then enters upon a calculation, from which, however, no definite results are deduced.

June 17, 1852.

The EARL OF ROSSE, President, in the Chair.

The following gentlemen were admitted:—

Rev. Jonathan Cape.	John Tyndall, Esq.
John Mercer, Esq.	

The following gentlemen were recommended by the Council for election as Foreign Members:—

Adolphe Theodore Brongniart.	J. Lamont.
Benjamin Peirce.	V. Regnault.

1. "On the Impregnation of the Ovum in the Amphibia (Second Series revised), and on the direct agency of the Spermatozoon." By George Newport, F.R.S., F.L.S. &c. Received June 17, 1852.

The author remarks that, having in a former paper shown that the spermatozoon alone is the impregnatory agent, he endeavoured in a subsequent communication to the Royal Society, a report of which is printed in the Proceedings for June 1851, to arrive at some conclusion as to the nature of its influence; and, from the facts he was then acquainted with, he announced the view that the spermatozoon appeared to be the organ of a special form or condition of force in the animal body. At that time he had no evidence that the spermatozoon penetrates into the coverings of the egg, as he had constantly found it attached only to the surface. Since then he has detected it within the substance of these coverings, and sometimes even partially imbedded in the vitelline membrane beneath them; but he has no evidence that it enters the vitelline cavity. While therefore the fact of penetration into the envelopes necessitates some revision of the details of the view announced, he still regards the spermatozoon as the organ of a special condition or form of force in the animal structure.

He then proceeds to show the relative duration of vitality in the spermatozoon and the egg, and points out that that of the former is shorter than is usually supposed; that at the temperature of 55° Fahr. it usually is lost in from three to four hours after removal from the body into water; but that at a lower temperature it is retained longer, and that when the spermatic fluid has contained many undeveloped cells, and has been preserved in a temperature of 51° Fahr., it has fertilized at the end of twenty-four hours. The egg loses its fitness to be impregnated very soon after it is passed into water, usually within the first hour, owing chiefly to the endosmosis and expansion of its envelopes. But when retained within the body of

the dead frog its vitality is preserved for twenty-four, and sometimes even for forty-eight hours, at a low temperature. He next shows that the results produced by the active vibratile spermatozoa on the dead egg are similar to those which are at first produced on the living one by solution of potass, viz. the yelk becomes shrivelled and contracted, and this result also occurs when decomposing spermatic fluid is applied to it. Having repeated the experiments formerly mentioned (Proceedings, p. 83), that the frog's egg may be fecundated by application of exceeding minute quantities of spermatozoa by means of the head, and even of the point of a small pin, to almost any part of its surface, he shows that there are some parts of the surface more, and some less, susceptible than others; and that, in a series of careful experiments made with a view to test this fact, he found that when the egg is placed vertically, with the centre of the white surface uppermost, and the spermatozoa are applied to this part, and not allowed to flow over the sides of the egg, fecundation is then but rarely effected; but that when the centre of the dark surface is uppermost, and the spermatozoon is applied to that part, fecundation of the egg is then almost invariably the result. A fact is also mentioned which is of some value in experiments on artificial impregnation. The chamber which is formed above the yelk in the fecundated egg, as described in the author's former paper, is commenced at the end of the first hour, by the contraction and depression of the upper or dark surface of the yelk; and thus affords an early proof as to whether or not the egg has been fecundated. When no chamber is formed, it is certain that the egg has not been fecundated. But the chamber may be formed, and the yelk not undergo segmentation; in which case fecundation has been only partial and incomplete. The motion of the spermatozoon in relation to its function is then examined, and the author states that he regards this motion as only the visible exponent of a peculiar power in the impregnating agent, and as essential to its function, and that it is associated with the material composition and structure of this body, the degree of procreative efficiency of which, he thinks, is indicated by the degree, or intensity of its motive power; although he believes that some portion of the substance of the body of the spermatozoon is also communicated to the egg in fecundation.

The author then shows that having adopted a mode of examining the egg, beneath the microscope, at the time of the spermatozoa being supplied to it, different from that which he formerly employed, he has been enabled to detect the fact of penetratien by the spermatozoon into the envelopes, and its arrival at the vitelline membrane, with great facility. Availing himself of the fact previously ascertained, that impregnation may be effected by the direct application of the spermatozoon by means of the pin's head or point, he put the fact of penetration to a very positive test beneath the microscope, and found that the spermatozoon always penetrates at the parts to which it is applied, and at no other part of the egg, and that a short time afterwards it may be detected striking into the vitelline membrane, by its thicker or body portion, in a line with the point at

which it has entered, and the centre of the yelk, and that he has usually found eggs so penetrated to have been fertilized and produce embryos. Further, that eggs in which no spermatozoa have been seen in contact with the yelk membrane, have usually been unfruitful, although numerous spermatozoa have been observed on their surface. During his experiments the author had an opportunity of examining some eggs which had been impregnated by the natural concurrence of the sexes, and then found that these most fully confirmed the results obtained by artificial impregnation. Spermatozoa were observed sticking into the vitelline membrane for many hours after the time at which the egg must have been fecundated; which the author believes must be within the *first half-hour*, and perhaps within the *first few minutes*; as he has sometimes found spermatozoa close to the vitelline membrane *within one minute* after they had been supplied to the egg. The spermatozoon invariably enters the egg with its thicker or body portion foremost, and passes onwards with a direct but slightly serpentine motion, in a centripetal direction to the vitelline membrane. A large proportion of the spermatozoa never enter the envelopes of the egg, if they happen to come into contact with them laterally, as is frequently the case; they then merely adhere to the surface, but do not fecundate. The greatest number penetrate when supplied to the egg within a few seconds after removal from the male body, and of the eggs from the body of the female. Some experiments are then detailed which the author states arose out of a communication made to him by Mr. Busk, F.R.S. The spermatozoa were narcotized by exposure for eight or ten minutes to the vapour of chloroform, and it was then found that when in this state, while perfectly motionless, as when dead, they did not impregnate. These experiments, in connection with others, seemed to show that the entrance of the spermatozoon into the egg is not the result of an endosmic action of the envelopes, but is that of the operation of a distinct power in the spermatozoon.

The nature of the influence of the spermatozoon is then examined. The author has endeavoured to put this to the test of experiment, *first*, by immersion of eggs, both before, and at the period of fecundation, and during the segmentation of the yelk, in solutions of potass; and *next*, by reducing the bodies of recently-obtained and perfectly active spermatozoa, to a fluid state, by trituration in a glass mortar, prepared for the purpose, and then applying the materials so obtained to the egg immediately it is expelled from the female, and before it has been in contact with water; and consequently at the time it is most susceptible of the fecundatory influence. The experiments by immersion in potass solution showed that the endosmic action of the egg envelopes is exceedingly rapid, as decomposition of the yelk was commenced in some within *three* minutes of the application of the solution. In very weak solution the result was different, and appeared to be favourable to the action of the spermatozoon. The fluid obtained by trituration of the spermatozoa was applied to several sets of eggs, but no fecundation of the egg was effected by it; the yelks, however, became affected, being in some

cases shrivelled and contracted, as when potass solution or decomposing seminal fluid is applied, thus showing that the substance of the broken down spermatozoa had passed to the yelk by endosmosis. These experiments were made at the same time with others made with portions of the same fluid which had not been triturated, and in which the spermatozoa were still active. In these instances fecundation was constantly effected, so that the conclusion deduced from these comparative trials was, that fecundation is not the result simply of the addition of the substance of the body of the spermatozoon to the egg, but primarily seems to be due to a force or dynamic power in the spermatozoon, which is lost when this body has ceased to give evidence of its retention of it, in its power of motion.

The author then proceeds to inquire whether these results do not justify our viewing the spermatozoon as the organ of a special form or condition of force in the animal structure? and states, as he has done on a former occasion (Proceedings, June 1851, p. 83), other grounds on which the hypothesis seems to be supported, pointing out that the spermatozoon, like muscle and nerve, has both general and special anatomical structure and special chemical composition; and that as we have been accustomed to regard the power of muscular contractility as a distinct force, or form of force, of the body,—the same view being held with regard to nerve, the properties of these two tissues being perfectly distinct from each other,—so it appears to be correct to view the property of the spermatic structure; which is not only perfectly distinct from either of these, but different from that of every other tissue in the organization, and is not exercised until the structure itself has been entirely separated from the body of which it originally formed a part.

2. "On the Functions of the Membrana Tympani, the Ossicles and Muscles of the Tympanum, and of the Eustachian Tube in the Human Ear, with an account of the Muscles of the Eustachian Tube and their action in different classes of Animals." By Joseph Toynbee, Esq., F.R.S. &c. Received June 15, 1852.

The author commences his paper by making some observations on the general arrangements of the *ossicula auditûs*. The malleus and incus being firmly connected together by ligaments, are considered as a single bone, forming an elastic arch, the anterior extremity of which is firmly attached to the Glasserian fissure, the posterior to the anterior part of the mastoid cells. This arch is kept steady by the actions of the tenser tympani. The movement of this arch is that of rotation; and it is effected by the tensor tympani muscle. When this muscle contracts, the lower part of the arch, consisting of the handle of the malleus and the long process of the incus, is drawn inwards; by this action the membrana tympani is rendered tense, and the stapes being pressed towards the cavity of the labyrinth, the fluid in the latter is compressed.

The anatomy and attachments of the *stapes* are next minutely described. The base of this bone, generally stated by writers on