

netic Force," that M. Kreil is of opinion that the observations of different years at Milan and Prague, when combined, would rather favour the contrary inference, viz. that the decennial inequality exists in the lunar as well as in the solar variations. The author was led therefore to re-examine this question by the aid of the observations of the Declination at the Hobarton Observatory, which he considers to be remarkably well suited for the purpose, as they comprise eight years of consecutive hourly observation with unchanged instruments and a uniform system of observation, and number, exclusive of Sundays, Christmas-days, and Good Fridays, and occasional but very rare omissions, no less than 51,998 observations.

These observations have been examined by the processes already described in the author's communication of last Session, and the results form the subject of the present paper, showing, in the author's belief, decided and systematic evidence of the existence of the diurnal inequality, having its minimum epoch in 1843-1844, and its maximum epoch five years later, in the mean diurnal variation due to the disturbances and in the more regular and ordinary solar-diurnal variation, and the absence of any trace of a similar inequality in the lunar-diurnal variation.

The Society then adjourned over the Christmas holidays, to January 8, 1857.

*January 8, 1857.*

WILLIAM ROBERT GROVE, Esq., V.P., in the Chair.

The following communications were read :—

- I. "On the Function of the Thyroid Body." By PETER MARTYN, Esq., M.D. Lond., Surgeon R.N. Communicated by Professor HENFREY, F.R.S. Received November 13, 1856.

(Abstract.)

After referring to the form, situation, connexions and internal structure of the thyroid body, its large supply of blood and its capa-

bility of sudden alterations of bulk ; the author briefly adverts to the unsatisfactory explanations which have been offered as to its function, and then proceeds to state his own views, as follows :—

“The upper part of the trachea, the larynx, and the passage of the fauces and mouth constitute the organ of voice ; the two former are the essential or voicing part as mechanics call it, that which produces the tone. The larynx and trachea—taking a share in other functions and being associated by juxtaposition and attachment with contiguous organs—are always pervious and open for respiration ; lengthen and shorten, fall and rise with the œsophagus in deglutition, and bend and turn with the universal motions of the head and neck.

“To admit of this great mobility and flexibility, a certain structure is necessary. The larynx is a triangular box enclosing the apparatus of the chordæ vocales ; its two cartilaginous sides or *alæ*, diverging from the front, are not fixed but free at the back, being completed by soft parts : the trachea is composed of a succession of incomplete cartilaginous hoops or rings lying apart, the back and intervals being made up and the tube completed by soft membrane.

“Now the structure of a wind instrument, such as that of the human voice is, requires the very opposite properties. It must be rigid, tense and inflexible. The qualities of the tone will be in exact proportion to these properties. How then is the soft, slack and flexible vocal tube rendered thus rigid, tense and inflexible, and fit to produce pure tone ? The muscles of the larynx, the thyro-hyoid and sterno-thyroid, merely raise or lower, or fix it in any position : not lying on, or being parallel to, but diverging from the vocal tube, they cannot effect the object referred to. It appears to me that the thyroid body is provided for this purpose. The act of uttering a tone or of speaking stops the return of the blood from that organ, distends and renders it tense, and from the nature of its attachment round the top of the trachea and on the free sides of the *alæ* of the larynx, renders them fixed, firm, and tense also. This effect is aided by the aforesaid muscles, the thyroid body being interposed and giving them more advantageous mechanical action. This tension may be in any degree, and on energetic speaking or singing, the increased size of the part and the fulness of the collateral veins may be seen. This is the reason of its large supply and free distribution of blood. An instance of the want of this tension in an instrument

may be seen in the bagpipe, where the *porte-vent* is attached to the chanter or voicing part by a flexible joint or by leather, and the tone is in consequence squeaking and uncertain.

“ Besides thus giving rigidity, firmness and tension to the organ of voice, the thyroid body also acts in another capacity—as a loader. In most musical instruments, loaders are used to render the vibrations slower and longer, and the tone in consequence fuller, louder and deeper. They compensate for want of size and space, and give to a small instrument, or to a small vibrating or voicing part of an instrument, the power and quality of a large one. The human organ of voice is 8 inches long, and has the same power and better quality of tone than the instrument that most nearly approaches it,—the French horn, which is 9 feet, or the “*vox humana*” pipe of a moderate-sized organ, which is from 4 to 8 feet long. This economy of size in the human organ has always been wondered at, but never, that I know, explained. Besides the thyroid body, another part, the structure of which I shall describe on another occasion, aids in this admirable economy. The nearer mechanism of human design approaches to perfection, the more it resembles similar structures in animal mechanics. The base of all stringed instruments and musical boxes is loaded: in most wind instruments the voicing part is thus loaded and strengthened, as in the organ pipe, horn, flute, clarinet, &c. The bassoon, which in its lower notes approaches the human voice, is uncertain and wheezy in tone for want of this provision.

“ When the thyroid body is small and thin, the voice will be found to be small and shrill; when large, the tone will be full and sonorous; when it is morbidly enlarged, the voice will be deeper and more base; and when very large, as in bronchocele, the voice will be smothered.

“ The compass of the voice is in great part produced by the raising and lowering of the larynx, the shortening and lengthening of the vocal tube. The thyroid body partakes of this motion, at the same time firmly fixing and rendering tense the parts in each position. By its change of shape, bulk and density—flattening and thinning when the larynx is raised, enlarging and bulging when it is lowered—it aids in giving the particular tone or pitch, high and acute in the first case, full and deep in the second; and, in like manner, by its varying shape, bulk, density, and pressure, it takes a great

part in producing the wonderful qualities of modulation and expression peculiar to the human voice. In animated conversation, declamation and singing, this may be seen.

“Its function then appears to be threefold—rendering the slack, mobile and flexible vocal organ or tube rigid, tense and inflexible, and fit to produce pure tone; by its bulk and density acting as a loader and strengthener, making the tone more sonorous, full and deep, and thus compensating for want of length and size in the organ; and finally, by its varying shape, bulk, density and pressure, furnishing an important aid in producing the inimitable qualities of modulation and expression enjoyed by the human voice.

“That it is a part of the organ of voice and an important accessory in giving it perfection, may be inferred also from its situation on the larynx and trachea, and its being supplied by the same nerves—its being largest in man, where the voice and speech are perfect—its being proportionally larger in women and children than in men, their smaller and more mobile organs requiring its peculiar aid. Among the lower animals, it is present (at least in a fully developed condition) only in the Mammalia, but among them there is a remarkable exception in the Cetacea—they have it not, and they have no voice. In Birds, which have such great power and modulation of voice, the structure of the vocal organ and tube is different from that in man, and sufficient in itself to produce these qualities.

“The importance of the thyroid body must be admitted when it is shown to be necessary for the perfection of the voice, and hence of speech—that great and indispensable agent in the cultivating and advancing the highest faculties of man.”

II. “Experimental Researches on the Strength of Pillars of Cast Iron.” By EATON HODGKINSON, Esq., F.R.S., Professor of the Mechanical Principles of Engineering, University College, London. Received November 20, 1856.

(Abstract.)

In a previous paper on this subject (*Philosophical Transactions*, 1840), I had shown,—1st, that a long circular pillar, with its