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BEST COLLEGE AWARD - UNIVERSITY OF MUMBAI

2nd January 2020

Volume 1

GULMOHAR – BOTANY NEWSLETTER

GULMOHAR

FROM THE EDITOR'S DESK

A warm welcome to our 1st edition . In this edition we have tried to publish some beautiful photographs captured by the students.

Do you know how cells sense and adapt to oxygen availability ? If you don't know , you will get the answer here .This research has won the Nobel prize recently . You also get to know about a new study related to fungus and bacteria. We have also put an article about the vertical wall garden which has been newly made in college garden . We have also tried to put up job and recruitment details for the students. Last but not the least ,don't forget to check out the photo gallery section which shows amazing photography skills of the students. HAPPY READING!

- Sneha Nair
  TYBSc

Discovering how cells sense and adapt to oxygen availability

Nobel Prize in Medicine 2019 has been jointly awarded to William G. Kaelin Jr., Sir Peter J. Ratcliffe and Gregg L. Semenza for their work in discovering how cells adapt to varying oxygen levels. They discovered how the cells can sense and adapt to changing oxygen availability. They had identified molecular machinery that regulates the activity of genes in response to varying oxygen levels. The discoveries revealed the mechanism for one of life's most essential adaptive processes. They established the foundation of understanding how oxygen levels affect cellular metabolism and physiological function. Though the fundamental importance of oxygen has been relayed for centuries, how cells adapt to changes in levels of oxygen has remained unknown. Oxygen is essential to convert food into energy.

Role of oxygen in sustaining life: - Oxygen (O2) makes up about one-fifth of Earth's atmosphere. Oxygen is essential for animal life, it is used by the mitochondria present in virtually all animal cells to convert food into useful energy. During evolution, mechanisms were developed to ensure there was a sufficient supply of oxygen to tissues and cells. The carotid body, which is adjacent to large blood vessels on the sides of the neck, contains special cells that sense the oxygen levels in the blood.

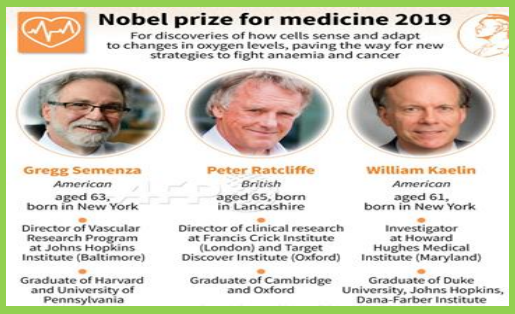
Hypoxia-Inducible Factor (HIF):- In addition to the carotid body-controlled rapid adaptation to low oxygen levels (hypoxia), there are other fundamental physiological adaptations. A key physiological response to hypoxia is the rise in levels of the hormone erythropoietin (EPO), which leads to increased production of red blood cells (erythropoiesis). Gregg Semenza studied the EPO gene and how it is regulated by varying oxygen levels. By using gene-modified mice, specific DNA segments located next to the EPO gene were shown to mediate the response to hypoxia. Sir Peter Ratcliffe also studied O2-dependent regulation of the EPO gene, and both research groups found that the oxygen sensing mechanism was present in virtually all tissues, not only in the kidney cells where EPO is normally produced. These were important findings showing that the mechanism was general and functional in many different cell types. Semenza wished to identify the cellular components mediating this response. In cultured liver cells he discovered a protein complex that binds to the identified DNA segment in an oxygen-dependent manner. He called this complex the hypoxia-inducible factor (HIF) . Extensive efforts to purify the HIF complex began, and in 1995, Semenza was able to publish some of his key findings, including identification of the genes encoding HIF. HIF was found to consist of two different DNA-binding proteins, so called transcription factors, now named HIF-1α and ARNT. Now the researchers could begin solving the puzzle, allowing them to understand which additional components were involved and how the machinery works.

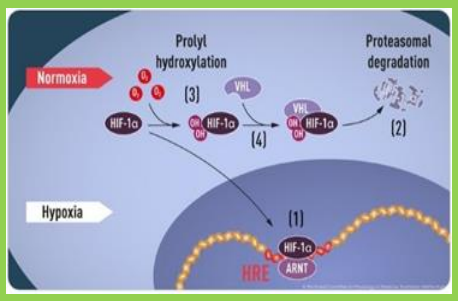
Linkage of VHL to HIF: - When oxygen levels are high, cells contain very little HIF-1α. However, when oxygen levels are low, the amount of HIF-1α increases so that it can bind to and thus regulate the EPO gene as well as other genes with HIF-binding DNA segments. Several research groups showed that HIF-1α, which is normally rapidly degraded, is protected from degradation in hypoxia. At normal oxygen levels, a cellular machine called the proteasome degrades HIF-1α. degradation in the proteasome. How ubiquitin binds to HIF-1α in an oxygen-dependent manner remained a central question. The answer came from an unexpected direction. At about the same time as Semenza and Ratcliffe were exploring the regulation of the EPO gene, cancer researcher William Kaelin, Jr. was researching an inherited syndrome, von Hippel-Lindau's disease (VHL disease). This genetic disease leads to dramatically increased risk of certain cancers in families with inherited VHL mutations. Kaelin showed that the VHL gene encodes a protein that prevents the onset of cancer. Kaelin also showed that cancer cells lacking a functional VHL gene express abnormally high levels of hypoxia-regulated genes; but that when the VHL gene was reintroduced into cancer cells, normal levels were restored. This was an important clue showing that VHL was somehow involved in controlling responses to hypoxia. Additional clues came from several research groups showing that VHL is part of a complex that labels proteins with ubiquitin, marking them for degradation in the proteasome. Ratcliffe and his research group then made a key discovery: demonstrating that VHL can physically interact with HIF-1α and is required for its degradation at normal oxygen levels. This conclusively linked VHL to HIF-1α.

Oxygen shifts the balance :- Many pieces had fallen into place, but what was still lacking was an understanding of how O2 levels regulate the interaction between VHL and HIF-1α. The search focused on a specific portion of the HIF-1α protein known to be important for VHL-dependent degradation, and both Kaelin and Ratcliffe suspected that the key to O2w-sensing resided somewhere in this protein domain In 2001, in two simultaneously published articles they showed that under normal oxygen levels, hydroxyl groups are added at two specific positions in HIF-1α . This protein modification, called prolyl hydroxylation, allos VHL to recognize and bind to HIF-1α and thus explained how normal oxygen levels control rapid HIF-1α degradation with the help of oxygen-sensitive enzymes (so-called prolylhydroxylases). Further research by Ratcliffe and others identified the responsible prolyl hydroxylases. It was also shown that the gene activating function of HIF-1α was regulated by oxygen-dependent hydroxylation. The Nobel Laureates had now elucidated the oxygen sensing mechanism and had shown how it works.

Importance of discovery :- Understanding how cells sense and adapt to oxygen availability is central to curing a large number of diseases. Hence, it has fundamental importance for physiology and also pave the way for discovering new strategies to fight diseases such as anemia and cancer.

- Dr. Mahavir Gosavi





Fungus & Bacteria Combo Can Help Crops Fight Salty Conditions

Scientists from the Florida International University have found coating seeds with fungus and bacterium could help valuable crops block the saltier groundwater & soil. The salt-sensitive snap bean that contributes more than 105 million dollars to Florida's economy every year is particularly at high risk due to extreme salty conditions. The Snap bean is grown in Miami-Dade and Palm Beach counties, coastal communities where rising seas and saltwater intrusion threaten underground aquifers used for irrigation and drinking water

Coating the seeds of snap bean with the rhizobium or the arbuscular mycorrhizal fungi helped snap beans fight wilting & nutritional issues associated with saltier conditions that can lower crop yield. Professor Krish Jayachandran, the co-director of Florid International University's Agroecology program & Director of the study, said that coating the seeds with both the bacteria and the fungus worked more like a vaccine to inoculate the plant from salt. The bacterium-fungus combination introduced by the scientists was also found to increase the production of a protein released by the arbuscular mycorrhizal fungi that helps soil clump together to keep from being blown or washed away. [Source : Biotechnika, December 2019]

LIVING WALL

It is also called as Green wall/ Bio wall/ Living wall or Moss wall. Living walls are self sufficient vertical gardens that are attached to exterior or interior walls of a building. Patrick Blanc in late 1980s came up with the idea of a living wall. Living walls are particularly suitable for cities, as they allow good use of vertical surface areas.

The students of TYBSc botany and horticulture have made two living walls in the college premises. The living walls are present near the front gate and one at the back side of the college. Both the walls give an appealing and aesthetic appearance. Plants planted at the wall present backside are *Rhoeo discolor* and Neon money plant and those planted at the wall present near the gate are *Rhoeo discolor Syngonium*,*Cholrophytum*, *Asparagus, Ixora* (mini variety), *Duranta*, Neon and Marble money plant, etc. Making a living wall has many benefits like it gives an appealing and aesthetic look to a wall, it purifies the indoor air, it's installation is very easy and etc.

Ruchika Dani, TYBSc

PHOTO GALLERY (Shubham Patkar, SYBSc)

Pelargonium zonale

Dahlia sp.

Cosmos sulphureus

Justicia aurea

Competitive Examination and Recruitment Alerts:

1. TIFR Direct R and D recruitment for MSc Biotech / Life Science/ Botany

   Name of the project – Anticancer potential novel class of metal complexes

   How to apply – Email your CV/Resume to medchemtifr@gmail.com

2. IIT Madras Biology Job – Biotech / Microbiology/Botany

   Apply online through https://icandsr.iitm.ac.in/recruitment/

3. ICAR – IARI Epigenomics Project Research Recruitment

   Name of the Project – Epigenomics of Phosphorus use efficiency in rice

4. ITC Life sciences and technology centre research associate job

   Industry – agriculture/dairy

5. NEIRST JRF Job opening – MSc Biotech/ Botany/ Microbiology

   Title of project – Exploration and Conservation of high value wild edible macrofungi (WEM)

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