15 Chronobiology in Everyday Life

15.1 Know Your Chronotype

The concept of chronotype was introduced in order to emphasise individual differences in internal clock phase relative to the day-night cycle. Chronotype reflects preferred sleep timing as well as the optimum distribution of daytime physical and mental performance. This is not a minor matter, despite light-hearted teasing of morning 'larks' and night 'owls'. In early agrarian society, 'the early bird catches the worm' had validity. Dawn and dusk delineated the work day – there was little choice but to carry out most activities in daylight. Now, in a 24/7 society that demands continuous services, we do not have to get up at dawn, yet the conventions of the past age remain, with the moral virtue of the early bird shining over the turpitude of the night owl.

It is important to recognise that we do not choose our chronotype: the largest part is genetically determined. Furthermore, chronotype changes with age [108]. The most remarkable shifts occur during adolescence, where average sleep timing drifts forward by about 15 min per year from age 12 to 20. The delay is greater for boys than girls. In girls, we have even been able to link the onset of delay shifts to menarche. After age 20, the average chronotype slowly shifts back earlier over the decades. Late chronotypes suffer varying degrees of 'social jet lag', manifested in delayed bedtimes and wake-up times as well as oversleeping on weekends in an attempt to catch up on alarm-clock-shortened sleep duration during the week [110]. Obviously, given the usual timing of school and work, the late chronotype suffers the most.

If we stratify the population for chronotype, we find significantly more depression in owls, who have the greatest difficulty in synchronising day-night rhythms with the day-night cycle. Clinicians should probe for chronotype whenever they meet a new patient. Chronotherapeutics can reduce this mismatch and the burden it creates.

15.2 Timing of School and Work Schedules versus Sleep

School times in every country have their regularity, as do normal work schedules. The range is quite small compared to the variability of chronotypes who have to fit their circadian clocks into the procrustean bed of the real world's demands.

The biologically determined delay in sleep timing with adolescence provides a serious argument for delaying the start of the school day. The additional peer pressure to stay up late may in fact reflect the delayed chronotype of this age group. The longer sleep need of younger children (9–10 h) would also be better accommodated by a later start to the school day. Current research on the role of sleep for learning and memory consolidation of the prior day's input emphasises the importance of sufficient sleep duration. By implementing delays in the school schedule, the educational establishment has an opportunity to promote daily cognitive and behavioural functioning and mental health, and perhaps even forestall the onset of mood and sleep disorders in adulthood.

Flexible work schedules (with block times for attendance) are one way to provide individuals with a time range – albeit usually small – to schedule their day to best fit their chronotype. Extreme owls usually self-select occupations that

allow night work, since they are the ones that suffer most from enforced early morning job arrival. Even with a later schedule, however, owls tend toward depression and should consider bright light therapy on awakening. One psychiatrist with delayed sleep phase disorder, who could not awaken before noon and was mildly depressed, focused office hours in the evening, which appealed to many of her patients. Her goal was not to normalise her sleep schedule, and light therapy at noon served to relieve her depression. By contrast, one neuroscientist who had slept from 7 a.m. to 3 p.m. for a decade, threatened with job loss for showing up at the lab at 5 p.m., was able to normalise sleep onset to 11:30 p.m. within two weeks using an advancing schedule of low-dose, controlled release melatonin (plus blue-blockers) 4 h before sleep onset and light therapy upon awakening on a schedule of daily advances. His reaction to the change was incredulous: 'I was positive my SCN was permanently damaged!' Motivation matters.

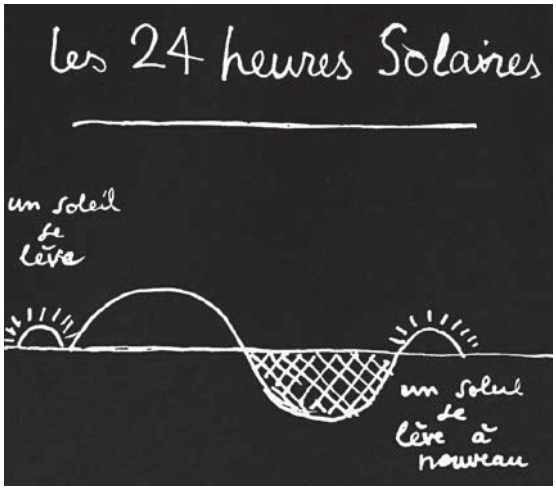

Fig. 33. The 24 solar hours, the fundamental rhythm in human life. From a lecture given in Milano, 1954. From Le Courbusier [159], p. 205, with permission. © FLC / 2009, ProLitteris, Zurich.

15.3

Light and the Built Environment: Implications for Architecture

'L'architecture est le jeu savant, correct et magnifique des volumes assemblés sous la lumière.' (Architecture is the masterly, correct and magnificent play of volumes brought together in light).

Le Corbusier: Vers une architecture, 1923

While the social clock dictates our sleep-wake schedule on work days, the built environment interacts by setting our access to daily light exposure. The intensity of room light usually lies in the range of 50–300 lx, adequate for visual perception and performance, but inadequate for maximising rhythmic stability on the desired schedule. How can we incorporate our knowledge of zeitgeber function into architectural practice? Can we implement rational light timing and intensity parameters that will work effectively depending on individual characteristics (e.g. chronotype, retinal sensitivity), or will circadian lighting installations require a compromise for the average needs of the group (workers, students, hospitalised patients)?

The principles of the circadian system and its response to light, as applied in chronotherapeutics, also directly apply to lighting design, with the aim of recapturing the biological benefits of exposure to the solar cycle. Dawn and dusk are the key signals for advancing and delaying the circadian clock, respectively; the regularity of this signal embeds sleep within the biological night and stabilises the rhythm. Light during the day is important for maintaining the amplitude of the rhythm, and a higher amplitude means better synchronisation. Thus, both appropriate timing and sufficient daytime exposure levels are necessary for healthy rhythms.

The increased incidence of sleep and depressive disorders over the last decades has of course a multitude of origins, including adverse societal