German Genetics Conference 2009: Session II

Martin Fenner, Gobbledygook

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Another guest post from Alex Knoll reporting from the German Genetics Conference in Cologne.

Dusko Ehrlich fom Jouy en Josas in France started off the second session of the meeting. He is working with the MetaHIT project, which tries to do a metagenomic analysis of the human intestinal tract. This is interesting because each individual human carries about ten times more microbial cell in the gut than there are human cells in the whole body! These microbes provide the interface between the food we take in and the epithelial cells of the gut. There, they play many roles not only in metabolising materials and molecules we are not capable of, but they also produce vitamins for us and help the immune system. It is therefore very important to understand this further organ of our body, as Dusko Ehrlich called it.

The MetaHIT project takes many approaches to understand the interaction between the human intestinal microbes and human phenotypes like obesity ore bowel diseases. For example, they want to sequence a reference gene set and then look for associations of these genes with diseases. The reference gene set is produced by Solexa paired-end sequencing of samples from 124 individuals, which produced almost 0.6 terabases of sequence in total already! From these sequences contigs are produced and ORFs are predicted, which are almost completey of bacterial origin. This then allows for the comparison of bacterial genes and genomes between the sampled individuals, and also the establishment of a 'minimal metagenome' of the gut ecosystem for absolutely required functions.

The second talk was really interesting to me: In Drosophila melanogaster the male flies perform a courtship dance to win over the female. Barry Dickson from the Institute of Molecular Pathology in Vienna is looking for the genetic neurobiologic basis of this behaviour.

The fruitless gene, which produces a transcription factor, is absolutely required for the courtship of male flies; females don't produce a protein product due to alternative splicing. But when females carry the male form of the fru gene, they show the typical male courtship behaviour. This means fruitless is some kind of molecular switch for male behaviour in Drosophila by programming the nervous system. So they looked at neurons that express the fru gene with the help of

reporter genes and found sensory, central and motor neurons that need to be active for male courtship. Dickson's lab was able to assemble a digital atlas of fru neurons, with stunning pictures, and were able to derive a 'wiring diagram'. Just six easy steps: Starting from fru-expressing olfactory receptor neurons that specifically sense pheromones it only takes this few neural connections to motor output in wing muscles that are required for the courtship song!

Now the group is trying to go the high throughput route by teaching a computer to analyze the courtship behaviour by itself, and the first results look very promising.

The third talk by Andrei Lupas of the Max Planck Institute for Developmental Biology in Tübingen, Germany, was about the genetic basis of protein fold evolution. Autonomously folding units in proteins are called domains, and usually the fold of a domain is conserved with a high evolutionary permanence.

Surprisingly for me, there are only about 10Â³ basic folds, that all were established around the time of the last universal common ancestor of all living organisms.
But there is the potential for a fold change in domains by specific alterations that go back to point mutations, deletions, insertions or recombination at the level of DNA. To understand how these changes come about, Lupas' group is looking at experimental changes and their outcome. For example, beta-propellers are structures that arise by repeating a single 'blade' a certain number of times. Actually, all present beta-propellers probably all go back to one ancestral blade that was amplified several times. How large can a propeller domain become? The biggest propeller in databases has 10 blades, a 14-blade propeller in yeast forms a split between blades 7 and 8. But Lupas was able to produce a 12-bladed propeller.