobel Prize for Physiology or Medicine for discovering how the body's cells sense and react to oxygen levels, work that has paved the way for new strategies to fight anemia, cancer and other diseases. Drs. William G. Kaelin Jr. of Harvard University, Gregg L. Semenza of Johns Hopkins University and Peter J. Ratcliffe at the Francis Crick Institute in Britain and Oxford University will share the 9 million kronor (\$918,000) cash award. (AP Photo/Frank Augstein)



Scientist Peter J. Ratcliffe, second from right, celebrates with his team at the University in Oxford, England, Monday, Oct. 7, 2019. Two Americans and a British scientist won the 2019 Nobel Prize for Physiology or Medicine for discovering how the body's cells sense and react to oxygen levels, work that has paved the way for new strategies to fight anemia, cancer and other diseases. Drs. William G. Kaelin Jr. of Harvard University, Gregg L. Semenza of Johns Hopkins University and Peter J. Ratcliffe at the Francis Crick Institute in Britain and Oxford University will share the 9 million kronor (\$918,000) cash award. (AP Photo/Frank Augstein)



William G. Kaelin, Jr. talks to a reporter after being awarded the Nobel Prize for Physiology or Medicine, Monday, Oct. 7, 2019, in Boston. Kaelin, who teaches at Harvard, will share the prize with Peter J. Ratcliffe and Gregg L. Semenza for their discoveries of how cells sense and adapt to oxygen availability, the Nobel Committee announced Monday. (AP Photo/Josh Reynolds)





Thomas Perlmann, far right, Secretary-General of the Nobel Committee announces the 2019 Nobel laureates in Physiology or Medicine during a news conference in Stockholm, Sweden, Monday Oct. 7, 2019. The prize has been awarded to scientists, from left on the screen, Gregg L. Semenza, Peter J. Ratcliffe and William G. Kaelin Jr. receiving the award jointly for their discoveries of "how cells sense and adapt to oxygen availability". (Pontus Lundahl/TT via AP)





Professor Randall Johnson of the Nobel Committee, right, speaks during a news conference in Stockholm, Sweden, Monday Oct. 7, 2019. The 2019 Nobel laureates in Physiology or Medicine has been awarded to scientists Gregg L. Semenza, Peter J. Ratcliffe and William G. Kaelin Jr. receiving the award jointly for their discoveries of "how cells sense and adapt to oxygen availability". (Pontus Lundahl/TT via AP)

The 2018 Nobel Literature prize was suspended after a sex abuse scandal rocked the Swedish Academy, the body that awards the literature prizes, so two prizes are being awarded this year.

The economics prize will be awarded next Monday. Officially known as the Bank of Sweden Prize in Economic Sciences in Memory of Alfred Nobel, it wasn't created by Nobel, but by Riksbanken, Sweden's central

bank, in 1968.

The laureates will receive their awards at elegant ceremonies in Stockholm and Oslo on Dec. 10—the anniversary of Nobel's death in 1896.

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