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GARNet

GARNet, the Genomic Arabidopsis Resource Network was established in 2000 to provide public functional genomics resources, which now operate through "user pays" cost recovery. Coordination activities are funded for 2005-2009, to provide an information resource (http://garnet.arabidopsis.info/, newsletter, annual meeting) and point of contact for other UK research communities and international genomics programmes. Plant systems biology and translational research are now important parts of GARNet's activities.

New Funding Programmes in the UK during 2007

The Biotechnology and Biological Science Research Council, BBSRC, is the major funding agency for Arabidopsis Research. In 2007 the following funding schemes were open to Arabidopsis Researchers.

- Systems Approaches to Biological Research (SABR)

  The BBSRC previously funded 6 centres in Systems Biology, spread across the UK (http://www.bbsrc.ac.uk/organisation/institutes/systems_biology_centres.html). The SABR initiative with a budget of £25.8M aimed to promote further uptake of systems biology amongst research groups in the UK. Of 6 projects funded 3 involved Arabidopsis Research.

  1. Regulation of Biological Signalling by Temperature (ROBuST) – Universities of Edinburgh, Liverpool, Warwick and York. Lead PI, Dr. Karen Halliday - University of Edinburgh
  2. Elucidating Signalling Networks in Plant Stress Reponses – Universities of Warwick, Essex and Exeter. Lead PI, Prof. Jim Beynon – University of Warwick
  3. A multi scale approach to genes, growth and geometry – John Innes Centre and the University of East Anglia. Lead PI Prof. Enrico Coen - John Innes Centre

- ANR-BBSRC Systems Biology Collaborations

  This joint call between the Agence Nationale de la Recherche (ANR) France and the BBSRC was set up to support high quality research in systems biology between France and the UK. It aimed to facilitate the development of systems biology research both nationally and in Europe by encouraging a wide community to become involved in Systems Biology. 10 consortia were funded via this scheme including 3 that involve Arabidopsis/Plant research.

- Networks in Synthetic Biology

  This scheme was launched in 2007 to develop and establish communication and networking between researchers in the biosciences, engineering and the physical sciences in the area of synthetic biology, with associated input from the social sciences and humanities. 7 Networks in Synthetic Biology will be funded via this scheme, representing a total budget of £1M from BBSRC, EPSRC, AHRC and ESRC.

- European Research Area for Plant Genomics (ERA-PG)

  After a successful first call, that funded 29 projects across Europe, ERA-PG launched it is 2nd call for projects at the end of 2007: "Strengthening the European Research Area in Plant Genomics – integrating new technologies in plant science". http://www.erapg.org/everyone. Like the first call, applications for this round of ERA-PG must consists of research groups from 3 or more countries taking part in the call (Austria, Belgium, Finland, Germany, Israel, The Netherlands, Portugal, UK and Canada).

- Crop Science Initiative

  During 2007 the BBSRC put £13M into funding 18 research projects that aim to translate the excellent basic plant science base in the UK, into practical applications that will benefit farmers and consumers. Problems being tackled include:- improving willow biomass yields for bioenergy by transferring our current knowledge of shoot branching in Arabidopsis to willow.

- Sustainable Agriculture Research for International Development (SARID)

  In collaboration with the DFID, this initiative supports high-quality basic and strategic biological and biotechnological research in crop science and sustainable agriculture, which will establish productive partnerships between scientists in the UK and developing countries.

Noteworthy breakthroughs by UK researchers in 2007

- Control of plant organ size by KLUH/CYP78A5-dependent intercellular signaling.

  Anastasiou E, Kenz S, Gerstung M, MacLean D, Timmer J, Fleck C, Lenhard M, Dev Cell 2007 Dec 13(6):843-56

  UK researchers have discovered how plants control the size of organ such as leaves and flowers. Cells at the margin of an organ secrete a non-cell autonomous mobile growth signal (plant specific cytochrome P450) that keeps the cells throughout that organ dividing and thus growing larger. However, since the growth signal is only produced by the margins, the concentration within the organ reduces as the organs grows and once it has dropped below a critical threshold the organ stops growing. Interestingly this growth signal does not appear to influence the classical phytohormones, suggesting that there are still growth-promoting substances to be discovered in plants.

  Animals also use a similar 'dilution' principle to control size e.g a fly's wing; indicating that a common mechanism for size measurement has evolved in plants and animals.

- Light-quality regulation of freezing tolerance in *Arabidopsis thaliana*

  Franklin KA and Whitelan GC, Nat Genet. 2007 Nov;39(11):1410-3.

  Unlike animals, plants are not able to control their core temperature, yet they are require to cope with large temperature fluctuations. So how to plants deal with such changes in their environment? Recent work in the UK has shown that the two separate pathways, regulating light perception and temperature sensing, work together to protect plants against freezing temperatures. On their own either low temperatures or low light levels are not enough to induce the cold acclimation pathway but the combination of the two prevents plants from freezing. Such a mechanism is likely to help plants predict the oncoming winter during the autumn and help them to prepare for colder temperatures.

- Step-by-step acquisition of the gibberellin-DELLA growth-regulatory mechanism during land-plant evolution

  Yasumura Y, Crumpton-Taylor M, Fuentes S, Harberd NP, Curr Biol. 2007 Jul 17;17(14):1225-30.

  In this paper a team of UK scientists illustrates how plants have evolved the ability to adapt to changes in climate and environment. Higher plants are known to use the gibberellin signalling pathway to promote growth and take advantage of favorable conditions or repress growth in unfavorable conditions. Researchers show how this mechanism has involved in a series of steps that are associated with the key stages of flowering plant evolution.

- An ancient mechanism controls the development of cells with a rooting function in land plants.

  Menand B, Yi K, Jouannic S, Hoffmann L, Ryan E, Linstead P, Schaefer DG, Dolan L, Science. 2007 Jun 8;316(5830):1477-80

  Land invasion by plants is significant step in evolution, which fundamentally changed the earth's ecosystem forever. Ancient plants such as moss exist with just one pair of chromosomes for the majority of their life cycle and don't have roots but instead grow cells such as rhizoids for anchorage. Whilst in higher plants the diploid phase dominates and roots are used to anchor the plant and absorb nutrients. In this paper UK researchers have discovered that the mechanism that controls the developmental of root hairs in Arabidopsis also controls the development of tip-growing cells with a rooting function in moss. This work would indicate the diversification of the body plan of plants for land colonization was dependent on the switch to a sporophyte dominant life cycle and recruitment of genes from the haploid to diploid phase.

- Pseudomonas syringae pv. tomato hijacks the Arabidopsis abscisic acid signalling pathway to cause disease.

  Torres-Zabala M, Truman W, Bennett MH, Lafforgue G, Mansfield JW, Rodriguez Egea P, Bögre L, Grant M., EMBO J. 2007 Mar 7;26(5):1434-43.

  Plant pathogens must manipulate their host to produce an environment conducive to their replication and dissemination. To do this many bacteria produce proteins, known as effectors that are targeted to the host cytoplasm. In this paper UK researchers have shown that the effectors of *Pseudomonas syringae* induced genes involved in the biosynthesis of and response to the plant hormone abscisic acid (ABA). They showed that in a successful colonization of a plant by the bacteria the levels of ABA rose. They also demonstrated that adding ABA increased host plant susceptibility whereas a mutant that disrupted the ABA synthetic pathway increased host resistance to the bacteria. These important data demonstrate that pathogens manipulate host hormonal balance to favour their growth and that specific pathogen effector proteins have evolved to exploit this route to suppress host defence mechanisms.

Relevant Meetings 2007

- GARNet 2007 - John Innes Centre Norwich.

  The aim of the annual GARNet meeting is to inform the UK Plant community of new advances, ideas and initiatives (http://www.sebiology.org/meetings/Notts08/Plant.html)

- Mathematics in Plant Science Study Group – University of Nottingham

  In collaboration with the Centre for Plant Integrative Biology (CPIB) GARNet hosted the inaugural Mathematics in Plant Science Study Group. This workshop brought together theoreticians and researchers to tackle 5 problems in plant science (http://cpib.info/workshop.shtml)

- Society of Experimental Biology – Annual Meeting

  This is an international conference comprising of high quality science, networking and education sessions, and techniques workshops (http://www.sebiology.org/meetings/index.php)

UK Funding Bodies

In addition to the BBSRC (http://www.bbsrc.ac.uk/), other relevant funding bodies include

- NERC (Natural Environmental Research Council) http://www.nerc.ac.uk/
- DEFRA (Department for Environment Food and Rural Affairs) http://www.defra.gov.uk/
- SEERAD (Scottish Executive Environment and Rural Affairs) http://www.scotland.gov.uk/topics/agriculture
- The Royal Society http://royalsociety.org/