

Capacity Building & Knowledge Transfer

Professor Anne Glover



Capacity Building

Capacity Building was a major objective of the Environmental Genomics directed programme

- Competence
- Community development
- Competitiveness and recognition
- Coordination and collaborations

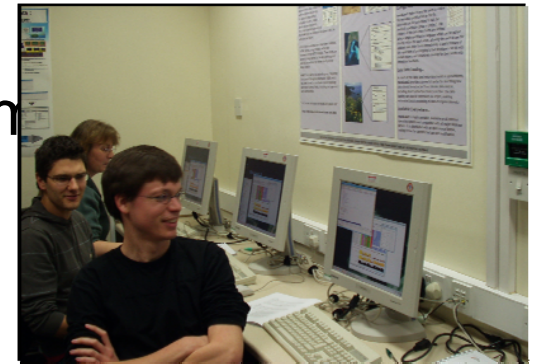




Competence

Promoted best practice through an extensive commitment to training and support

- Provided grass roots training opportunities
 - fund for students and post-docs
 - community driven
 - open to public funded stakeholders
- Bioinformatics
 - 35 training courses provided from experim microarray analysis to programming
- Delivered Master Classes

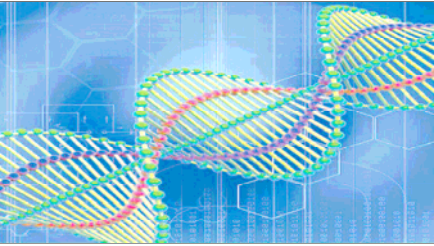




Competence

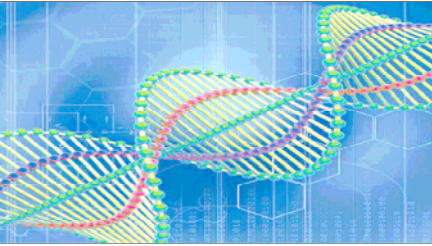
Master Classes provided in sequence analysis, transcriptomics, proteomics, metagenomics and metabolomics:

- Aimed to promote best practice and minimise repetition
- Made the UK and International experts in each field accessible to our students and PDRA's
- Mixture of workshops and laboratory-based fora
- Enabled proof of concept studies
- Jointly funded two master classes with the Society of General Microbiology



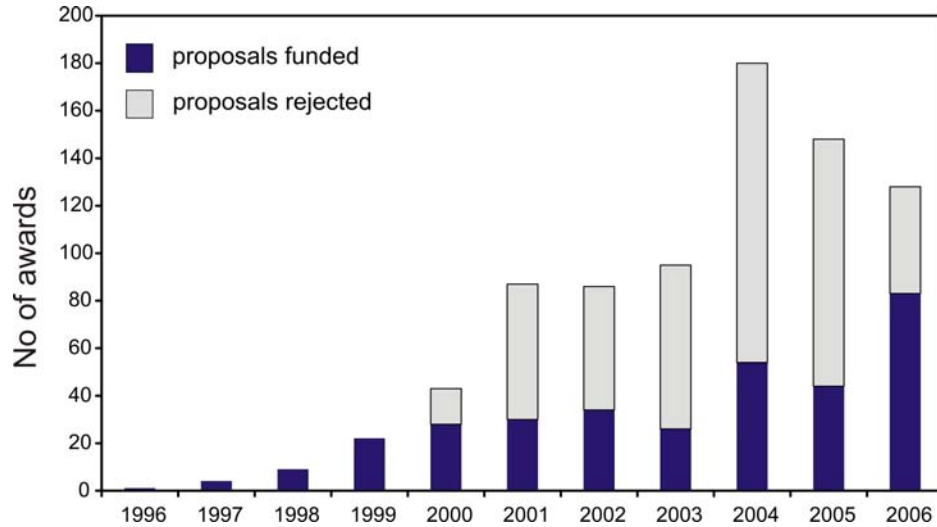
Community Development

- Brought the community together *via* training opportunities
- Held annual workshops and invited interested stakeholders
- Participated in Stakeholder events
 - Industry event with CEFIC (Brussels)
 - York Workshop (coordinated by EA)
- Provided access to resources outside the programme
- Supported new NERC molecular genetics facilities

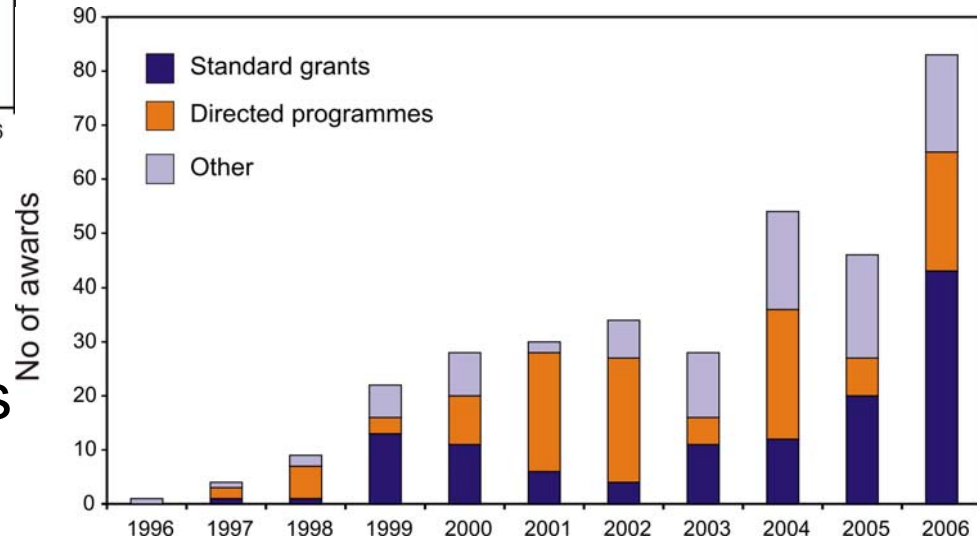


Community Development

Genomics proposals received by NERC



Funded proposals
By award type



Genes in the environment



Competitiveness & Recognition

- Only one of two international funding bodies to require MIAME Compliance (minimum information about a microarray experiment)
- Developed MIAME/ Env
 - ensured data standards were relevant to NERC
- Delivered long-term studies and integrated genomics with traditional life history, reproduction and development end-points
 - e.g. roach, zebrafish and worm studies





Competitiveness & Recognition

- Only environmental presenters at ICCA workshop on toxicogenomics
- Actively participated in WHO-IPCS workshop on human and environmental health (Berlin)
- Presented to OECD Chemicals group in 2002
- Major contributors to OECD Environmental genomics workshop (Kyoto)
- Contributed to two SETAC special workshops
 - Pensacola September 2003
 - Michigan September 2005



TOXICOGENOMICS *in* Regulatory Ecotoxicology

GERALD T. ANKLEY
GEORGE P. DASTON
SIGMUND J. DEGITZ

U.S. EPA

NANCY D. DENSLow

UNIVERSITY OF FLORIDA, GAINESVILLE

ROBERT A. HOKE

E. I. DUPONT DE NEMOURS CO.

SEAN W. KENNEDY

ENVIRONMENT CANADA

ANN L. MIRACLE

PACIFIC NORTHWEST NATIONAL

LABORATORY

EDWARD J. PERKINS

U.S. ARMY CORPS OF ENGINEERS

R&D CENTER

JASON SNAPE

ASTRAZENECA (U.K.)

DONALD E. TILLITT

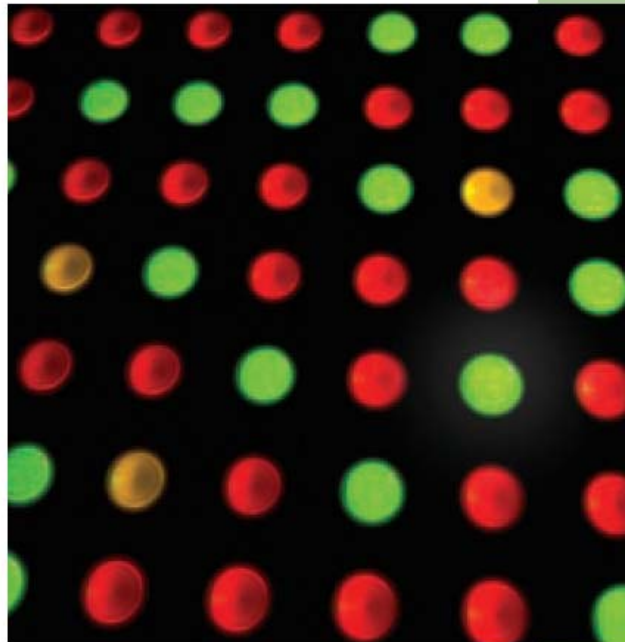
U.S. GEOLOGICAL SURVEY

CHARLES R. TYLER

UNIVERSITY OF EXETER (U.K.)

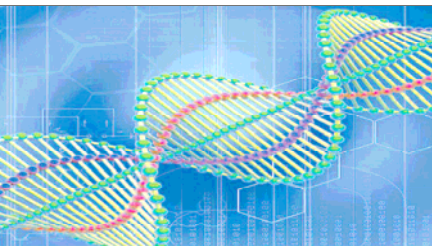
DONALD VERSTEEG

PROCTER & GAMBLE



Powerful new genomic techniques could significantly change how regulators evaluate contaminants; however, many practical and conceptual challenges remain before the promise of toxicogenomics can be achieved.

Output from SETAC Michigan



Competitiveness & Recognition

“The current understanding of biological systems is rapidly changing in ways previously unimagined. Novel applications of genomic technologies have already been commercialised. These advances in genomics may have significant implications for risk assessment policies and regulatory decision-making. **In this regard the international efforts of NERC are critical to establishing a universal understanding and approach. NERC-funded researchers working on the Environmental Genomics programme are to be commended for their vision and scientific leadership.**”

**Professor Bill Benson, Acting Chief Scientist,
US Environmental Protection Agency**

Coordination & Collaborations

Data
Management

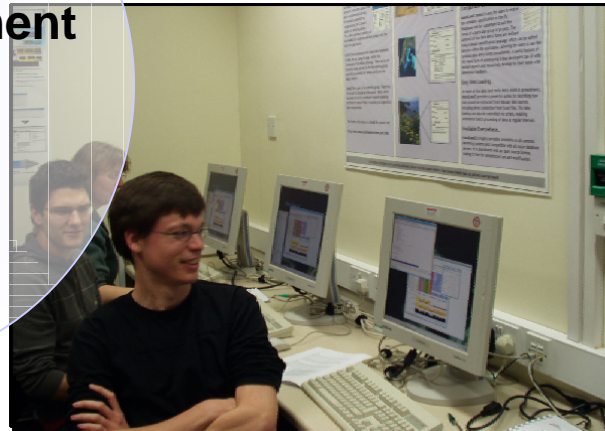
Software &
Standards
Development

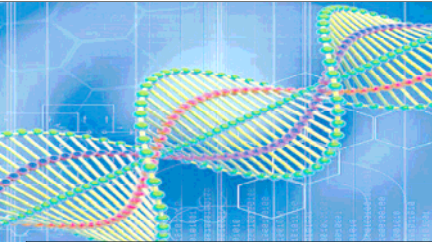
Bioinformatics
Workstations

NEBC

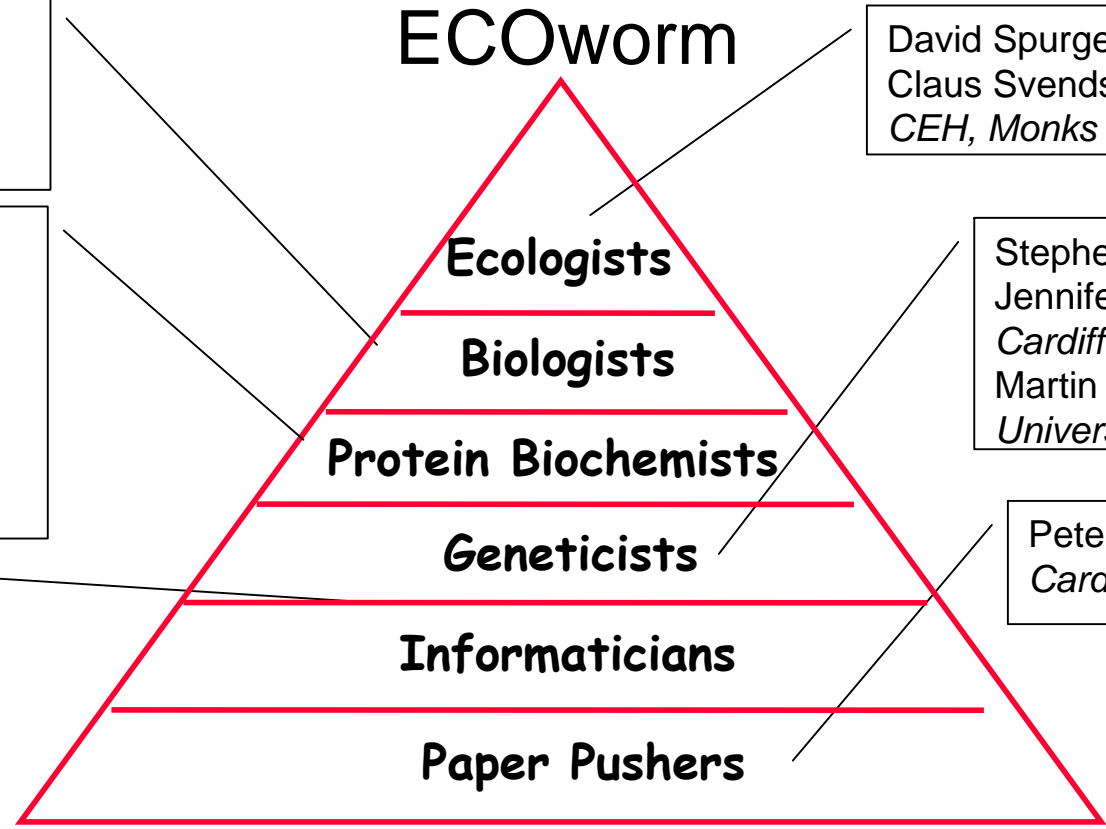
Training
and
Support

NEBC has played a pivotal role in coordinating the programme





Coordination & Collaborations



Stephen Sturzenbaum
KCL
A. John Morgan
Cardiff University

David Spurgeon
Claus Svendsen
CEH, Monks Wood

Peter Brophy
Jim Jefferies
James LaCourse
Liverpool University
Stephen Kelly
John Barrett
Swansea University

Stephen Sturzenbaum
Jennifer Chaseley
Cardiff University
Martin Jones
University of Edinburgh

Mark Blaxter
Ann Headley
John Parkinson
Ralf Schmid
Alister Anthony
James Wasmuth
University of Edinburgh

Peter Kille
Cardiff University

Collaborators:



Genes in the environment



Knowledge Transfer

The Environmental Genomics directed programme has endeavoured to ensure its research outputs have been communicated to all interested stakeholders to:

- training
- ensure environmental policy exploiting genomics is based on sound science (e.g. ecotoxicology)
- increase the economic impact of NERC-funded research

Regulators involved to ensure that the gap between science and policy does not grow



Knowledge Transfer

At the outset NERC have ensured that there was stakeholder representation on the Environmental Genomics Steering Committee:

- Environment Agency
- Syngenta (agrochemical industry)
- English Nature

NERC also appointed a Science Coordinator from Industry (AstraZeneca)



Exploitation

Genes have been identified in a virus that may slow down the ageing process of the infected cell by **keeping the host healthy** for as long as possible

The anti-aging properties of ceramide are well known to the beauty industry and it is a key component of anti-ageing creams.





Genomics & Environmental Toxicology

Industry & Environmental Regulators have an expectation that genomics will have a major impact on:

- Toxicology
 - assessing the impact of chemicals and pollution on man
- Environmental toxicology
 - assessing the impact of chemicals and pollution on wildlife



Genomics & Environmental Toxicology

If efforts in the later part of the 20th century focused on identifying chemicals that were toxic to man and wildlife, then the challenge for the 21st century is to understand the mechanistic basis of (eco)toxicity

Question?

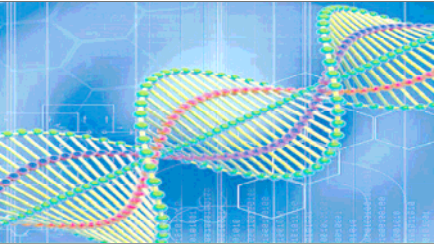
Can genomics identify robust, valid, and ecologically relevant biomarkers that offer increased environmental protection ?



Genomics & Environmental Toxicology

- Identification of mode(s) of action
 - new validated biomarkers
 - preference for *in vitro* screens
- Identification and quantification of sensitive sub-populations
- Improved interspecies extrapolation
 - between species
 - between aquatic vertebrates
 - wildlife to human?
- Identification of new bioindicators
 - broader ecological protection

REACH
WFD



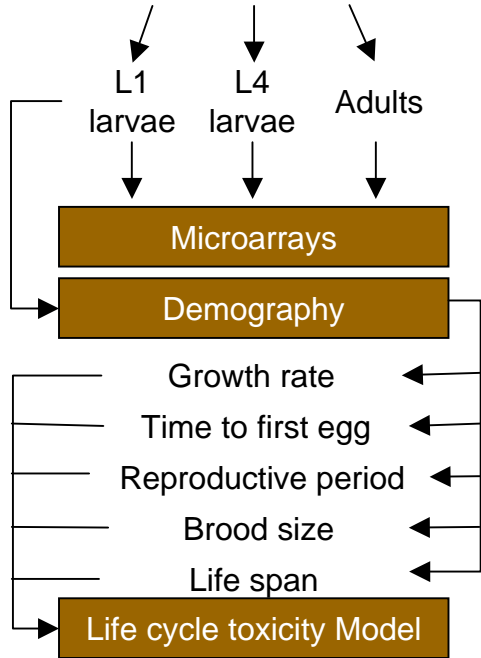
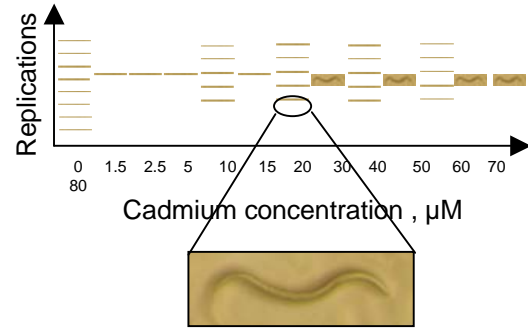
Genomics & Environmental Toxicology

The Environmental Genomic Programme has delivered the most comprehensive long-term exposure studies conducted to date

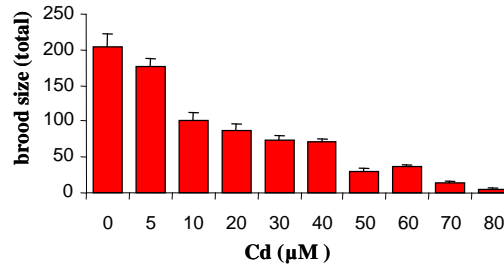
- fish
- Invertebrates

Omic tools have been integrated with traditional endpoints e.g. growth and reproduction

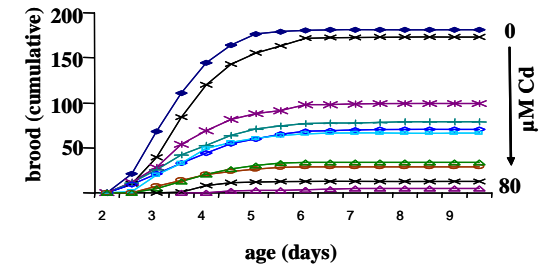
Genomics & Environmental Toxicology



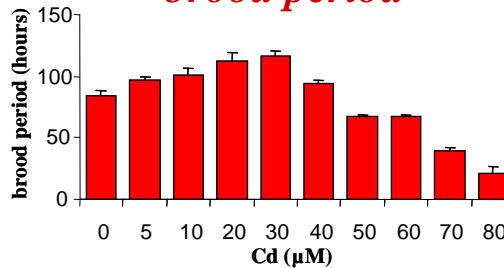
• brood size (total)



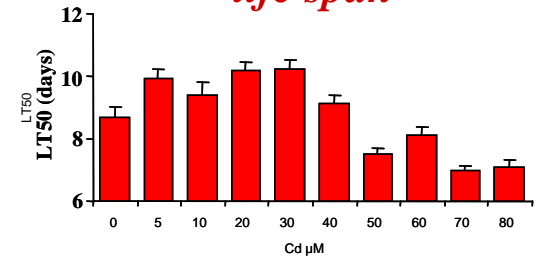
• brood size (cumulative)



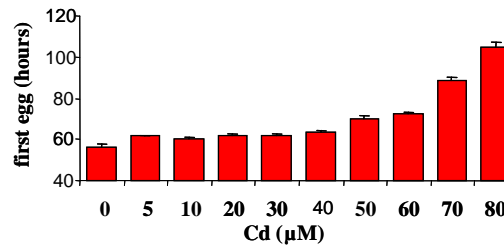
• brood period



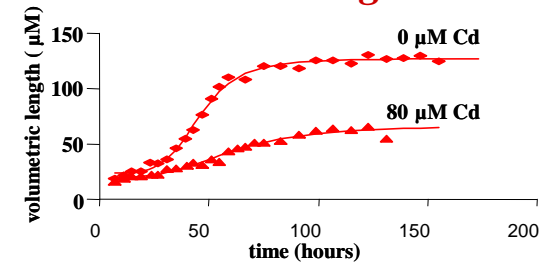
• life span



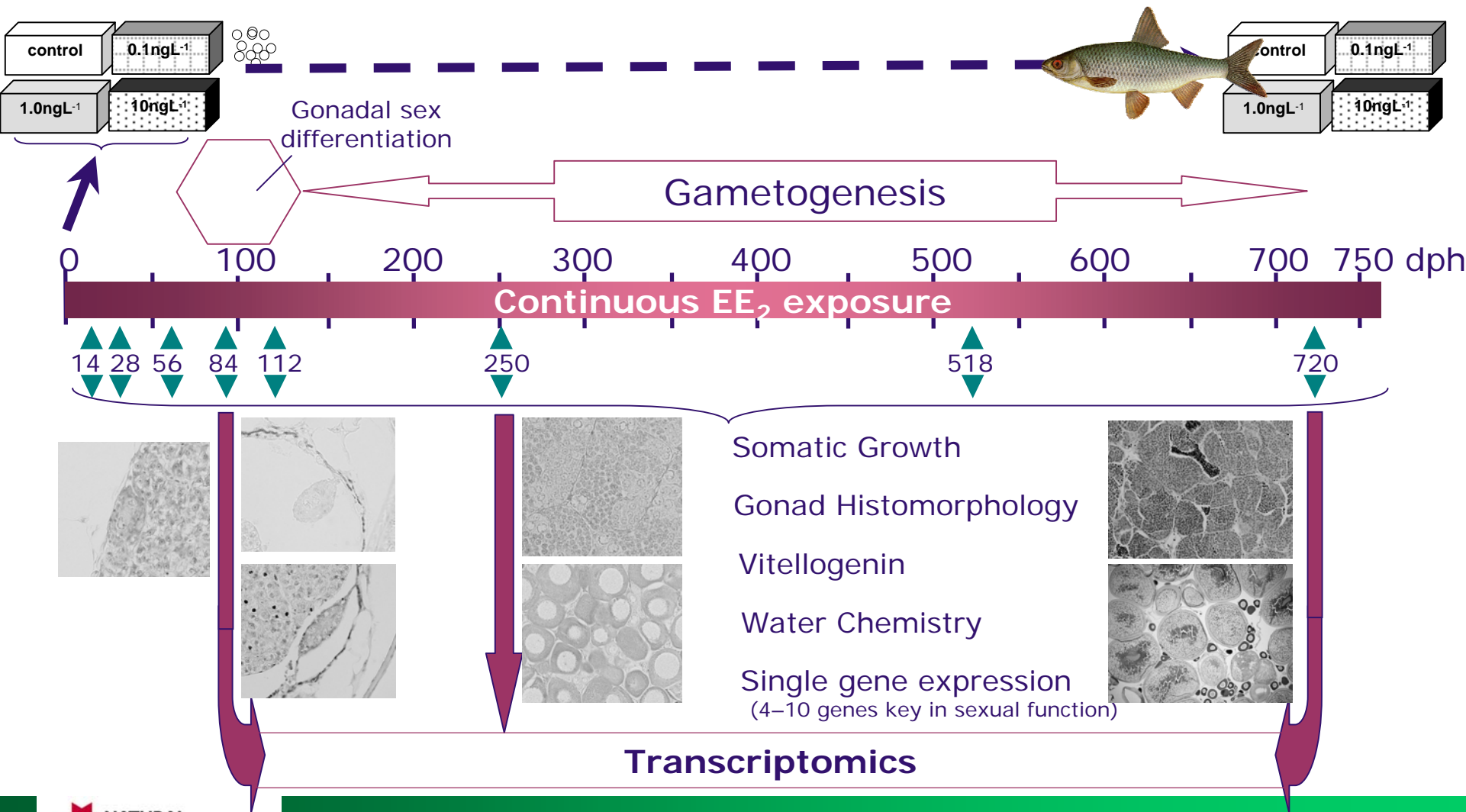
• time to first egg



• volumetric growth



Genomics & Environmental Toxicology





Benefits to Ecotoxicology

- Identification of new biomarkers
 - more relevant endpoints
 - *in vitro* assays
 - monitoring tools (e.g. worms)
- Potential for cost and animal welfare benefits



Genomics & Environmental Toxicology

“The Environment Agency has benefited from the new community of researchers, established by NERC, and the data generated by this programme. The programme has provided high quality training and developed national expertise in a new field. Researchers from the programme developed beneficial dialogue between the research community and end users. The latter including both policy and industry regulated groups that need a sound understanding of genomic technologies and the implication for regulatory activities.”

**Dr Jim Wharfe, Head of Science Programmes,
Environment Agency**