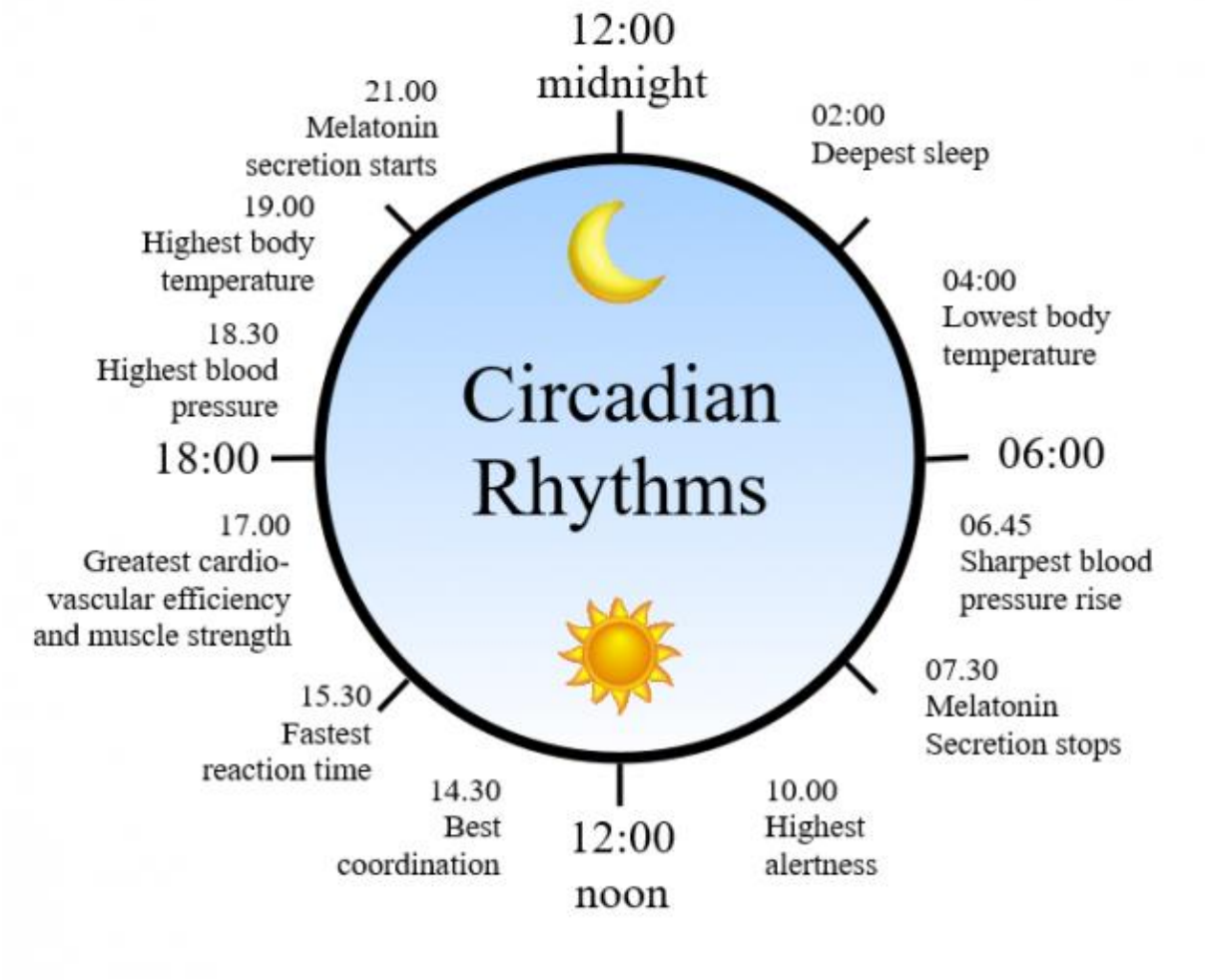
Sleep & circadian rhythm

All physiology and behaviour shows a 24-hour (circadian) rhythm. These rhythms are driven by our body clocks, found in all of the cells of the body, which are synchronised by the master circadian pacemaker, located in the suprachiasmatic nuclei (SCN) of the brain. The SCN is entrained to environmental light and in turn coordinates the activity of the entire circadian system.

The sleep-wake cycle is the most familiar 24-hour cycle, but involves more than the SCN. Sleep is a highly complex state arising from an interaction between multiple brain regions, neurotransmitter pathways and hormones, none of which are exclusive to the generation of sleep.



Sleep and Circadian Rhythm Disruption (SCRD) occurs when our natural circadian rhythms are pushed out of sync. Small changes in brain function can have a big impact on sleep, and disrupted sleep leads to health problems ranging across increased stress hormones, heart disease, weight abnormalities, reduced immunity, increased risk of cancer, and emotional and cognitive problems.

Severe SCRD is a feature shared by some of the most challenging diseases of our time – from schizophrenia and bipolar disorder to Alzheimer's and stroke, as well as in serious disorders

of the eye. SCRD is also widespread in the ageing population, those who work shifts and everyone affected by the demands of today's 24/7 society. Despite the prevalence of SCRD, its origins remain a mystery, its detection is frequently overlooked, and it is rarely treated.

New data suggests that parallel brain pathways might be affected in these diseases and in sleep disturbance. It is paramount that we learn to understand this data and use it to develop new approaches to correct abnormal sleep, so improving the broader health problems and quality of life for sufferers.

Studies have estimated that around a third of the general population have difficulties getting to sleep or staying asleep (insomnia). So, whilst it can feel like a lonely experience lying awake at night, there are many people who have a similar experience.

Sleep difficulties are often short lasting and improve by themselves, but for some people they may require some extra help. We hope that the following tips will help to get your sleep back on track.

Tips to help you sleep

- **Create a sleep friendly bedroom**
  Is there anything obvious in the bedroom that is getting in the way of a good night's sleep? Do you need to get your blinds fixed to block out the light? Is your bedroom too hot or too cold? Too noisy? Create a bedroom space that is dark and comfortable to best promote sleep.

- **Wind down routine**
  Take time to prepare your mind and body for winding down before sleep. Set time aside, ideally around 90 minutes, for doing something relaxing and enjoyable. Some ideas might include reading a book, listening to calming music or practicing relaxation exercises. If you find that your mind is racing when you head to bed, you could use part of this time to find a way to close off the day. Perhaps write a diary to take the power out of your thoughts, or make a plan of the things that you would like to do the following day to stop these thoughts popping up when you are in bed.

- **Bed is just for sleep and intimacy**
  Our minds are clever and create lots of links without us necessarily being aware. This is why it's important to create a strong link between bed and sleep by avoiding using bed for other activities that aren't sleep, for example checking emails or watching TV.

- **The quarter-of-an-hour rule**
  If you have difficulties sleeping you've probably noticed that you spend lots of time in bed awake. This means that bed might become connected with being awake, frustrated or anxious about sleep. To promote your bed-sleep connection, follow the quarter-of-an-hour rule: if you notice that you aren't asleep within around 15 minutes of going to bed, try getting out of bed, go to another room go through your wind down routine until you are feeling sleepy-tired and ready to return to bed for sleep. There's no need to clock-watch though; just estimate quarter-of-an-hour.

- **Rise time**
  If sleep is that elusive state that feels unreachable, it can be tempting to try and catch up on lost hours by having a lie in. In fact, this is likely to decrease the likelihood of a good night sleep the following night, because you won't have been awake long enough to build up 'sleep pressure' across the day. Set a regular rise time and see if you can stick to it 7 nights a week. It might be hard work in the short term but will improve your chances of falling asleep each night. To help with getting out of bed at your rise time, plan some things to help get you going; perhaps a lively piece of music, a nice breakfast or a shower.

- **Keep active!**
  Keeping active can set us up for a good night's sleep, both physically and emotionally. Keep active to tire your body ready for sleep (e.g. walking, yoga, cycling) but try to make sure this isn't too close to bedtime (i.e. within 2 hours of bedtime).

- **Consider what you put in your body**
  You want to give your body the message that the later part of the evening is for switching off. So, try to avoid stimulants such as caffeine and nicotine in the hours before bed. Alcohol before bed also impacts on sleep by decreasing sleep quality so you are less likely to wake up feeling rested. Lastly, consider the timing of meals – the

purpose of food is to supply energy, so eat at regular times through the day and avoid eating a large meal within four hours of bedtime.

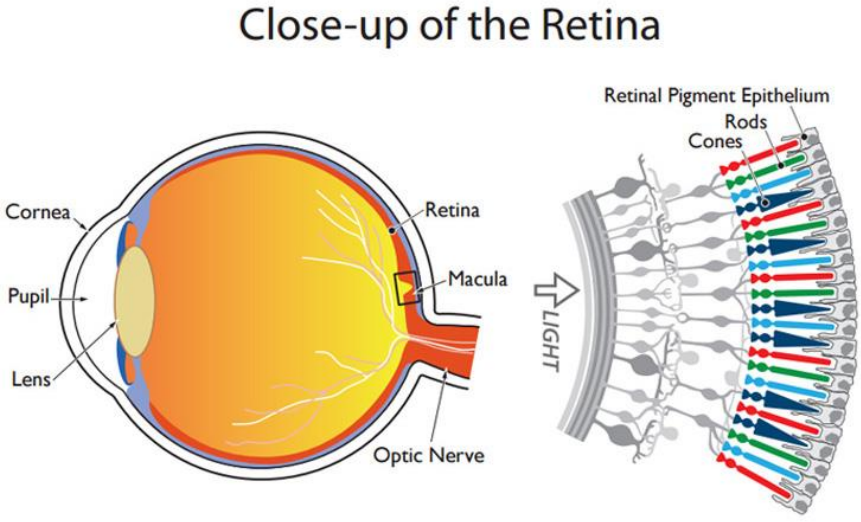
- **Natural light – it is all about timing**
  Natural light suppresses the production of melatonin (a hormone associated with sleep). Try to avoid bright light before bedtime to promote melatonin production. Conversely, try to expose yourself to lots of natural daylight when it's time to be awake (particularly early morning). This will help you to feel awake, alert and ready for the day.

- **Screens and electrical devices**
  Back-lit screens and devices such as many smart phones, TV's or laptops contain a large amount of blue light. This kind of light is the strongest for suppressing melatonin production. Using them last thing at night can therefore disrupt sleep quality. Try to limit your use immediately before bedtime.

- **BE SMART WITH YOUR NAPS**
  The longer we are awake, the more likely we are to sleep, because our 'sleep pressure' has had time to build up. To increase your chances of drifting off at night try to avoid naps throughout the day. Of course, if you feel dangerously tired, do take a short nap (of around 20 minutes) but try to plan this earlier in the day to allow your sleep pressure to build again afterwards.

Light and the Eye

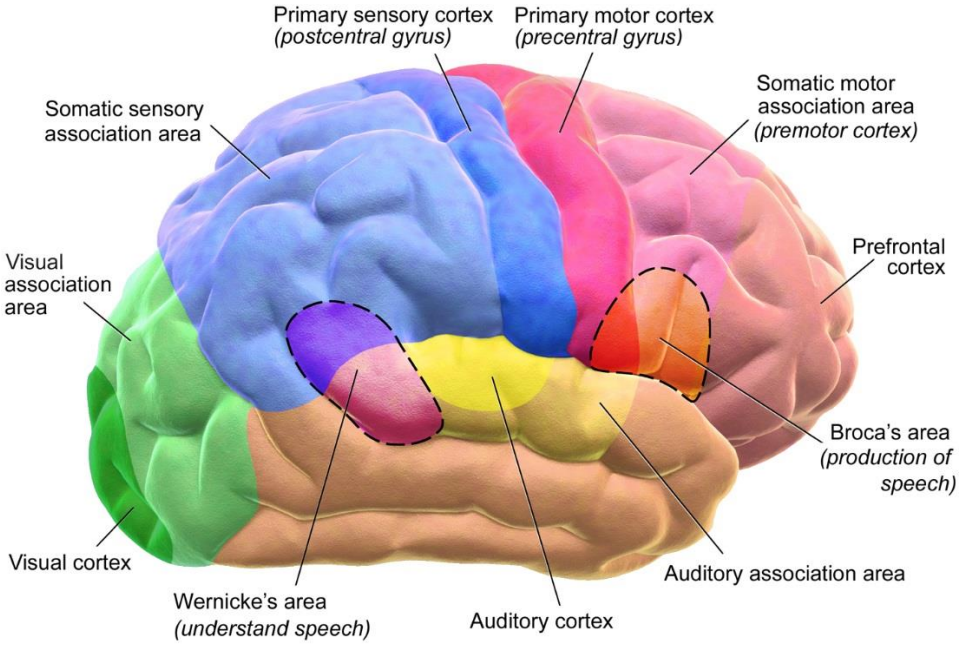
The long-recognised role of the eye is to generate an image of the world using rod and cone photoreceptors. Recent research has led to the discovery that the eye contains another class of photoreceptor called photosensitive retinal ganglion cells (pRGCs). These specialised neurons detect environmental brightness and regulate circadian rhythms, sleep, alertness, mood and even pupil size.



These findings have transformed the understanding of how the eye works and helped to redefine assessment, treatment and care of individuals with eye disease.

Sleep and mental illness

At any one time, 16 per cent of adults in the UK have a common mental disorder, while 1 per cent has a severe mental illness, such as schizophrenia or bipolar disorder. Mental disorders are estimated to become the biggest cause of disability by 2030.



A recent study by the European Brain Council estimated the cost of brain disorders to Europe alone at €800 billion in 2010. A striking, long-recognised and diagnostic feature of mental illness is SCRD and poor health. Although clinically recognised, the precise nature, causes and effects of SCRD in mental illness are poorly defined, and its treatment invariably neglected.

Human phenotyping

Psychiatric illness and poor sleep have a profound impact upon the quality of life of sufferers, their families and caregivers, and markedly impair health and productivity. Psychiatric disorders affect 16.7 million people in the UK, account for over 15% of the disease burden, and have associated costs estimated in England as over £77 billion/year. On their own, the psychoses (schizophrenia and bipolar disorder) confer huge health, societal and economic costs. Psychoses affect over 8 million Europeans and cost 93 billion Euros per year; insomnia affects 29 million Europeans and costs 35 billion Euros. It is important to stress that these conditions do not only impair mental and emotional well-being, but are linked to substantially impaired physical health and raised mortality rates.

The basis for the co-occurrence of sleep and circadian rhythm disruption (SCRD) and psychosis is unclear but it likely involves SCRD

Therapeutic intervention

There is already good evidence that psychological and behavioural sleep interventions can have large clinical benefits for difficulties sleeping, especially insomnia, but these have seldom

been used with patients with psychosis nor the effects on psychotic symptoms systematically examined. The few studies that have examined the impact of sleep interventions on psychiatric symptoms indicate significant benefits on mood, hallucinations and delusions. For example, CBT-I (cognitive behaviour therapy for insomnia) was recently used as an intervention in psychosis for the first time. Highly significant reductions were found in levels of insomnia and the persecutory delusions and the changes were maintained at the follow-up. Moreover, the intervention proved very popular with patients.