EMBL Podcast January 2012: Chemistry at EMBL

**Sonia:** The periodic table of the elements and the tree of life may seem worlds apart, but in essence they’re both attempts to create order from chaos, to make sense of the world around us by dividing things – be they chemical elements or living beings – into categories, and showing the relationships between them. Scientists at EMBL and beyond are demonstrating that there can be chemistry between the study of matter and the study of life.

**John Overington:** “Science is now too broad to be able to have a credible grasp of all areas, so you have to be able to bring together people with strong skills in each of these areas to come up with a bigger whole.”

**Sonia:** That was John Overington, head of the computational chemical biology, or ChEMBL, group at EMBL’s European Bioinformatics Institute in Hinxton, UK.

John’s group runs the ChEMBL database, with information on the properties of more than a million bioactive drug-like small molecules. In terms of research, the group is trying to understand why only a fraction of the genome seems to be targetable by drugs, helping to predict drug safety and tolerability, as well as to improve treatment.

ChEMBL is one of several groups at EMBL working in chemical biology, a highly interdisciplinary field that investigates biological questions by using chemical strategies and tools.

And there’s more to chemical biology than drug discovery, John says:

**John:** “It's always really tempting to think of chemical biology as a sort of drug discovery approach, but also there’s a lot of history and track record in research of using it to unlock fundamental biological principles – things like apoptosis, you know, and stem cell differentiation.”

**Sonia:** This large scope has led biologists and chemists to seek each other out, as Matthias Wilmanns, head of EMBL Hamburg, emphasises.

**Matthias Wilmanns:** “The bottom line is that there is a very strong interest, I would say, from both communities. Both from the life science, biology-oriented community to collaborate with chemists, but we also do notice that there’s a strong interest from chemists to cooperate also – I could give you a range of names…”

**Sonia:** Matthias is a chemist by training, who has spent most of his career working in structural biology. He is interested in combining chemical, structural and infection biology.

Maja Köhn’s group in Heidelberg is combining cell biology and organic chemistry techniques to study enzymes called phosphatases. Their goal is to find new approaches for creating drugs that inhibit those phosphatases, which can play key roles in cancer. Roughly half the group are biologists by training, and the other half chemists – although there are also pharmacologists and biochemists – and the mix has a positive effect, says Maja:

**Maja:** “I enjoy being able to work with both fields, actually. You look at the question, be it chemical or biological, from different perspectives, because biologists and chemists have very different views on things, and very different ways of thinking – and that is very productive.”
Sonia: Using chemistry techniques, scientists can study processes *in vitro* – that is, in the test tube – where they can control the whole environment and eliminate confounding variables. Studying a simplified system is easier to follow. Once they have an understanding of how things work, researchers can then take advantage of molecular and cell biology techniques to validate those results, by confirming to what extent they hold true in living cells.

But not everything can be best studied by cutting down to the bare essentials in the test tube, as Maja points out:

Maja: “There are things that you cannot really look at *in vitro* because you need the complex system [...] you don’t know all the components, so you *need* the *in vivo* situation.”

Sonia: Carsten Schultz’s group in Heidelberg, for example, has developed chemistry tools that can be used inside living cells.

Carsten: “So we are interested in intracellular signalling networks, and we are developing methods to image biochemical events in living cells and in entire organisms. So we do a cross-over between organic chemistry to develop tools and then do cell biology with those tools to answer biological questions in the field of signal transduction.”

Sonia: Matthias Wilmanns hopes to take advantage of these tools and those developed by Maja’s lab for stabilising and manipulating phosphatases and other molecules.

Matthias: “We’re very interested in using chemical biology tools created by Carsten and Maja to explore *in vitro* and *in vivo* relationships.”

Sonia: He’s not the only one – chemical biology methods developed in Carsten’s, Maja’s and other labs are generating an interest in groups across all EMBL sites, with collaborations spanning from studies of cell migration in embryos to attempting new strategies to fight viruses. Carsten’s group have even developed an imaging tool that’s now being used in the clinic to help with early diagnosis of lung emphysema.

There’s another advantage to this upsurge in interdisciplinarity and collaboration being fostered at EMBL.

Carsten: “We believe that if the scientists that leave EMBL can do both, then that will be extremely beneficial for their career.”

Sonia: Whether they realise it or not, young scientists in many of these labs are being trained not as chemists, bioinformaticians, or biologists, but as chemical biologists.

John: “It’s great to see these highly multi-disciplinary scientists coming out of some of these sort of powerhouse chemical biology labs.”