

THE GUY FOUNDATION

Quarterly Review

December 2024

Welcome to the 10th edition of the Quarterly Review, a digest of quantum biology and The Guy Foundation news.

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Welcome



It gives me great pleasure to reflect on such a busy and productive year for the Foundation and the wider quantum biology community. 2024 has proved to be a year of growth, not only in the numbers engaging, but also in the scope and

direction of research. For me, the undoubted highlight was the publication of our report '**The health hazards of space travel: novel insights from quantum biology**' in October.

One of our aims has always been to stimulate interest in quantum biology as a research field in academic and medical circles but also in the popular imagination. Space travel is a subject of great fascination, but very little is known about how the human body will respond to extended periods of time spent in deep space. We saw an opportunity to harness the interest of the space community in the implications of quantum biology, particularly since space health research has rather neglected the effects of hypomagnetic fields and the altered light spectrum, topics on which we are currently conducting experiments. We have connected with many dedicated and knowledgeable scientists who share our interest in exploring biology across disciplines and in new environments, and we are excited to see where this journey takes us. The report has already stimulated dialogue with a number of national space agencies and commercial space companies and we remain committed to leveraging insights from quantum biology towards space as well as terrestrial health.

Since my wife Kate and I established the Foundation in 2018,

we have seen interest in quantum biology grow appreciably and we are keen to accelerate that trend. As part of our mission to bring QB to a wider audience, we have just published a new book, **'Quantum Biology: A Glimpse into the Future of Medicine'**. Written for the general reader, it discusses the implications of quantum phenomena for human health. We hope that it will prompt the next generation of medical practitioners to rethink the ways in which they treat a wide range of conditions.

Elsewhere, the launch of the Quantum Biology Ecosystem in California this year shows great promise, and next year shows no signs of slowing down. We are looking forward to the second QB Gordon Research Conference in March, for which the Foundation has again been delighted to offer financial support. We hope to see many familiar faces in person and meet a new cohort of quantum biology researchers.

Behind the scenes, our excellent staff, along with the trustee and advisor team, have been developing our grant-making, finance and governance systems, keeping our policies and procedures up to date, and delivering our research and scientific education programme – which is freely available for the QB community.

I would like to thank the Foundation team and you all for your input and support this year. I wish you a happy and peaceful Christmas holiday season and I look forward to seeing you in the New Year.

Professor Geoffrey Guy

Founder and Chairman, The Guy Foundation



The Guy Foundation's recent meeting at the Royal Society of Medicine in London.

From left to right: Nina Copping (Programme Director), Richard Brass (Trustee), Eric Dixon (Trustee), George Freeman MP, Russell Bowyer (Treasurer), Lord William Waldegrave (Trustee), Geoffrey Guy (Founder and Chairman), Kate Guy (Trustee), Alistair Nunn (Director of Science)



For more information about The Guy Foundation, including how we came to be established and about our team, scan the code above to visit the 'About us' section of our website.

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SPACE HEALTH REPORT LAUNCH

The Guy Foundation's report '**The health hazards of space travel: novel insights from quantum biology**' was launched in October. The report draws on the combined expertise of a working group comprising scientists specialising in a number of relevant fields from space science to medicine.



Its principal conclusion is that humans may be less able to cope with space travel than many realise, especially beyond low earth orbit (LEO), potentially leading to an accelerated ageing

syndrome. In effect, long periods in space could result in a more rapid physiological decline of many organ systems than would be normal. This could be become debilitating to the point of compromising mission objectives, say, on a manned mission to Mars. These effects may be difficult to mitigate with current technology and if confirmed by research, could call into question the viability of extended human exploration in deep space in the short term.

With a Foreword by George Freeman MP, former UK Minister of State for both Life Science and Space, the report reviews existing research and takes a holistic viewpoint while providing some novel insight into how microgravity in low-Earth orbit likely removes the stimulation to keep cells healthy, manage oxidative stress and generate energy. This, combined with increased radiation levels, altered circadian rhythms and, as the report emphasises, a lack of a magnetic field and changes in the light spectrum could further

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stress the system beyond its ability to adapt. Health could be further compromised as an astronaut's microbiota could evolve in a direction that negatively affects them. The report calls for these effects to be investigated and explained as a matter of urgency before longer distance journeys into space are undertaken.

At the time of the report's launch, our Chairman, Professor Geoffrey Guy said,

⁶⁶ Up to now, the space community's focus has been on the physical and engineering challenges inherent in space travel. These longer-term health issues do not seem to have been recognised. Nor have they been adequately addressed. Just surviving in space is not the same as living in optimal health and thriving. ⁹⁹

The report was sent to space agencies and companies as well as to interested researchers and the media. It was picked up by *The Economist* and discussed internationally on social media. Since its publication, we have had positive approaches from national agencies and commercial enterprises in the space industry.

The full report and a short talk on its contents are available here.

Thank you to Alistair Nunn and Betony Adams for their enormous contribution to the report and we thank the space health working group for their invaluable input and contributions.

If you would be interested in hearing more about our space health programme please contact Nina Copping (n.copping@theguyfoundation.org).

2024 AUTUMN SERIES ON BIOELECTRICITY

The 2024 Autumn Series 'Genes and metabolism: bioelectricity and the quantum spark of life' concluded on 4 December with a roundtable discussion. The series was aimed at examining more closely the role that bioelectricity plays in living organisms in order to expand our understanding of biology beyond a strictly gene-centric point of view. The underlying premise for this is the idea that life is basically electrical, and has been since its origins. This perspective does seem to offer the tantalising hint that metabolism did indeed come before genes – a central unresolved dogma in biology. Electric fields could well have been key in the origins of life, providing the template for how cells use bioelectricity today.

After a thorough introduction by **Michal Cifra** to the fundamental features of bioelectricity, the series entered more speculative territory. While we have grown familiar with discussions of quantum behaviour in biological systems, **Greg Scholes** introduced the idea of 'quantum-like' behaviour as a productive way in which to model the larger electrical networks that constitute the brain. The brain was also the subject of **Johnjoe McFadden**'s presentation, in which he presented the hypothesis that consciousness is the result of the electromagnetic field created by networks of neurons. From questions of consciousness, the series addressed another of the big questions in biology, the origins of life. **Nick Lane** presented on the fundamental role of the proton-motive force in kickstarting life as we know it. And finally, **Mike Levin** outlined how bioelectric fields may, quite literally, shape life as we recognise it today.



Electron transfer is fundamental to life and could echo its beginnings; the electron transport chains in mitochondria are responsible for generating a large electrical gradient across their inner membrane, mainly achieved by pumping protons, which is equivalent to a bolt of lightning.

This electrical gradient is key to many processes in the cell, including the generation of the main energy currency for all cells, ATP and through management of oxidative stress, life and death.



Bioelectricity plays an important role in morphogenesis and regeneration as it seems to contain coded information, which appears to be "above" genetics. Not only can altering bioelectric fields by manipulating ion channels lead to

strange new forms such as this two-headed planarian from Mike Levin's research group, but electromagnetic manipulation is well known to control healing.

Many thanks to our excellent speakers, we highly recommend the videos of the series talks, which are available on our **website** and **YouTube channel**. We are currently compiling the Proceedings and look forward to sharing these in the New Year.

2025 SPRING SERIES ON WATER

Commencing on 12 March, The Guy Foundation 2025 Spring Series will be on the topic of water and the many roles that this enigmatic substance plays in the biology of life. The physics of water is far more complex than many realise and viewing it from the quantum perspective may provide fresh insight into its role in life. For instance, both the polarity of membranes and the charge across them could induce water order, enabling some interesting quantum effects, such as tunnelling, or the ability to absorb energy from infrared radiation. Thus, this series will also examine whether quantum mechanics plays any part in the mechanisms by which water facilitates processes fundamental to living systems.

While speakers are still being confirmed, sessions will include presentations on the importance of water in quantum tunnelling in charge transfer and enzyme action as well as a closer look at the complex physics of water. These sessions will also explore water and its interactions with essential biological materials such as proteins and membranes, and the therapeutic implications of these interactions for understanding the mechanism of action of photobiomodulation. We are looking forward to a fascinating series and hope to see you there.

Once all speakers are confirmed the programme will be available on our website **here**, or see **Dates for your diary**. Feel free to share it with colleagues. If they would like to attend the live sessions and aren't already registered, please ask them to contact Nina Copping **n.copping@theguyfoundation.org**. Again, for this series we will upload the recordings of the talks to our **website** and **YouTube channel** so they are freely accessible.

New MITOCHONDRIA STUDY



Holly Tonks and Karl Morten in the laboratory at Oxford

The Guy Foundation is pleased to welcome Karl Morten and Holly Tonks to the collaborative research programme. The Foundation has donated £30,000 to their project which is exploring whether functional mitochondrial respiratory chain proteins are found in membranes outside of mitochondria.

Karl is Director of Graduate Studies at the Nuffield Department of Women's & Reproductive Health, University of Oxford, where Holly is a PhD student. It is conventionally accepted that mitochondria are the main sites of respiration in most life, where oxygen acts as the ultimate electron acceptor enabling the

formation of the proton gradient that can be used to generate ATP. However, some have suggested that some of the key components of the electron transport system, and the ATPase that uses ensuing gradient to make ATP, can be exported to other membranes, for instance, in retinal cells in the eye. It has also been suggested such a system has been utilised by cancer to enhance its survival by transferring some of these components to the plasma (outer) membrane. This study will seek to confirm these ideas by identifying alternative extra-mitochondrial membranes in which oxidative energy production occurs. In addition to identifying these novel energy producing sites, the project will go on to test how quantum these systems might be by examining the effects of isotope substitution. And finally, these new insights will be turned towards a therapeutic end by testing how extra-mitochondrial energy production relates to diseases such as cancer.

Karl commented:

⁶⁶ Holly's PhD project borders on heresy, suggesting mitochondrial respiratory chain components operate in other membrane systems. We are building up data, in the retina, cancer cell membranes and myelin which strongly support the data of other researchers such as Alessandro Morelli and Isabella Panfoli.

NEW BOOK ON QUANTUM BIOLOGY



Geoffrey Guy with his new quantum biology book

On Thanksgiving Day a new book was published from our Founder and Chairman, Geoffrey Guy, discussing the implications of quantum phenomena for human health. 'Quantum Biology: A Glimpse into the Future of Medicine' draws on the latest research from the Foundation and elsewhere to examine quantum effects in processes as diverse as the functioning of the brain and the body's

approach to combating inflammation and disease. Geoffrey underlines how we may need to rethink the ways in which energy and information are carried round our body.

Written for the general reader, but with a scope and depth designed to satisfy medical professionals, the book assesses the implications for cancer treatment and mental disorders and reopens discussion of areas such as light therapy. It also raises questions about the potentially damaging effects of space travel on astronauts' health and how they might have to be mitigated.

Geoffrey's previous book 'A Worthwhile Medicine', published in 2021, documented his development of the world's first licensed cannabis pharmaceutical. Both are available on Amazon and we venture to suggest that they would sit very well together on your bookshelf...

REGENERATIVE HEALTH PODCAST INTERVIEW

In the previous issue of the Quarterly Review we showcased The Guy Foundation YouTube channel and highlighted Geoffrey Guy's recent talk on **quantum biology**. Geoffrey continues to spread the word on quantum biology to a wide audience, with a recent **interview** on Max Gulhane's Regenerative Health Podcast, which has already been watched by over 12,000 viewers. Geoffrey talks about phenomena in quantum mechanics, such as entanglement and spin, and how these might be usefully turned towards a new understanding of biology and a revolution in medicine.

The Regenerative Health Podcast also featured a summary of the Foundation's recent space report, you can watch it **here**.

LIFE ON THE EDGE EDUCATIONAL VIDEOS

On the subject of raising awareness, we were also interested to watch some of the videos produced as part of the University of Surrey's project, Life on the Edge: Quantum thermodynamics, quantum biology and the arrow of time. The project, funded by a John Templeton Foundation philanthropic grant, looked at how time and quantum mechanics are related and how this relationship plays out differently in living and non-living materials. Part of the project entailed a series of **educational videos**, which introduce concepts ranging from Olbers Paradox to quantum mechanics and quantum biology. The animated videos were written and narrated by Jim Al-Khalili, who is known in the quantum biology community as a co-author of the seminal book *Life on the Edge: The Coming of Age of Quantum Biology* and is also well known in the UK as the presenter of BBC Radio 4's excellent programme 'The Life Scientific'.

BOOKS & PAPERS

JOURNAL CLUB

For this issue's journal club, Alistair Nunn and Betony Adams have picked four thought-provoking papers on topics relating to bioelectricity.



In 2023 The Guy Foundation co-hosted a meeting with Cancer Research Horizons to discuss the ways in which quantum biology might advance the understanding and treatment of cancer. One of the presentations at this meeting focused

on the use of electric fields as a cancer therapy.

We were thus interested to see the recent paper in the *British Journal of Cancer*, **'Tumor Treating Fields (TTFields) combined with the drug repurposing approach CUSP9v3 induce metabolic reprogramming and synergistic anti-glioblastoma activity in vitro'**. The paper focuses on research into the synergistic use of TTFields in conjunction with a CUSP9v3 drug-based protocol, for the treatment of glioblastoma. The electric fields, which are administered using non-invasive arrays were demonstrated to strongly enhance the effects of the drug protocol, increasing apoptosis and decreasing metabolic markers such oxidative phosphorylation and the expression of respiratory chain complexes.

The synergistic application of different stimuli is the subject of another interesting paper, published in the journal *Bioengineering*.

The paper 'Synergistic Cellular Responses Conferred by Concurrent Optical and Magnetic Stimulation Are Attenuated by Simultaneous Exposure to Streptomycin: An Antibiotic Dilemma' investigates the use of concurrent optical and magnetic stimulation (COMS) for enhanced wound healing. The authors document the

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different effects of each stimulus on its own, as well as the two combined. They conclude that, while magnetic fields appear to have a slightly bigger physiological effect than light does when applied separately, synergistic application amplifies these individual responses. Furthermore, the authors investigated how the application of magnetic fields and light is modulated by a chemical stimulus, such as antibiotics. They found that COMS efficacy is reduced in the case of aminoglycoside antibiotics administered during treatment but not after. Effective application of COMS as a therapeutic agent will thus have to factor in the confounding effects of antibiotic treatment. It is likely that as electromagnetic therapeutics become part of mainstream medicine, a great deal more research the way in which chemical and electromagnetic stimuli interact in biological systems.

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A bioabsor	bable mechanoelectric fiber as electrical
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Stimulation Zhouquan Sun, Yuef Zhang, Kerui Li, Haik	n Sutture an Jin, Jiabeil Luo, Lincens Li ^{(전} , Yue Dine, Yu Luo, Yan Qi, Yaocans Li, Qinghong 10 Shi, Sharkai Yin, Hongzhi Wang ^{CI} , Hui Wang ^{CI} & Chengyi Hou ^{CI}
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Another recent paper 'A bioabsorbable mechanoelectric fiber as electrical stimulation suture' explores combining the effects of different stimulus to enhance wound healing, in particular large incisions. The

paper, published in Nature Communications, reports on the design

of a novel biodegradable mechanoelectric suture that combines mechanical suturing with electrical stimulation, to maximise therapeutic efficacy. The combination of mechanical and electrical degrees of freedom allows customised delivery of electric fields in response to movement and stretching and halves wound healing time.



And finally, rather than the combined application of different biological stimuli, the paper 'Gut epithelial electrical cues drive differential localization of enterobacteria', examines the isolated effects of electrical

communication on the movement and location of bacteria in the gut. The paper, published in *Nature Microbiology*, compared the behaviour of bacteria populations with and without chemotaxis to better understand the role that electrical signals play in population localisation. The authors concluded that, for a variant of Salmonella bacteria, bioelectric cues allow bacteria to target specific locations in the gut. Given the growing evidence that our gut microbiome is fundamental to all aspects of health, the study is another step in understanding just how these bacterial colonies communicate with their host organism.

Book corner



For this issue's book corner Betony Adams has written a review of *Life as No One Knows It: The Physics of Life's Emergence* by Sara Imari Walker published by Penguin in 2024.

LIFE AS NO ONE KNOWS IT BY SARA IMARI WALKER

Of all the big unanswered questions in science, it is the mystery of life that most goes to the heart of human experience. What is life is a question that has intrigued some of the greatest minds in science, not least the founding figures of quantum mechanics, such as Schrodinger, who wrote a book about the subject. Sara Imari Walker's recent book, *Life as No One Knows It: The Physics of Life's Emergence*, outlines the history and context of this question and the advances that have been made towards answering it.

Perhaps what makes life so difficult to explain is the lack of an accepted consensus on how we define life, and the book begins with a discussion of the various ways in which this definition has been attempted. Walker, a theoretical physicist and astrobiologist by training, then details the role that physics – which is arguably the most fundamental theory we have of the universe – might play in

quantifying and understanding life. In particular she explains the principles of assembly theory, as a way to describe living systems.

Assembly theory, developed by Walker and fellow scientists, models the complexity of entities as a measure of how difficult it is, how many steps it takes, to assemble this entity from its fundamental constituent pieces. Walker goes on to explain how this approach to modelling living systems is not only experimentally testable but widens our ideas of what it means to be alive, from the confines of the biology we recognise on Earth, to what may be a far more universal phenomenon.

Conferences & Meetings

The Guy Foundation website includes a page dedicated to quantum biology related conferences and meetings, both online and in person. For more information see **our website**. If you have conferences or meetings to include, please let us know.

2025 GRC ON QB IN TUSCANY



The Guy Foundation is pleased to have once again been able to contribute a US\$10,000 donation to the Gordon Research Conference on quantum biology which will take place from 2 – 7 March 2025, near Lucca, Italy and will be preceded by the inaugural

Quantum Biology Gordon Research Seminar (GRS), from 1 - 2March. The programme is now available on the Quantum Biology GRC website. The deadline for registration and abstract submission on 2 February is fast approaching and we encourage you to visit the website for details on how to apply.

APS March 2025 MEETING



The deadline for abstract submissions for The American Physical Society's 2025 March Meeting has passed but you can still register to attend. The meeting will take place from 16 – 21 March in

Anaheim, California and will feature aquantum biology focus session, organised by Ramakrishna Podila. Keep an eye on the **website** for more details.

QUANTUM BIOSCIENCE WORKSHOP

The Institute of Physics is organising a Quantum Bioscience Workshop, to bring together interdisciplinary researchers across the UK who are working at the intersection of quantum physics and biology. This in-person, one-day event is taking place on 16 December 2024 in London and has an exciting line-up of speakers, including Johnjoe McFadden, a recent speaker at the Foundation's 2024 Autumn Series. The aim of the meeting is to build and strengthen a community of like-minded scientists in the quantum physics and physics of life disciplines. See the **website** for more details.

QUANTUM BIOLOGY SEMINARS ROUND-UP

The Big Quantum Bio meetings

Clarice Aiello of the Quantum Biology Ecosystem organises these meetings which take place online every Thursday and are free to attend. To join the group, email **quantumbiology@googlegroups.com**. (See our Community News section for more about the Quantum Biology Ecosystem).

QIS and Quantum Sensing in Biology Interest Group

The National Institutes of Health's QIS and Quantum Sensing in Biology Interest Group hosts online meetings that would be of interest to data/information scientists, bioengineers, chemists, biologists, physicists, and clinicians. There is an upcoming talk on 16 December 2024 by Skylar Chan, from the Imaging Biomarkers and Computer-Aided Diagnosis Laboratory, NIH Clinical Center. For more information visit the **website**.

Bioelectrodynamics seminars

These meetings are hosted by the Bioelectrodynamics group at The Czech Academy of Sciences. For more information visit their **website**.

DATES FOR YOUR DIARY



THE GUY FOUNDATION

2025 SPRING SERIES PROGRAMME WATER AS A QUANTUM BIOMOLECULE

Session 1 The physics of water in biology Wednesday 12 March Dr Philip Kurian, Howard University

Session 2

The physics of water: charge, membranes and interactions with light Wednesday 26 March Dr Ali Hassanali, The International Center for Theoretical Physics, Trieste

Session 3

Quantum effects of water associated with proteins - the importance of order Wednesday 23 April

TBC

Session 4

Origins of life: water, lights, action

Wednesday 7 May

Professor Alistair Nunn, The Guy Foundation and University of Westminster

Session 5

Implications of water as a quantum biomolecule for quantum biology research

Wednesday 21 May

TBC

Followed by roundtable discussion among series speakers and participants

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

JOB OPPORTUNITIES

QUANTUM CLOUD LAB AT THE UNIVERSITY OF CALGARY

The Quantum Cloud Lab at the University of Calgary is advertising various positions for qualified and motivated applicants. Contact Daniel Oblak for information on current opportunities and potential projects, which include research into ultraweak photon emission from biological materials. See the **website** for more details.

LEVERHULME QUANTUM BIOLOGY DOCTORAL TRAINING CENTRE (QB-DTC)

The Leverhulme Quantum Biology Doctoral Training Centre (QB-DTC) offers postgraduate research opportunities in quantum biology. The centre is based at the University of Surrey and PhD students have access to a wide range of skills training, including advanced spectroscopy, ion beam proton irradiation, nanotechnology and mass spectrometry. See the **website** for more details.

Community News

AFSHIN BEHESHTI'S SPACE MEDICINE INITIATIVE



Afshin Beheshti

Afshin Beheshti has given invaluable advice and information as we prepared the Foundation's recent report on the health risks of space travel. We are thus thrilled to see his own space health initiative take flight. Afshin has formed the Center for Space Biomedicine at the University of Pittsburgh and has taken up the Director role. Among other things, Afshin will develop research into the role that microRNAs –

non-encoding proteins that regulate gene expression – play in space-related physiological changes. The ultimate aim being to develop new technologies to mitigate the health risks of space flight as well as turning these insights towards advancing terrestrial medicine. Afshin is a true proponent of collaborative science and is always generous with his time and expertise and we wish him well with this exciting new initiative.

CLARICE AIELLO LAUNCHES QUANTUM BIOLOGY ECOSYSTEM

Clarice Aiello has also been very busy this year. She recently announced the launch of the **Quantum Biology Ecosystem** which she founded with Geoff Anders from Leverage, in order to accelerate quantum biology as a research field. The Quantum Biology Ecosystem comprises three organisations that are aimed at building the quantum biology community. The first of these is the Quantum Biology Institute, a non-profit organisation which will facilitate the underlying research at the laboratory in Los Angeles. The Institute is committed to an open science approach and Clarice gave a fascinating talk, at a recent Big Quantum meeting, on the results of their first experiment, which looked at tadpole embryogenesis in hypomagnetic fields. The Ecosystem also features the Quantum Biology Incubator, a for-profit, the aim of which is to develop technical expertise and foster quantum biology startups. And finally, the Quantum Biology DAO is an entity aimed at engaging researchers, crypto enthusiasts, industry experts and the interested public towards growing the exciting field of quantum biology.



The Quantum Biology Ecosystem website home page

for launch in 2025.

Angeles.

ONION PRIZE WINNING RESEARCH

Nathan Babcock, winner of The 2023 Guy Foundation Onion Prize was recently awarded a grant to travel to the Annual Meeting of the Mid-Atlantic Section of the American Physical Society to present his winning research, entitled 'Open Quantum Systems Theory of Ultraviolet Ultraweak Photon Emissions: Revisiting Gurwitsch's Onion Experiment as a Prototype for Quantum Biology'.

We are delighted that the research has just been published in the quantum biology focused journal *CSBJ General, Quantum Biology and Biophotonics* - available **here**.

Nathan also gave an excellent introduction to quantum biology talk at a recent Big Q seminar, you can view the talk on his **YouTube channel**.

VISIT FROM AERON TYNES-HAMMACK, THE MOLECULAR FOUNDRY

Rhys Mould, The Guy Foundation funded postdoctoral researcher in Jimmy Bell's research group at University of Westminster, had a recent internship at the prestigious Molecular Foundry at the Lawrence Berkeley National Lab, California. During this time Rhys set up a lab to run experiments investigating ultra-weak photon emission (UPE) in biological systems. While the in-person internship lasted three months, the experiments were set up to run for a year and possibly longer. Aeron Tynes-Hammack, from the Foundry, recently visited Rhys and the STFC Harwell team and had a very productive few days. Rhys commented:

⁶⁶ I was enormously grateful for the placement opportunity at the Molecular Foundry. The facilities (and the views) are truly world-class. Not only were we able to design, build, and test new technology to detect UPE, but also forged a closer collaboration between Westminster, The Guy Foundation, STFC Harwell, and the Foundry that is sure to facilitate more exciting research. ⁹⁹



Aeron Tynes-Hammack from the Molecular Foundry visiting the UKRI-STFC campus at Harwell.

From left to right: Alasdair Mackenzie, Rhys Mould, Stan Botchway, Alix Bailie, Aeron Tynes-Hammack.

CONGRATULATIONS TO IFI AND BETONY ON THEIR PHDS

We are sure you will join us in offering our congratulations to Ifigeneia Kalampouka, The Guy Foundation PhD Student, and Betony Adams, who undertakes the Foundation's scientific communications, who both were awarded their PhDs this Autumn.

Ifi's PhD research included exciting work on cellular senescence as well as novel insights into the effects of photobiomodulation on cancer cells. The research took place under the supervision of Louise Thomas and Jimmy Bell at the University of Westminster's Centre for Optimal Health as part of the wider Foundation grant to investigate non-chemical communication in biology. Ifi is continuing her work in the Westminster laboratory as a postdoctoral researcher.



Ifi Kalampouka after her PhD viva with her colleagues and examiners

From left to right: John Murphy, Rhys Mould, Ifi Kalampouka, Glen Jeffery, Jimmy Bell



Betony Adams and PhD supervisor Ilya Sinayskiy at the University of KwaZulu-Natal in South Africa

Betony completed her PhD at the University of KwaZulu-Natal in South Africa under the supervision of Francesco Petruccione and Ilya Sinayskiy. Her thesis investigated quantum effects in the nerves and brain, and whether theoretical models developed in quantum biology might be usefully applied in specific neurological contexts. Betony has recently joined Francesco's group at Stellenbosch University as a postdoctoral researcher in quantum biology.

We wish Dr Kalampouka and Dr Adams the best of luck in their new research careers.

We hope you have enjoyed reading the Quarterly Review. Please feel free to get in touch with any suggestions for future editions - n.copping@theguyfoundation.org



The Guy Foundation team

Geoffrey Guy, Founder and Chairman, celebrated his 70th birthday in September with a drone show

www.theguyfoundation.org



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