their duplicity at times, cannot be dwelt on here; but that they are the results of a great inundation, seems to be the conclusion which is most compatible with recent observation.

A further fact which has recently attracted particular attention is the frequent observation of bright projections on the terminator of the planet's disc. It may be here simply mentioned that the observations as yet seem to point to the presence of high mountains as the cause of these bright markings.

A discussion of this question will be dealt with, however, in a future article, which will contain a detailed account of the work up to the present time.

Such, then, are some of the facts which have been brought before us by the Arizona observations. Observations at other observatories, such as that of Juvisy, &c., are also at hand, but the weather seems to have been hard on these eager watchers, so the observations are very few. The surface of Mars is still a puzzle to be unravelled, and there are many who are employed in the fascinating work of solving it. One may repeat, what has often been stated before, that in the study of planetary details, the aperture or the size of object-glass is not the most important function for good observations. A keen and patient observer sitting at the eye-piece of a comparatively small equatorially-mounted telescope, if he makes his observations carefully and with due regard to atmospheric conditions for good seeing, can do more useful and valuable work than one who has a large aperture at his disposal, and employs it indifferently. For Martian detail, Mr. Lowell puts the observer first, then the atmosphere, and lastly, the instrument, as the order of weights to be given as factors of a good observation. W. J. LOCKYER.

Note.—In my article on "The Discs of Jupiter's Satellites," which appeared in a previous number of this journal (August 2, p. 320), the table, giving the measurements of the position angle of the 1st satellite, requires a slight alteration, owing to a printer's error in that number of *Astronomy and Astrophysics* from which the table was taken. In the column indicating the initials of the observers, the following measures, 1, 3, 5, 7, 9, 11, ought to be attributed to Prof. Pickering, and the rest to Mr. Douglas. This alteration makes no change in the text necessary, as it was only stated that there was "a mean personal correction of about 7°·1," which, in the light of the revised column, still holds good. The correction, with one exception, simply reverses the names of the observers in each case. W. J. L.

THE ARCHOPLASM AND ATTRACTION SPHERE.

PLATNER in 1886, when dealing with the spermatocytes of helix, showed that the great "nebenkern" in these elements was derived after each division from a coalescence of the spindle-fibres. At the same time he pointed out in the interior of the structure bright refractive points answering in every way to what was then known about the centrosomes. Some time afterwards F. Hermann, in an exquisite description of the karyokinetic process in the spermatocytes of salamander, successfully homologised the great "archoplasm" (as he termed the nebenkern of these cells), on the one hand with Platner's nebenkern, and with the sphere-attractive and archoplasm of Van Beneden and Boheri on the other. I subsequently drew attention to the fact that this archoplasm in the salamander arose by a collection of the spindle-fibres precisely in the same manner as that of helix, *i.e.* these structures (attraction-spheres) in widely separated groups present precisely similar constituents, and arise in a precisely similar way.

The clear appreciation of the mutual equivalence of these bodies is of considerable value, as it paves a way towards the systematic splitting up of a whole group of structures present in reproductive cells, which had all previously been loosely grouped under the head of nebenkerns. Nevertheless, if we accept it, a certain difficulty arises, to which I referred briefly at the time, and to which Dr. Neves has since called my attention in an interesting letter from Kiel:—If the archoplasm of the spermatocytes with its inner constituents is the homologue *in toto* of the attraction-sphere when at rest (Fig. 3), or during the initial phases of mitosis, what is to be said of it in the later phases of this process?

In the attraction-sphere as first described and ordinarily understood in ascaris, the centrosomes, with their light-surrounding zone, occupy the middle of an extended archoplasm which divides with the centrosomes during the course of the mitotic change, but in the case of salamander the archoplasm remains undivided as a rule; and its whole mass is used up in the construction of the spindle, the centrosomes appearing at the apices of the figure related to a radiation of the non-archoplasmic and external protoplasm. Now when the karyokinesis is completed, and the daughter nuclei formed, the centrosomes can be found at the remote sides of the nuclei (as in Fig. 4, *c*, one-half of a dividing spermatocyte of a rat), but the two new archoplasmic masses are being regenerated on each side of the division plane (as in the rat, Fig. 4, *b*). These masses become completely formed, but in consequence of their position are destitute of centrosomes, which must acquire a secondary connection with them; so that at this phase the sphere is divided into two parts in each cell, that which attracts (centrosomes) being at one side of the nucleus, that which is regarded as primarily attractive (the archoplasmic portion of the kytoplasm) on the other. In salamander these anomalous conditions eventually become righted by the centrosomes wandering round the nuclei into the archoplasm.

Turning, however, to a still higher type of vertebrates, the Mammalia, a short time ago I found in the spermatocytes of various forms, besides other and well-known accessory bodies, a great lightly staining nebenkern (archoplasm), which can be determined as arising during the spermatogenesis by a coalescence of the spindle-fibres (Figs. 1, 2, *a*), so that we must regard this body as having the same value as the nebenkern in Amphibia, in Helix, in Echinoderms, or that it is the archoplasmic portion of the attraction-sphere; but at no time, either at rest or during active mitosis, does it contain within its mass the centrosomes! In the resting spermatocytes of the rat (Fig. 2) these bodies lie quite outside the archoplasm (Fig. 2, *c*), they become duplicated, and enter into the formation of a spindle without any connection with the archoplasm (Fig. 1, *c*), which passes further away, and ultimately degenerates (Fig. 1, *a*). The spindle-fibres are constructed anew out of the kyto- and superficial nuclear-plasm, and the mass of substance thus utilised is collected on either side the division plane as the archoplasmic bodies of the daughter cells.

The archoplasm, then, has no permanent existence in these cells, and is of no immediate consequence in the formation of the spindle. The fact, however, that the transitory body formed in mammals from each new crop of spindle-fibres, after each division (Fig. 4) rapidly dissolves and reincorporates itself into the surrounding kytoplasm, is distinctly favourable to the view now gaining ground, that the spindle has a kytoplasmic origin.

From all this it will be seen that we cannot regard the archoplasmic portion of the sphere as a permanent organ of the cell any more than the ripples wind produces are the permanent features of the surface of a pond.

On the other hand, all the more recent investigations concerning normal or karyokinetic propagation of cells, whenever sufficient pains have been taken to insure good results, show that the centrosomes retain their individuality through every change. Couple with these facts the discovery by Dr. Field of the entry of the centrosomes into the spermatozoa of the echinoderms, and a quite similar state of things I have found to occur in mammals, and there seems much evidence that the centrosomes, unlike the other constituents of the sphere, retain their individuality during successive mitoses, and are incorporated as an essential constituent of the spermatozoa.

Further, the well-known observations of Fol, and more recently those of Fick, show clearly that these bodies assume their old functions as dominants of the attractive process in the initial steps of fertilisation. Their identity through successive generations being thus maintained, the

FIG. 4.

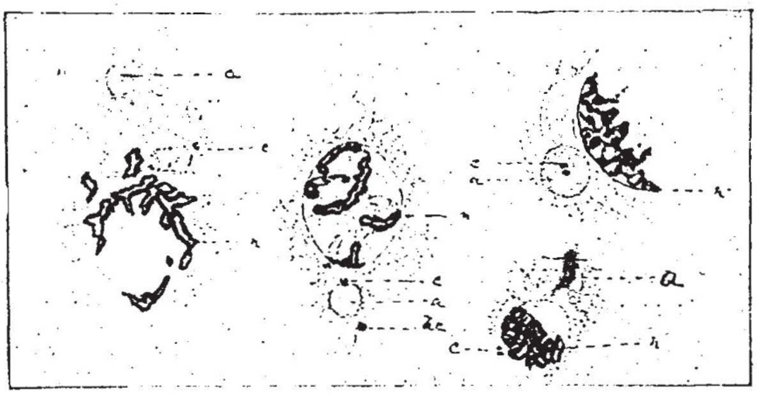

FIG. 1. FIG. 2. FIG. 3.

important functions they perform in the division process itself necessitates our regarding them, with Van Beneden, as organs of the cell, although, when viewed in such a light, they will have to be disrobed of their more conspicuous radial and archoplasmic vestments. With respect to these latter, in whatever degree they may be present, it seems an unavoidable conclusion that they can only be regarded as the effect produced by the inconstant action of polarity or whatever power is exercised by the centrosomes on the surrounding kytoplasm.

J. E. S. MOORE.

HERMANN VON HELMHOLTZ.

HONOURED and mourned by all, Prof. von Helmholtz, one of the most brilliant men who have devoted their lives to science, passed away at Charlottenburg, on Sunday last. Shortly before his death, the Empress Frederick sent a telegram of inquiry as to his condition, and upon hearing of his decease messages of sympathy were sent to the sorrowing relatives by the Emperor and herself. This fact is a significant indication of the regard in which the representatives of science are held in Germany.

Hermann Ludwig Ferdinand Helmholtz was born August 31, 1821, at Potsdam, where his father, Ferdinand Helmholtz, was Professor in the Gymnasium, his mother, Caroline Penn, being of an English family. While but a schoolboy he developed a love for science, and studied all the books on physics which his father's library contained. They were very old-fashioned; phlogiston still held sway, and electricity had not grown beyond the voltaic pile. When the class was reading Cicero or Virgil, he was finding the paths of the rays in a telescope, or developing optical theorems not usually met with in text-books. At that time there was little possibility of making a living out of physics, so, acting on the advice of his father, Helmholtz took up the study of medicine. He entered the Army Medical School, the Friedrich Wilhelms Institut, and while there came under the influence of a profound teacher—Johannes Müller. He eventually became a military surgeon, and continued in that position till the end of 1848, when he was appointed Assistant of the Anatomical Museum of Berlin, and Teacher of Anatomy at the Academy of Arts.

In 1847, that is, during his career as an army surgeon, Helmholtz's essay, "Ueber die Erhaltung der Kraft," was published. In this, the principle of the conservation of energy was developed. About Joule's researches on the same subject, he knew at that time but little, and nothing at all of those of Robert Mayer. He was led to write the essay by an examination of Stahl's theory, adopted by most physiologists, which accorded to every living body the nature of a *perpetuum mobile*. The essay contained the results of a critical investigation of the question whether any relations existed between the various kinds of natural forces for perpetual motion to be possible. It was written for the benefit of physiologists, but, to Helmholtz's surprise, the physicists took up the doctrine of the conservation of energy, which some of these were inclined to treat as a fantastic speculation. Jacobi, the mathematician, recognised the connection between the line of thought in the essay, and the principles investigated by Daniell, Bernouilli, d'Alembert, and other mathematicians of last century, and soon the members of the then young Physical Society of Berlin accepted Helmholtz's results. It is unnecessary for us to dwell upon the marvellous influence that these results have had upon physical science during the last half-century. The principle of the conservation of energy has long passed through the debatable stage, and some of the greatest discoveries in thermodynamics and other branches of modern physics have been deduced from it.

In 1849 Helmholtz went to Königsberg as a Professor of General Pathology and Physiology; seven years later he accepted a similar position at Bonn University. While at the former University he designed the ophthalmoscope for the diagnosis of diseases of the inner parts of the eye—a discovery which shows the great importance to the physiologist and physician of a thorough knowledge of physical principles. The year 1859 saw him occupying the chair of Anatomy and Physiology at Heidelberg; and in 1871 he was appointed Professor of Natural Philosophy in the University of Berlin, a post which he held until his death.

The two great works of Helmholtz on "Physiological Optics" and on the "Sensations of Tone," are splendid examples of the application of methods of analysis to the two kinds of sensation which furnish the largest proportion of the raw material for thought. In the first of these works, the colour-sensation is investigated, and shown to depend upon three variables or elementary sensations. The study of the eye and vision is made to illustrate the conditions of sensation and voluntary motion. In the work on the "Sensation of Tone as a Physiological Basis for the Theory of Music," the conditions under which our senses are trained are illustrated in a yet clearer manner. His researches threw a flood of light upon what may be termed the mechanical, physical, physiological, and psychological processes involved in seeing and hearing.

No good end would be served by enumerating Helmholtz's contributions to knowledge. The versatility of his genius is well known among all workers in the realm of nature. Mathematics, physics, physiology, and psychology are but a few of the branches of knowledge which have been enriched by his investigations. His acquaintance with science was not only extensive but