

occur in this movement, but seems to belong to the second we have mentioned, viz., that of mastication.

The articulating surface, strictly speaking, on each condyle appears to constitute the thread, or rather part of the thread, of a conical screw passing over an axis lying at or about right angles to the plane of motion in simple opening and closing of the jaws. This spiral course of the articular surface is perhaps best seen in some of the larger carnivora, such as the lion, but is also obvious in a well-developed human condyle.

The action of this conical screw or tap within the glenoid cavity, considered as the conical die, takes place with accuracy only when one joint alone acts with the condyle within the glenoid cavity—the other condyle being beyond it, and gliding upon the surface of the zygoma, as during mastication. The food is in this process crushed between the molar teeth of that side whose condyle remains within the glenoid cavity; this condyle screwing the jaw back, so to speak, to its natural position at each closure of the teeth.

By this construction a great amount of friction is avoided; what would otherwise be a *rubbing* being thus converted into a *rolling* motion between the condyloid and glenoid surfaces; while by one or other condyle always remaining in the glenoid cavity during mastication greater steadiness and security is afforded to the joint.

##### 5. On some properties of Ice near its Melting Point. By Professor Forbes.

“ During the last month of March I made some experiments on the properties of ice near its melting point, with particular reference to those of Mr Faraday, published in the *Athenæum* and *Literary Gazette* for June 1850, to which attention has been more lately called by Dr Tyndall and Mr Huxley in relation to the phenomena of glaciers.

“ Owing to indisposition, I have been obliged to leave my experiments for the present incomplete. But I am desirous, before the session of the Royal Society closes, to place on record some facts which I have observed, and also some conclusions which I deduce from these and other recent experiments and discussions.

“ Mr Faraday's chief fact, to which the term ‘regelation’ has been more lately applied, is this, that pieces of ice, in a medium

above  $32^{\circ}$ , when closely applied, freeze together, and flannel adheres apparently by congelation to ice under the same circumstances.

“ 1. These observations I have confirmed. But I have also found that metals become frozen to ice when they are surrounded by it, or when they are otherwise prevented from transmitting heat too abundantly. Thus a pile of shillings being laid on a piece of ice in a warm room, the lowest shilling, after becoming sunk in the ice, was found firmly attached to it.

“ 2. Mere *contact*, without *pressure*, is sufficient to produce these effects. Two slabs of ice, having their corresponding surfaces ground tolerably flat, were suspended in an inhabited room upon a horizontal glass rod passing through two holes in the plates of ice, so that the plane of the plates was vertical. Contact of the even surfaces was obtained by means of two very weak pieces of watch-spring. In an hour and a half the cohesion was so complete, that, when violently broken in pieces, many portions of the plates (which had each a surface of 20 or more square inches) continued united. In fact, it appeared as complete as in another experiment where similar surfaces were pressed together by weights. I conclude that the effect of pressure in assisting “*regelation*” is principally or solely due to the larger surfaces of contact obtained by the moulding of the surfaces to one another.

“ 3. Masses of strong ice, which had already for a long time been floating in unfrozen water-casks, or kept for days in a thawing state, being rapidly pounded, showed a temperature  $0^{\circ}3$  Fahrenheit below the true freezing point, shown by delicate thermometers (both of mercury and alcohol), carefully tested by long immersion in a considerable mass of pounded ice or snow in a thawing state.

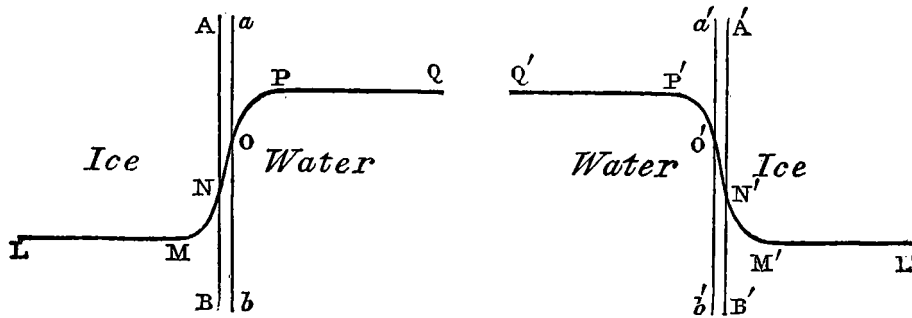
“ 4. Water being carefully frozen into a cylinder several inches long, with the bulb of a thermometer in its axis, and the cylinder being then gradually thawed, or allowed to lie for a considerable time in pounded ice at a thawing temperature, showed also a temperature decidedly inferior to  $32^{\circ}$ , not less, I think, than  $0^{\circ}35$  Fahrenheit.

“ I think that the preceding results are all explicable on the one admission, that Person’s view of the gradual liquefaction of ice is correct (*Comptes Rendus*, 1850, vol. xxx. p. 526),\* or that ice

\* Quoted by me in 1851, in my sixteenth letter on Glaciers.

gradually absorbs latent heat from a point very sensibly lower than the zero of the centigrade scale.

“ I. This explains the permanent lower temperature of the interior of ice.



“ Let AB be the surface of a block of ice contained in water at what is called a freezing temperature. That temperature is marked by the level of the line QP above some arbitrary zero. LM is, in like manner, the permanent but somewhat lower temperature possessed by the interior of the ice. The space, partly water, partly ice, or partaking of the nature of each, MNOP, has a temperature which varies from point to point, the portion NO corresponding to what may be called the physical surface of the ice between AB and *ab*, which is “ plastic ice,” or “ viscid water,” having the most rapid variation of local temperature.

“ II. Such a state of temperature, though it is in one sense permanent, is so by compensation of effects. Bodies of different temperatures cannot continue so without interaction. The water *must* give off heat to the ice, but it spends it in an insignificant thaw at the surface, *which therefore wastes even though the water be what is called ice cold*, or having the temperature of a body of water inclosed in a cavity of ice.\*

“ This waste has yet to be proved ; but I have little doubt of it ; and it is confirmed by the wasting action of superficial streams on the ice of glaciers, though other circumstances may also contribute to this effect.

“ III. The theory explains “ regelation.” For let a second plane surface of ice A'B' be brought up to nearly physical contact with

“ \* I incline to think that water, in these circumstances, may, though surrounded by ice, have a fixed temperature somewhat higher than what is called 32°. But I have not yet had an opportunity of verifying the conjecture.

“ [My idea is that the invasion of cold from the surrounding ice is spent in producing a very gradual “ regelation” in the water which touches the ice, leaving the interior water in possession of its full dose of latent heat, and also

the first surface AB. There is a double film of "viscid water" isolated between two ice surfaces colder than itself. The former equilibrium is now destroyed. The films ABba and A'B'b'a' were kept in a liquid or semi-liquid state by the heat communicated to them by the perfect water beyond. That is now removed, and the film in question has ice colder than itself on both sides. Part of the sensible heat it possesses is given to the neighbouring strata which have less heat than itself, and the intercepted film of water in the transition state becomes more or less perfect ice.

"Even if the second surface be not of ice, provided it be a bad conductor, the effect is practically the same. For the film of water is robbed of its heat on one hand by the colder ice, and the other badly-conducting surface cannot afford warmth enough to keep the water liquid.

"This effect is well seen by the instant freezing of a piece of ice to a worsted glove even when on a warm hand. But metals may act so, provided they are prevented from conveying heat by surrounding them with ice. Thus, as has been shown, metals adhere to melting ice."

Edinburgh, 19th April 1858.

The following Donations to the Library were announced :—

Monthly Return of the Births, Deaths, and Marriages, registered in the eight principal towns of Scotland, with the causes of Death, at four periods of Life, March 1858.—*From the Registrar-General.*

Supplement to the Monthly Returns of Births, Deaths, and Marriages. Year 1857.—*From the Registrar-General.*

Monatsbericht der Königlich Preuss Akademie der Wissenschaften zu Berlin. Sept., Oct., Nov., Dec. 1857. 8vo.—*From the Berlin Academy.*

The American Journal of Science and Art. March 1858, 8vo.—*From the Editors.*

of a temperature which may slightly exceed 32°. By similar reasoning, a small body of ice, inclosed in a large mass of water, will preserve its proper internal temperature below 32°; but, instead of regelation taking place, the surface is being gradually thawed. This is the case contemplated in the paragraph of the text to which this note refers.]"

N.B.—*The words in brackets were added to this note during printing.* 13th May 1858.

J. D. F.

- Proceedings of the Royal Medical and Chirurgical Society of London. Vol. II., No. 1. London, 1858. 8vo.—*From the Society.*
- Catalogue of the Antiquities of Stone, Earth, and Vegetable Materials in the Museum of the Royal Irish Academy. By W. R. Wilde, M.R.I.A. Dublin, 1857.—*From the Irish Academy.*
- Account of the Astronomical Experiment of 1856, on the Peak of Teneriffe. By Professor C. Piazzi Smyth, Astronomer Royal for Scotland.—*From the Author.*
- Monthly Notices of the Royal Astronomical Society, from November 1856 to July 1857. Vol. XVII. London, 1857. 8vo.—*From the Society.*
- Memoirs of the Royal Astronomical Society. Vol. XXVI. London, 1858. 4to.—*From the Society.*
- Mémoire sur un rapprochement nouveau entre la Théorie moderne de la propagation linéaire du son, dans un tuyau cylindrique, horizontal d'une longueur indéfinie et la Théorie des pulsions, exposée par Newton dans les deux Propositions XLVII, et XLIX du second Livre des Principes, par Jean Plana. Turin, 1857. 4to.—*From the Author.*
- Mémoire sur la mouvement conique à double courbure d'un pendule simple dans le vide abstraction faite de la rotation diurne de la terre, par Jean Plana. Turin, 1858. 4to.—*From the Author.*
- Abhandlungen der Königlich Bayerischen Akademie der Wissenschaften. Mathem.-Physikalischen Classe, achten Bandes, erste abtheilung. Philosoph. philologischen Classe, achten Bandes, erste und and zweite abtheil. Munchen, 1856. 4to.—*From the Bavarian Academy.*
- Proceedings of the Zoological Society. Nos. 339–348. London, 8vo.—*From the Society.*
- Gelehrte Anzeigen der K. Bayerischen Akademie der Wissenschaften. Bände 42–45. Munchen, 1856–57. 4to.—*From the Bavarian Academy.*
- Comptes Rendus hebdomadaires des Séances de l'Académie des Sciences, par MM. les Secretaires perpetuels. Paris, 1857–8.—*From the Academy.*
- Madras Journal of Literature and Science, edited by the Committee of the Madras Literary Society, and Auxiliary Royal Asiatic Society, Vols., I., II., and III., of New Series.—*From Dr Cleghorn, Madras.*