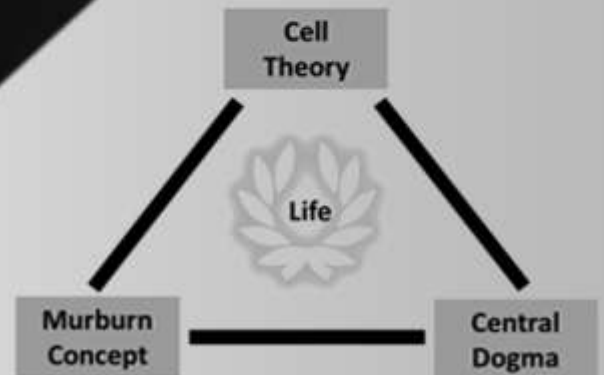


# Murburn Concept

Workshop on seeing living cells as  
'simple chemical engines'

Dates: 15 (Wed) - 16 (Thu)  
March, 2023



Murburn (from '*mured burning*') concept postulates that diffusible reactive species (DRS, like superoxide radical) are obligatorily involved in routine physiology. It deems cells as simple chemical engines (SCE) that work owing to redox activity initiated by effective charge separation (ECS). Murburn concept is a stochastic principle that supplements central dogma's deterministic and affinity-driven cellular functions.

Murburn models have been proposed to explain: *bioenergetics (respiration / photosynthesis / thermogenesis), coherence, homeostasis, electrophysiology, sensing and response to stimuli, etc.*



Venue: GG301 and GG303,  
IIT Bombay

## **Target Audience**

1. Academicians (students, researchers, and teachers) from physics, chemistry, bioscience, bio/ electrical/ chemical/ mechanical engineering streams with a genuine interest and orientation towards understanding the fundamental mechanistic underpinnings of life processes.

2. Professionals from bio-associated industry and policy-makers from various types of research activities, such as drug metabolism, drug-drug interactions, unusual dose responses, cancer-/musculo-/neuro- biology, redox, respiratory physiology and oxidative stress, photosynthesis, metabolo-proteomics, etc.

## **Workshop Outcome**

The workshop shall aim to impart basic ideas and key theoretical outlooks in murburn concept, alongside a critical and thorough comparison with the classical ideas that are provided in modern textbooks. It is projected that these insights shall impart a competitive edge in the participants' understanding and pursuit of biological sciences and technology.

## **Workshop Structure & Contents**

There would be two sessions per day and each session would be of ~2 hours (9AM to 11 AM and 11:30 AM to 1:30 PM). Each session would be of two parts, with each part having one lecture of 40 minutes, followed by ~20 minutes interaction. The attendees can also get to interact with the speaker, each other, and the organizers after the sessions. At the end of each day, a single-page written feedback shall be acquired. The resource person would be available for free interactions in the afternoons, after the daily sessions. The attendees shall be awarded with a certificate of participation. Day 1 would be chaired by Prof. Nandita Madhavan (CHY) & Prof. Amit Sethi (EE) and Day 2 would be chaired by Prof. Raghunath Chelakkot (PHY) & Prof. Sharad Bhartiya (CHE).

**Inaugural Session 15<sup>th</sup> March, Wednesday: (8:30 to 8:50 AM)** A brief function of ~20 minutes, with Chief Guest, Convenors and other dignitaries.

**Day 1, Wed, 15<sup>th</sup> March, Session 1 (9 AM - 11 AM):** *Mechanism of biological electron/moiety transfers*: Insights into murzymes (enzymes that abide by murburn mechanisms generating or sustaining or utilizing DRS) and three simple examples- (i) biochlorination, (ii) drug metabolism, and (iii) unusual dose responses. [ doi: [10.1016/j.bbapap.2006.05.012](https://doi.org/10.1016/j.bbapap.2006.05.012) [10.1021/bi7022656](https://doi.org/10.1021/bi7022656) [10.1371/journal.pone.0013272](https://doi.org/10.1371/journal.pone.0013272) [10.1371/journal.pone.0010601](https://doi.org/10.1371/journal.pone.0010601) [10.1016/j.biochi.2016.03.003](https://doi.org/10.1016/j.biochi.2016.03.003) [10.1039/C5RA26122H](https://doi.org/10.1039/C5RA26122H) [10.3389/fphar.2016.00161](https://doi.org/10.3389/fphar.2016.00161) [10.1177/1559325818774421](https://doi.org/10.1177/1559325818774421) [10.1002/cbf.3682](https://doi.org/10.1002/cbf.3682) ]

**Day 1, Wed, 15<sup>th</sup> March, Session 2 (11:30 AM - 1:30 PM):** *Bioenergetics (e.g. respiration, thermogenesis & photosynthesis)*: How are cells powered? Why is oxygen needed? How does small amount of cyanide kill so quickly? How is heat generated in cells? How do plants tap sunlight? How can cyanobacteria respire and photosynthesize simultaneously? Can bicarbonate enhance oxygenesis? [ doi: [10.1177/1178626418818442](https://doi.org/10.1177/1178626418818442) [10.1080/07391102.2018.1552896](https://doi.org/10.1080/07391102.2018.1552896) [10.1016/j.abb.2019.108128](https://doi.org/10.1016/j.abb.2019.108128) [10.1515/bmc-2020-0004](https://doi.org/10.1515/bmc-2020-0004) [10.1016/j.tox.2020.152369](https://doi.org/10.1016/j.tox.2020.152369) [10.1080/07391102.2020.1835715](https://doi.org/10.1080/07391102.2020.1835715) [10.1016/j.jpap.2020.100015](https://doi.org/10.1016/j.jpap.2020.100015) [10.1007/s12013-020-00945-y](https://doi.org/10.1007/s12013-020-00945-y) [10.1016/j.pbiomolbio.2021.05.010](https://doi.org/10.1016/j.pbiomolbio.2021.05.010) [10.1080/07391102.2021.1953606](https://doi.org/10.1080/07391102.2021.1953606) [10.1080/07391102.2021.1953607](https://doi.org/10.1080/07391102.2021.1953607) [10.1002/cbin.11746](https://doi.org/10.1002/cbin.11746) [10.1080/07391102.2022.2060307](https://doi.org/10.1080/07391102.2022.2060307) [10.5772/intechopen.103132](https://doi.org/10.5772/intechopen.103132) [10.1016/j.bbamem.2022.183981](https://doi.org/10.1016/j.bbamem.2022.183981) [10.5772/intechopen.106996](https://doi.org/10.5772/intechopen.106996) ]

**Day 2, Thu, 16<sup>th</sup> March, Session 3 (9 AM - 11 AM):** *Electrophysiology (e.g. vision & Na/K differentials)*: How do erythrocytes remain coherent and continuously homeostasize, even though they lack nucleus and genetic control? How can we explain the structure of human eye and visual transduction? How do lithium, cardiotoxic steroids (like bufalin, frog toxin), halo-hydrocarbons, etc. affect neuro-musculo physiology? [ doi: [10.1080/07391102.2021.1925592](https://doi.org/10.1080/07391102.2021.1925592) [10.1002/jcp.30547](https://doi.org/10.1002/jcp.30547) [10.1002/jcp.30578](https://doi.org/10.1002/jcp.30578) [10.1002/jcp.30786](https://doi.org/10.1002/jcp.30786) [10.1002/jcp.30925](https://doi.org/10.1002/jcp.30925) ]

**Day 2, Thu, 16<sup>th</sup> March, Session 4 (11:30 AM - 1:30 PM):** *Comprehensive and futuristic perspectives (understanding post-translational modifications or PTMs, evolution, lactate metabolism in Corey cycle and Warburg effect, motility, etc.)*: Why are some PTMs more common and how are they explained? How can murburn concept enable a better understanding of origin/evolution/termination of life? Why are proteins like lactate dehydrogenase tetrameric? In cells, are enzyme reactions freely reversible? Do bacterial flagella rotate? [ doi: [10.14748/bmr.v29.5854](https://doi.org/10.14748/bmr.v29.5854) [10.1002/jcp.30661](https://doi.org/10.1002/jcp.30661) [10.1002/jcp.30954](https://doi.org/10.1002/jcp.30954) ]

**Closing Session, 16<sup>th</sup> March, Thursday (1:30 to 2:00 PM):** Sharing of experiences/inputs, scope for further explorations/collaborations, etc.

## Chief Guest

Dr. Petety V. Balaji, Professor, Dept. of Biosciences and Biongeering, IITB  
<https://www.bio.iitb.ac.in/people/faculty/balaji-pv/>

## Convenor

Dr. K V Venkatesh, Professor, Dept. of Chemical Engineering, IITB  
<https://www.che.iitb.ac.in/web/faculty/kvv/index.html>

## Co-Convenors

Dr. Amit Sethi, Professor, Dept. of Electrical Engineering, IITB  
<https://www.ee.iitb.ac.in/web/people/amit-sethi/>

Dr. Sharad Bhartiya, Professor, Dept. of Chemical Engineering, IITB  
<https://www.che.iitb.ac.in/faculty/sharad-bhartiya>

## Speaker / Resource person

Dr. Kelath Murali Manoj,  
(PhD from IIT Madras; Postdoctoral work at CNRS-Marseille, France & University of Illinois, USA)  
Trustee, Satyamjayatu: The Science & Ethics Foundation, Shoranur-2, Kerala-679122.  
[www.satyamjayatu.com](http://www.satyamjayatu.com)

## Registration



<https://forms.gle/7AdZN84w5cXSdNon6>

## Contacts

Speaker: Dr Kelath Murali Manoj (satyamjayatu@yahoo.com, +91 70124 12598),  
Co-convenors: Prof. Amit Sethi (asethi@iitb.ac.in), Prof Sharad Bhartiya (bhartiya@che.iitb.ac.in)

## Online meeting link



<http://tiny.cc/b9f4vz>, but please register first.

Online recording will be available on March 17, 2023 at <https://www.youtube.com/@satyamjayatu5613>