NATURAL ENVIRONMENT RESEARCH COUNCIL

Environmental GENOMICS

Genome - the entire DNA sequence of an organism
Genomics - translating DNA sequence to knowing what genes do

Working with the other UK research councils, NERC is investing £28 million in environmental genomics, post-genomics and proteomics from 2000. The initial phase, the Environmental Genomics programme, invested £2.5 million in a data centre that collects and stores research data for public access. This centre will work with the NERC research community to ensure that the data generated meet the emerging standards for all the 'omic' technologies.

To see which organisations are involved in the programme, visit: www.nerc.ac.uk/egenomics

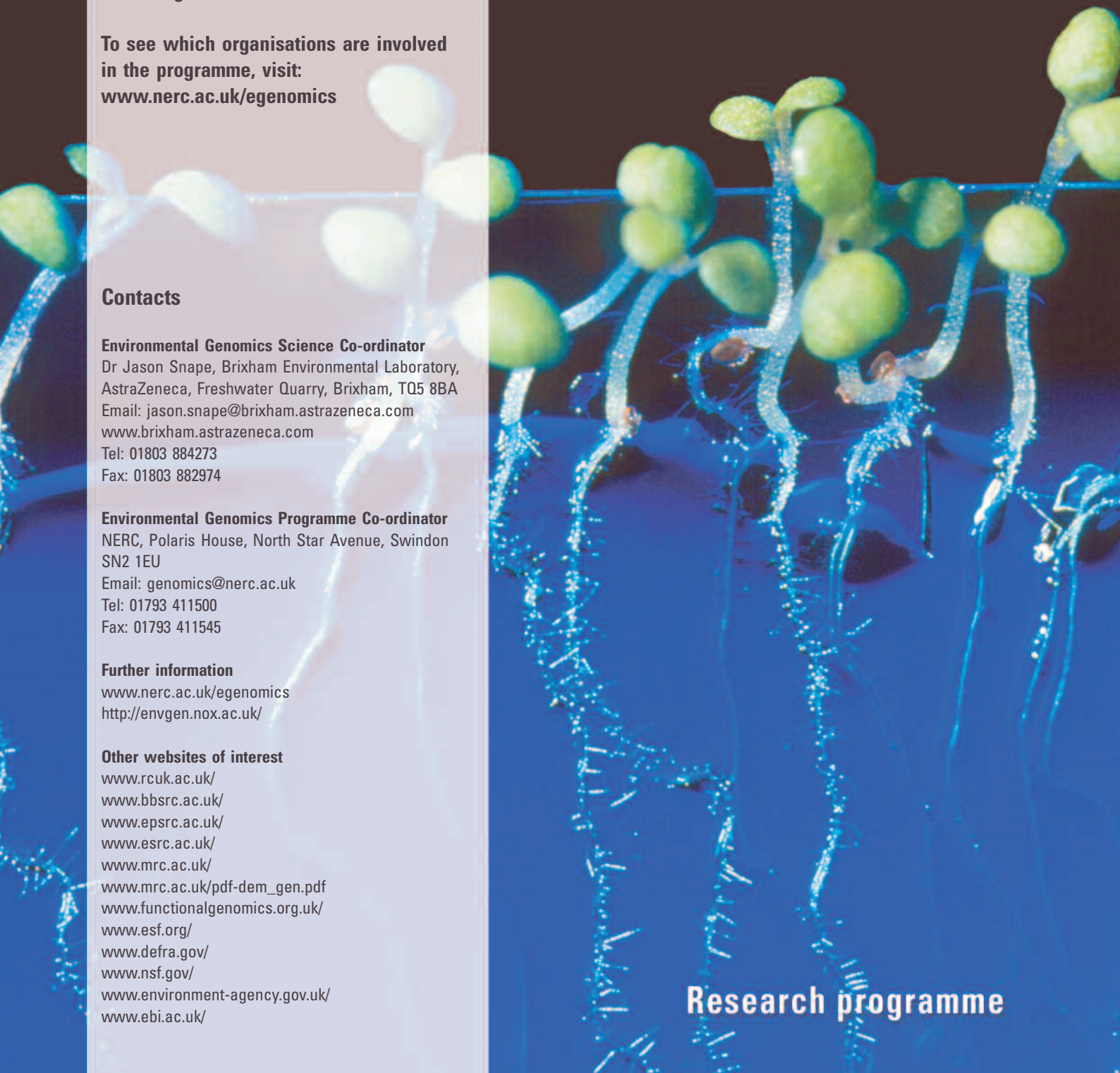
Contacts

Environmental Genomics Science Co-ordinator
Dr Jason Snape, Brixham Environmental Laboratory, AstraZeneca, Freshwater Quarry, Brixham, TQ5 8BA
Email: jason.snape@brixham.astrazeneca.com
www.brixham.astrazeneca.com
Tel: 01803 884273
Fax: 01803 882974

Environmental Genomics Programme Co-ordinator
NERC, Polaris House, North Star Avenue, Swindon SN2 1EU
Email: genomics@nerc.ac.uk
Tel: 01793 411500
Fax: 01793 411545

Further information
www.nerc.ac.uk/egenomics
http://envgen.nox.ac.uk/

Other websites of interest
www.rcuk.ac.uk/
www.bbsrc.ac.uk/
www.epsrc.ac.uk/
www.esrc.ac.uk/
www.mrc.ac.uk/
www.mrc.ac.uk/pdf-dem_gen.pdf
www.functionalgenomics.org.uk/
www.esf.org/
www.defra.gov/
www.nsf.gov/
www.environment-agency.gov.uk/
www.ebi.ac.uk/



Research programme

Genes and the environment

The environment an individual finds itself in shapes not just how it looks and behaves, but also which of its genes are switched on or off. Over time these short-term responses can determine the evolution of whole populations and even eco-systems. When an organism reacts to a change in its environment, tens of thousands of genes respond. But until recently, scientists could only study one gene at a time. Now, with 'omic' technologies, they can study many thousands of responses simultaneously, and this is set to revolutionise NERC-funded science.

The Natural Environment Research Council (NERC) Environmental Genomics programme is using genomic technology to answer such questions as: Why do some earthworms thrive in polluted soil? How did our genetic code evolve to separate us from chimpanzees and gorillas? Why do some pollutants interfere with sexual development and how does this affect fish populations? How do plants, animals and microbes adapt or evolve to cope with changing conditions such as rising temperatures or polluted environments? Which genes are most important for survival and breeding? How will human activities and changing climate alter the way ecosystems function?

By integrating this technology with traditional environmental science, the programme aims to not only answer today's important ecological questions, but also point to the important questions of the future.

Mauro Fermariello/Science Photo Library

'Omic' technologies

By studying an individual's entire genetic code (the genome level), we can see which genes are active at any time, under any conditions, and how they affect outward characteristics. Other new 'omic' research disciplines are rapidly developing. Transcriptomics studies the part of the genetic code that is activated or inactivated in response to environmental change. Proteomics investigates the proteins and enzymes produced when genes are activated; and Metabolomics investigates the chemical status of a cell at any given point. These tools help us understand what controls early development, from individual cells through to the whole organism. We can learn which genes and proteins are crucial for survival for both individuals and populations.

Studying relevant species

To date, most studies have focused on a few model species with a well-understood genetic code. These may be important in medicine or industry, but usually don't play crucial roles in natural ecosystems. The Environmental Genomics programme is examining a wide range of plants, animals and microbes, often alongside model species, such as a model nematode worm alongside the common earthworm, and the zebra fish, often studied in the laboratory, alongside the roach, found in our rivers and streams.

Tackling real-life issues

Environmental Genomics is using 'omic' technologies to answer environmental and ecological questions. But first we need to know what's normal. How do plants, animals and microbes respond to abrupt or temporary changes, like the seasons' varying temperatures or changing salt concentrations in tidal rivers and estuaries? How have they evolved to cope with gradual but long-term shifts such as past climate changes? We want to enable environmental managers to monitor how pollutants and other changes affect wildlife populations so that risks and hazards can be properly assessed.

The programme is nurturing a new UK scientific research community, bringing together ecologists and geneticists, and forging links with industry and environmental policy makers and regulators such as the Environment Agency. NERC has also co-sponsored discussions, on integrating 'omic' technologies into environmental management, with the Federation of European Chemical Industries, the American Chemistry Council, the Japanese Chemical Industry Association, the US Environmental Protection Agency and the US Geological Survey.

Related work elsewhere

Environmental Genomics researchers are working with scientists in similar programmes such as Investigating Gene Function and Exploiting Genomics (funded by the Biotechnology and Biological Sciences Research Council, BBSRC). Genomic research is multidisciplinary and creates large amounts of information that needs to be analysed and stored. The developing disciplines of bioinformatics and e-science are helping meet these needs, and our researchers are involved with bioinformatics schemes organised through the Engineering and Physical Sciences Research Council (EPSRC). Our scientists are collaborating with international colleagues, and the programme's data centre is developing strong links with the European Bioinformatics Institute. The programme has good links with the European Science Foundation and the US National Science Foundation (NSF). The NSF's Tree of Life sequencing project is providing new genomic information for environmentally important species, which will be highly relevant for NERC science.