MetaBeeAI
Workshop

April 1–4, 2025

Doctoral Training Centre, Keble Road, Oxford

Lead Organiser: Rachel Parkinson
Co-organisers: Caitlin Newport, Heloise Stevance

Contents

Welcome

Welcome to the MetaBeeAI Workshop! I am thrilled to bring us together in Oxford for what promises to be an exciting and productive few days of collaboration, discussion, and innovation.

The goal of this workshop is to explore how artificial intelligence – particularly large language models – can help synthesize and advance research on the effects of pesticides on bees. By bringing together experts in pollinator ecotoxicology, AI and machine learning, environmental policy, and research funding, we aim to forge new connections, exchange knowledge across disciplines, and chart a path forward for this rapidly evolving field.

Over the next few days, we will engage in hands-on AI sessions, historical and forward-looking discussions on the state of bee and pesticide research, and conversations about how scientific findings can inform policy and environmental risk assessments. We will work together to identify key challenges and opportunities, ensuring that the outcomes of this workshop benefit both our research community and the broader goal of pollinator conservation.

Your expertise, insights, and contributions are invaluable, and we encourage open discussion and collaboration throughout. Thank you for being part of this important initiative—we look forward to learning from each other and shaping the future of MetaBeeAI together.

Rachel Parkinson

Agenda Overview

> **Agenda Details**
>
> 1. **Expert Presentations:** Insights from leading researchers in AI, pollinator ecology, and environmental policy
> 2. **Group Discussions & Breakout Sessions**
> 3. **Hands-on Large Language Models Workshop**: Practical experience with LLMs for research synthesis
> 4. **Social Activities:** Networking opportunities in historic Oxford venues

Tuesday, April 1

Duration	Event
14:00 – 17:00	Arrivals and Check-in *(Trinity College)*
18:30 – 21:00	Welcome Reception *(The Kings Arms Pub)*

Wednesday, April 2

Duration	Event
8:00 – 9:00	Breakfast *(Trinity College)*
9:30 – 10:00	Welcome and Intros
10:00 – 10:30	**MetaBeeAI Update**
10:30 – 10:45	Break *(Tea and Coffee)*
10:45 – 11:15	**SoTA in LLM-researchers**
11:15 – 12:00	**Workshop Goals and Introduction to Breakouts**
12:00 – 12:45	Lunch Onsite *(Occasions)*
12:45 – 15:00	**BREAKOUT SESSION 1**
15:00–15:30	Break *(Tea and Coffee)*
15:30 – 16:30	**Invited Talk: Steve Roberts – Oxford University**
15:30 – 17:30	Dinner *(Lamb & Flag Pub)*
17:30 – 19:15	"Uncomfortable Oxford" Walking Tour

Thursday, April 3

Duration	Event
8:00 – 9:00	Breakfast *(Trinity College)*
9:30 – 12:00	**LLM Workshop: Ryan Daniels – Cambridge University** *Break (Tea and Coffee) at 10:30*
12:00 – 12:45	Lunch Onsite *(Taylors)*
12:45 – 15:00	**BREAKOUT SESSION 2**
15:00–15:30	Break *(Tea and Coffee)*
15:30 – 16:15	**Invited Talk: Amy Hinsley – Oxford University**
16:15 – 17:00	**Invited Talk: Carmen Elphick – HSE CRD**
17:00 – 18:15	Break
18:15 – 19:00	Drinks Reception *(Trinity College Upper Senior Common Room)*
19:00 – 21:00	Dinner *(Trinity College Old Bursary Room)*

Friday, April 4

Duration	Event
8:00 – 9:00	Breakfast *(Trinity College)*
10:00 – 10:45	**Invited Talk: Andy French – AIBIO–UK**
10:45 – 11:00	**Break (Tea and Coffee)**
11:00 – 11:45	**PollinERA x MetaBeeAI**
11:45 – 12:00	Walk to Browns for Lunch
12:00 – 13:30	Lunch *(Browns)*
13:30 – 15:300	**BREAKOUT SESSION 3**
15:30 – 15:45	**Closing Remarks and Next Steps**
15:45 – 17:00	Visit to Natural History Museum

Saturday, April 5

Duration	Event
8:00 – 9:00	Breakfast *(Trinity College)*
9:00 – 11:00	Check-out and Departures

Agenda Details

## Invited Presentations

Steve Roberts

University of Oxford
Department of Engineering

Stephen's main area of research lies in the theory and application of machine learning for data analysis, especially sequential data and dynamical systems. He has particular interest in the development of machine learning theory to help create robust, reliable and uncertainty–aware solutions for real–world applications. Current research develops theory and methodology for application across diverse problem domains including astrophysics, environment and ecology, finance and data–centric engineering. He leads the Machine Learning Research Group, is a Professorial Fellow of Somerville College, founding Director of the EPSRC Centre for Doctoral Training in Autonomous, Intelligent Machines and Systems (AIMS), Director of the Oxford ELLIS unit and was Director of the Oxford–Man Institute from 2015–2021. Stephen is Co-Founder and Scientific Advisor of Mind Foundry, PI of Oxford's Schmidt AI in Science Postdoctoral Fellowship programme and co–I of the Intelligent Earth Centre for Doctoral Training.
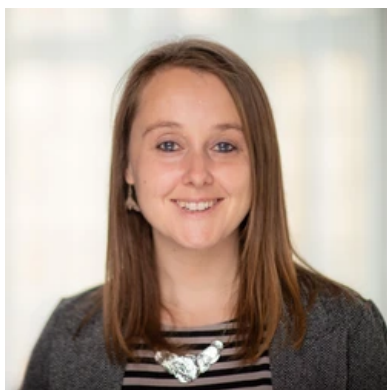
Amy Hinsley

Schmidt AI in Science Fellow, Director of the Oxford Martin Programme on Wildlife Trade
amy.hinsley@biology.ox.ac.uk

I am an interdisciplinary conservation scientist using social sciences and machine learning methods to understand complex threats to wild species. I focus on the wildlife trade, with the aim of understanding how different factors and drivers interact to increase or decrease trade. My current research focuses on developing nowcasting models to provide near term predictions for wildlife trade trends to improvise evidence for policy makers.

Carmen Elphick

Senior Regulatory Scientist, Ecotoxicology, Health and Safety Executive Chemicals Regulation Division
amy.hinsley@biology.ox.ac.uk

I am an interdisciplinary conservation scientist using social sciences and machine learning methods to understand complex threats to wild species. I focus on the wildlife trade, with the aim of understanding how different factors and drivers interact to increase or decrease trade. My current research focuses on developing nowcasting models to provide near term predictions for wildlife trade trends to improvise evidence for policy makers.

Andrew French

University of Nottingham, Director of AIBIO–UK
andrew.p.french@nottingham.ac.uk

Andrew leads the AI in Biosciences BBSRC community building project. The AIBIO vision is to bring together AI and core bioscience researchers to unravel biological fundamentals and tackle impeding societal challenges. To do this, we run events, and fund activities and pilot projects, to bring new members of the community together.

In this talk we will look at some relevant applications of AI in the Biosciences, and consider the state of AI capabilities at the current time, in particular computer vision and large language models.   An introduction to AIBIO–UK will be included; AIBIO–UK is a BBSRC community building network to bring together the AI and biosciences communities.

Breakout Sessions

The breakout sessions will provide a focused environment for interdisciplinary collaboration, where participants will work on specific aims critical to advancing the MetaBeeAI project. These sessions are designed to be highly interactive and productive, allowing attendees to contribute their expertise while learning from others in the field.

Each session will address a key challenge or research question related to MetaBeeAI, with breakout groups working on the following topics:

Expert Reviews of LLM Output from the MetaBeeAI Systematic Review

- Assessing the accuracy, consistency, and reliability of LLM–generated outputs.
- Identifying areas for improvement and refining prompt engineering strategies.
- Discussing validation approaches to enhance credibility and regulatory relevance.

Drafting the Outline for a Perspectives Paper

- Structuring a high-impact paper summarizing key findings and future directions for AI–driven pesticide risk assessment.
- Integrating insights from interdisciplinary participants into a cohesive narrative.
- Identifying target journals.

Working on the MetaBeeAI LLM Git Repository

- Refining and expanding existing code for systematic review automation.
- Addressing issues, debugging, and optimizing workflows.
- Implementing best practices for version control, documentation, and collaborative coding.

Creating Visualizations and Time Series Analyses on LLM Output

- Designing intuitive and informative visual representations of AI–generated results.
- Developing temporal trends and network analyses to explore patterns in extracted data.
- Identifying ways to communicate findings effectively to diverse stakeholders.

Future Directions for AI in Environmental Risk Assessment

- Exploring long-term applications of AI-driven systematic reviews in regulatory science.
- Discussing challenges in integrating AI tools with existing pesticide risk assessment frameworks.
- Defining next steps for MetaBeeAI, including funding opportunities and potential partnerships.

Generating a Benchmarking Dataset for Use in the LLM Pipeline Validation

- Defining criteria for a high-quality benchmarking dataset.
- Compiling and curating relevant literature to serve as ground-truth validation data.
- Establishing evaluation metrics for assessing LLM performance in systematic reviews.

Participants will be assigned to breakout groups based on their expertise, ensuring a balance of AI specialists, ecotoxicologists, and regulatory stakeholders. Each group will have a facilitator to guide discussions and ensure key takeaways are recorded. To fully participate, attendees should bring their laptops, as some sessions will involve hands-on work with AI models, databases, and literature review tools.

Large Language Models Workshop

Ryan Daniels

University of Cambridge

rkd43@cam.ac.uk

Ryan is a machine learning engineer and is interested in driving forward scientific research which is grounded in excellent software engineering and machine learning fundamentals. Ryan's research interests have explored unconventional approaches to computing using complex physical devices from the world of condensed matter physics.

Social Activities &
Off site meals

Welcome reception

King's Arms Pub

April 1 | 18:30–21:00
40 Holywell St, ~4 min walk from Trinity College

The King's Arms is one of Oxford's most historic and beloved pubs, perfectly situated at the corner of Parks Road and Holywell Street, just across from the iconic Bodleian Library and a stone's throw from Radcliffe Camera.

Lamb & Flag Pub

(Walking tour meeting point)
April 2 | 16:30–17:30
12 St Giles', ~1 minute walk from the Doctoral Training Centre

The Lamb and Flag is a historic Oxford pub established in 1566, known for its literary connections to writers like J.R.R. Tolkien and C.S. Lewis, who frequently gathered there as part of the Inklings literary group. Its charming interior with low beams, wooden furnishings, and traditional British pub atmosphere makes it a beloved Oxford institution with centuries of academic and cultural heritage.

"Uncomfortable Oxford" Walking Tour

April 2 | 17:30–19:00

Discover the stories beneath the spires with a university historian as your guide. We take you on a unique journey through the historic city centre, offering an engaging and rich walking tour about the complex history that has shaped the beauty and grandeur of the Oxford landscape. Our tours provide newcomers with a good introduction to the city while going beyond the traditional narratives. We highlight histories of race, gender, class, and disability, while raising uncomfortable questions about the lasting legacies of empire. All our guides are university researchers who are passionate about the city, its people, and its diverse history.

Drinks Reception
Trinity College Upper Senior Common Room
April 3 | 18:15–19:00
Broad Street (~8 minute walk from the Doctoral Training Centre)

College Dinner
Trinity College Old Bursary Room
April 3 | 19:00–21:00
Broad Street

Lunch at Browns Oxford
Browns Oxford
April 4 | 12:00–13:30
5–11 Woodstock Road (~2 min walk from the Doctoral Training Centre)

Visit to the Natural History Museum
Oxford University Museum of Natural History
April 4 | 15:45–17:00
Parks Road (~2 minute walk from the Doctoral Training Centre)

James Hogan (Collections manager, Hymenoptera and Lepidoptera) will give us a special tour of the bee collections at the museum.

Logistics

Contact

If you need any assistance during the retreat please email rachel.parkinson@biology.ox.ac.uk text or call +44 7388804843.

Doctoral Training Centre

The main entrance to the building is through Keble Road. The building is marked by a large blue sign.

Trinity College Oxford

Address: Trinity College, Broad Street, Oxford, Oxfordshire, OX1 3BH, United Kingdom
Check-In: From 2.00pm to 10.00pm. Check-Out: By 10.00am.
Breakfast is served from 8am–9am.

Trinity College entrance is situated on Broad Street, opposite the entrance to Turl Street. It is a 10-15 minute walk from the railway station (taxis are available outside) and 5 minutes walk from the Gloucester Green bus and coach station and car park.

When you arrive, please visit the Lodge and let them know you have booked accommodation for the MetaBeeAI Event.

Workshop and Break out Rooms:

All workshop sessions will take place in the Doctoral Training Centre,

Dining Recommendations

Coffee shops and breakfast spots

Near the Doctoral Training Centre:

- **Common Ground**
  https://maps.app.goo.gl/Y7Avp6VHZ8LB99Q6A (Pastries and great overnight oats)
  Common ground is also a co-working area so if you need alone time to deal with urgent work stuff or emails it's a good spot to find a comfy seat

- **Tree Artisan Cafe**
  https://maps.app.goo.gl/vevNCqw9Td1yNCpKA (Sandwiches and pastries)

- **Gail's bakery**
  https://maps.app.goo.gl/SQHRzKyJ8ubXuzVY9 (Excellent bread, coffee, & pastries)

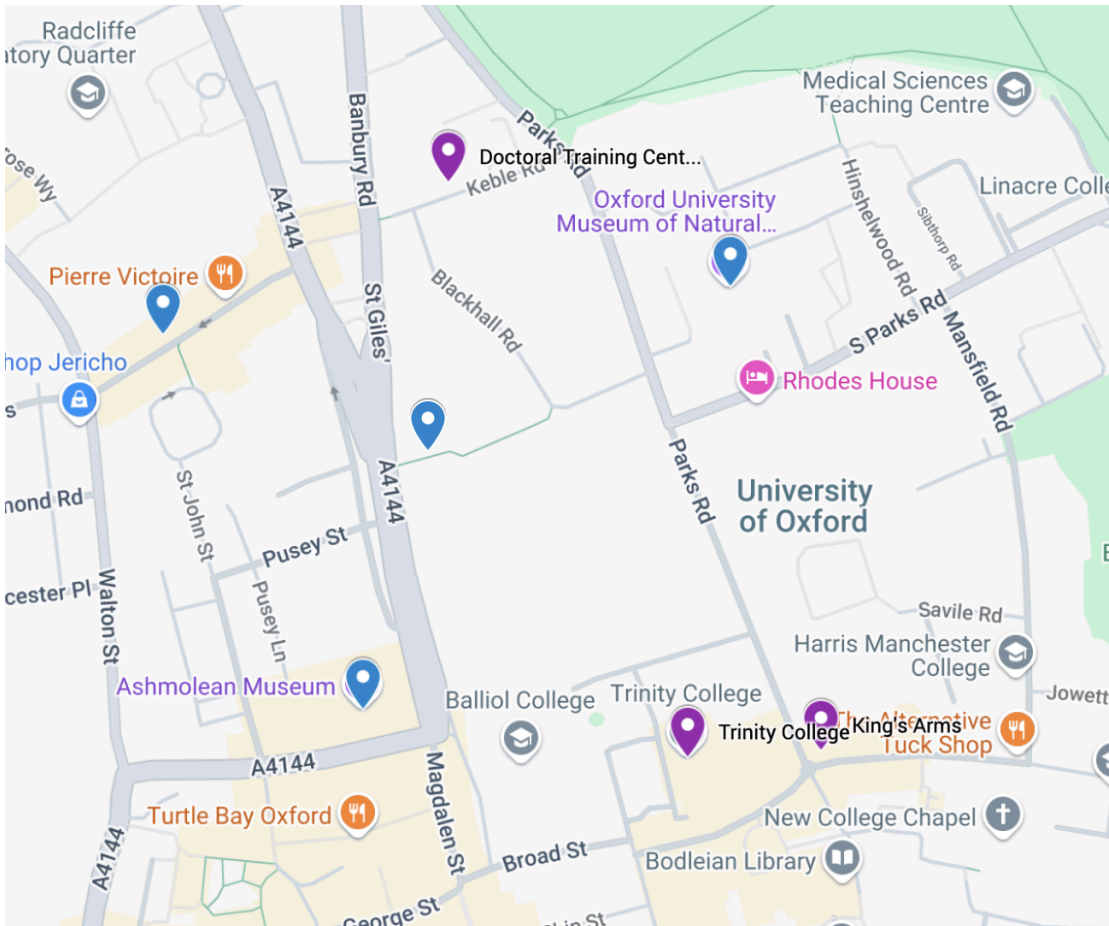## Dinner spots

- Alshami (Amazing and relatively cheap lebanese food / Great for larger groups)
- Gloucester Green and George Street (and nearby streets) have nice spots for dinner
- The Covered Market (open until 10pm on Thursdays and Fridays)
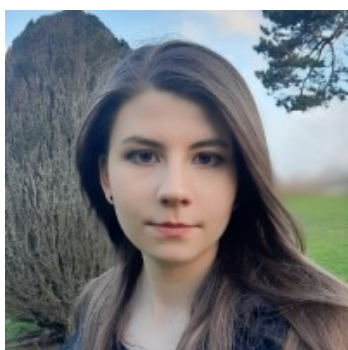- Jericho has many great restaurants and pubs (Quieter but pricier than the town center)

Map

https://www.google.com/maps/d/u/0/edit?mid=1mDhjZSyOs-D9hqPzpDqbxUUgGh_c5GE&usp=sharing

Attendees

Emily Armstrong

Oxford Brookes University

19222817@brookes.ac.uk

I'm a PhD student researching the structure and function of nicotinic acetylcholine receptors in insects under the supervision of Dr. Andrew K Jones and Professor Isabel Bermudez. I have specific interests in neuropharmacology in bees, especially Apis Mellifera. This extends form insecticide interactions to neurotransmitter function.

Chris Bass

University of Exeter

c.bass@exeter.ac.uk

Our group's research exploits recent advances in transcriptomics, genomics and post-genomic functional approaches to understand adaptive evolution in insects. A significant focus of our work is understanding how insects detoxify the natural and synthetic xenobiotics they encounter in the environment. This includes both plant secondary metabolites and man-made insecticides.

Cristina Botias

University of Alcalá

c.botias@uah.es

Cristina Botías is a research fellow in the department of Life Sciences at the University of Alcalá (Spain). Her broad research interests span biodiversity, ecology and conservation of pollinators, with a focus on the responses of bees to environmental stressors such as pesticide or pathogen exposure.
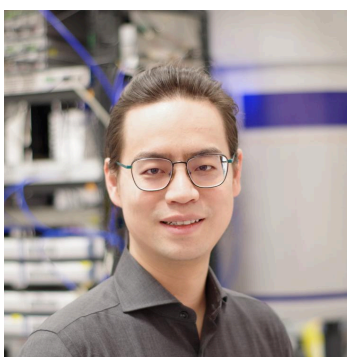
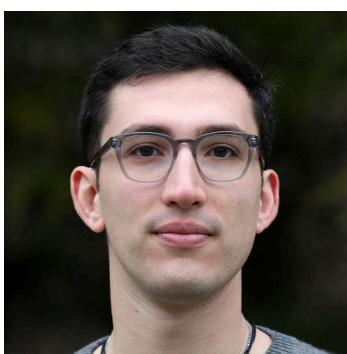## Andrew Brown

University of Bern
andrew.brown@unibe.ch

I enjoy mathematical modeling, and in particular, predictive modeling pertaining to Apis mellifera and Bombus terrestris. I have been working in Ecotoxicology for the last year, and use AI on a daily basis to help with data visualization.

Shuxiang Cao

University of Oxford
shuxiang.cao@physics.ox.ac.uk

Henry Cerbone

University of Oxford
henry.cerbone@biology.ox.ac.uk

My research is focused on quantifying embodiment in living systems. I also have a continued interest in using modern AI/ML methods in 3D reconstruction and monitoring of forest biodiversity. I am advised by Graham Taylor and Chris Thorogood and funded via a Rhodes Scholarship.

Lina Herbertsson

Lund University

lina.herbertsson@biol.lu.se

I am broadly interested in biodiversity conservation, and my research revolves around climate and land-use changes, insects and vascular plants. My experience in ecotoxicology includes field studies, systematic reviews, and behavioural studies, primarily focused on non-Apis bees. My goal is to promote policy makers and other stakeholders with robust scientific evidence to facilitate evidence-based conservation.

Andrew Jones

Oxford Brookes

a.jones@brookes.ac.uk

I am a lecturer at Oxford Brookes University. I am interested in the evolution and functional genomics of cys-loop ligand-gated ion channels in insect species, which are molecular targets of insecticides such as neonicotinoids. I study how species-specific differences in these ion channels can affect sensitivity to insecticides.

Mikael Mieskolainen

Imperial College

m.mieskolainen@imperial.ac.uk

Schmidt AI in Science Fellow at Imperial College London. Research interests in generative AI (diffusion and flows, LLMs) for natural sciences, Monte Carlo simulation based modelling, optimization and high-dimensional simulation-based inference.

Nicolas Nagloo

Lund University
nicolas.nagloo@gmail.com

I am a neuroethologist by training and am interested in the neural basis of behaviour in both vertebrates and invertebrates. I have only recently become involved in ecotoxicological studies that investigate how pesticide exposure can alter insect behaviour. This is particularly interesting when it affects pollinators which have to accomplish a complex set of behaviours to successfully pollinate a flower.

Cait Newport

University of Oxford
caitlin.newport@biology.ox.ac.uk

My research is in animal behaviour and focuses on the cogniti abilities of fish and the mechanisms that underpin navigationa use computer vision and AI techniques to reconstruct the 3D movements of fish in the wild from video recordings.

Beth Nicholls

University of Sussex
e.nicholls@sussex.ac.uk

I am interested in how environmental stressors such as pesticide exposure, poor nutrition and climate change interact to affect social and solitary bee physiology and behaviour. I use approaches from neuroscience to study bees sensory responses to floral rewards and combine respirometry with automated behaviour tracking to study the effects of larval exposure to stressors on metabolism.

Rachel Parkinson

University of Oxford
rachel.parkinson@biology.ox.ac.uk

I am interested in the impacts of environmental stressors on insect brains and behaviour, especially in terms of sensory perception. I am using AI methods to improve the resolution of sublethal toxicity testing, and I am keen to develop methodologies for incorporating sublethal testing in environmental risk assessment.

Elisa Rigosi

Lund University
elisa.rigosi@biol.lu.se

I am a neurobiologist and neuroethologist studying how insect sensory systems function, particularly in non-model pollinators like hoverflies. My research focuses on the sublethal effects of pesticides on insect brains and behavior, combining neurobiology, chemical ecology, and cognitive science. With a background in visual and olfactory processing, I have worked in multiple interdisciplinary teams across Italy, Sweden, and Australia, using advanced neurophysiological techniques.

Fabio Sgolastra

University of Bologna
fabio.sgolastra2@unibo.it

I am an Associate Professor in General and Applied Entomology at the University of Bologna. I would define myself as a "bee ecologist". Since 2002, my research activity focuses on ecology and conservation of bees in the agroecosystems and the valorisation of the pollination service. In particular, I study the impacts of the environmental stressors (mainly pesticides) on bee health following a holistic approach. This approach, which includes the assessment of potential synergistic effects among different stressors in laboratory and the analysis of data gathered from field monitoring studies, aims to improve the current environemental risk assessment and pollinator health.

Harry Siviter

University of Bristol
harry.siviter@bristol.ac.uk

I'm interested in the behaviour, ecology and conservation of pollinators. Much of my research has focused on the impact of anthropogenic stressors (pesticides, habitat loss, etc) on bumblebee and solitary bee health. I am also interested in animal cognition and specifically about how bees learn and respond to an ever changing environment.

Dara Stanley

University College Dublin
dara.stanley@ucd.ie

I'm an ecologist interested in the interactions between pollinators and plants, from basic ecology through to conservation, management and interactions with agriculture. Some of my work has focussed on the impacts of pesticides (insecticides, fungicides and herbicides) on bee behaviour, reproduction and delivery of pollination services to crops. Increasingly, I'm interested in mitigation measures that can limit impacts of pesticides on pollinators.

Heloise Stevance

University of Oxford
hfstevance@gmail.com

I am an astrophysicist working for sky surveys, looking for rare explosions in a big sky of billions of sources. I work mainly with image processing and feature based classifiers to design Virtual Research Assistants. Also keen on innovative ways to use LLMs to better search the literature and our own manuals because we write so much software.

Lars Straub

Bern University
lars.straub@unibe.ch

Since October 2021, I hold the position as the Vinetum Foundation lecturer in wild bee health at the University of Bern. My research aims to understand the mechanisms underlying wild bee declines and how environmental stressors affect wild bee health. Key interests are studying the interactions among agricultural pesticides and relevant pathogens as well as focusing on male insect reproductive health.

Edward Straw

edwardastraw@gmail.com

Working on questions of bumblebee susceptibility to pesticides, comparing wild and reared bees. Special interest in co-formulants and adjuvants, and the emerging understanding of their impacts on wildlife.

Rafaela Tadei

University of Bologna
rafaelatadei@gmail.com

I am a biologist evaluating the effects of pesticides on non-target organisms, particularly bees. By integrating lethal and sublethal endpoints, my researches aims to improve ecological risk evaluation and enhance conservation strategies.

Kieran Walter

University of Oxford
kieran.walter@biology.ox.ac.uk

I am interested in the effects of neonicotinoid pesticides, and others that share their mode of action, at sublethal, field–realistic concentrations. I explore behavioural impacts of pesticide exposure in bumblebees; if outright toxicity correlates with the severity of these impacts and whether social interaction mitigates these effects.

Funding information