Computer models may reveal what makes human bo

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By University of Edinburgh, Scientists at the University of Edinburgh are using digital technology to develop an artificial body clock which can tell them more about the causes of sleeplessness. The computer-designed clock, which mimics the workings of key genes and proteins in the brain, can shed new light on the complex biological processes which influence our internal rhythms. The study is part of major Europe-wide investigation into sleep disturbance, which is a growing problem in the EU where one in every five employees now works shifts.

Understanding the subtleties of the human body clock is a hugely challenging task and, so far, attempts to explain its workings have met with only limited success. In order to build a clearer picture of the complex processes involved, the Edinburgh team has adopted a novel approach. Rather than observing how the clock functions in humans, and trying to discern what each 'part' does, scientists have begun building their own artificial clock from scratch.

Researchers are using leading edge technology to replicate the behaviour of a few, well-understood genes and proteins. These functions - in effect, the cogs and wheels of the human body clock - are reproduced in the laboratory using computer models. Once the team has developed a number of these key components, a prototype clock will be assembled by researchers in Szeged, Hungary.

Researchers will then test the new clock in simple yeast samples. Yeast is the perfect testing ground because it has no 24-hour clock of its own to upset the experiment, giving the scientists complete control over experiments. The new clock can be manipulated easily and analysed rapidly. The team will then test whether these artificial clocks can trigger in yeast cells the same rhythmic signals that produce the time-keeping function in the human clock.

Professor Andrew Millar, of the University of Edinburgh's School of Biological Sciences, said: “Our aim is to build basic clocks and make them progressively more complicated. We will use the genetic information which we have at our disposal - and leading edge technologies - to introduce our synthetic 'clockwork' on to the blank canvas which yeast provides.

“This novel way of 'learning by doing' will test how much we currently understand about the biological clock and suggest ways in which we can adapt these circuits for other purposes in the future.”

The Edinburgh study is part of the EUCLOCK project, which involves researchers at 29 sites in 11 countries. Scientists will carry out a range of research projects, each designed to find out more about how genes and proteins are connected in humans, mice and flies to influence the workings of biological clocks.

Also playing a key role in the 16 million Euro project is an Edinburgh based start-up company, LUX biotechnology. The company will provide EUCLOCK scientists with innovative research tools which will monitor gene activity to assess the success of the various experimental approaches.

LUX's innovative technology, based on the light-emitting enzymes (luciferases), will provide researchers with a continuous read-out of the activity of the clock genes which will help scientists monitor how their artificial clocks are functioning.
- School of Biological Sciences, University of Edinburgh www.ed.ac.uk