

THE GUY FOUNDATION

Quarterly Review

June 2024

Welcome to the 8th edition of the Quarterly Review, a digest of quantum biology and The Guy Foundation news.

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2024 SPRING SERIES ON AGEING

The 2024 Spring Series on Ageing concluded in May with a presentation by The Guy Foundation's Director of Science, Alistair Nunn, followed by a roundtable discussion. Alistair detailed the insights that quantum biology and thermodynamics might offer in the context of understanding mechanisms around ageing.

This was a fitting conclusion to a series of talks that began with Joao Pedro Magalhaes from the University of Birmingham, who outlined established theories of ageing which focus on the genes that are implicated in ageing, and what this may mean in the quest for longer lifespans. Ken Raj, from Altos Labs, Cambridge Institute of Science, then introduced the concept of epigenetic clocks and the relationship between ageing and the methylation of the genome. This focus on genetic mechanisms was then complemented by presentations by both Alistair Nunn and Wayne Frasch in the third session on the role that bioenergetics might play in ageing. Alistair outlined the ways in which exercise may guard against age-related degeneration at the macroscopic level, while Wayne, from Arizona State University, discussed what this means on the microscopic, mitochondrial level at which energy is stored and released, focusing his talk on one of the key components of healthy mitochondrial functions, ATPase. Nick Lane from University College London then expanded on this theme with his thoughts on ageing mitochondria.

Given the Foundation's interest in space health as a model for ageing, the 2024 Spring Series gave us an excellent opportunity to look more closely at the many different approaches to this multi-faceted biological phenomenon. The written Proceedings and video recordings of the talks are available on our **website** and the talks are also available on **The Guy Foundation YouTube channel**.

2024 AUTUMN SERIES ON BIOELECTRICITY

In previous series, we have explored quantum theory and electromagnetism in the context of biology, as an alternative to more established ideas that focus on the central importance of genetics. The 2024 Autumn Series '**Genes and metabolism: bioelectricity and the quantum spark of life**', starting on 25 September, will explore how biological systems exploit electromagnetism as well as how this might intersect with genetic approaches.

We are thrilled to announce the programme and thank our prestigious speakers: Michal Cifra will open the series with an overview of electricity in the biological context, from both historical and current perspectives. Gregory Scholes will discuss how electrical charge moves through biological circuits, and the role that quantum mechanics may play in facilitating this charge transfer. Nick Lane will outline the role that charge transfer may have played in the origins of life. Charge transfer will also be the subject of the presentation by Johnjoe McFadden, this time in the context of proton tunnelling in DNA mutation. Finally, Michael Levin will discuss the importance of membrane potential and how bioelectricity can be viewed as an epigenetic mechanism.

The programme is available **here** or see **Dates for your diary**. If you are not already registered and would like to attend the live sessions, please contact Nina Copping **n.copping@theguyfoundation.org**.

NEW PUBLICATIONS FROM OUR RESEARCH PROGRAMME

The Guy Foundation's **Research Programme** has been aimed towards curating a programme of research with a coherent bigger picture, undertaken by collaborating teams who work closely with the Foundation. Each grant builds on fundamental principles of interest to the Foundation, by generating peer-reviewed data, with the aim of bringing quantum biology and bioenergetics research into the mainstream. It is gratifying to see this bigger picture begin to take concrete form in the emergence of publications from the various research teams and we thought this was a good opportunity to present a round-up.

We reported on two of these publications in the **2023 December Newsletter**. Jimmy Bell, Rhys Mould and colleagues at University of Westminster published the paper 'Non-chemical signalling **between mitochondria**' in *Frontiers in Physiology* which confirmed the possibility that cells use light-based communication. The way in which biological systems generate and use light was also the subject of the second publication by Stan Botchway and Alasdair Mackenzie, from the Central Laser Facility at Harwell. The paper, 'Rooting out ultraweak photon emission a-mung bean sprouts', was published in the *Journal of Photochemistry and Photobiology*.

These two publications reflect The Guy Foundation's long history of interest in the interaction of light with biological systems, which stems from our research into light-reactive molecules known as chromophores. The Guy Foundation's Director of Science, Alistair Nunn, kickstarted this experimental journey with his investigation into how mitochondrial modulation by natural products can be tracked using NADH fluorescence. This led to Alistair being senior author on the subsequent **paper** published in *Frontiers in* *Molecular Biosciences* in 2021. Since then, the Foundation has continued to explore the role that electromagnetic radiation plays in a range of different biological contexts, including cancer, which is the subject of a publication from the University of Westminster group, 'Selective induction of senescence in cancer cells through near-infrared light treatment via mitochondrial modulation' published in the *Journal of Biophotonics*. The paper is the result of



Ifigeneia Kalampouka

work done by first author and the Foundation's PhD Student Ifigeneia Kalampouka to measure the effects that specific wavelengths of light have on cancer cells. Photonic modulation informs a new research collaboration between our UK research teams at University of Westminster and the Central Laser Facility (STFC-UKRI), and Princeton University's

Greg Scholes as well as with collaborators at Picchio International and FB Dermatology. The aim of this project is to investigate how light, and more precisely fluorescent light energy (FLE), modulates metabolism, inflammation and angiogenesis using the proprietary gel-based fluorescence system being advanced by FLE International as a healing technology.

Given this focus on light-matter interactions, we are pleased to announce two more new publications from our programme that reinforce and expand on this theme, tying our focus on mitochondria to quantum processes at the single photon scale and the novel use of quantum technologies to shine light on biological structures. The recent paper, **'The use of NADH anisotropy to investigate mitochondrial cristae alignment'**, by Smith et al., published in *Scientific Reports*, is an excellent example of this.

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Article Open acces	ss Published: 12 March 2024		
The use of l	NADH anisotrony to investigate		
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The authors describe how they used one and two-photon absorption techniques to study the in vivo nano-scale structure of mitochondria in live cells. Specifically the research

exploited the fluorescent properties of nicotinamide adenine dinucleotide (NADH) to show that mitochondria do appear to demonstrate alignment of their cristae, which are important folds in the mitochondrial membrane.

Senior author Stan Botchway commented:

⁶⁶ NADH fluorescence offers an exciting window of insight into the structural properties of living cells, due to the fact that it responds to light with a strongly directional pattern. NADH is also an important molecule in



Stan Botchway

the context of quantum biology research. We hope that the techniques highlighted in this paper can be further utilised to answer some of the open questions in this field. ⁹⁹

Stan presented these results at the 2023 Spring Series, you can watch his talk **here**.

In addition to novel quantum techniques, the Foundation is also interested in how novel quantum effects, such as superradiance, play a role in biology. Superradiance is a phenomenon that occurs when light-sensitive atoms or molecules interact collectively with a common light source. This means that instead of the light source exciting a single molecule at a time, it causes excitation of a network of molecules at once. In the limit of ultraweak excitation or a single photon, a fundamentally quantum effect can still arise due to that photon being coherently shared across the network, which enhances the fluorescence decay rate.



On this subject, we are excited to note that groundbreaking quantum biology results from another of our funded research studies have been published in *The Journal of Physical Chemistry*, with selection as a feature cover by **The JPC** and as an Editors' Choice by *Science* magazine. The project was led by Philip Kurian, Principal Investigator and Founding Director of the **Quantum Biology**

Laboratory (QBL) at Howard University in Washington, DC, who with coworkers in Mexico, Italy and Switzerland demonstrated that superradiant states can be supported in large protein aggregates characteristic of living systems. Nathan Babcock was the first author on the publication, which went viral, attracting 25,000 article views in less than a month, garnering an Altmetric attention score of 180 as of the beginning of June and placing it in the top 1% of all (~26M) research outputs ever tracked by the service.

Philip Kurian presented this research as part of The Guy Foundation 2023 Spring Series, and his presentation is now available to view **here**. For a News article on the paper see our **website**, the American Association for the Advancement of Science EurekAlert! **news release**, and the **QBL website**. The study on light-matter interactions in protein aggregates has led to an externally funded collaboration between the Kurian Lab and the group of Michael Levin, Director of the Tufts Center for Regenerative and Developmental Biology and himself a Guy Foundation research collaborator. The \$1M grant procured by the QBL from the **Alfred P. Sloan Foundation Matter-to-Life** programme will be used to investigate self-organisation and agency due to light-matter interactions in the syncytial slime mold, *Physarum polycephalum*.



Philip Kurian

Philip Kurian commented:

** The QBL is very grateful to The Guy Foundation for their substantial investment in our lab over the last few years. This publication is an exciting result for quantum biology, expanding the scope of light-matter interactions in biological systems. We believe this

research could have wide implications, improving our knowledge of quantum information processing as well as contributing to medical innovation for the treatment of complex diseases. ⁹⁹

This is not the first time that conversations fostered by The Guy Foundation have resulted in a new collaboration. Michael Levin's research into membrane potential, morphology and regeneration is revolutionising our understanding of the extent to which the electrical properties of cells inform their collective behaviour. Networks of membrane potential, as Michael puts it, are the 'cognitive glue' that enables cellular collectives to create and repair complex macroscale anatomies. Funded by a Foundation grant, the Levin Lab has investigated how morphological and regeneration processes depend on the bioelectric properties of groups of cells. The Tufts team published a number of papers relating to this project, including 'Minimal developmental computation: a causal network approach to understand morphogenetic pattern formation' and 'Cell systems bioelectricity: how different intercellular gap junctions could regionalize a multicellular aggregate'. Further publications are listed on the Levin Lab website here.

However, cells also contain another version of ATPase, called V-ATPase ("V" standing for "vacuolar"), which is not found in mitochondria, but is found, in various forms, in all other membranes – including the outer or plasma membrane. V-ATPase uses the energy in ATP to pump ions across the membrane, and is thought to play a pivotal role in generating the bioelectric fields that Michael Levin is investigating in his laboratory. Critically, each species on earth has its own variety of these V-ATPases, which although they are similar, contain different subunits. With facilitation and funding from the Foundation, Michael and Wayne are undertaking a collaborative research project to replace the V-ATPase subunits in Xenobots with those from different species. Not only could this lead to deeper understanding of how these bioelectric fields modulate everyday cellular function, in particular, how they may control organism development, shape, regeneration and even behaviour and ageing, but also the role that bioenergetics may play. This seems an apt reflection of a research programme that aims both to investigate and relate quantum biology and bioenergetic effects at each of the scales relevant to living organisms.

To find out more about our collaborating centres and the projects we have funded, please visit the newly updated '**Our research programme**' page on our website.

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HEALTH IS THE NEW WEALTH CONFERENCE – QUANTUM BIOLOGY LECTURE

Geoffrey Guy, Founder and Chairman of The Guy Foundation was delighted to be invited as the keynote speaker at the Rothschild & Co Wealth Management UK's Spring Conference on 9 May, on the theme 'Health is the New Wealth'. In his lecture Geoffrey presented an overview of quantum biology, discussing how humans might harness nature in developing non-chemical therapeutic interventions that will advance regenerative medicine and ameliorate the process of ageing. Towards this end, he outlined groundbreaking research into the regeneration of macroscale anatomies, the creation of living 'robots', as well as information processing in biological organisms. A link to the recording of the talk is available on The Guy Foundation **website** and **YouTube channel**.



Geoffrey Guy giving an introduction to quantum biology at the Rothschild & Co Wealth Management UK's Spring Conference

SPACE HEALTH REPORT

The Guy Foundation team has been busy working on our report on space health and the draft has now been circulated to the working group for their input and comments. If you would be interested in reviewing the draft or joining the working group please contact Nina Copping (**n.copping@theguyfoundation.org**). We have had a number of meetings with scientists working in this area and we remain very keen to be of assistance in investigating some of these crucial aspects of space travel. We look forward to sharing our progress with you in due course.

USEFUL RESOURCES WEBSITE PAGE

We are delighted to say we've relaunched the Useful Resources page on The Guy Foundation's **website** which aims to provide an invaluable resource for those new to the subject as well as quantum biology research scientists. As well as research papers, the page includes popular articles, books and videos, organised into categories of interest around quantum biology and bioenergetics research.

Going forward, we hope to continue to add new sections and expand on the listed resources in each section. Please take a look at the page and let us know of any useful material we could add.

Quantum biology topics	
Quantum biology overview	>
Bioelectricity and biophotons	>
Bird migration and oxygen radicals	>
Circadian rhythms	>
Consciousness and anaesthetics	>
DNA and olfaction	>
Mitochondria	>
Origins of life	>
Photosynthesis	>
Quantum mechanics	>

BOOKS & PAPERS

JOURNAL CLUB

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



In the recent Spring Series, Ken Raj gave a talk on epigenetic clocks and what they can tell us about the process and mechanics of ageing. There have been great

advances in mapping out the human genome. However, just how genes interact with their environment, accruing epigenetic modifications through methylation, is less well understood. We were interested to read Ken's recent collaborative paper, '**DNA methylation networks underlying mammalian traits**', published in the journal *Science*. The authors describe how they used DNA methylation profiles from numerous mammalian species to build the epigenetic analogy of a phylogenetic tree, or evolutionary lineage. Their results show that DNA methylation seems to follow genetic evolution, with specific methylation patterns for maximum lifespan. This is a fascinating study that demonstrates the close association of genetic and epigenetic evolution in different mammalian species.

Investigating measures of ageing is the subject of another recent paper, 'A molecular index for biological age identified from the metabolome and senescence-associated secretome in humans',

Aging Cell	ANATOMICAL Society
RESEARCH ARTICLE 💧 Open Access 🛛 🛞	•
A molecular index for biolo	gical age identified from the
metabolome and senescen	ce-associated secretome in humans
metabolome and senescen Shruthi Hamsanathan, Tamil Anthonymuthu, Neil M. Resnick, Subashan Perera, Satoshi Ok	cce-associated secretome in humans Denise Prosser, Anna Lokshin, Susan L. Greenspan, Jawa, Giri Narasimhan, Aditi U. Gurkar 📾
metabolome and senescen Shruthi Hamsanathan, Tamil Anthorymuthu, Neil M. Resnick, Subashan Perera, Satoshi Ok First published: 07 March 2024 https://doi	Ce-associated secretome in humans Denise Prosser, Anna Lokshin, Susan L. Greenspan, Jawe, Giri Narasimban, Aditi U. Gurkar C

published in the journal *Aging Cell*. Chronological age is not the best measure of the health of an individual. Indeed biological age may vary widely for two

individuals of the same chronological age. The authors of the paper describe how they developed a way to measure biological age by looking at inflammation markers related to the human metabolome and secretome, and how these vary between healthy and unhealthy individuals. The study allowed them to draw a number of conclusions, such as identifying the role that fatty acid oxidation mechanisms play in ageing. They also developed an ageing index based on metabolites associated with healthy ageing.

Ageing is not the explicit subject of the paper, 'ROS production by mitochondria: function or dysfunction' in the journal Oncogene. However, inflammatory processes involving reactive oxygen species



(ROS) do play a role in healthy and unhealthy ageing. The paper supports emerging thinking that upends established views that mitochondrial function is primarily geared towards the production of ATP when under normal oxygen conditions, whereas excessive ROS production is an inevitable and uncontrolled outcome of abnormal conditions associated with dysfunction and disease. The authors conclude that far from being a byproduct of ATP production, ROS production is a primary function of mitochondria, essential for feedback homeostatic processes that support living organisms. Equally, this supports data the mitochondria can also act as net sinks of ROS, as they have their own powerful antioxidant systems, which are integrated with the cell-wide redox control system. This begins to explain why failing mitochondrial function, such as that found in the metabolic syndrome, leads to chronic inflammation.

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On the subject of living organisms, there are a number of theories as to how life began. Indeed, theories of ageing could well benefit from a better understanding of the very first simple processes that drove

the evolution of living systems. Given the importance of redox processes in biology, it would seem likely that electron transfer played some role in the origins of life. A new paper 'Ferredoxin reduction by hydrogen with iron functions as an evolutionary precursor of flavin-based electron bifurcation' in the journal *PNAS* discusses the origins of the electron bifurcation essential to carbon dioxide fixation. As we currently understand it today, splitting the electron pair in molecular hydrogen in order to charge ferrodoxin requires enzymes and cofactors. However, the authors show that iron can also facilitate this transfer of electrons from molecular hydrogen to ferrodoxin. This theory supplies a mechanism for electron bifurcation in metabolic processes that could have arisen before the evolution of enzymes and cofactors we know today.

Book corner



For this issue's book corner, Betony Adams has written a review of *How Life Works: A User's Guide to the New Biology*, published in 2024 by Picador.

HOW LIFE WORKS: A USER'S GUIDE TO THE NEW BIOLOGY, BY PHILIP BALL

It has been two decades since the human genome was successfully sequenced. Philip Ball's new book, *How Life Works: A User's Guide to the New Biology*, opens with all the high excitement of an era in which a better understanding of our genetic machinery promised to unlock the mysterious animating force at the heart of living organisms. Our knowledge of the genome, however, hasn't quite lived up to this promise. Advances in genetics have given us great insight into the importance of the materials – such as proteins – out of which life is built. But determining just how these blocks are assembled into living organisms remains frustratingly elusive.

The author drives this point home with a discussion of the COVID-19 pandemic. Despite all our medical knowledge, the

progress of the disease in individual patients has proved difficult to predict. The book goes on to unravel the stranglehold that genes have on the biological imagination. Ball outlines the important role that DNA and proteins play while situating this within the wider framework of new ideas about just how flexible living organisms are within the bounds of their genetic expression. These new ideas include other ways in which biology manages and stores information, such as membrane potential, and Michael Levin's research into bioelectricity and regeneration is referenced a number of times in the book. The author also addresses notions of agency in approaches to understanding life, where agency can imply a number of ideas, including the pursuit of goals.

Agency in the context of biology has become somewhat of a contentious term, Ball suggests, but to fully understand how life works the subject of agency, purpose, and intelligence will need to be addressed in a rigorous, scientific manner. Only then might we be able to fully answer the question that has puzzled physicists, biologists and philosophers alike: What is life?

Conferences & Meetings

Visit The Guy Foundation **website** for a listing of quantum biology related conferences and meetings, both online and in person.

MITOX APRIL 2024

The **MitOX conference** took place on 12 April at the University of Oxford. The annual conference, which focuses on mitochondrial research, was organised by Jo Poulton and Karl Morten and colleagues at the Nuffield Department of Women's & Reproductive Health. The Guy Foundation's Director of Science, Alistair Nunn, chaired one of the sessions and a number of The Guy Foundation's team joined online. Alistair reported:

⁶⁶ MitOX 2024 proved to be another highly eclectic and fascinating mix of all things mitochondrial. Scientifically, some of the key highlights involved data showing how mutations in mitochondrial DNA and thus heteroplasmy could be involved in various medical issues and diseases, such as low birthweight, cancer, inflammation, chronic fatigue syndrome and neurodegeneration. The key message was that we have to consider not just nuclear DNA, but also mitochondrial DNA in the evolution of complex traits and disease susceptibility, and how this affects key multimeric complexes involved in electron transport in the mitochondrion, and how this affects both energy production, and the production of reactive oxygen species (ROS). Critically, this also affects a person's response to the environment, and whether they express a medical

condition. Other research, which is related to this, continued to indicate that removal of damaged mitochondria, via the process of mitophagy, is also a key component of maintaining good health, as, if it fails, it can lead to problems like inflammation and accelerated ageing. Another factor discussed at the meeting was the role of Krebs cycle intermediates, such as fumarate, in signalling and homeostasis – which continues to emphasise that most biochemical compounds have multiple functions. As is now emerging, these intermediates are not just key in modulating inflammation, but key in controlling what happens in the nucleus, for instance, via epigenetics, so providing further evidence of the link between mitochondrial health and the ageing process. There was also a further discussion on the role of extra-mitochondrial oxidative ATP production, which could completely turn biology upside down. Finally, of great interest to the Foundation, was a lecture and a number of posters discussing how near-infrared (NIR) and infrared light seems to be modulating metabolism, perhaps by affecting mitochondrial function, suggesting that it can be used to treat several problems, such as eye dysfunction, diabetes, recovery from exercise, and the possibility that for humans, and other creatures, it may be a requirement to have a daily dose of it – a theory proposed by Glen Jeffery. This of course could have relevance to health, both on earth and in space, due to current usage of blue shifted LEDs. ??

To read more about Glen's research on the effects of red light on mitochondrial function and related glucose demand, see his recent publication **here**. Given the prominent role that red light plays in photobiomodulation, it seems a matter of concern that lighting sources, including those on the ISS, have eliminated red/NIR wavelengths in the switch from incandescent to LED light sources.



Glen Jeffery presenting his research at the MitOX conference

MOLECULAR BIOPHYSICS WORKSHOP JULY 2024

The Molecular Biophysics workshop will take place from 1 - 4 July in Montpellier, France, with the aim of facilitating conversations between researchers involved in theoretical, experimental and computational research exploring fundamental physics effects in biological systems. The deadlines for abstract submission and registration have passed, but for more information see the **website**. If you attend the conference and would like to share a report in the next Newsletter, please do let us know.

QUANTUM BIOLOGY GRC MARCH 2025

The second Gordon Research Conference (GRC) on Quantum Biology will take place from 2 – 7 March 2025, near Lucca, Italy. The programme will be available on the **Quantum Biology GRC website**. The main meeting will be preceded by the inaugural Quantum Biology Gordon Research Seminar, which will take place from 1 – 2 March. Visit the **Quantum Biology GRS website** for more information.

QUANTUM BIOLOGY SEMINARS ROUND-UP

The Big Quantum meetings

These meetings take place online every Thursday and are free to attend. For more information visit the **website**. Forthcoming talks include magneto-mechanical stimulation as a mechanism for quantum sensing in the brain, and topics relating to quantum materials and quantum entanglement.

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 at NIH. For more information visit the **website**. A forthcoming talk is on 20 June, with Youngchan Kim, University of Surrey, speaking.

Bioelectrodynamics seminars

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

If you have conferences or meetings to include, please let us know.

DATES FOR YOUR DIARY



THE GUY FOUNDATION

2024 AUTUMN SERIES PROGRAMME

GENES AND METABOLISM: BIOELECTRICITY AND THE QUANTUM SPARK OF LIFE

Session 1 The life electric: the evidence Wednesday 25 September Dr Michal Cifra, The Czech Academy of Sciences

Session 2

Electrical circuits in biology – quantum or classical? Wednesday 9 October Professor Gregory Scholes, Princeton University

Session 3

Putting the quantum into DNA and genetics Wednesday 23 October Professor Johnjoe McFadden, University of Surrey

Session 4

Why life is electrical – the flux capacitor Wednesday 6 November Professor Nick Lane, University College London (UCL)

Session 5

Bioelectricity and genetics Wednesday 20 November Professor Michael Levin, Allen Discovery Center at Tufts University

Session 6

Roundtable meeting

Wednesday 4 December

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

	BIG QUANTUM BIOLOGY WIEETINGS
	HOSTED BY UCLA AND UNIVERSITY OF SURREY
13 June	LGBTQuantum+
	Monica de Longpre, Catalent Pharma Solutions
20 June	Remote magnetomechanical stimulation - a new way for
	quantum sensing in the brain?
	Anja Kunze, Montana State University
27 June	TBC
11 July	Two-dimensional materials for classical, probabilistic, and
	quantum bits
	D. Loc Duong, Montana State University
18 July	Quantum entanglement from the lab to New York City
	Mehdi Namazi (Mazzi), Qunnect Inc.
	See the Big Quantum meetings website for the Zoom details

JOB OPPORTUNITIES

Should you have any job opportunities or career-related information, such as postdoctoral positions or internships, that you would like us to include here please contact Betony Adams at **b.adams@theguyfoundation.org**.

Community News

CLARICE AIELLO'S LAB LAUNCHES OPEN SCIENCE EXPERIMENT

In exciting news for quantum biology, tadpoles are trending on X. Clarice Aiello, from the Quantum Biology Tech (QuBiT) Lab has launched a pop-up experiment to investigate the effects of different hypomagnetic fields on the embryonic development of tadpoles and zebrafish. The experiment, which will take place over three months, uses a custom-built hypomagnetic chamber to reduce the Earth's magnetic field by over three orders of magnitude. The experiment



The Tadpole Experiment investigating the effects of different hypomagnetic fields on tadpole development (photograph reproduced from The Tadpole Experiment website)

was inspired by previous results that demonstrate that tadpoles raised in a hypomagnetic field show a much higher rate of developmental non-viability. Verification of these results will have implications for a number of research fields, from evolutionary biology, to space health and medical innovation. Clarice and her team have used a novel open science approach, where the public can view the experiment as it unfolds in real time.

For the live feed and more details about The Tadpole Experiment see their **website**. You can also follow them on **x.com/TadpoleExpt**.

MOLECULAR FOUNDRY INTERNSHIP FOR RHYS MOULD

Welcome home to Rhys Mould, The Guy Foundation funded postdoctoral researcher in Jimmy Bell's research group at University of Westminster, who has spent the last few months at the



Inside the UPE detector built by Rhys Mould and colleagues at The Molecular Foundry

prestigious Molecular Foundry at the Lawrence Berkeley National Lab, California, deepening his knowledge of the phenomena of ultra-weak photon (UPE) emission. The Affiliate programme at Lawrence Berkeley Lab lasts for a year in total, and users can access the facilities at any time. While on site for an initial 3 months, Rhys has set up the lab at the Molecular Foundry to run experiments for the year, with a view to extending the collaboration further after this point.

NEW LABORATORY FOR TRAVIS CRADDOCK

May marked a move for Travis Craddock from Nova Southeastern University in Florida to the University of Waterloo in Ontario Canada. While he has published on a wide range of different subjects, Travis will be focusing his research on quantum neurobiology. In April this year, he was an invited speaker at the 2024 Science of Consciousness conference workshop on quantum biology which took place in Tucson, Arizona, USA. You can read more about his research on the role that quantum effects might play in consciousness **here**. Research opportunities for postdocs and graduate students are available in his group. We wish Travis all the best with this new endeavour.

June 2024

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



The view from The Molecular Foundry, with San Francisco across the bay.

www.theguyfoundation.org



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