U3A Explores Science at the Royal Institution

Monday 24 March 2014

Below is a brief summary of the above seminar at the RI that Deborah Lay and Ken Derham attended. There were three talks, chaired by Barbara Lewis, who chairs the Third Age Trust.

Helen Czerski – Bubbles: the bath and beyond

Physicist Helen Czerski did her PhD at Cambridge on "experimental explosives". Subsequently worked at the Scripps Institute of Oceanography in San Diego and is now at the Institute for Sound and Vibration Research in Southampton.

- Understanding one aspect of physics enables it to be applied in other situations.
- Bubbles absorb sound according to size. So it is possible to measure the number and size of bubbles by passing sound through and listening to what comes out.
- Oceans absorb gas in the tropics and release gas near the poles. Hence oceans profoundly affect the atmosphere and vice versa.
- Studying bubbles in the ocean helps to understand air/sea interaction.
- **Champagne** – choice of glass is important for determining the size and flow of bubbles and hence the way that flavours are carried through the liquid to the nose and mouth.
- We learned why champagne tastes different from flat wine.
- Oceans absorb gas from phytoplankton (as well as from the air)
- Gas escaping from oceans affect cloud formation and hence weather
- When making cakes and bread, gas bubbles expand on heating, raising the mixture. The dough must set before the gas escapes (hence your mother's admonishment not to open the oven door before the cake was baked!)
- Bubbles collect impurities, e.g. in washing/washing up
- Clean bubbles burst early; 'dirty' bubbles last longer
- Ice is usually white because of bubbles in it. Ice with no bubbles tends to be blue.
- HC has estimated that there ae 10^{17} bubbles in the ocean. Each carries and releases gas particles; so although each bubble is small, together they have a big effect on weather.
- Penguins release bubble trapped in their feathers which then act as a lubricant to enable them to swim faster through the water.
- Carbon dioxide is absorbed by the oceans which increases the acidity from pH8.5 to 8.1. This might not sound much but it is a significant hardship for a range of sea creatures and corals that utilise dissolved calcium.

Elizabeth Stokoe – The Conversational Racetrack

With degrees in psychology, Elizabeth Stokoe is now Professor and Chair of the Dept of Social Sciences at Loughborough University and a member of the Institute of Learning and Teaching.

Prof Stokoe's work involves recording conversations, transcribing them and then analysing different types of conversations to find out what works.

Recent work has involved working with a mediation service to help, eg neighbours in dispute. Little previous work has been reported by psychologists on neighbours.

Prof Stokoe provided some insightful and amusing examples of how conversations can fail to achieve their desired goal.

David Whitmore – Biological Clocks, light and what happens in a cave

Professor of Chronobiology at University College London's Research Department of Cell and Developmental Biology, and Centre for Cell and Molecular Dynamics.

For most organisms their environment changes, eg temperature, composition of surroundings etc, but the repetition of the day/night cycle is regular.

Most organisms have cycles of activity that is approximately daily, ie circa-dien or circadian. However it may vary from 23 to 25 hours and needs to be set by daylight.

The circadian cycle is linked with gene expression, ie genes switch on and off at predictable times.

Conventional understanding expected oscillations to be focused primarily in the brain and pineal gland. However in zebra fish it was difficult to locate the pineal gland. In trying to do so it was found that all organs exhibit circadian cycles independently. In cultured tissue it is possible to switch to different cycles of light without interaction of eyes, brain or pineal gland. I.e. individual organs and cells are sensitive to light.

In humans, eyes detect light and transmit signals to the brain, which sends signals other organs to control the circadian cycle. (A question was asked whether and how blind people control their circadian cycle. It depends on the type and cause of the blindness. If the problem is in the rods and cones of the retina, it can be that other cells detect light without providing vision and that is sufficient to inform the brain of light or darkness. However if the blindness is caused by a failure of the optic nerve, connecting the eye and brain, then there is no awareness of light).

Prof Whitmore's team has worked on Mexican fish in which two closely related species live respectively in rivers and in caves. In the lab, the blind cave fish show a daily oscillation, but it is not as strong and lags by about 6 hours compared with the surface fish.

In cave fish, the genes are mostly switched on, ie they behave as if in constant light (although they live in constant darkness). In the wild, the cave fish swim all the time and have no detectable circadian cycle.

Light is critical for repairing DNA damage. In cave fish, the repair genes are active all the time. This may be of some advantage but is probably less efficient that switching according to light cycles.

Next meeting

The next U3A meeting at the RI will be on Tuesday 30 September 2014. Information will be in a forthcoming edition of Third Age Matters.

Ken Derham

25/3/2014