EMBL

EMBL Podcast August 2011: Model Organisms at EMBL

Sonia Furtado: What's your favourite model organism?
Voice1: "Yeah… mouse"
Voice 2: "Yeast, *Saccharomyces cerevisiae"*
Voice3: "Mouse"
Voice 4: "Frog"
Voice 5: "Mycoplasma pneumoniae"
Voice 6: "Drosophila"

Sonia: What do these creatures all have in common? As model organisms, they are species that allow scientists to study biological processes. As the name implies, they're models, representatives. Chosen because they develop rapidly and are easily kept in the laboratory, they can be plants, animals or as simple as bacteria.
In this podcast, we visit some of the many model organisms that are studied at EMBL.

(*sound of cage cleaning machine in the animal house)*

Sonia: A mammal, genetically very similar to us humans, and therefore ideal to draw parallels between the two species, is the mouse. The mouse's brain, for example, has the same structures as ours.
Cornelius Gross, a group leader at EMBL Monterotondo, uses mice to try to understand anxiety. His team would like to find a way to measure anxiety in mice, by looking at their brain activity.

Cornelius Gross: Are they having fearful thoughts for example? Do they occasionally think about threats? Are these thoughts increased if the animal has been previously exposed to a threat, let's say… So this would be kind of a mouse model of human rumination, where humans ruminate or repetitively think about bad events. And we would like to see if you could find similar thoughts in mice.

Sonia: Even without that 'model of rumination', Cornelius has already discovered the function of a group of cells in the amygdala. The amygdala is a brain structure that's known to be important for fear-related behaviours and memory. Cornelius' team showed that when certain cells in the amygdala are active, when a mouse perceives a threat, it freezes – it stays still. But when the scientists turned off those cells, the animal became more active and tried to find out more about that potential threat.

Cornelius: You can image that those are two different strategies that might be good depending on the situation in the wild where the animal is. So we discovered that these cells are part of a kind of complex circuitry, which adjusts the way that animals express their fear. And that was something that wasn't known before.

(sound of water bubbling in fish room)

Sonia: If you want to see how an organism develops, it is difficult to study this in mammals such as mice or humans, as their embryos are hidden inside the mother's womb. Fish, however, lay their eggs in the water, and their embryos develop externally. Darren Gilmour, a group leader in Heidelberg, explains what the developing zebrafish egg looks like when seen under a microscope:

Darren Gilmour: The egg has a big fat belly, which has all the yolk. And the cells that make the animal have no fat, and that makes them crystal clear – they look like diamonds.

In the bottom of the fish box, it looks as if you're, you know, you're panning for diamonds, essentially. And what will happen then is the cell that sits on top of this yolk ball, will then divide very quickly. And it goes from being one cell to multiple cells. And it does this every ten minutes – so we can watch this happening.

Sonia: Since the embryo that forms inside this ball is also transparent, Darren and his colleagues can follow single cells in the developing organism.

Darren: So we're interested in how these inner organs form, essentially everything inside. And the Zebrafish allows us he ability to look straight through the animal, and just stop where we want. So we can look straight into the middle of the brain, as the brain forms. And we can go further than that: we can look straight into the cells that the brain is made of, and deeper and deeper. This small transparent embryo gives us unlimited visualisation possibilities.

(sound of steps, beep, door opening)

Sonia: Another marine animal that calls EMBL home is the worm *Platynereis dumerilii*. Detlev Arendt, another group leader in Heidelberg, uses this marine worm to study how species such as our own evolved.

Detlev Arendt: They are just a few cm long. Although they are related to the earthworm, and of course represent the worm, they look quite different.

Sonia: Unlike the earthworm, *Platynereis* has little feet on each segment of its body. It uses these feet to swim, moving like a snake., and this marine worm is what scientists call a "living fossil", because it hasn't changed much over the last 600 million years.

Detlev: So our marine annelid has kept many ancestral features. It shows probably in many ways what ancient species were like. It just kept these ancient characteristics, and this is, I think, still the main advantage.

Corinne: *Platynereis* shows us what our ancestors may have looked like, enabling scientists like Detlev to study how the human body and brain evolved.

Detlev: Obviously this is one of the most exciting questions in biology: how did the brain come about, that ultimately led to our consciousness? And how did it start? And for this *Platynereis* seems to also be a nice model.

(sound of steps, door closing)

Sonia: Model organisms don't always have to be animals. Take, for instance, a single-celled organism used not only in science but also frequently in other applications, like making beer, wine or bread: baker's yeast. Raeka Aiyar, a Scientific Communications Officer in Lars Steinmetz' group at Heidelberg, describes it:

Raeka Aiyar: They're bigger than bacteria, but not very much. And when you grow them on plates, you can see that a single cell forms a colony – so that's when it replicates over a couple of days, you'll actually see a visible spot on the plate that originated from a single cell, because it divides very rapidly.
Overall, yeast has been an excellent model organism.It was the first genome to be sequenced in eukaryotes, so this was really a huge step in molecular biology.

Sonia: From yeast to fruit flies, mice to plants, model organisms are helping scientists at EMBL and elsewhere unravel life's mysteries, and providing clues to how our own bodies work. And as different organisms are best suited to answering different questions, researchers ultimately choose their model not because it's their favourite, but because of what they want to study.