ASTRONOMICAL PHENOMENA FOR THE WEEK, 1885, *AUGUST* 23-29

(FOR the reckoning of time the civil day, commencing at Greenwich mean midnight, counting the hours on to 24, is here employed.)

At Greenwich on August 23

Sun rises, 5h. 0m.; souths, 12h. 2m. 22·7s.; sets, 19h. 5m.; decl. on meridian, 11° 19′ N.: Sidereal Time at Sunset, 17h. 14m.

Moon (Full on August 25) rises, 17h. 49m.; souths, 22h. 40m.; sets, 3h. 38m.*; decl. on meridian, 13° 55′ S.

Planet	Rises h. m.	Souths h. m.	Sets h. m.	Decl. on meridian ° ′
Mercury ...	6 54 ...	13 1 ...	19 8 ...	0 41 N.
Venus ...	7 46 ...	13 54 ...	20 2 ...	0 50 N.
Mars ...	0 41 ...	8 56 ...	17 11 ...	23 18 N.
Jupiter ...	6 8 ...	12 50 ...	19 32 ...	7 41 N.
Saturn ...	0 8 ...	8 17 ...	16 26 ...	22 26 N.

* Indicates that the setting is that of the following day.

Occultations of Stars by the Moon

August	Star	Mag.	Disap. h. m.	Reap. h. m.	Corresponding angles from vertex to right for inverted image ° °
26 ...	67 Aquarii ...	6 ...	5 9 ...	6 9 ...	151 325
27 ...	B.A.C. 8365 ...	6½ ...	20 48	near approach ...	162 —

The Occultations of Stars are such as are visible at Greenwich.

August	h.	
27 ...	11 ...	Mercury in conjunction with and 6° 1′ south of Jupiter.

THE MOTOR CENTRES OF THE BRAIN AND THE MECHANISM OF THE WILL[1]

FEELING deeply as I do the responsibility I have incurred in undertaking to address you to-night, I desire to express my regret that I cannot instead share with you the pleasure of listening to the distinguished man who has been prevented by a most painful bereavement from addressing you to-night.

My subject being the mechanism of the will, it might be asked, "What has a surgeon to do with psychology?" To which I would answer, "Everything." For without sheltering myself behind Mr. Jonathan Hutchinson's trite saying that "a surgeon should be a physician who knows how to use his hands," I would remind you that pure science has proved so good a foster-mother to surgery, that diseases of the brain which were formerly considered to be hopeless, are now brought within a measurable distance of the knife, and therefore a step nearer towards cure. Again, I would remind you that surgeons rather than physicians see the experiments which so-called Nature is always providing for us,—experiments which, though horribly clumsy, do on rare occasions, as I shall presently show you to-night, lend us powerful aid in attempting to solve the most obscure problems ever presented to the scientist.

The title I have chosen may possibly be objected to as too comprehensive; but until we are ready to admit a new terminology we must employ the old in order to convey our meaning intelligibly, although there may be coupled therewith the risk of expressing more than we desire. Thus when I speak of the mechanism of the will and the motor centres of the brain, I do not intend (as indeed must be obvious) to discuss the existence of the so-called freedom of the will, or the source of our consciousness of voluntary power.

I shall rather describe to you first the general plan of the mechanism which conveys information to our brain, the thinking organ; next the arrangement of those parts in it which are concerned with voluntary phenomena; and finally I shall seek to show by means of experiment that the consciousness of our existing as single beings, the consciousness of our possessing but one will as people say, while at the same time we know that we possess a double nervous system, is due to the fact that pure volition is dependent entirely on the exercise of the attention which connotes the idea of singleness. Consequently that it is impossible to carry out two totally distinct ideas at one and the same moment of time, when the attention must of course be fully engaged upon each.

[1] Lecture at the Royal Institution of Great Britain by Victor Horsley, F.R.C.S.

I fear that in making my argument consecutive, I shall have to pass over very well-beaten paths, and so I must ask your patience for a few moments while I make good my premisses.

The nervous system, which in man is composed of brain, spinal cord, nerves, and nerve-endings, is arranged upon the simplest plan, although the details of the same become highly complex when we arrive at the top of the brain.

At the same time, while we have this simple plan of structure, we find that there is also a fundamental mode of action of the same—a mode which is a simple exposition of the principle, no effect without a cause—a mode of action which is known as the phenomenon of simple reflex action.

The general plan of the whole nervous system is illustrated by this model. Imbedded in the tissues all over the body, or highly specialised and grouped together in separate organs, such as the eye or ear, we find large numbers of nerve-endings,—that is, small lumps of protoplasm from which a nerve-fibre leads away to the spinal cord and so up to the brain.

These nerve-endings are designed for the reception of the different kinds of vibration by which energy presents itself to us. As the largest example of these nerve-endings, let me here show you one of the so-called Pacinian bodies, or more correctly, Marshall's corpuscles, for Mr. John Marshall discovered these bodies in England before Pacini published his observations in Italy. Here you see one of these small oval bodies arranged on the ends of one of the nerves of the fingers, and here you see the nerve-fibre ending in the little protoplasmic bulb which is protected by a number of concentric sheaths.

Pressure or any form of irritation of this body at the end of the nerve-fibre causes a stream of nerve-energy to travel through the spinal cord to the brain, and so we become conscious that something is happening to the finger.

Here in this section of the sensitive membrane of the back of the eye, the retina, you see a similar arrangement, only more complicated,—namely, nerve-fibres leading away from small protoplasmic masses which possess the property of absorbing light and transforming it into nerve-energy. It is this transformation of nerve-energy into heat, light, pressure, &c., which it seems to me should alone be called a sensation, irrespective of consciousness. And in fact we habitually say we *feel* a sensation. The terms "feeling" and "sensation," however, are frequently used as interchangeable expressions, although, as I shall show you directly, "feeling" is the conscious disturbance of a sensory centre in the surface of the brain, and in fact feeling is the conscious perception of sensations. This distinction between feeling and sensation, if dogmatic, will save us from dispute as to the meaning of the word "sensation"; and further, the distinction is one, as I have just shown, which is justified by custom.

Now the nerve fibre which conveys the energy of the sensation is a round thread of protoplasm which in all probability connects the nerve-ending with a sensory corpuscle in the spinal cord. These nerve-fibres running in nerves are white, whereas, as you know, protoplasm is gray. They are white because each is insulated from its fellow by a white sheath of fatty substance, just as we protect telegraph wires with coatings. It is not stretching analogy too far to say that nerve-force may probably escape unless properly insulated.

In consequence of the fibres being covered with these white sheaths, they form what is called the white matter of the brain; while the nerve centres are grayish, and therefore form what is called the grey matter of the brain, so that the grey matter receives and records the messages conveyed to it by the white insulated fibres.

From the sensory corpuscle, which is a small mass of protoplasm provided with branches connecting it to neighbouring corpuscles, the nerve energy, if adequate, passes along a junction thread of protoplasm to a much larger corpuscle, which is called a motor corpuscle, and the energy of which, when liberated by the nerve impulse from the sensory corpuscle, is capable of exciting muscles into active contraction. These two corpuscles form what is called a nerve centre.

Not only are the motor corpuscles fewer as well as much larger than the sensory ones, but also the nerve fibres which go out from them are larger too. In fact it would seem as if we had another close analogy to electrical phenomena; for here, where we want a sudden discharge of a considerable intensity of nerve force, we find to hand a large accumulator mechanism and a large conductor, the resistance of which may justly be supposed to be low. Finally, the motor nerve-fibre terminates in a protoplasmic mass which is firmly united to a muscle fibre, and which

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