RESEARCH SOFTWARE ENGINEERING
WITH DR JOANNA LENG

Talking *points*

KNOWLEDGE

1. At what facility is the UK's national synchrotron housed?
2. What are the three pillars of scientific discovery outlined by Joanna?
3. What does EVM stand for?

COMPREHENSION

5. How do Sarah's models contribute to drug development?
6. What is a practical application of the software Alistair is developing?
7. What does Nicole use electron microscopes for?

APPLICATION

8. What imaging technique might you use if you wanted to study the interior properties of a nano-material?
9. What imaging technique would you use if you wanted to determine the elemental composition of a sample?

ANALYSIS

10. What is the problem with fluorescent microscopy? How does Michelle's dSTORM technique overcome this?
11. Lawrence creates playful and engaging sculptures based on the work of scientists. Before creating his artwork, Lawrence spends a lot of time getting to know the scientists and their fields. Why do you think he does this?

SYNTHESIS

12. Research software engineering is an emerging field that is limited by a lack of skilled RSE and by a lack of understanding by those who fund and manage it. How could this problem be tackled? What could research software engineers, other scientists and artists like Lawrence do to help?

EVALUATION

13. What impact do you think Lawrence's artworks have on the people who see them?
14. Having read about the research Joanna and her colleagues are conducting, what have you learnt about scientific imaging that you did not know before?
15. How important do you believe research software engineering will be in the coming decades? Why?

Activities

1. Diamond Light Source board game

Joanna mentioned that she has worked at Diamond Light Source, which houses the UK's national synchrotron. Diamond Light Source has developed a board game that you can print out and play in class or at home.

In this game, you and your friends and family get to take on the role of a researcher at Diamond Light Source. You visit different sections of the synchrotron to progress through a range of scientific projects that cover fields such as chemistry, physics and cultural heritage. As you travel around the synchrotron, you will have to work with your fellow researchers and conduct experiments as you attempt to become the most famous scientist at the centre.

The game was created by Dr Mark Basham and Dr Claire Murray, from Diamond Light Source, and Dr Matthew Dunstan from the University of Cambridge in the UK. It is designed to showcase the research performed at the centre and to give you first-hand experience of the different aspects of working in scientific research. The game shows you the variety of science that exists, the value of collaboration with other scientists and research software engineers, as well as showing you that experiments do not always succeed!

The game is for two to five players and lasts between 20 to 30 minutes. You can download the game and find the instructions here: **www.diamond.ac.uk/Public/DiamondTheGame.html**

There is also a YouTube video that explains how to play here:
www.youtube.com/watch?v=EZ7Ra_1iIKY&t=23s

Good luck!

Diamond Light Source aerial view
(Image courtesy of Diamond Light Source)

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2. Sculpting science

In the article, we met Lawrence Molloy who is the artist in residence at The Museum of the History of Science at the University of Leeds. Lawrence designs sculptures and artwork based on research conducted by scientists in a variety of different fields.

Currently, he is working with Dr Nicole Hondow to create a piece of art that explores her research on the composition of nanomaterials. This is a challenging project as the materials Nicole studies exist at such tiny scales, and the images she produces are already beautiful and captivating. Lawrence's job is to design and construct a sculpture that engages, excites and educates the general public.

Choose any of the research projects discussed in the article and design your own sculpture or artwork for it. Draw a diagram of your artwork and write a short summary explaining your concept. Think about how you can make it visually striking, whilst also teaching your audience a little bit about the science. Get creative and experiment with different scales, colours and textures to make your sculpture really stand out.

The research projects discussed in the article include:

- Professor Sven Schroeder's research into chemical engineering
- Dr Sarah Harris' research on how thermal fluctuations affect protein molecules
- Professor Michelle Peckham's research on the cytoskeleton and related diseases
- Dr Alistair Curd's research on the relative positions of molecules
- Dr Nicole Hondow's research on nanomaterials.

More *resources*

- Watch Professor Michelle Peckham's lecture entitled "A History of Small" to learn more about the history of microscopy: **www.youtube.com/watch?v=1j2XFD4h9Wg**

- Explore Marty Jopson's YouTube channel, microminute, where he investigates tiny objects through microscopes: **www.youtube.com/user/martyjopson**

Michelle recommends several scientific societies that provides resources to help you learn about scientific imaging and the disciplines that benefit from it:

- The British Society for Cell Biology has lots of information about careers and university courses in cell biology: **www.bscb.org/learning-resources/softcell-e-learning/careers-and-courses**

- The Biochemistry Society provides information about careers in biochemistry and resources for high-school students. It also hosts events such as webinars and panels that discuss biochemistry: **www.biochemistry.org/education/careers/becoming-a-bioscientist/what-is-biochemistry**

- The Royal Microscopical Society is a great place to keep up with new advances in micropscopy. It loans out microscope activity kits to primary schools, recommends which microscopes are best for secondary schools, and provides interesting resources for students to explore: **www.rms.org.uk**

- The Virtual Microscope is a project funded by NASA that provides simulated scientific equipment for students to try out. You can explore what it would be like to study samples through three different kinds of microscope, including an electron microscope: **www.virtual.itg.uiuc.edu**

- Find out more about the ground-breaking James Webb Space Telescope: **www.nasa.gov/mission_pages/webb/main**