JOHN INNES CELEBRATES ITS CENTENARY - GENETICS 100 YEARS ON

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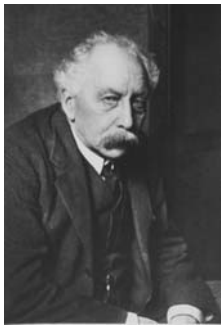
John Innes Centre

In 2010 the John Innes Centre will have been at the forefront of 100 years of scientific breakthroughs benefiting the world through pioneering research in genetics. Its Centenary focus celebrates the legacy of William Bateson, the first Director.



William Bateson, first Director of JIHI, coined the word genetics

Founded by the bequest of London property developer, John Innes (1829-1904), the John Innes Horticultural Institution (JIHI) opened in January 1910. Its remit was discussed by Trustees of the will, the Board of Agriculture, the Board of Education and the Director of Kew Gardens who established the JIHI as a training school for practical gardeners, a fruit-breeding research station, and an institution 'for the promotion of horticultural instruction, experiment and research'. William Bateson (1861-1926) was chosen as the first Director because he led the new science of genetics in Britain. He translated and promoted Gregor Mendel's papers on plant hybridisation and coined the word 'genetics' in 1905. Bateson assembled a group of enthusiastic young scientists and used Mendel's principles to attack problems of inheritance in plants. From 1910 to 1948 the Institution was based at Merton in Surrey, centred on the Manor House at Merton Park, Mr Innes' former home. Two moves followed, first to Bayfordbury, a stately home south of Hertford in 1949, and in 1967 to Colney near Norwich (its present site) to form an association with the newly-established University of East Anglia.

For the first half of the twentieth century the JIHI was the only place in Britain undertaking research in plant genetics, and where students could train in the subject. During controversies over the role of genetics in biology, particularly with Russian science under Stalin, its scientists acted as spokespeople for genetics in Britain. Although University expansion has greatly increased Britain's resources for genetics, the John Innes Centre continues to play a world-leading role in research and training today.

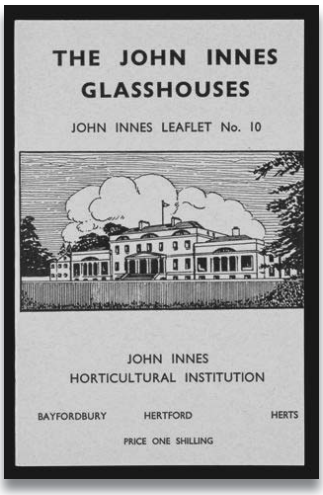
From 1910 to 1946 the John Innes Horticultural Institution was an independent research centre funded by the John Innes Charity and much of its unique character was due to its valued independence. By 1946 the needs of the Institution had outgrown the resources of the Charity and JIHI became a grant-aided station of the Ministry of Agriculture, later administered by the Agricultural Research Council (which became the AFRC, then BBSRC). Today, the John Innes Foundation trustees contribute to research and training, sponsoring several graduate studentships each year and supporting the study of the history of genetics. The Foundation owns a very significant collection of archival material, the History of Genetics Library and the 'Special Collection' of rare botanical books at JIC.

During the first phase of the Institution's history the fruit industry helped shape the research agenda with representatives of the Fruiterers' Company and the National Fruit Growers' Federation on its managing body. Fruit breeding was one of the main lines of research until the 1970s. Although many of the early crosses were made to study inheritance and not to produce new varieties, the JIHI ultimately released 53 fruit varieties, 28 flower varieties and 15 vegetable varieties. One of the lasting contributions of UK fruit development was the MM (Malling Merton) series of rootstocks, originally bred for woolly-aphid resistance in apples but now used in modern rootstocks to provide other properties.

During World War II JIHI published a series of leaflets on fruit planting and fertility, and on composts for specific uses, as part of its contribution to the war effort. Later the horticultural trade made 'John Innes' a household name. But JIHI never made or sold compost and received no monetary gain from that major development in plant propagation, as the recipes were published and not patented.

Fruit breeding was one of the main lines of research until the 1970s

Horticultural training was provided through the Institution's student gardener scheme which ran from 1911 to 1939. Six student gardeners ('exhibitioners') were taken on every year to receive specialist instruction in the gardens and glasshouses.



Glasshouse design was pioneered at JIHI

In 1960 the Institution changed its name to the John Innes Institute, signalling the inclusion of microbial science in the research programme and a move towards more fundamental research in biology. Applied genetics work moved away from fruit and began to concentrate on peas and other horticultural crops; today JIC does not breed new plant varieties. In 1994 the Institute was renamed again as the John Innes Centre, after the John Innes Institute integrated with the non-privatised part of the Plant Breeding Institute, relocated from Cambridge, and the AFRC Nitrogen Fixation Unit which moved from the University of Sussex.

The modern day JIC operates on a scale that allows studies from the atomic level to crop field performance, and promotes the rapid transfer of knowledge from model organisms to target crops and industrial microbes This integrated, multidisciplinary approach enables JIC to tackle the unprecedented challenges facing the world such as food security, sustainable land use, increased cost of energy and commodities, living with the impact of rapid environmental change, rapid loss of biodiversity, reducing reliance on petrochemicals, increased population pressures, healthy ageing and control of infectious diseases, and the production of sufficient safe and nutritious food. The improvement or development of crop plants for enhanced food and feed quality and the production of raw materials is a priority, as is food composition for animal and human nutrition, the prevention of chronic diseases and healthy ageing.

Research at JIC continues to have a significant impact for wealth generation, quality of life and human health because plants are our food and that of our farmed animals, providing most of our fossil energy reserves and a large range of industrial products. Plants are sustainable and eco-friendly 'factories' for the production of starches, oils and lubricants, drugs, plastics and pharmaceuticals. JIC scientists are underpinning the development of improved and novel crops by understanding plant function at the molecular level, genetic variation underlying important traits such as yield, and the impact of the environment and environmental change on productivity. Through bioengineering, JIC is developing efficient systems for protein production in plants, especially for high-value proteins, nanoelectronics, biosensors and drug delivery devices.

Healthy ageing is hampered by the emergence of antibiotic resistance which has led to an urgent requirement for new anti-infectives, and the need for a better understanding of the mechanisms of resistance. The discoveries being made at JIC and the exploitation of new antibiotics and other bioactive products from microbes will be critical for future disease control.

Our research is providing solutions to global challenges and securing our future.

A recent economic impact report highlighted significant benefits resulting from JIC's research. The identification and development of the semi-dwarfing gene in wheat has helped to increase production by £75M per annum in the UK alone. Work to mitigate major losses in world wheat production could potentially be as much as £4.3B pa. Gene mapping in cereals underpins actions to address world hunger, and can be seen as leveraging World Bank funding of £2.6M pa into organisations such as IRRI (Philippines) and CIYMMT (Mexico). Through research into semi-leafless varieties, JIC's work underpins the £38M annual UK pea market, with directly attributable sales of £2.9M pa. Newly-introduced "Super-Broccoli" is adding value to UK consumers of £0.5M pa, and may also contribute to reduced incidence of cancer. JIC discovered the genetic basis of antibiotic properties in *Streptomyces*, a global market now worth $35B pa. The spin-out companies Novacta (in receipt of a £3M Wellcome Trust grant to work on solutions to *Clostridium difficile* and MRSA) and Procarta Biosystems (developing novel strategies for overcoming antibiotic resistance) have arisen from this fundamental science, and if successful could add £194M to the UK economy through prevention of avoidable deaths.

John Innes Centre at Colney, Norwich

A focal event to celebrate 100 years of John Innes science takes place at the John Innes Centre in Norwich, UK from 9th-11th September 2009. An international line-up of science historians will cover the history of John Innes with topics including the background behind the founding of the 'John Innes Horticultural Institution', the role of women scientists in the John Innes workforce in the early years, Bateson's contributions to evolutionary theory, and JI's place in the history of genetics from the inter-war years to the atomic age. They will be joined by scientists Mike Gale and Keith Chater, and science philosopher Sabina Leonelli, to cover JIC's contribution to the modern sciences of crop genetics, bacterial genetics and *Arabidopsis* research - history in the making! This will be followed by a science symposium reflecting on the various areas of human interest that have been transformed by a genetic approach, examining where these areas are now and where they might be in the next 100 years. The meeting is being opened by Nobel Laureate Professor Sir Paul Nurse, delivering the Bateson Lecture.

To view information on these and other Centenary events including 'Discovery Day' for the public to explore the science at JIC, a planned Economic Impact event at the House of Lords and a Forward Look Conference in London, go to www.jic.ac.uk/centenary/

Front Cover Image

Scientists at JIC have expressed two genes for production of anthocyanins in tomato fruit which originated from the garden flower Antirrhinum (snapdragon). Genetic modification offers the opportunity to develop food with large amounts of phytonutrients (in this case, anthocyanins) with health promoting properties.