Distances at which Sounds of Heavy Gun-firing are Heard.

IN NATURE of September 30 I see a letter from Dr. Henry de Varigny on the above subject. It reminds me of September 2 last year, when I noted in my diary:—"The day here (400 ft. elevation on scarp of the Lower Greensand overlooking the Weald) was brilliantly fine and warm, without a cloud, South Downs misty, a gentle wind from the south-eastward. My sister heard very distant continuous rumbling, like guns, all the morning up to 1.30, and several times mentioned it when sitting in the garden; my coachman and a maid-servant also heard it. What was going on that day in France it would be interesting to know; there was no gun-firing on the coast of Sussex." I wrote, after taking bearing on map:—"It may possibly be as far as 150 miles to Amiens." I find twice since, and only a fortnight ago, similar continuous rumbling has been heard, but unfortunately the date not noted. I am much too deaf to hear such sounds myself. H. H. GODWIN-AUSTEN.

Nore, Godalming, October 1.

THE only papers on this subject with which I am acquainted are the following:—(1) The distance to which the firing of heavy guns is heard, NATURE, vol. lxii., 1900, pp. 377–79; (2) the audibility of the minute-guns fired at Spithead on February 1, *Knowledge*, vol. xxiv., 1901, pp. 124–25. Reference might also be made to NATURE, vol. xli., 1890, p. 369, and vol. lx., 1899, p. 139. The firing during the funeral procession of the late Queen Victoria was heard to a distance of 139 miles from Spithead. There is therefore no reason why firing along the Belgian coast should not, with favouring winds, be heard for many miles inland from our coasts. The air-vibrations affect pheasants and other birds (probably by swaying the branches of trees) for some distance after they cease to be perceptible to the human ear, as was widely observed on the occasion of the North Sea battle on January 24. I would suggest that observations of this kind should also be forwarded to Dr. de Varigny.

I may add that the literature relating to explosions is more extensive and much more valuable than the above. Prof. Omori's memoirs on the eruptions of the Asama-yama (Bull. Imp. Earthquake Inves. Com., Tokyo, vol. vi., 1912, pp. 1–147, and vol. vii., 1914, pp. 1–215) contain many interesting observations. A few cases of recent explosions in factories are noticed in NATURE, vol. lxi., 1899, pp. 91–92, and *Knowledge*, vol. i., 1904, pp. 94–95. Mr. S. Fujiwhara has lately published a valuable memoir on the abnormal propagation of sound in the atmosphere (Bull. of the Centr. Meteor. Obs. of Japan, vol. ii., pp. 1–143). This contains a mathematical discussion of the problem, with special reference to the observations recorded by Prof. Omori. References to recent German literature on the subject are also to be found in this memoir.

CHARLES DAVISON.

16 Manor Road, Birmingham.

The late Prof. E. A. Minchin on "The Evolution of the Cell."

PROF. E. A. MINCHIN was looking forward with interest at the time of his death to distributing the "extra prints" of his Manchester address, which was three times as long as will appear in NATURE. These "extras" are now in my possession, but I have no means of getting Prof. Minchin's "list." I shall be very happy to send a copy to anyone who will send me a postcard asking for it.

EDWARD HERON-ALLEN.

Large Acres, Selsey Bill, Sussex, October 12.

DEATH FROM STATIC CHANGES IN ATMOSPHERIC PRESSURE.

AS mentioned in a note in NATURE of July 8 (p. 515), M. R. Arnoux has found that a momentary diminution of at least 350 mm. of mercury in barometric pressure may be produced within three metres of a bursting high-explosive shell; and he suggests that the sudden diminution of pressure may cause death by the liberation of gas-bubbles in the blood, and consequent blocking of the circulation.

In his book on "La Pression Barométrique," published nearly forty years ago, Paul Bert proved that the various symptoms which often follow decompression from high atmospheric pressure are due to liberation of gas-bubbles in the blood or tissues. In diving work, and various kinds of engineering work under water or in water-bearing strata, men are exposed to high atmospheric pressure. During the exposure the blood passing through the lungs takes up in simple solution an extra amount of gas in proportion to the increased partial pressure of each gas present in the lung air. The gases present are oxygen, carbon dioxide, and nitrogen. The extra free oxygen taken up is, however, very small in amount as compared with the total free and combined oxygen taken up at normal atmospheric pressure; and since much of this total is used up as the blood passes through the tissues, there is no appreciable rise in the very low partial pressure of oxygen in the blood of the systemic capillaries or veins or in the tissues. There is also no rise in the low partial pressure of carbon dioxide in the lung air or blood, since the breathing is so regulated as to maintain a practically constant partial pressure of carbon dioxide in the lung air. On the other hand, the partial pressure of nitrogen in the blood leaving the lungs rises in proportion to the increased atmospheric pressure, and as no free nitrogen is used up, every part of the body becomes gradually saturated with nitrogen at this increased partial pressure. If, now, the atmospheric pressure is again reduced to normal, the blood and semi-liquid tissues of the body are left in a condition of super-saturation with nitrogen, and as a consequence bubbles, consisting almost entirely of nitrogen, are apt to form, and to cause very serious effects. Death may result from blockage of the circulation through the lungs or heart-muscle; paralytic attacks may be caused by blockage in the brain or spinal cord; while characteristic localised pain (so-called "bends") may be produced by the presence of bubbles elsewhere.

It is clear that if the atmospheric pressure is considerably diminished from normal, a similar condition of super-saturation of the body with nitrogen will exist, so that bubbles may be formed; and it is natural to suspect that a sudden, though only momentary, diminution, due to the bursting of a shell, might liberate bubbles. There are, however, facts which tell strongly against this hypothesis.

In the first place, it must be pointed out that a considerable interval of time elapses between decompression and the onset of symptoms due to bubble-formation. It is commonly fifteen or twenty minutes, and often far more, before the appearance of symptoms caused by bubbles after rapid decompression from a high atmospheric pressure. Sudden effects, such as those said to be produced by bursting shells, are never observed, however rapid the decompression may have been. The formation of bubbles of sufficient size to do any harm is evidently a process which takes considerable time. A momentary decompression, even if it were extreme, could scarcely, therefore, have any serious effect.

If, however, minute bubbles were formed, they would rapidly disappear again when the momentary wave of negative pressure had passed. Abundant experience has shown that there is no more rapid and certain means of treating the symptoms due to bubbles than recompression. When men who have come out of compressed air are affected, they can be relieved by returning them to the compressed air from which they came, or placing them in a medical recompression chamber provided for the purpose. As an instance of the application of this treatment, a recent case may be recorded of a naval diver who, owing to some emergency, had returned to surface suddenly, without carrying out the prescribed regulations for safety. About twenty minutes afterwards he became ill, lost consciousness, and was apparently dying from bubble formation. In accordance with the recommendations for dealing with such a case, in the absence of a re-compression chamber, his helmet was screwed on, and he was then lowered to the depth from which he had come. He recovered consciousness rapidly, and was soon able to answer the telephone, after which he was safely brought up, with due precautions. In the case of a man exposed only momentarily to decompression, the remedy for bubble-formation is, of course, automatically applied at once, since he returns at once to the pressure from which he was decompressed.

Recent investigations in this country have shown that symptoms due to bubble-formation do not occur unless the absolute barometic pressure is diminished by more than half. Thus it is safe to decompress rapidly from two atmospheres' pressure to one, or from six to three; and the Admiralty regulations for safety from bubble-formation in diving are based on this fact. Hence a sudden diminution of pressure from normal to half an atmosphere would not be dangerous, even if the decompression were a prolonged one. The momentary diminution observed by M. Arnoux was, however, only 350 mm., or not quite half an atmosphere.

It appears, therefore, to be impossible to accept the bubble theory of the action of bursting shells in killing men without visible wounds or mechanical injury. The newspaper accounts of men being killed by bursting shells in some sudden and mysterious manner, without wounds or bruises, appear to be imaginary. The experience of those who have been exposed to shell fire does not, so far as the writer's inquiries go, lend any support to these accounts. Neither poisonous gases nor any other known cause would account for men being instantly killed without mechanical injuries. An air-wave of sufficient violence may doubtless knock men over and inflict mechanical injury capable of causing death; but the actual fatal injuries caused by shells appear to be almost all due to fragments of metal or of stone or other material set in motion by the explosion. J. S. HALDANE.

DR. J. MEDLEY WOOD.

WE record with regret the death, on August 26, at the Botanic Gardens, Durban, in his eighty-seventh year, of the veteran director of the Natal Herbarium, Dr. John Medley Wood. Dr. Medley Wood was a native of Mansfield, Nottinghamshire, and had resided in Natal for sixty-three years.

Before his appointment as curator of the Natal Botanic Gardens in 1882 he practised for a time as a solicitor, and then went trading to Zululand, afterwards devoting himself to farming. His home was then at Inanda, where he spent some ten years, and besides undertaking experiments in the cultivation of arrowroot and castor oil he interested himself in the local flora, and contributed large and important collections of Natal plants to Sir Joseph Hooker for the National Herbarium at Kew. His activities in this latter direction were naturally stimulated on his appointment to the Gardens. Not only did he continue to enrich the collections at Kew, but he founded and gradually built up the very valuable Herbarium of Natal plants at Durban, which is a model of what a colonial herbarium should be.

When Dr. Medley Wood was appointed curator of the Natal Garden in February, 1882, by the Durban Botanic Society, the condition of the garden was by no means flourishing, but as funds allowed he was not long in restoring it to a condition of beauty and usefulness. The value of his work was so far appreciated that the Government grant towards the upkeep of the garden and the maintenance of the collections was gradually increased, and in 1902 the new building for the Herbarium was completed. In 1909 the Herbarium collection consisted of some 43,000 mounted and classified specimens. Medley Wood's publications on the Natal flora form valuable contributions to botanical science. In 1886 he published an analytical key to the orders and genera of Natal plants, but the most important of his works is that entitled "Natal Plants," of which six volumes have been published, the first part, consisting of fifty plates with descriptions, having appeared in 1898. Other useful publications include his "Handbook to the Flora of Natal" (1907) and a "Revised List of the Flora of Natal" (1908). His "Guide to the Trees and Shrubs in the Natal Garden," published in 1897, giving dates of planting, is a valuable record of