Listen to your body clock

Inside the brain is a body clock that resets every 24 hours, and it's important for your health, **Nyssa Skilton** writes

Deep inside our brains lies a tiny clock that ticks over 24 hours and resets with light each morning. This clock, found in life forms right down to the lowest organisms, including fungi, can regulate body temperature, when we feel sleepy or alert, and maybe even how strong we are.

Population studies have revealed those who ignore their inner clocks risk poorer health and now scientists are working to find out how.

Associate Professor David Kennaway, a world-leading expert on clock genes, has studied biological timing for the past 30 years.

At the University of Adelaide, Kennaway and his team study the body clocks in mice and rats to try to uncover the mechanisms of how they work and how they interact with the rest of the body.

Kennaway explains clock genes are like a genetic battery of the cell.

Genes contain information needed to make proteins, the ''building blocks of life''. Clock genes, which scientists are now showing operate throughout many of our cells, produce proteins on a feedback loop to a rhythm of 24 hours.

''I think it's a really fundamental part of our biology that keeps us going,'' Kennaway says.

''The value is that it allows our bodies to predict what's going to happen if you like.

''A good example would be getting your body ready for the onslaught of waking up, getting up, and having breakfast. You're going from rest to activity, so your heart's got to be prepared, your digestive system has to be ready to utilise breakfast and that has all been set up ahead of time by the cellular clocks in your liver and your muscle and up in your brain.''

The master clock, which rests deep in the brain behind the eyes in a small part of the hypothalamus, ''talks'' to the clocks throughout the body through neural connections or hormones like the sleep hormone melatonin. This clock exists in a group of cells called the suprachiasmatic nucleus. Scientists have separated this part of the brain in animals, placed it into a culture dish and watched it continue to tick away in the absence of any other inputs for at least three to four days.

In the brain, the master clock is in contact with the outside world through the eyes. Light that makes contact with nerves in the eyes resets the clock each day, like a watch that runs too fast or slow and needs to be adjusted.

University of South Australia Centre for Sleep Research assistant director Dr Sally Ferguson studies circadian rhythms and how the environment, particularly light, can influence them.

Ferguson says the growing body of research on peripheral clocks in different tissues throughout the body shows how important it is to listen to your body rhythms.

''We don't really know exactly what their roles are and all the interactions yet, but we're starting to understand how they regulate things like digestion and all those sorts of body functions,'' she says.

''Messing around with when you eat and when you sleep is starting to look like that's what's impacting on health with shift workers and other workers who are trying to operate outside of the normal hours.''

Population studies find shift workers are at higher risk of developing type 2 diabetes, cardiovascular disease and obesity. Emerging studies reveal disruption to the circadian system associated with shift work, in combination with sleep disruption, may affect metabolic health. The studies suggest peripheral clocks in the body may have a role in the way we process nutrients.

Listening to your body rhythms may involve more than just going to sleep at night and waking up in the morning. It may be important to be aware of when you feel alert and sleepy – whether a morning or an evening person.

Morning people tend to feel more alert in the morning, while evening people feel liveliest at night. This difference relates to individual's body clocks and the fact that they don't all run to exactly a 24-hour rhythm. Just like real clocks, some run fast and some run slow.

If you're body clock runs fast, for example 24.1 hours, then you are a morning person and are happiest when you go to bed early and get up early. Evening people's body clocks run a bit slower, for example 24.6 hours, and they like to go to bed late and get up late.

A new study from neuroscientists at the University of Alberta in Edmonton, Canada, examined the differences between the brains of larks and owls. The neuroscientists found the brains of people who identified themselves as morning people were most excitable at 9am, and slowly decreased throughout the day. Evening people's brains were most excitable at 9pm.

Even more interestingly, the researchers studied how rhythms in the nervous system related to human movement.

They designed an experiment to test muscle strength, which involved participants pushing down with their foot on a device like a car accelerator pedal. They found evening people became physically stronger throughout the day, but the maximum amount of force the morning people could produce was constant.

One of the study authors, Associate Professor David Collins, says they think morning people may never reach their true maximum because they have opposite ''rhythms of excitability'' of the brain and spinal cord.

Studying the excitability of the spinal cord and the brain, Collins and his colleagues found for evening people, both the brain and spinal cord were most excitable in the evening and this is when they were strongest.

In contrast in the morning people, the rhythms of brain and spinal cord excitability were opposite. The brain was most excitable in the morning and spinal cord at night and the researchers found no difference in how much force they generated during voluntary contractions over the day.

''Thus, we suggested that the opposing rhythms of excitability of the brain and spinal cord offset each other and they never reach their true maximum,'' Collins says.

''In contrast the synchronised rhythms for the evening people allow them to perform maximally at night.''

Collins says their work may one day have applications for maximising human performance, perhaps in sports or shift workers.

Kennaway says biological timing is an intriguing area of biology, but it's a system that even his fellow scientists often totally ignore.

He says he sees profound changes in systems across 24 hours which are as large as some of the changes scientists see in their experiments with a particular treatment.

''So that then begs the question of, sometimes in experiments and studies that people do, whether their results may even be confounded by the time of day they made their observations,'' he says.

''We try and control everything we use the same sort of animal, the same weight. But often what goes astray is when researchers don't do the experiment at the same time of day each time.''

Routines are important, Kenneway says, not just in science, but also in our day-to-day lives.

But despite advances in knowledge of our biological rhythms, it's a system our 24/7 lifestyle often forces us to ignore.