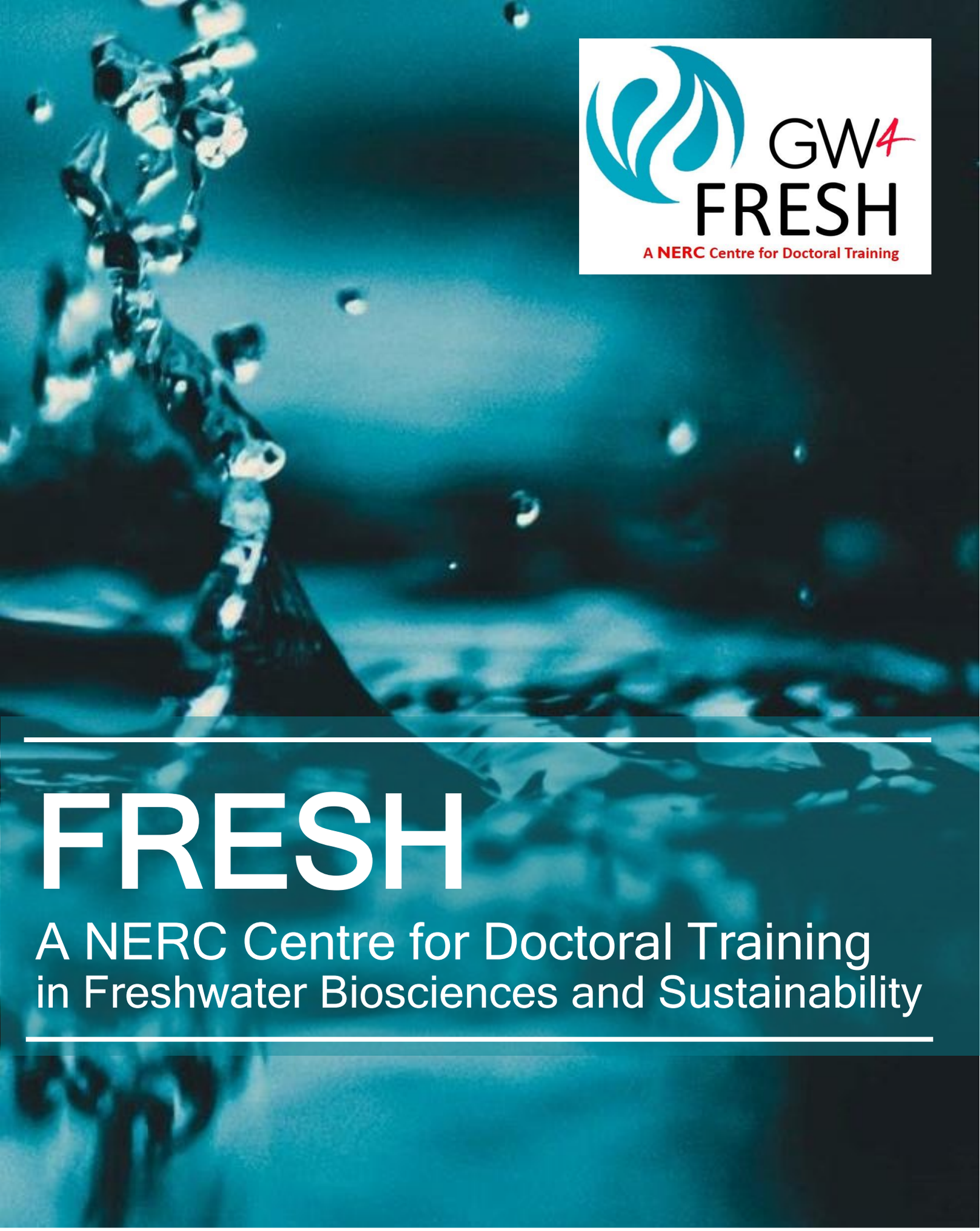

GW4 FRESH

A NERC Centre for Doctoral Training

FRESH

A NERC Centre for Doctoral Training in Freshwater Biosciences and Sustainability

University of Bath · University of Bristol · Cardiff University · University of Exeter · NERC Science of the Environment · British Geological Survey · Natural Environment Research Council · CEH

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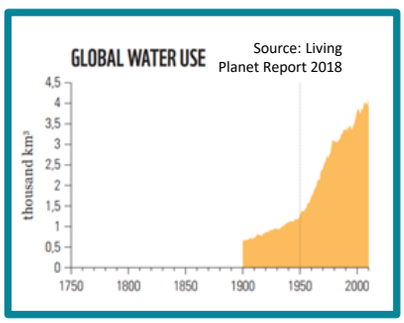
> The FRESH CDT offers an opportunity to markedly strengthen integration between the research and end-user communities, recognising the environmental benefits that this will realise.
>
> Dr Rob Collins
> The Rivers Trust

Foreword

Managing freshwater resources to keep pace with competing and evolving needs is a crucial societal and governance challenge with unprecedented urgency. Biogeochemical cycles are seriously impaired in freshwater catchments globally, while freshwater ecosystems – among the Earth's major biodiversity hotspots – incur species extinction rates faster than any other (Living Planet 2018).



The cumulative societal costs from ecosystem service failure are yet to be accurately determined, but the World Economic Forum identifies water crises as among the world's greatest threats (WEF, 2019). Whilst 4 out of 5 jobs depend on water globally, the uncertainties of global change, diminishing regulatory capacity and growing demand across all sectors threaten water security worldwide (UN World Water Development Report, 2019). The sustainability of freshwaters will therefore require transformational governance rooted in excellent science.

The NERC Centre for Doctoral Training in Freshwater Biosciences and Sustainability (FRESH CDT) provides a world-class doctoral research and training environment for the next generation of interdisciplinary freshwater scientists, equipping them to tackle future global water challenges.

FRESH harnesses freshwater scientists from four of the UK's most research-intensive universities (Bath, Bristol, Cardiff and Exeter, known collectively as the GW4 Great Western Alliance) plus world-class research organisations the Centre for Ecology and Hydrology (CEH) and British Geological Survey (BGS) and builds on their recognised training expertise.

It is also supported by the UK's largest water research community – the GW4 Water Security Alliance (WSA). More than 200 water researchers provide a world-class platform of skills, facilities and opportunities that are pivotal for delivering the NERC Centre. It ensures that the multi-disciplinary depth of research is transferred to a new generation, along with training in cutting edge techniques, to help ensure the sustainable management of freshwater resources and ecosystems regionally, nationally and internationally. In synergy with other doctoral training programmes such as the GW4 EPSRC CDT in Water Informatics (WISE), FRESH contributes to the creation of a major long-term hub for water innovation.

FRESH is in a unique position to deliver transformational change in freshwater training. In response to increasing stakeholder demand, our vision is to build experts and leaders that will be more equipped than any previous generation to deal with the Earth's most pressing challenge – of sustaining water for people and ecosystems.

Prof Isabelle Durance
FRESH CDT Director

Engagement

What makes FRESH Unique?

Located in a strategic UK region for water spanning two Government administrations (UK and Wales), FRESH helps accelerate economic growth nationally, while our vision is that NERC's investment will have global impact.
Our aim is to tackle real world problems. Projects are co-designed with government, business, regulatory bodies, charity, consultancy and land management sectors, and all projects have an end-user on the supervisory team. This will ensure that outcomes will have immediate application and lasting impact, whilst our researchers will be developing the agile thinking, problem solving skills and ambition to work with stakeholders who confront the 21st century's water challenges.

Our research themes

Our core themes use **Freshwater Bioscience** to:

- Quantify and manage emerging risks to freshwaters ecosystems that stem from changing patterns in behaviours, demography, governance or climate;
- Develop and test next generation tools for ecosystems and ecosystem services; such as eDNA or remote sensing tools;
- Tackle extinction and impairment in freshwater ecosystems;
- Create integrated solutions to manage ecosystem service sustainability.

"FRESH has provided great training experiences spanning statistics workshops and laboratory skills, to field courses and industry visits. It has provided me with a far broader understanding of my project and where it fits than I would have been able to reach as a 'standalone' PhD student"

Toby Champneys, Cohort 1 Student

Our ambition

- Nurture a dynamic and interactive community of students, researchers and stakeholders who will co-design and support research that addresses real world issues;
- Provide students with the theoretical and applied capability to tackle the complexity of freshwater challenges, and develop and apply pioneering science across disciplines;
- Instil students with a problem-solving 'can-do' view of the problems affecting freshwaters and their political, economic, scientific, technological, legal and ethical contexts.

How to get involved

There are different levels of partner engagement available, from in-kind support such as co-supervision, access to data and facilities or participation in FRESH activities), to full or partial financial support of a studentship (equivalent to CASE* studentships). So if your organisation wants to get involved in FRESH, here are a few options:

1. Co-design 'real-life' research

The central component of the FRESH programme will be a challenging and original research project focused on one of the priority themes. Each FRESH project will bring together supervisors from two different FRESH research institutions, along with the involvement of an external stakeholder or international colleague. If you would like to input ideas for projects and be on a supervisory team then please get in touch and we can put you in contact with academics, to work up an idea. Alternatively, come to the Annual Conference of the Water Security Alliance, where academics from different FRESH institutions and stakeholder partners can form links and start co-designing.

Projects are advertised in October each year. Stakeholders, along with an academic partner, build a project proposal that should:

- define a clear question and approach to answering it
- highlight its originality and/or significance,
- explain how it adds to, develops, or challenges existing literature in the field
- make a case for the importance of the work

2. Train the next-generation

Stakeholder partners can be involved in more ways than just developing/supervising the project itself, for example through delivering training at our courses in cross-cutting skills, developing 'real world' challenges for students to work on at training events, attending the WSA annual conference or sharing job opportunities.

3. Collaborate

Whenever possible or relevant, students will be encouraged to take up collaborative opportunities with stakeholders and end-users. If you think you have a suitable placement and would consider hosting one of our students for a few weeks then please get in touch.

"Working with a stakeholder is a brilliant way of using your PhD research to solve real-life problems"

Victoria Hussey, Cohort 1 Student

*CASE studentships (formerly known as 'Collaborative Awards in Science and Engineering') provide doctoral students with a first-rate, challenging research training experience within the context of a mutually beneficial research collaboration between academic and non-academic partner organisations. Non-academic partners include those from industry, business, public and the third/civil sectors.

Our doctoral projects

• 2018 Cohort

Speciation of emerging contaminants in wetland systems

Student: Dominic Macias; Lead Supervisor: Prof Barbara Kasprzyk-Hordern, Bath University; Stakeholder: Wessex Water

Microbial ecology and fate of pathogens in constructed polishing wetlands

Student: Franciszek Bydalek; Lead Supervisor: Dr Jannis Wenk, Bath University Stakeholder: Wessex Water

Integrated Biosensing Platform for Waterborne Pathogen Detection: Improving Public Health

Student: Joshua Rainbow; Lead Supervisor: Dr Pedro Estrela, Bath University; Stakeholder: Public Health England

Crayfish conservation: using eDNA to detect endangered and invasive species

Student: Jack Greenhalgh; Lead Supervisor: Prof Gareth Jones, Bristol University; Stakeholder: Applied Genomics

How does behaviour underpin the impact of invasive tilapia on native fish?

Student: Toby Champneys; Lead Supervisor: Dr Christos Ioannou, Bristol University; Stakeholder: GCRF Africa, Tamatamah

Nitrogen metabolism in phytoplankton under natural conditions and the presence of inorganic fertiliser and organic waste

Student: Elliot Druce; Lead Supervisor: Dr Patricia Sanchez-Baracaldo, Bristol University; Stakeholder: Natural England

Investigating nutrient cycling, retention and bioavailability of effluents discharged from constructed wetlands: optimising wetland management to reduce emerging risks to freshwaters

Student: Victoria Hussey; Lead Supervisor: Prof Penny Johnes, Bristol University; Stakeholder: Wessex Water

Determining the impact of nutrient, organic matter and contaminant fluxes from melting Himalaya Glaciers on downstream ecosystems

Student: Rory Burford; Lead Supervisor: Prof Jemma Wadham, Bristol University; Stakeholder: GCRF India, National Oceanography Centre

Environmental triggers for Geosmin production in freshwater ecosystems

Student: Annalise Hooper; Lead Supervisor: Dr Rupert Perkins, Cardiff University Stakeholder: Welsh Water

Does riparian woodland increase the resilience of stream ecosystems to floods and droughts?

Student: Fiona Joyce; Lead Supervisor: Dr Ian Vaughan, Cardiff University Stakeholder: Forest Research, Woodlands Trust

Biomonitoring of Antimicrobial Resistance in UK Freshwater Ecosystems: an Integrated Microbiological and Genomic Approach

Student: Mary Clare Brown; Lead Supervisor: Dr Frank Hailer, Cardiff University Stakeholder: Defra, Cefas

Combining a novel phenotypic virulence screen with genomic approaches to uncover bacterial acquisition of multi-drug resistance and virulence in aquatic environments

Student: Luke Lear; Lead Supervisor: Dr Michiel Vos, Exeter University; Stakeholder: Environment Agency

• 2019 Cohort

High resolution modelling of fate and transport of organic micropollutants and their effect on ecosystems in small rivers

Student: Thomos Homan; Lead Supervisor: Prof Jan Hofman, Bath University; Stakeholder: Wessex Water

Stereoisomerism of antimicrobial agents and risks to freshwater ecosystems

Student: Anania Lippi; Lead Supervisor: Barbara Kasprzyk-Hordern, Bath University; Stakeholder: Wessex Water

Predator-prey interactions under near-future environmental change: The combined effects of increasing temperature and turbidity

Student: Costanza Zanghi; Lead Supervisor: Dr Christos Ioannou, Bristol University; Stakeholder: Freshwater Habitats Trust

Defining nutrient sources and fluxes driving lowland drinking water reservoir ecosystem response

Student: Chris Webb; Lead Supervisor: Prof Penny Johnes, Bristol University; Stakeholder: Bristol Water

Diversity and speciation of aquatic macroinvertebrates of Malawi

Student: Harry Layfield; Supervisor: Martin Genner; Stakeholder: Department of Fisheries, Malawi

Diagnosing the reasons for biodiversity decline in rural rivers

Student: Emma Pharaoh; Lead Supervisor: Dr Ian Vaughan, Cardiff University; Stakeholder: Environment Agency

Using environmental DNA to understand the role of connectivity in pond ecosystems

Student: Claire Robertson; Lead Supervisor: Dr Daniel Read, CEH; Stakeholder: Freshwater Habitats Trust

Quantifying the impact of beaver reintroduction on aquatic ecology

Student: Kye Davies; Lead Supervisor: Prof Richard Brazier, Exeter University; Stakeholder: Devon Wildlife Trust

Investigating selection for antimicrobial resistance by non-antibiotic drugs in freshwater microbial communities

Student: April Hayes; Lead Supervisor: Dr Aimee Murray, Exeter University; Stakeholder: Astra Zeneca

Adapting to life in metal polluted rivers: implications for conservation, genetic diversity and fisheries management in the brown trout (Salmo trutta)

Student: Daniel Osmond; Lead Supervisor: Prof Jamie Stevens, Exeter University; Stakeholder: Game and Wildlife Conservation Trust

Antibiotic exposure impacts on fish health in natural freshwaters

Student: Eleanor Hawkins; Lead Supervisor: Prof Charles Tyler, Exeter University; Stakeholder: Cefas

Quantifying synergies between multiple stressors and biodiversity loss on the functioning of freshwater microbial communities

Student: Hebe Carmichael; Lead Supervisor: Prof Gabriel Yvon-Durocher, Exeter University; Stakeholder: Freshwater Habitats Trust

"Being part of the CDT is an excellent opportunity to meet researchers across a wide variety of disciplines, whilst learning useful skills and gaining relevant knowledge in freshwater science. Working with different universities and stakeholders really helps to highlight the importance of our individual research projects within the wider context of freshwater sustainability and conservation, and provides a great support network" Fiona Joyce, Cohort 1 Student

Meet our team

Sixteen international leaders in complementary fields of freshwater bioscience and sustainability from Cardiff, Bristol, Bath and Exeter Universities, CEH and BGS, will form the core training body and play key management or expert advisory roles. Over 60 other academic experts augment this critical mass to form a pool of supervisors with the array of multi-disciplinary skills required to deliver the FRESH CDT specifications.

Director

Isabelle Durance
(Cardiff)

Cohort 1 Students

Co-Directors

Jan Hofman
(Bath)

Penny Johnes
(Bristol)

Steve Ormerod
(Cardiff)

Charles Tyler
(Exeter)

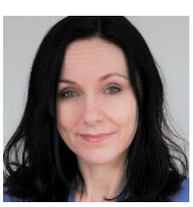
Stephen Thackeray
& Dan Read (CEH)

Daren Goody
(BGS)

Training Leads

Joanne Cable
(Cardiff)

Martin Genner
(Bristol)



Barbara Kasprzyk-Hordern
(Bath)

Gabriel Yvon-Durocher
(Exeter)

Admin Hub

Sarah Brasher
Manager

Kelsie Patton
Admin Officer

Advisory Team

Ian Bateman
(Exeter)

Philippe Blondel
(Bath)

Peter Kille
(Cardiff)

Thorsten Wagener
(Bristol)

In addition, we have a Steering Committee of end-users to advise on the strategic development, direction and future sustainability of the centre, as well as on all aspects of training offered by the CDT, including the prioritisation and development of PhD projects. Currently they are:
Ruth Barden (Wessex Water), Stuart Clarke (National Trust), Michael Dobson (APEM Ltd), Tony Harrington (Welsh Water), Tom Nisbet (Forestry Commission) and Glen Watts (Environment Agency).

GW4 FRESH

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in Freshwater Biosciences and Sustainability

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For more information, visit http://www.gw4fresh.co.uk

University of Bath · University of Bristol · Cardiff University / Prifysgol Caerdydd · University of Exeter · NERC Science of the Environment · BGS 1835 · British Geological Survey, Natural Environment Research Council · CEH