

Genomics tackles major breeding issues

The 21st Robert Fraser Gordon Memorial Lecture, annually given at the WPSA-UK branch annual meeting, highlighted the possibilities of genomics in poultry breeding.

By Dr Peter Hunton

The Robert Fraser Gordon Memorial lecture honours the founding director of the UK Animal Health Trust's Houghton Poultry Research Centre. The 21st lecture was given by Dr Grahame Bulfield, until recently director of the Roslin Institute, and now vice-principal and head of the College of Science and Engineering at the University of Edinburgh.

Dr Bulfield was responsible, while at Roslin, for establishing its genomics laboratory. He said that this is now a "research hotel", and anyone in the UK with an interest in the area studied there is welcome to visit and contribute to the effort. Presumably, this could include scientists working for commercial breeders as well as academics.

The challenges recognized by the genomics lab include those of feeding the world, being competitive in a complex market place, and responding to public concerns. Biotechnology, by its very nature, increases the pace of research and blurs the boundaries between some of the more traditional disciplines. Bulfield emphasized the need for researchers to identify and promote new strategies, such as genomics research. In most cases, he sees governments seizing on such initiatives within a few years as the next important area of funding. Where the research infrastructure already exists, this makes funding targeted and rapid.

In poultry genomics (the same as for other species - laboratory animals such as mice have been much more intensively studied) priority areas have included:

- markers, genes and the gene map
- quantitative trait loci (QTL's) and Marker Assisted Selection (MAS)
- isolation of "trait genes"
- functional analysis - attempting to bridge "The phenotype gap."

Working on disease resistance

The poultry gene map is developing rapidly, and comparisons with other species



Dr Graham Bulfield (right), receives the Gordon Memorial medal from professor Peter Biggs.
(photo Claire Weeks)

have been made. Nearly all the information is in the public domain, and available on the Roslin web site.

Scientists are now identifying chromosome areas of interest in relation to phenotypic traits. For example, use of crosses between extreme phenotypes have enabled genes to be identified with major effects on body weight, growth rate, carcass and meat quality.

Of considerable interest to breeders is work on disease resistance and responsiveness to vaccines. These areas have traditionally been difficult because standard challenges are hard to define, and must be used outside a conventional breeding program. Nevertheless, selection studies by Hutt and Cole as long ago as the late 1960's showed that major genes existed for such traits as resistance to Marek's disease. The value of molecular genetics research is that the genes may be identified, and selection imposed, without using direct challenge with virulent disease organisms.

In general, Dr Bulfield said that there is still a gap between identification of QTL's, trait genes, etc. and commercial exploitation. However the "functional genomics toolkit" is being rapidly developed to address this challenge.

Traits with low heritability

Of greatest benefit to commercial breeders, according to Dr Bulfield, will be identification of genes or markers controlling traits with low heritability, or which cannot be measured on live animals. These would include carcass traits, reproductive traits like egg production that can be measured only in one sex, and traits related to welfare and behaviour.

Finally, Dr Bulfield introduced the Genesis Faraday Partnership (Farm Animal Genetics and Genomics.) This is a new concept and involves many cooperating groups and members. It will attract major government funding, and will have resources for pre- and post-Doctoral training, reciprocal staff transfers, and will concentrate on knowledge transfer and practical implementation of research results. Current membership includes 14 academic bodies (research institutions and Universities) 16 breeding entities (including multinational corporations and breed societies), and three animal health companies.

All told, an exciting future, for those scientists and corporations with the resilience to survive in the competitive world of breeding and genomics. ■