Available online at www.climatechangejournal.org

DOI: http://dx.doi.org/10.18782/2583-4770.119

ISSN (E): 2583 – 4770

Emrg. Trnd. Clim. Chng. (2023) *2*(1), 7-10

Review Article

Emerging Trends in Climate Change

Peer-Reviewed, Refereed, Open Access Journal

A Call to Action: Computational Cum Molecular Biology Towards a Green Recovery

S Rehan Ahmad*

Assistant Professor, Hiralal Mazumdar Memorial College for Women, Kolkata, W.B, India

*Corresponding Author E-mail: zoologist.rehan@gmail.com

Received: 17.1.2023 | Revised: 28.03.2023 | Accepted: 9.04.2023

ABSTRACT

The field of computational and molecular biology has great potential for combating global warming and biodiversity loss. But it is mainly missing from the tactics being used today. We demand a widespread initiative to put computational and molecular biology at the forefront of counteracting climate change.

Keywords: *Green Recovery, Computational Biology: Molecular Biology.*

INTRODUCTION

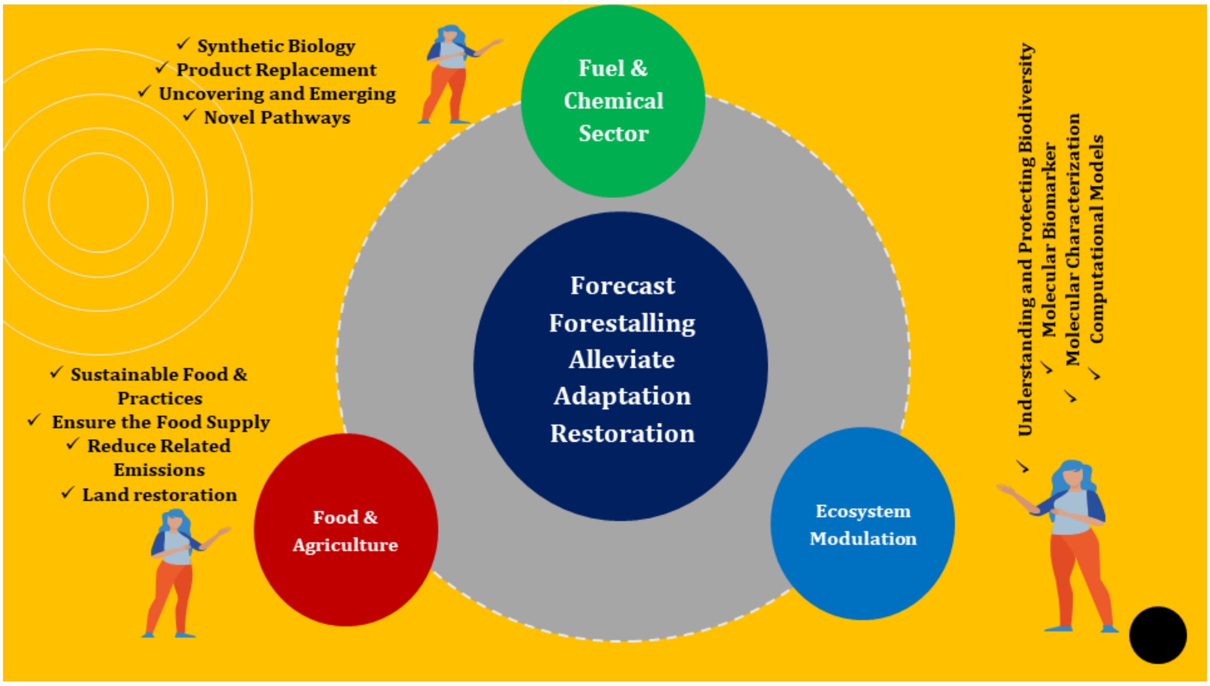
One of the biggest problems that humanity is currently facing is climate change. Several man-made factors, such as the alarming rate of biodiversity loss, are heralding the start of a sixth mass extinction.. In order to keep the rise in global temperature to 1.5°C above pre-industrial levels, society and the economy must immediately and drastically shift. The COP26 conference, which took place in Glasgow in October and November 2021, focused on the physical and earth sciences, which was good. However, the life sciences were underrepresented, and molecular life science was startlingly absent. In this perspective, we argue that molecular biology should be at the forefront of efforts to address environmental and climate change.

Currently, non-biological technologies like chemical CO_2 collection and photovoltaic energy are mostly being used to mitigate and adapt to climate change. Molecular Biology is still on the periphery, despite its enormous untapped potential, while nature-based initiatives, such as those centred around agriculture and conservation, are drawing more attention. Molecular biology has made it possible to study and engineer the fundamental biological processes that occur at all scales, from the cellular to the planetary, and this research has the potential to not only help us reduce and adapt to the alarming trends of global warming and biodiversity loss, but even to reverse them.

Cite this article: Ahmad, S. Rehan (2023). A Call to Action: Computational Cum Molecular Biology towards A Green Recovery, *Emrg. Trnd. Clim. Chng. 2*(1), 7-10. doi: http://dx.doi.org/10.18782/2583-4770.119

It is commonly known that biological processes significantly impact the planet's climate. The profusion of species on this planet is a result of the massive oxygenation that microbial photosynthesis caused some 2 billion years ago. It is also ironic that fossil fuels used to fuel the current calamity were created through photosynthesis. Although molecular biology has provided insights into these and other crucial life processes, it is not a major component of the plans being developed to mitigate climate change. This is troubling since molecular biology is crucial for determining the best intervention methods, monitoring the health of ecosystems, and creating the instruments needed to implement those strategies.

As a part of the All4Climate Italy 2021 programme, the European Molecular Biology Laboratory recently hosted a scientific session to better understand the significant areas in which molecular life sciences can have an impact. Global warming, biodiversity loss, biogeochemical fluxes, and man-made pollutants all represent threats to the four planetary limits (RockstromJ et al., 2009; & Steffen W et al., 2015), and their combined effects are addressed by existing and planned solutions (Picture 1). The meeting's strategies and possible routes to their realization are outlined in the sections below (Heard et al., 2021).



Picture – 01

One of the main potential effect areas is the reduction of greenhouse gas emissions, which can be achieved by altering current food and agricultural systems (Loboguerrero et al., 2022). The development of novel foods with balanced nutrition while retaining sensory appeal could be made possible through molecular biology. To preserve food security, it will be crucial to engineer and breed crops for traits like improved nutrition, resistance to salt and drought, and more. Cattle methane emissions and nitrous oxide emissions from increased land use in agriculture may be reduced by altering the soil, stomach, and rumen bacteria. To boost direct N2 fixation, microbial fertilizers can replace chemical fertilizers, potentially restoring the equilibrium of the world's N2 flow.

Engineered or naturally occurring microbial communities may be used in degraded ecosystems, some of which have already been pushed past their breaking point, to remove the toxins.

The chemical and fuel companies should leverage the enormous biochemical diversity of organisms to discover and develop novel enzymes and carbon conversion pathways. (Coelho et al., 2022; & Zrimec et al., 2021). These could be used by synthetic biology to help the world shift from petrochemical and fossil-based materials to renewable resources based on photosynthesis and waste stream valorization (Liew et al., 2022; & Schwander et al., 2016).

A targeted change to the ecology is another opportunity for influence. With the help of genetic characterization of inter-species interactions and computational models based on these discoveries, we may be able to predict complex ecosystem dynamics and direct interventions to alleviate the negative effects of anthropogenic emissions. It should be made easier for plants and environmental microbiomes to absorb CO2 and methane. The model-guided augmentation of biodiversity may reduce the gap between the ability of wild and planted forests to sequester carbon. Similar approaches could reduce the loss of marine biodiversity and promote CO2 fixation by phytoplankton and algae (Cornwall et al., 2021; & Smetacek et al., 2021). The potential for this process could be further increased by responsible genetic engineering. It is feasible to create genetic and metabolomic indicators that can be used as biomarkers to evaluate ecosystem health and detect tipping points before they occur. Integrating these modulation approaches with land use, marine resource, and economic policies will enable better local community adaptation to climate change and the deployment of treatments for re-establishing ecological balance.

Declarations:

Ethics approval and consent: This study has nothing to do with human and animal testing.

Consent for Publication: All the authors give their consent to publish the current manuscript.

Competing Interest: The authors declare that they have no conflict of interest.

Funding Declaration: It hereby declares that any agency did not fund the current project.

ORCID id: https://orcid.org/0000-0003-0796-5238

REFERENCES

Coelho, L. P., Alves, R., DelRio, A. R., Myers, P. N., Cantalapiedra, C. P., & Giner-Lamia, J. (2022). Towards the biogeography of prokaryotic genes. Nature. *601*(7892), 252–6. Epub 20211215. pmid:34912116

Cordier, T., Alonso-Saez, L., Apotheloz-Perret-Gentil, L., Aylagas, E., Bohan, D. A., & Bouchez, A. (2021). Ecosystems monitoring powered by environmental genomics: A review of current strategies with an implementation roadmap. *Mol Ecol. 30*(13), 2937–58. pmid:32416615

Cornwall, W. (2021). To draw down carbon, ocean fertilization gets another look. *Science. 374*(6574), 1424–. pmid:34914509

Heard, E. (2021). Harnessing molecular biology to accelerate the Green Recovery: *European Molecular Biology Laboratory*; [cited 24-03-2022].

Liew, F. E., Nogle, R., Abdalla, T., Rasor, B. J., Canter, C., & Jensen, R. O. (2022). Carbon-negative production of acetone and isopropanol by gas fermentation at industrial pilot scale. *Nat Biotechnol*. pmid:35190685

Loboguerrero, A. M., Eisen, M. B., & Brown, P. O. (2022). Rapid global phaseout of animal agriculture has the potential to stabilize greenhouse gas levels for 30 years and offset 68 per cent of CO2 emissions this century. *PLOS Climate. 1*(2), e0000010.

Rockstrom, J., Steffen, W., Noone, K., Persson, A., Chapin, F. S. 3rd, & Lambin, E. F. (2009). A safe operating space for humanity. *Nature. 461*(7263), 472–5. pmid:19779433

Schwander, T., von Borzyskowski, L. S., Burgener, S., Cortina, N. S., & Erb, T. J. (2016). A synthetic pathway for the fixation of carbon dioxide in vitro.

Science. *354*(6314), 900–4. pmid:27856910

Steffen, W., Richardson, K., Rockstrom, J., Cornell, S. E., Fetzer, I., & Bennett, E. M. (2015). Sustainability. Planetary boundaries: guiding human development on a changing planet. *Science*. *347*(6223), 1259855. Epub pmid:25592418.

Smetacek, V. (2021). A whale of an appetite revealed by analysis of prey consumption. *Nature*. *599*(7883), 33–4. pmid:34732860

Zrimec, J., Kokina, M., Jonasson, S., Zorrilla, F., & Zelezniak, A. (2021). Plastic-Degrading Potential across the Global Microbiome Correlates with Recent Pollution Trends. *Mbio*. *12*(5), ARTN e02155-21 10.1128/mBio.02155-21. pmid:34700384