the day and prowl in search of food in the night ; some hibernate during the winter season, passing into long periods of sleep during both day and night ; and men whose avocations require them to work during the night find that they can maintain health and activity by sleeping the requisite time during the day.

The approach of sleep is usually marked by a desire for sleep, or sleepiness, embracing an obscure and complicated group of sensations, resembling such bodily states of feeling as hunger, thirst, the necessity of breathing, Ac. All of these bodily states, although on the whole ill defined, are referred with some precision to special organs. Thus hunger, although due to a general bodily want, is referred to the stomach, thirst to the fauces, and breathing to the chest ; and in like manner the desire for sleep is referred chiefly to the region of the head and neck. There is a sensation of weight in the upper eyelids, intermittent spasm of the sub-hyoid muscles causing yawning, and drooping of the head. Along with these signs there is obscuration of the intelligence, depression both of general sensibility and of the special senses, and relaxation of the muscular system. The half-closed eyelids tend more and more to close ; the inspirations become slower and deeper ; the muscles supporting the lower jaw become relaxed, so that the mouth opens ; the muscles of the back of the neck that tend to support the head also relax and the chin droops on the breast ; and the limbs relax and tend to fall into a line with the body. At the same time the hesitating utterances of the sleepy man indicate vagueness of thought, and external objects gradually cease to make an impression on the senses. These are the chief phenomena of the advent of sleep. After it has supervened there are many grada­tions in its depth and character. In some cases the sleep may be so light that the individual is partially conscious of external impressions and of the disordered trains of thought and feeling that pass through his mind, constituting dreams, and these may be more or less vivid according to the degree of consciousness remaining. On the other hand, the sleep may be so profound as to abolish all psychical phenomena : there are no dreams, and when the sleeper awakes the time passed in this unconscious state is a blank. The first period of sleep is the most profound. After a variable period, usually from five to six hours of deep sleep, the faculties awaken, not simultaneously but often fitfully, so that there are transient periods of consciousness. This is the time of dreaming. As the period of waking approaches the sensibility becomes more acute, so that external impres­sions are faintly perceived. These impressions may influence and mould the flow of images in the mind of the sleeper, frequently altering the nature of his dreams or making them more vivid. The moment of waking is usually not instantaneous, but is preceded by an intermediate state of partial consciousness, in which there are feelings of a pleasant lassitude, a sense of repose, a luxurious abandon­ment of the body to any position in which it may happen to be, and a strange play of the mental faculties that has more of the character of an “ intellectual mirage ” than of consecutive thought.

The intensity of sleep has been measured by Kohlschütter by the intensity of the sound necessary to awaken the sleeper. This intensity increases rapidly during the first hour, then decreases, sometimes rapidly, sometimes slowly, during the next two or three hours, and then very slowly until the time of waking. This statement agrees generally with experience. As a rule the deeper the sleep the longer it lasts.

Various physiological changes have been observed dur­ing sleep, but much remains to be done in this direction. The pulse becomes less frequent ; the respiratory move­ments are fewer in number and are almost wholly thoracic,

not abdominal ; all the secretions are reduced in quantity; the gastric and intestinal peristaltic movements are less rapid ; the pupils of the eye are contracted and during profound sleep are not affected by light ; and the eyeballs are rotated upwards. The pupils dilate slightly when strong sensory or auditory stimuli are applied, and they dilate the more the lighter the sleep ; at the moment of waking they become widely dilated. Whilst muscular relaxation is general, there seems to be increased contrac­tion of certain sphincter muscles, as the circular fibres of the iris and the fibres concerned in closing the eyelids. The state of the circulation of the brain has been fre­quently investigated. The older view was that there was a degree of plethora or congestion of the vessels of the brain, as is the state of matters in coma, to which the state of sleep has a superficial resemblance. Coma, how­ever, is not sleep, but a condition of inactivity of the cerebral matter owing to the accumulation of dark venous blood in its vessels. This has been actually observed in cases where it was possible to see the brain. During sleep the surface of the exposed brain has been observed to become pale and to shrink somewhat from the sides of the opening (Blumenbach). A careful experimental re­search was conducted by Arthur E. Durham in 1860, in which he trephined a portion of bone as large as a shilling from the parietal region of a dog, and, to obviate the effects of atmospheric pressure, inserted a watch glass into the aperture so that the surface of the brain could be seen. His results are summarized thus :—

“ (1) Pressure of distended veins on the brain is not the cause of sleep, for during sleep the veins are not distended ; and, when they are, symptoms and appearances arise which differ from those which characterize sleep. (2) During sleep the brain is in a comparatively bloodless condition, and the blood in the encephalic vessels is not only diminished in quantity, but moves with diminished rapidity. (3) The condition of the cerebral circulation during sleep is, from physical causes, that which is most favourable to the nutrition of the brain tissue ; and, on the other hand, the condition which prevails during waking is associated with mental activity, because it is that which is most favourable to oxidation of the brain sub­stance, and to various changes in its chemical constitution. (4) The blood which is derived from the brain during sleep is distri­buted to the alimentary and excretory organs. (5) Whatever in­creases the activity of the cerebral circulation tends to preserve wakefulness ; and whatever decreases the activity of the cerebral circulation, and, at the same time, is not inconsistent with the general health of the body, tends to induce and favour sleep. Such circumstances may act primarily through the nervous or through the vascular system. Among those which act through the nervous system may be instanced the presence or absence of impressions upon the senses, and the presence or absence of excit­ing ideas. Among those which act through the vascular system may be mentioned unnaturally or naturally increased or decreased force or frequency of the heart’s action.”

Dr William A. Hammond and Dr Weir Mitchell have repeated and extended Durham’s observations, with the same general results (1866), and more recently Ehrmann, Salathé (1877), François Franck (1877), and Mosso (1881), by more refined methods of observation, have arrived at the same general conclusions. Mosso in particular has applied with great success the graphic method of registra­tion to the study of the movements of the brain and of the circulation during sleep. He made observations on three persons who had lost a portion of the cranial vault and in whom there was a soft pulsating cicatrix. They were a woman of thirty-seven years of age, a man of thirty-seven years, and a child of about twelve years. By special arrangements, Mosso took simultaneous tracings of the pulse at the wrist, of the beat of the heart, of the movements of the wall of the chest in respiration, and of the movements of the denuded brain. Further, by means of the plethysmograph,—an instrument of Mosso’s own in­vention,—he obtained tracings showing changes in the volume of the hand and forearm ; and he succeeded in showing that during sleep there is a diminished amount