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Songbird genome to aid understanding of learning and memory

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Medical Research Council (MRC) scientists have helped to sequence the zebra finch genome, discovering more about the genetics behind the wiring of the brain when learning and memorising, as well as immunity and fertility – and how this might be applied to human health.

The collaborative study involved experts from the MRC Functional Genomics Unit in Oxford as well as six other UK institutions and further international teams.

The zebra finch is only the second ever bird genome to be sequenced, the first was a chicken.

Learning and Memory

Zebra finches and other songbirds have one important thing in common with humans: they learn how to converse with one another, which is very rare in other animals. Chickens do not demonstrate this kind of vocal communication and so a comparison between the zebra finch and chicken genomes has helped to identify and locate the genes that are directly involved in vocal learning.

Professor Chris Ponting, an author on the paper from the MRC Functional Genomics Unit at the University of Oxford said:

"Normally we think of genomes providing a blueprint for making only proteins, but there are indications here that song stimulates the zebra finch to turn off the production of even more exotic molecules called RNAs."

The next stage will be to investigate whether these RNAs play roles in learning and memory for the zebra finch, or even humans.

Fertility

Dr Jon Slate, University of Sheffield and colleagues have discovered that there is a genetic component to sperm length and speed in the zebra finch. This genome could be invaluable for research into human fertility. Dr Slate said:

"Discovering the genes that explain these differences in fertility is now possible, and it is likely that the same genes will have similar effects in humans as well".

Mick Watson, an author on the paper and Head of Bioinformatics at the Institute for Animal Health said:

"To understand a genome, we need more than just the DNA sequence itself. Many scientists must work together to define which parts of the DNA are functional, and what they do. This broad collaboration has allowed a large group of researchers to work together to share data, knowledge, tools and expertise to produce a meaningful genome sequence that will be invaluable to many areas of research."

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The study also enabled scientists to identify genes that related to the bird's immunity, which may help to create specific vaccines for birds in future. In addition the zebra finch was a useful model for identifying genes responsible for the remarkable diversity of bird plumage, song and behaviour.

Understanding the link between genetics and disease is embedded in the MRC's research strategy. The MRC funds the highest quality science that will help develop this knowledge, taking it from laboratory bench to patient bedside as quickly as possible, such as determining the likelihood of genetic diseases and targeting new treatments.

The research, which is published in *Nature* on 1 April 2010, is a collaboration between: USA (Washington University, University of Illinois, UCLA, Duke University, Oregon Health & Science University, University of Houston, Institute for Systems Biology, Louisiana State University, University of Colorado, Harvard University, and Monsanto), Sweden (Uppsala University), UK (EMBL-EBI, The Wellcome Trust Sanger Institute, MRC Functional Genomics Unit, Institute for Animal, University of Kent, University of Sheffield and The Roslin Institute), Spain (Universidad de Oviedo), Israel (Weizmann Institute of Science) and Germany (Freie Universitaet Berlin and Max Planck Institute for Molecular Genetics). The research is funded by National Human Genome Research Institute (NHGRI) with additional support from The Biotechnology and Biological Sciences Research Council, NIH, Swedish Research Council, and the Knut and Alice Wallenberg Foundation.

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