Science and Technology Facilities Council

The Facilities
Research Council Funding Mechanism

STFC is an independent, non-departmental public body of the Department for Business, Energy and Industrial Strategy.

Department for Business, Energy & Industrial Strategy

RCUK Executive Group

Science & Technology Facilities Council
STFC

• Mission: *To maximise the impact of our knowledge, skills, facilities and resources for the benefit of the United Kingdom and its people*

• Budget: Approx. £600m:- 1/3; 1/3; 1/3

• 5,122 unique users; 3,105 experiments; 1,523 papers (2015/16)

• World class research, innovation and skills to help build a globally competitive, knowledge based UK economy”
We work with international partners

- CERN
- European Southern Observatory
- European Space Agency
- European Synchrotron Radiation Facility
- Institute Laue-Langevin
- European Spallation Source
- Gemini Observatory
STFC Facilities – Driving Scientific Research

Neutron Sources
Providing powerful insights into key areas of energy, biomedical research, climate, environment and security

High Power Lasers
Providing applications on bioscience and nanotechnology and demonstrating laser driven fusion as a future source of sustainable, clean energy

Light Sources
Providing new breakthroughs in medicine, environmental and materials science, engineering, electronics and cultural heritage
Central Laser Facility

**ASTRA GEMINI**
- High power, ultra-short pulse dual beams of 15 J, 30 fs pulses
- Pulse every 20s

**VULCAN**
- Ultra high-power laser
- Up to 1 PW peak power
- Focused intensity $> 10^{21} \text{ Wcm}^{-2}$

**ARTEMIS**
- fs and as ultrafast spectroscopy
- High harmonic generation
- IR to soft x-ray

**ULTRA**
- Ultrafast vibrational spectroscopy

**OCTOPUS**
- Imaging, laser tweezers and microscopy

High-power, ultra-intense lasers for extreme conditions science & applications

Laser applications in the physical and life sciences (materials, chemistry, biology)
Neutrons & X-rays...

- Where atoms are
- What they are doing
Neutron and X-ray Properties

H  Li  C  O  S  Mn  Zr  Cs

X-rays

neutrons
Neutron and X-ray Properties

D  H  Li  C  O  S  Mn  Zr  Cs

X-rays

neutrons
Wheat Proteins

- Puroindolines (Pins): small amphiphilic proteins from wheat & barley – role in texture of wheat and possibly in seed defence

- Toxic to a broad range of bacterial and fungal species – perturbs membrane function via ion channel formation

- In vitro studies with lipid monolayers suggest Pin-a aggregates within lipid monolayers rather than discrete assemblies needed for channel formation

- Use SANS to study Pin-a aggregation in D_2O – ellipsoidal aggregates formed

L. Clifton (ISIS-STFC) & R. Frazier et al (University of Reading) *PCCP* 2011, 26, 8881-8888
Dairy Products

- Stability of dairy products (for transport and increased shelf life) is very important
- Lengthscales of interest often fall well within SESANS range
- Samples can be studied in-situ whilst changing the conditions – temperature, pH etc.
- Here it can be seen how the particles in yoghurt and curd are much larger than those found in milk
Neutrons could reveal how pesticides protect crops

Scientists have created a model of a leaf’s waxy surface, similar to those found in wheat crops and are now studying the interaction of surfactants with the model at ISIS.

Surfactants are a key component in pesticides and enter the plant through the leaf surface to take effect. By understanding on a molecular level how surfactants get through the leaf’s waxy surface pesticide formulations could be optimised to further increase crop yields.

Science at the CLF

Investigation of vulnerability of plants to pathogen attacks

By enabling the movement of individual molecules in living plant cells to be observed in real time it was possible to reveal that the cell wall allowed proteins to stabilise in the plasma membrane.

This restricts their ability to move around and fight invading pathogens and so increases the plant’s vulnerability.

The information could hold the key to making crops more disease-resistant.
Thank You for Listening!

Dr Sarah Rogers
SANS Team Leader and Instrument Responsible for Sans2d
sarah.rogers@stfc.ac.uk
www.stfc.ac.uk