



THE GUY FOUNDATION

NEWSLETTER

June 2023

**Welcome to the 4th edition of The Guy Foundation Newsletter.
We hope you enjoy reading it, do get in touch with any
suggestions for future editions.**

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2023 SPRING SERIES: PRESENTATIONS FROM OUR FUNDED STUDIES

The 2023 Spring Series, in which each of The Guy Foundation's funded teams presented results from their projects, concluded with a robust and edifying roundtable discussion. It has been remarkable to see the progress made since the Foundation was set up five years ago in curating and supporting its collaborative [programme of research](#) into aspects of quantum biology and bioenergetics. Each team presented research that focused on the Foundation's core interests, from light-matter interactions in biological systems, to the role of membrane potential in determining anatomical form.

The talks and roundtable discussion are written up in the **Spring Series Proceedings**, which will be circulated to the Foundation faculty, and made available on the website once the relevant data are published. The lecture recordings are being made available on our [website](#) and [YouTube channel](#) as the results are published.

THE SPACE HEALTH PROGRAMME

The Foundation is launching the Space Health Programme to build on the enthusiasm generated by February's [online symposium](#). One to one meetings and dialogue with a number of scientists from a range of disciplines have shown there is widespread interest in the subject and the scientists we have met seem very engaged, fascinated by the questions being posed and can see the merits in taking a quantum look at the effects of space on human health.

We consider the merits to be three-fold:

1. to assist those in undertaking space travel programmes in considering ways in which the electromagnetic, gravitational and other effects of the space environment can be potentially mitigated, to optimise health in space
2. to serve as an excellent model for us to learn more about quantum effects in physiology to bring benefits to human health on Earth
3. as a catalyst to attract interest in the quantum biology field from the wider scientific community, public and funders alike

A working group is being formed, to provide a pool of expertise for the Foundation team to draw on in reviewing evidence and suggestions, formulating recommendations and preparing a white paper to set out the issues and the research necessary to better understand the consequences of space travel for human health, particularly beyond low Earth orbit.

If you are interested in getting involved, please contact Nina Copping n.copping@theguyfoundation.org.



“Quantum Biology takes off just like a rocket”

The Guy Foundation researcher Alasdair Mackenzie comments on the conference outing to NASA's Space Center in Houston, during the GRC in Galveston.

2023 AUTUMN SERIES: SPACE HEALTH

The Autumn Series of online lectures will focus on space health, to expand on the issues and questions raised so far in our discussions. The series will open with a consideration of the day-to-day experience of being in space and health aspects, to mitochondria, to microgravity and radiation, to potential effects of magnetic fields, to quantum gravity and its possible implications.

If you have colleagues who would be interested in attending the live sessions please ask them to contact Nina Copping n.copping@theguyfoundation.org. Alternatively a good way to keep up to date is to subscribe to The Guy Foundation [YouTube channel](#) and request notifications when new talks are added. The full programme is available on [page 17](#) of this Newsletter.

THE GUY FOUNDATION ONION PRIZE 2023

A reminder that the deadline for The Guy Foundation Onion Prize is **Tuesday 26 September 2023**. The competition marks a century since Alexander Gurwitsch hypothesised the existence of non-chemical communication between onion roots. The prize will be awarded to the best, or most novel or imaginative, replication / reinterpretation of Gurwitsch's original experiment. For more details please visit our [website](#). Please help us to spread the word by circulating details of the competition to your contacts and networks, especially early career researchers.



NEWSLETTER FEEDBACK

We would love your feedback and suggestions for future editions. Please email Betony Adams b.adams@theguyfoundation.org.

BOOKS & PAPERS

JOURNAL CLUB

For this issue's journal club, Alistair Nunn and Betony Adams have picked four thought-provoking papers that have been published recently.

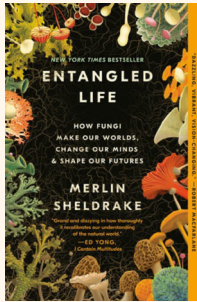
Giuseppe Vitiello shared his latest [paper](#), 'Living Plants Ecosystem Sensing: A Quantum Bridge between Thermodynamics and Bioelectricity', published in a Special Edition of the journal *Biomimetics* that focused specifically on bioinspired sensorics, information processing and control. The paper documents the "Cyberforest Experiment", which investigated collective measurements of spruce forests in Italy. These measurements included bioelectric potentials as well as thermal fluctuations. The analysis of these measurements employed methodologies from, among other things, quantum field theory and thermodynamics. The results give some insight into the complex interactions – the collective intelligence as such – of these forests, and how correlations between the elements of this interaction reflect the environment in which they are found.

Speaking of bioelectricity, **Michal Cifra** pointed out this [short article](#) on how Kirchhoff's law for the movement of current through electrical devices can equally describe how electron transfer in biological systems produce adenosine triphosphate (ATP). The article, by Robert Eisenberg, demonstrates how Kirchhoff's current law makes it possible to study current without atomic detail in both

engineering and biology, making it a useful tool for the simplified simulation of complex biological systems. The article includes the option to leave a review. It would be interesting to know what mitochondrial experts think of the idea.

Continuing on the theme of bioenergetics and mitochondria, a recent paper published in Nature investigates how the structural organisation of mitochondrial networks relates to their bioenergetic activity in cancer cells. The [paper](#) 'Spatial mapping of mitochondrial networks and bioenergetics in lung cancer', documents experimental techniques which include positron emission tomography imaging, respirometry and three-dimensional scanning block-face electron microscopy. Intriguingly, the research suggests that in non-small cell lung cancer, mitochondrial networks show distinct structural organisations and compartmentalisations that align with distinct bioenergetic phenotypes.

And finally, [Clarice Aiello](#) has [an article](#) in *The Conversation* as well as a recent [opinion piece](#) published by American Physical Society (APS). These are a timely follow up to the very successful inaugural Quantum Biology GRC. Clarice Aiello outlines the ways in which quantum biology could give insights into nature's quantum engineering skills, as well as contributing to the progress of new non-invasive medical interventions. She also addresses how this research has been neglected by conventional funding. With interest in the field growing, these are informative and essential reads and a great call to action.



Book corner

For this issue's book corner, Betony Adams has written a review of *Entangled Life* by Merlin Sheldrake, published in May 2020.

ENTANGLED LIFE BY MERLIN SHELDRAKE

The secret lives and special properties of fungi are a topic of growing interest. In the March Newsletter we reported that Foundation research collaborators [Philip Kurian](#), Founding Director of the Quantum Biology Laboratory at Howard University and [Mike Levin](#), Distinguished Professor of Biology, Director of the Tufts Center for Regenerative and Developmental Biology, had been awarded an Alfred P. Sloan Foundation Matter-to-Life grant to investigate problem-solving behaviour in syncytial slime moulds.

While the animal and plant kingdoms have generated substantial research, fungi, at least in the opinion of mycologist and author [Merlin Sheldrake](#), have been to some extent neglected. His recent book *Entangled Life: How fungi make our worlds, change our minds and shape our futures* addresses the question in exquisite detail. In the context of these fascinating organisms, we are still somewhat in the dark. This is to a degree literal, and Sheldrake describes how the visible signs of fungi above ground – the moulds and the mushrooms – are complemented by the vast filamentous networks of underground mycelia.

Despite their relative obscurity, fungi are essential to life as we recognise it. In the barren environments of the early Earth, fungi led the way: breaking down rock into soil; supplying root-like systems before plants evolved their own. Without fungi, we would be buried

beneath the weight of the dead. They are masters of decomposition, even offering potential solutions for the toxic waste – nuclear, oil, plastic – that is the long shadow cast by human advancement. Their role in the discovery of antibiotics changed the face of modern medicine. They are even implicated in our more everyday pleasures. In his vivid description of an episode of truffle hunting, the author elaborates on the language of volatile compounds that fungi use to communicate and to seduce the noses of both animals and humans.

Sheldrake's fungal interests span numerous scientific disciplines, even touching on questions of consciousness. Intelligence is almost exclusively attributed to humankind. But what of the ability that fungal networks demonstrate to communicate information – at least in part by electrical signals reminiscent of neural activation potentials – and to store this information – in a manner that looks a lot like memory. Indeed, while optimisation problems can be computationally expensive, researchers have found that fungi can solve network questions such as the travelling salesman problem remarkably efficiently. There are also the intriguing ways in which they can hijack the agency of other species, and the Zombie-ant fungus is a particularly disturbing example of this. Fungi are – quite literally – mind bending, their production of psychedelic compounds such as psilocybin offering a new way to think about – and treat – the mind and its disorders.

But their propensity for revelation is not merely chemical. The example they hold up – their incredible resourcefulness – offers new ways in which to imagine our own conflicted relationship with resources. Sheldrake sketches out a different idea of what it means to be alive, an idea that recognises the power of relationships and the entangled lives of all living organisms. In a world that seems increasingly skewed towards the needs and desires of a single species, this is a compelling metaphor.

CONFERENCES & MEETINGS

GORDON RESEARCH CONFERENCE ON QUANTUM BIOLOGY



The inaugural GRC on Quantum Biology was a great success. The conference took place in Galveston, Texas, in March and was attended by 142 conferees. The programme included nine scientific sessions, 35 invited talks,

16 trainee short talks and 82 poster presentations across a diverse range of topics. The different presentations were consistently excellent.

Two of The Guy Foundation's Scientific Advisors, Stan Botchway and Philip Kurian were involved as speakers and session chairs, with Stan commenting that the conference felt

“ timely considering the creation and expansion of new quantum biology institutes, departments and charitable foundations around the world”.

The format of Gordon Research Conferences with shared meals and social events once again helped to foster a number of illuminating discussions which will hopefully lead to new collaborations. The Foundation's Director of Science, Alistair Nunn, commented on this as one of his highlights, with everyone showing a willingness to share ideas and thoughts.

“ It was wonderful to see so many familiar faces in person. It was also very exciting to see the next generation of quantum biology researchers so well represented.”

The Guy Foundation PhD Student Ifigeneia Kalampouka, who gave a short talk, mentioned this in particular:

“ I had fruitful discussions with high-level academics, post-docs and PhD students, and witnessed younger researchers being given priority in Q&A sessions. This encouraged the exchange of ideas and facilitated the development of their ideas for further collaboration.”

The Guy Foundation was also well represented in the poster session, with Rhys Mould and Alasdair Mackenzie engaging in many lively debates. Rhys Mould commented that the poster sessions felt particularly useful for furthering interdisciplinary conversation.

“ From my own poster, I had the unique and invaluable chance to get feedback from scientists outside my own field, and from a diverse range of experience. The community created a friendly and informal opportunity to explore work that I would otherwise not have access to, especially from more early-career researchers.”

Both Rhys and Alasdair felt that the in-person nature of the event was particularly successful, with Alasdair commenting:

“ The GRC was a much-needed meeting after the long stretch of international lockdown. Being able to meet in person the faces of the quantum biology community that we normally only see online or in writing gives the human side to the science that is often forgotten about.”

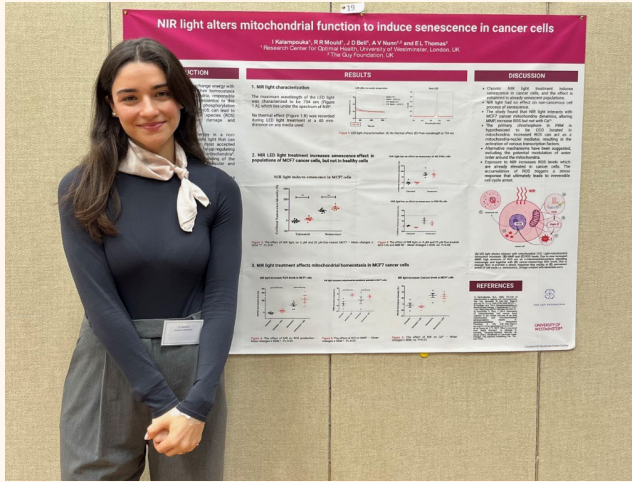
The Guy Foundation was delighted to support this inaugural GRC with our scientific involvement and US\$10,000 donation to support the conference costs, helping to enable these vital conversations and collaborations between scientists from diverse backgrounds.

The next Quantum Biology GRC will be held in March 2025. **Wendy Beane** and **Jonathan Woodward** will be the Chairs and **Alexandra Olaya-Castro** and **Alex Jones** the Vice-Chairs.



Photo with kind permission from the GRC Chairs

MITOX CONFERENCE



The Guy Foundation PhD student Ifigeneia Kalamouka in front of her winning poster at MitOX 2023.

This year's MitOX conference, organised by **Karl Morten** and colleagues at the Nuffield Department of Women's & Reproductive Health, was a successful meeting. Run for the first time as a hybrid conference, around 100 delegates gathered in Oxford on 21 April with a further 95 attending online.

The talks and poster sessions spanned cancer metabolism, neuroscience, diabetes, mitochondrial disorders and general mitochondrial biology. We are very pleased to report that The Guy Foundation's Ifigeneia Kalamouka won joint first prize for her poster presentation on NIR-induced senescence in cancer cells. During the conference, Alistair Nunn met up with Afshin Beheshti, KBR at NASA Ames Research Center, and had an interesting discussion on the emerging evidence that there are commonalities in the underlying mitochondrial pathophysiology between what happens in COVID-19, space travel and cancer. In particular, around the role of micro-RNA. This led to Alistair attending and presenting, virtually, at the recent Long-COVID, Inflammation and Cancer Conclave meeting held in Charlotte, North Carolina.

LONG-COVID INTERNATIONAL RESEARCH CONCLAVE

The SARS-Cov-2 pandemic has initiated a spate of long-term post-viral symptoms, often referred to as Long-COVID. The condition is still poorly understood, involving as it does system-wide effects, with suspected strong links to mitochondrial function (see Karl Morten’s talk Mitochondrial dysfunction: relevance for Chronic Fatigue Syndrome and Long-COVID on our website [here](#)).

Early in the pandemic The Guy Foundation was keen to support efforts to understand the virus and in March 2020 [awarded a donation](#) to the [Health Care Worker Covid-19](#) study, led by Barts Health NHS Trust.

Since then, The Guy Foundation’s Director of Science, Alistair Nunn and co-authors have had a number of research papers published on aspects on COVID-19, including Long-COVID, listed below. It is thus exciting to see the multidisciplinary approach of the recent Long-COVID, Inflammation and Cancer Conclave meeting, that took place in North Carolina, USA, as a hybrid in-person and online event in May. Alistair gave an invited talk ‘From the origins of life to SARs-CoV-2, mitochondria and cancer; what we might need to know’. Other familiar faces among the speakers were [Afshin Beheshti](#) and [Doug Wallace](#).

COVID-19 articles by The Guy Foundation:

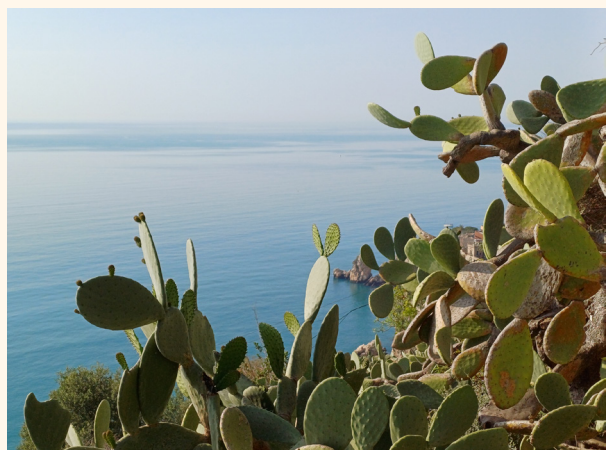
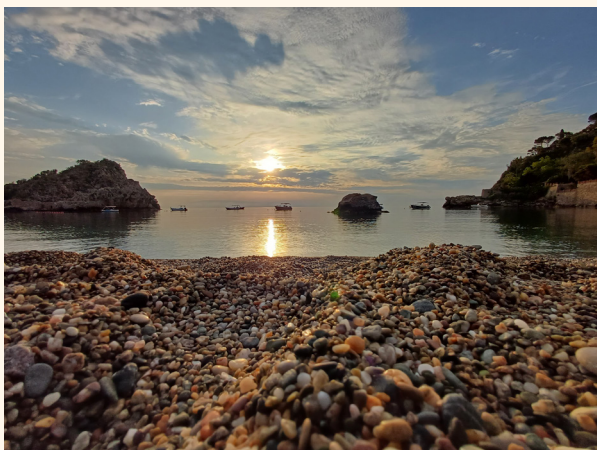
- SARS-CoV-2 and mitochondrial health: implications of lifestyle and ageing ([read more](#))
- SARS-CoV-2 and EBV; the cost of a second mitochondrial “whammy”? ([read more](#))
- Understanding Long COVID; Mitochondrial Health and Adaptation—Old Pathways, New Problems ([read more](#))

SCIENCE OF CONSCIOUSNESS CONFERENCE



Despite an eruption from Mount Etna that temporarily closed the airport and delayed a number of participants, the 2023 **Science of Consciousness** conference took place from 23 – 28 May in Taormina, Sicily. In its 29th year the meeting focused on interdisciplinary research – conceptual, empirical, cultural, artistic – that may shed some light on the question of consciousness. The conference included presentations from renowned consciousness scholars, including David Chalmers and Anil Seth, whose **TED Talk** on consciousness has had over 14 million views. Quantum biology was also very well represented, with invited speakers that included Roger Penrose, Stuart Hameroff, Jim Al-Khalili, Johnjoe McFadden, Travis Craddock and Guy Foundation research collaborator Mike Levin. Betony Adams remarked:

“It was a wonderful experience to interact with researchers across such diverse disciplines, from physics to philosophy to music and more, with the beautiful landscapes of Sicily supplying a suitable existential awe.”



QuEBS 2023

The annual **Quantum Effects in Biological Systems** (QuEBS) meeting is coming up soon, from 26 – 30 June, 2023 at the University of Surrey, UK. The programme has an exciting range of talks, including topics on tunnelling in enzymes, exciton and charge transfer dynamics in photosynthetic complexes, and the magnetic sense of animals. Speakers include Clarice Aiello, Judith Klinman, Alexandra Olaya-Castro, Sam Hay, Suzanna Huelga, Iannis Komninos, Nirosha Murugan and Jonathan Woodward. Some of The Guy Foundation team are attending. Unfortunately the deadline for registration has now passed but we look forward to meeting some of you there.



WORKSHOP ON THE PHILOSOPHY OF BIOPHYSICS

The Department of Philosophy at the University of Bristol is hosting a Workshop on **The Philosophy of Biophysics**, from 14 – 15 September 2023. Among other things, the philosophical study of biophysics might shed some light on fundamental questions around how living systems arise out of non-living matter. Early career researchers are particularly encouraged to submit abstracts. Abstracts should be no longer than 500 words (not including references) and should be submitted as a pdf attachment, emailed to margarida.hermida@bristol.ac.uk.

The deadline for submissions is 15 June 2023 11.59pm (BST).

BIG QUANTUM MEETINGS

The **Big Quantum** weekly online meetings continue to be an invaluable resource. The meetings are well attended and speakers address a range of topics relevant to all aspects of quantum biology. Trainees are encouraged to give short introductory talks before the main speaker. The programme is available on **page 18** of this Newsletter.

NIH MEETINGS

The National Institutes of Health's QIS and Quantum Sensing in Biology Interest Group hosts monthly online meetings that would be of interest to data/information scientists, bioengineers, chemists, biologists, physicists, and clinicians interested in advancing translational research in medicine. The focus is on developing novel therapies based on the understanding of quantum-in-biology and quantum-for-biology concepts. Recent meetings include presentations on new quantum techniques and technologies as well as industry perspectives on how these will impact biomedicine.

For more information visit the website [here](#).

**If you have conferences or meetings for us to include
in the newsletter, please let us know.**

DATES FOR YOUR DIARY



THE GUY FOUNDATION

**2023 AUTUMN SERIES ON QUANTUM BIOLOGY AND
SPACE HEALTH PROGRAMME**

Session 1: Wednesday 20 September

Day to day life of an astronaut and effects on healthDr Thomas H Marshburn, Sierra Space and retired NASA Flight Surgeon
and AstronautDr Scott M Smith, Human Health and Performance Directorate, NASA
Johnson Space Center

Session 2: Wednesday 4 October

Mitochondria and spaceProfessor Douglas C Wallace, The Children's Hospital of Philadelphia
(CHOP) Research Institute

Dr Afshin Beheshti, KBR at NASA Ames Research

Session 3: Wednesday 18 October

Microgravity and radiation effectsProfessor Christopher D Porada, Wake Forest Institute
for Regenerative Medicine

Dr David Furman, Buck Institute for Research on Aging

Session 4: Wednesday 1 November

Potential effects of magnetic fields

Professor Jonathan Woodward, The University of Tokyo

Professor Wendy Beane, Western Michigan University

Session 5: Wednesday 15 November

Quantum gravity and inertial stresses

Professor Vlatko Vedral, University of Oxford

Session 6: Wednesday 29 November

Roundtable meeting

Short talks to recap the series and roundtable discussion

All sessions 15:00hrs – 17:00hrs UK-time on Zoom
Please contact n.copping@theguyfoundation.org to register

**BIG QUANTUM BIOLOGY MEETINGS
HOSTED BY UCLA AND UNIVERSITY OF SURREY**

- June 15** Magnetic control of emissivity in multichromophoric molecular systems
Seigei Vinogradov
- June 22** TBA
Sabre Kais (Purdue University)
- June 29** Giant atoms: a new frontier in quantum optics
Franco Nori (Riken University)
- July 6** Weak magnetic fields in vertebrate development and regeneration
Kelly Tseng (University of Nevada)
- July 13** The nicotine/cotinine interaction in planarians: simple antagonism, regulatory site, or (perhaps) a quantum effect?
One Pagan (Westchester University)
- July 20** Curious effects of non-Markovian dynamics and how it can be important for quantum sensing in biological systems
Murphy Niu (University of Maryland)
- July 27** TBA
Amy S. Gladfelter (University of North Carolina)
- August 3** TBA
Alfredo Franco-Obregon (National University of Singapore)
- August 10** Building an equitable physics community
Katherine Wright (American Physical Society)

See the Big Quantum meetings [website](#) for the Zoom details

COMMUNITY NEWS

AMERICAN PHYSIOLOGY SOCIETY AWARD FOR JAMES W. LEE



James W. Lee receiving his award at the American Physiology Summit in the Convention Center, Long Beach, California.

James W. Lee, from Old Dominion University, Norfolk, USA, has been awarded the American Physiology Society award for his research on protonic membrane capacitors. His award acceptance speech, entitled “Better the Fundamental Understanding of Action Potential and

Neural Stimulation”, was well received at the American Physiology Summit conference in Long Beach, California. Lee’s research investigates proton coupling, in particular how the transmembrane-electrostatically localised protons (TELP) theory can be applied to bioenergetic systems. To learn more about this research his paper is available [here](#).

MUSIC ON MARS

It is an often-repeated cliché that the arts and the sciences are separate disciplines. Albert Einstein, one of the founding figures of quantum theory, however, once said about his love of music: ‘If I were not a physicist, I would probably be a musician. I often think in music. I live my daydreams in music. I see my life in terms of **music**’. At the core of each is human creativity: a novel way of looking at the world.

Afshin Beheshti, trained physicist and Principal Investigator at the KBR at NASA Ames Research Center, is a case in point. His band *The Medical Maps* released their latest album ***That is That*** in March.

The band has been described as incorporating elements of prog rock, indie rock, post rock and folk. Song titles such as ‘The Dog Door on Mars’ and ‘Modern Magnet and Miracles’ reflect Afshin’s scientific focus as well as something more than this: science will get us into space, but music will comfort us there.



The Guy Foundation meeting with Afshin Beheshti at the Royal Society of Medicine London in April 2023. From left: Geoffrey Guy, Afshin Beheshti, Rhys Mould, Alistair Nunn, Ifigeneia Kalam pouka.

Read a review of the album [here](#).

We hope you've enjoyed this edition of the newsletter.
If you have some news that you'd like to share, comments on the
newsletter or would like to unsubscribe, please email
n.copping@theguyfoundation.org

The Guy Foundation team



**Members of The Guy Foundation scientific team at the GRC on Qantum Biology
in March 2023**

Left to right: Stan Botchway, Philip Kurian, Alasdair Mackenzie,
Ifigeneia Kalampouka, Rhys Mould, Alistair Nunn, Nathan Babcock,
Betony Adams

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