In chapter iv. he explains a "physiological hypothesis," that the natural impression given by binary rhythm arises probably from the naturally symmetrical structure of the human body, and the binary action of its functions, such as breathing and the beating of the heart, whereas a ternary rhythmic motion seems something heterogeneous and unnatural. In chapter v. he discusses the effects of rhythms on our organism, simple or natural rhythms giving an agreeable impression, and unnatural or complicated rhythms giving one of a contrary description. Then follows a long chapter of formulæ and complicated arithmetical statements of rhythmical combinations of various kinds.

These remarks, on rhythms generally, occupy two-thirds of the pamphlet; the remaining third is intended to show how they may be applied to the nature and effects of musical sounds. Chapter vii. contains a description of the major musical scale as harmonically deduced by the aid of the monochord; and after that we begin to get a glimpse, though obscurely, of the nature of the general argument. The following extracts may give an idea of it:—

"The only sounds of the scale which are in binary rhythm are the first, 1 : 1, and the last, 1 : 2; and these are in fact the only ones which imply rest. The fifth, 2 : 3, is constituted by a ternary rhythm, and is, in fact, the sound of greatest motion which is contained in the scale. This most powerful motive action gives to this sound the greatest tendency towards the sounds of rest, authorizing it to fall directly on them, however distant from it.

"The ratio 4 : 5, which represents the major third, is constituted by a quinary rhythm—a rhythm of semi-motion which has such an action that while it makes us feel faintly the need to pass to the fundamental, it may almost supply it coming after the fifth."

Thus we arrive at the kernel of the theory, which appears to be that the effects of different combinations of rhythmical blows or noises are assumed to be applicable to the vibrations causing musical sounds, and to account for the effects of such sounds in an emotional point of view. It is something akin to the old Euler doctrine of the "simplicity of ratios," but it professes to be more comprehensive.

It is not carried out very far in this book, but the author promises that if he lives long enough, and has sufficient means, he will complete it in a larger treatise. Then, perhaps, we shall see how it will explain the construction of "Israel in Egypt," Haydn's Quartettes, and Beethoven's Ninth Symphony.

THE MUSEUMS ASSOCIATION.

THE first annual meeting of the Museums Association was held in Liverpool on June 17, 18, and 19, under the presidency of the Rev. H. H. Higgins, M.A. Liverpool was represented by the President, Mr. J. T. Moore, Mr. R. Paden, Mr. J. Chard, Mr. P. Cowell, Mr. H. A. Tobias, and a number of other gentlemen. In addition to the home contingent, the following were present:—Mr. F. W. Rudler, Mr. R. J. Howard, Mr. R. Ashton (Blackburn); Mr. J. Vicars, Mr. J. J. Ogle (Bootle); Mr. W. W. Midgley (Bolton); Mr. Butler Wood (Bradford); Mr. John Storrie (Cardiff); Mr. Montagu Browne (Leicester); Mr. C. G. Virgo (Manchester); Mr. T. J. George (Northampton); Mr. J. W. Carr (Nottingham); Mr. R. Howse (Newcastle); Prof. Boyd Dawkins, Mr. W. E. Hoyle (Owens College); Major Plant (Salford); Alderman Brittain, Mr. E. Howarth (Sheffield); Lieutenant-Colonel Turner, Mr. John Tym (Stockport); Mr. Robert Cameron, Mr. J. M. Bowley (Sunderland); Mr. L. Greening, Mr. H. Roberts, Mr. F. W. Moncks, Mr. C. Madeley (Warrington); Mr. H. M. Platnauer (York).

The proceedings were opened by Mr. J. T. Moore, as Mr. S. W. North, chairman at the last meeting (held in York), was unavoidably absent. The Rev. H. H. Higgins gave his presidential address, and the following papers were read and discussed:—"On Museum organization and arrangement," by Prof. W. Boyd Dawkins, F.R.S.; "Suggestions for aid in the determination of natural history specimens in Museums," by Mr. F. W. Rudler; "A new method of mounting Invertebrates for Museum and lecture purposes," by Dr. H. C. Sorby, F.R.S.; "Notes on the Liverpool Free Public Museum," by Mr. T. J. Moore; "Circulating school cabinets for elementary schools," by Mr. John Chard (Assistant in the Liverpool Museum); "The best means of making Museums attractive to the public," by Mr. R. Cameron; "A plea for local geological models," by Mr. T. J. Moore; "Museum cases and Museum visitors," by Mr. E. Howarth; "Notes on the Moscow Museum," by Mr. Willoughby Gardner; "Winter evening lectures in Museums," by Mr. R. Paden (Assistant in the Liverpool Museum).

Some very pleasant expeditions were made, thanks to the untiring energy of the local Secretary, Mr. H. A. Tobias, who was ably seconded by Mr. Cowell and Mr. McMillan. The members of the Association were most hospitably received; they were entertained at lunch by his worship the Mayor, and received invitations to a *soirée* of the Library, Museum, and Arts Committee, and to a magnificent *conversazione* given by the Japanese Consul, Mr. James L. Bowes.

SCIENTIFIC SERIALS.

American Journal of Science, June.—Prof. Elias Loomis: a memorial address prepared by H. A. Newton at the request of the President and Fellows of Yale College.—The magnetic field in the Jefferson Physical Laboratory, Part II., by R. W. Willson. In the February number of the *Journal* the author gave some observations of the variations of the horizontal intensity in different parts of the Jefferson Physical Laboratory in 1886-87, and upon the disturbance in the magnetic field produced by the presence of iron steam pipes and other iron masses. He now finds from extended observations that brickwork produces a great disturbance of the magnetic field, and thinks, therefore, that in general it would be safer to make exclusive use of wood for buildings and piers intended for refined magnetic measurements.—The electrical resistance of the alloys of ferro-manganese and copper (from determinations made by Mr. B. H. Blood), by Edward L. Nichols. The observations show that ferro-manganese-copper alloys decrease in electrical resistance each time they are subjected to a change of temperature. In one case an alloy containing 80·82 per cent. of copper and 19·12 per cent. of ferro-manganese, was hard drawn in the process of obtaining a strip suitable for measurement. Its specific resistance at 20°, referred to pure copper as unity, was 30·38; this resistance gradually diminished as the strip was repeatedly heated to 100° and cooled to 20°, until after seven such heatings it had fallen to 30·072. The effect of successive annealings upon the resistance of a number of alloys is also described.—Fluid volume and its relation to pressure and temperature, by C. Barus. The paper contains the introductory part of a series of experiments on the compressibility of liquids, in progress at the Physical Laboratory of the U.S. Geological Survey. Taking the results from 0° to 185° as a whole, it follows that if with the observed thermal expansion compressibility be supposed to increase inversely as the first power of the *pressure binomial* $(A + p$, where A is constant), then temperature and pressure must vary linearly to maintain constancy of volume.—On hamlinite, a new rhombohedral mineral from the herderite locality at Stoneham, Mi., by W. E. Hidden and S. L. Penfield.—On a large spring-balance electrometer for measuring (before an audience) specific inductive capacities and potentials, by Alfred M. Mayer. The chief characteristic of the excellent piece of apparatus described is that it shows *directly*, and not inferentially, that different dielectrics transmit the force of electricity in different degrees.—Notice of new Tertiary mammals, by O. C. Marsh.

THE *American Meteorological Journal* for June contains:—An article on the distribution of cloud over the globe, specially prepared by M. L. Teisserenc de Bort from a former paper on this subject (NATURE, vol. xxxvi. p. 15), with diagrams of mean isonephs for March, which is the clearest month over the globe, aud for July, which, on the whole, is a cloudy month, and also with figures showing the appearance of the cloud bands on the earth, compared with other planets having atmospheres.—Is the diurnal variation of the magnetic needle a meteorological phenomenon?, by Prof. R. Owen. The object of the paper is to show that our atmosphere is the medium influenced magnetically by the sun, in affecting the diurnal movement of the needle. The author thinks that the facts adduced may aid us in understanding why storms in the northern hemisphere rotate from right to left, and advance from lower to higher latitudes.—A translation of Dr. R. Assmann's paper on the climatological influence of influenza.—Report of the meeting of the New Eng-

land Meteorological Society on April 15. The chief subject of discussion was climatic changes, which were considered in two divisions: (*a*) Secular changes, introduced by Prof. W. M. Davis. He stated that secular variations have undoubtedly taken place, but we cannot give specific explanations of them. (*b*) Supposed recent changes, introduced by Prof. W. Upton. Several long series of observations were examined, and, while slight indications of periodicity were found, there was no trace of progressive change.—Trombes and tornadoes, by M. H. Faye (concluded from the May number).—Method of determining the direction of the wind by observation of the undulations at the margins of the disks of the heavenly bodies, especially the sun and moon, viewed through a telescope, by Don V. Ventosa, of the Madrid Observatory. The author states that there are always two points on the limb diametrically opposite, where the undulations travel tangentially to it and in the same direction, while in intermediate regions the waves appear more or less inclined to the limb. These motions indicate by their directions those of the wind which produces them.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, June 19.—"On the Changes produced in the Circulation and Respiration by Increase of the Intracranial Pressure or Tension." By Walter Spencer, M.S., Assistant Surgeon to Westminster Hospital, and Victor Horsley, B.S., F.R.S.

The authors have made for some time the effect of an increase in intracranial pressure or tension the subject of an experimental inquiry, so far as the increase affects the circulation and respiration.

They conclude that the increase in intracranial pressure influences the circulation and respiration through the diminution in the physiological activity of the medulla which it causes.

The authors first give an historical *résumé* of the work of previous observers.

The following is a summary of the chief results obtained :—

I. *The Heart.*—A considerable increase of the intracranial tension was required to influence the heart; it became slowed and finally arrested. This happened more readily after respiration had ceased, and required a higher pressure to produce it when artificial respiration was employed, whilst division of both vagi nerves abolished any slowing or arrest. The arrest, when produced, continued permanently, unless the pressure was quickly removed, or artificial respiration employed, or the vagi divided. But if the pressure was maintained whilst artificial respiration enabled the heart to start again, then the cardio-inhibitory influence was gradually lost, so that the heart returned from being very slow to its normal rate, or increased beyond the latter until the rate became equal to that seen after division of the vagi. When the vagi were divided at this stage the rate of the heart did not alter.

The Blood Pressure.—A primary rise, small in the dog, larger in the monkey, was followed by a fall distinct from that produced by the slowing of the heart, and not necessarily accompanying it. When the heart started again the blood pressure rose, finally reaching the level seen after division of the vagi, so that no further rise took place when this was done. The power of producing a fall of blood pressure was easily lost. After division of the vagi the blood pressure was raised by increasing the intracranial tension and by artificial respiration, so that it could be maintained at a level between 300 and 400 mm. Hg for considerable periods.

Respiration.—This was likewise impaired and arrested. Its arrest reacted upon the heart and the blood pressure upon it, so that after the rise of blood pressure respiration occurred, even although a much higher intracranial tension was maintained than had been sufficient to arrest it when the blood pressure was lower.

II. By the direct application of pressure in the upper part of the 4th ventricle a slowing of the heart with a rise of blood pressure was caused, whilst respiration continued, so rapid as even to be nearly three times the rate of the heart in some cases. Pressure below the calamus scriptorius arrested the respiration without directly influencing the heart, whilst in the lower part of the 4th ventricle respiration was impeded or arrested along with a fall in blood pressure, and some slowing of the heart, followed by arrest, after the respiration had ceased.

"On the Alleged Slipping at the Boundary of a Liquid in Motion." By W. C. Dampier Whetham, B.A., Coutts Trotter Student of Trinity College, Cambridge. Communicated by J. J. Thomson, M.A., F.R.S., Cavendish Professor of Experimental Physics, Cambridge.

The experiments of Helmholtz and Piotrowski on the oscillations of a metal sphere suspended bifilarly, and filled with various liquids, gave finite values to the slipping coefficients. The theory of the flow of liquids through capillary tubes, applied to these results, show that such an effect would produce a marked change in the time of flow of a given volume of liquid. Poiseuille showed that for a glass tube there was no slip, and it follows that the flow through a gilt tube of about a millimetre in diameter should be twenty times as fast as through a glass one.

The time of flow of a given quantity of water through a glass tube was observed, and the interior of the tube was then silvered. The time was always the same for the glass and for the silver surface. The velocity of flow was varied within wide limits, and pushed near the point at which the flow ceases to be linear.

Other experiments were made on drawn copper tubes, which also agreed with Poiseuille's laws. Even when the interior surface was modified by cleaning with acids and alkalies, polishing with emery powder, coating with oil, or amalgamating with mercury, there was no change in the rate of flow. There is certainly no slip with substances which are wetted by the liquid.

Some preliminary experiments of Piotrowski on an oscillating glass flask, the interior of which was afterwards silvered, were then repeated, and it was shown that, when more precautions than Piotrowski took were used, the friction on the flask was the same, whether the surface was glass or silver.

Physical Society, June 20.—Prof. W. E. Ayrton, F.R.S., President, in the chair.—Prof. A. W. Worthington made a communication on the stretching of liquids. The three known methods by which this may be effected—viz. the barometer tube method, the centrifugal method, and the method of cooling—were described, and the precautions necessary in filling the tubes and in freeing the liquids from air discussed. With non-volatile liquids, such as sulphuric acid, the tubes are put in communication with a good pump, and before sealing, the liquid in the tube is kept at a higher temperature than that in the communicating vessel, in order that a stream of vapour may be passing outwards and carry with it any air liberated from the glass during the process of sealing. Before using tubes by the centrifugal method the author finds it advantageous to subject them to considerable "jarring" at intervals. This usually breaks the liquid column, and liberates a small bubble of air which may then be floated out. By repeating this many times, the adhesion of the liquid is greatly increased. With these precautions he had subjected water to a tension of 7·9 and sulphuric acid to one of 12 atmospheres. The cooling method of Berthelot (*Ann. de Chemie*, xxx., 1852) was then tried. In this method the liquid nearly fills a strong closed glass tube at a particular temperature. On slightly heating, it expands and fills the whole tube, any residual air being dissolved. On cooling again, the liquid remains extended, and still fills the tube until at last it lets go with a violent "click," and the bubble of residual air and vapour reappears. The tension of the liquids tested under these circumstances have usually been calculated from the relative change of volume on the assumption that the coefficient of extensibility is the same as that of compressibility. The author exhibited and described an apparatus by which the tension and the extension can be measured simultaneously. The tension is ascertained from the enlargement of the ellipsoidal bulb of a thermometer sealed into the containing vessel, and the extension calculated from the volume of the bubble after the click. The tension thermometer had been calibrated by internal pressure, and in determining the extension, correction is made for the change of volume of the apparatus. By this method he had subjected alcohol to a tension of 17 atmospheres, and found that the coefficient of extensibility is much less than that of compressibility. It is not clear what causes the liquid to let go of the glass, but it is found that the bubble can be caused to reappear by passing an electric current through a wire sealed in the capillary tube. Sir Wm. Thomson remarked that Prof. Worthington's paper was a curious commentary on the usual mathematical definition of "a liquid" as a substance which offered no resistance to being separated into parts. Speaking of freeing liquids from air, he said the beneficial effect of jarring could