

Speaker's manuscript – Medicine Prize 2019 How cells adapt to oxygen availability

The Nobel Prize in Physiology or Medicine

- The Nobel Prize in Physiology or Medicine is one of the five prizes founded by Alfred Nobel and awarded on December 10 every year.
- Before Alfred Nobel died on December 10, 1896, he wrote in his will that the largest part of his fortune should be placed in a fund. The yearly interest on this fund would pay for a prize given to "those who, during the preceding year, shall have conferred the greatest benefit to humankind."



Who is rewarded with the Medicine Prize?

- The Nobel Prize in Physiology or Medicine is thus awarded to people who have either made a discovery about how organisms work or have helped find a cure for a disease.
- This is May-Britt Moser, 2014 Nobel Laureate in Medicine. In 2005 she and Edvard Moser discovered a type of cell in the brain that is important for determining one's position. They also found that those cells cooperate with different nerve cells in the brain that help us to navigate. You can say that the Laureates discovered and explained a kind of GPS system in the brain.
- Other Medicine Laureates include: Francis Crick, James Watson and Maurice Wilkins, who received the 1962 Prize for their discoveries and descriptions about the structure of DNA molecules. Alexander Fleming, Ernst Chain and Howard Florey, who received the 1945 Prize for the discovery of penicillin and its curative effects on bacterial diseases.



The 2019 Medicine Prize

- The 2019 Medicine Prize is about what happens in cells if they receive too much or too little oxygen. When the amount of oxygen increases or decreases inside a cell, it must adapt itself.
- The 2019 Nobel Laureates have found out what reactions then occur in the cell, what substances are active and how they affect each other.



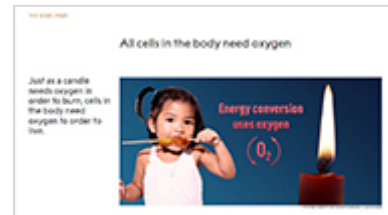
The Nobel Laureates

- The 2019 Nobel Laureates – William G. Kaelin Jr, Sir Peter J. Ratcliffe and Gregg L. Semenza – did their research in the 1990s.
- They contributed various pieces to the puzzle, and as a result we now have a detailed picture of how cells adapt to the body's oxygen supply.



All cells in the body need oxygen

- The body is made up of many billions of cells. Just as a candle needs oxygen in order to burn, each cell needs oxygen in order to live.
- Without oxygen, a cell can't convert food into usable energy. The cell uses this energy to perform many different tasks that are important so that we can function and feel well.
- The reaction in which food is converted into energy is called cellular respiration.



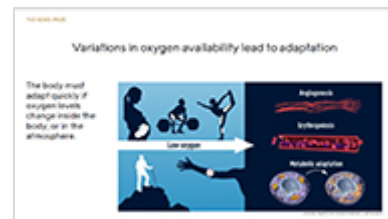
Transporting oxygen through the body

- The red blood cells perform the task of picking up oxygen in the lungs and then transporting it to all the cells in our body.



Variations in oxygen availability lead to adaptation

- Sometimes there are changes in the availability of oxygen to certain cells in the body. For example if you have a wound, blood can't reach all the cells around the wound. Another example is when a muscle is at work. Then it uses more oxygen, because the muscle needs more energy to move.
- When you are at a high altitude, there is less oxygen in the air, which leads to a lower oxygen level in your blood. If so, all cells throughout your body will receive less oxygen. Oxygen sensing is also essential during foetal development – for controlling formation of an unborn baby's blood vessels and placenta development.
- When cells adapt to oxygen availability, this may lead the body to form more red blood cells, slow down respiration or form more blood vessels.



The benefits

- The Laureates' discoveries have given us new knowledge about human physiology – that is, how our organs and tissues function. We now understand better what happens during foetal development, exercise and adaptation to high altitudes. We know more about how our metabolism and immune systems are affected by oxygen availability.
- The Laureates' discoveries have also increased our knowledge about diseases, for example anaemia and cancer. Hopefully this will enable us to develop new medicines.



"We make knowledge. That's what I do."

- Right after the 2019 Prize announcement one of the Laureates, Sir Peter J. Ratcliff, was interviewed. He talked about the importance of basic research: research that is pursued without any objective other than gaining new knowledge. Sir Peter believes that a researcher doesn't always know – or need to know – what benefits this new knowledge may lead to.
- Basic research enables us to increase our collective knowledge. This often eventually leads to new applications, such as new medicines.

