

### Letters to the Editor.

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#### A Relation between the Radial Velocities of Spiral Nebulae and the Velocity of Dissolution of Matter.

ACCORDING to a fundamental formula of Einstein's cosmological theory of gravitation, the total mass of the universe,  $M$ , is connected with the radius of curvature of the universe,  $R$ , by the formula

$$(1) \quad M = \frac{c^2 \pi}{2f} R.$$

In this equation  $c$  denotes the velocity of light and  $f$  the constant of gravitation.

If we regard the size of the universe as variable, and if we denote by  $a$  the 'disintegration constant' of matter and by  $v$  that 'cosmic velocity' which represents the differential coefficient of  $R$  with respect to time, we obtain from equation (1):

$$(2) \quad M a = \frac{c^2 \pi}{2f} v.$$

As is well known,  $a$  is equal to the mass equivalent of 2 ergs per gram-second in the case of the sun. The average value for all fixed stars undoubtedly agrees in order of magnitude with that value. Hence, approximately,

$$(3) \quad v = \frac{4f}{\pi c^4} M = 1.1 \times 10^{-49} M.$$

If we insert for  $M$ , according to Hubble (*Astrophys. Jour.*, 64, p. 369; 1926),  $1.8 \times 10^{57}$  gm., equation (3) yields for  $v$  a value of about  $2 \times 10^8$  cm. or 2000 km. per second. This value agrees well with the magnitude of the velocity with which the farthest spiral nebulae appear to recede from us.

ARTHUR HAAS.

University of Vienna,  
Oct. 11.

#### Animal Husbandry.

THE term 'animal husbandry' is gradually becoming more employed by both administrators and scientists concerned with the live stock industry. That it is differently employed by different speakers is the apology for what follows.

The aim of the science of animal husbandry is the efficient production of farm live stock: it deals with the application of those basic sciences which affect the production and maturation of our farm live stock. The principal sciences from which it derives are genetics, nutrition, animal health, economics, and physiology, both reproductive and nutritional. These basal sciences seek to discern fundamental principles by the formation of hypotheses, which as evidence accumulates become theories, and eventually on final proof take their place as laws. In their turn these sciences draw on others.

The science of animal husbandry does more than apply the sciences from which it derives: it coordinates them. The real function of the scientific animal husbandman consists, not in the direct application of new knowledge or the mere testing upon a

large scale of such hypotheses as its basal sciences may bring forth, but in the relation of new facts to existing circumstances. This implies that animal husbandry is not merely an applied science: it can evolve new techniques and can prosecute research.

Just as other sciences have various aspects, so has the science of animal husbandry. In a certain aspect one of its basal sciences may predominate. The science of animal husbandry in relation to a particular science applies that particular science to practice and at the same time takes into consideration the other basal sciences which affect the problem under consideration.

In Great Britain there is no school of scientific animal husbandry as such. Consequently this science has been largely developed by those institutes connected with agriculture which are concerned with research into the basal sciences, particularly genetics, nutrition, and physiology. Each kind of institute has, to a greater or less degree, developed animal husbandry. For example, there is the science of animal husbandry based upon the science of nutrition; the science of nutrition alone can make little contribution to the material welfare of mankind through live stock without taking into consideration the other basal sciences. Thus there are developed animal husbandmen who are primarily nutritionists but who also must have a sufficient understanding of the principles and findings of the other sciences to enable them to coordinate the work with which they are mainly identified. In the same way, there are animal husbandmen who are primarily either veterinarians or geneticists.

At the present time it is open to question whether the industry of agriculture can profit more from the new scientific discoveries which one may reasonably anticipate will be made by the research workers in the basal sciences or from an intelligent and coordinated application of that knowledge which is already available. Hitherto greater emphasis has been laid on the value of fundamental researches: and rightly so, since these are an absolute prerequisite to the proper functioning of the science of husbandry. It can, however, be fairly debated whether the time is not now ripe for an organised development of the science of husbandry. But whether this should be directed as a separate entity seems doubtful. Since its inspiration is drawn from the research institutes, separation would possibly sterilise it.

It would appear better were the science of animal husbandry to continue to be based on the various research institutes, but that the dissemination of results should be made, not through the existing county organisers (who have such a wide field to cover that they can be expert in no one subject without some sacrifice in another), but through advisory animal husbandmen, each operating in an area. These men would have no administrative duties. Their function would be to maintain contact with the various research institutes (they could, in fact, have their headquarters at one of these) and to apply the results of the animal husbandry sections of the various research institutes to the particular problems of their area. Such animal husbandmen would specialise in different aspects, such as pigs, horses, dairy cattle, etc. They would at the same time act as *rapporteurs* to the animal husbandry section of the research institute on which they are based. Undoubtedly there is a weak link in the chain which connects scientific research designed for the assistance of agriculture to the practice of farming. A recognition that animal husbandry exists as a science would do much to strengthen this link.

A precise definition cannot be confined to a few words. Briefly, animal husbandry may be defined as

that branch of science which interprets, co-ordinates, and finally applies the results of science to problems of live stock production.

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The University of Edinburgh,  
Oct. 16.

#### Highest Recorded Shade Temperature.

In the issue of NATURE for Sept. 6, 1930, at the bottom of page 386, appears an item, "Sept. 13, 1922. Highest Recorded Temperature."

The validity of the reading at Azizia has been questioned by so eminent an authority as Dr. G. Hellmann—see *Monthly Weather Review*, May 1930, page 208. Weather Bureau authorities are of opinion that the Azizia record of maximum temperature cannot be classed as having been obtained under standard conditions of exposure. We are not un-mindful of the fact that it is a difficult matter to determine the maximum temperature in a shelter situated in a desert region. The chief evidence against the Azizia record is the fact that it is not supported by the readings of other thermometers in the same region, as pointed out by Dr. Hellmann, and was independently developed by the Weather Bureau climatologists.

A. J. HENRY.

U.S. Weather Bureau,  
Washington, Sept. 24.

THE observations at Azizia were published by Prof. F. Eredia in 1923 (*Roma, Boll. Inform. econ.*, 1923, No. 5). After describing the site, in a plain surrounded by hills, he tells how a complete meteorological station, including registering instruments, was established in 1913, of a permanent character, *similar to the other stations installed at various places in Tripolitania*. He adds that during the period when he lived at Azizia, he determined the frequency of high temperatures from hourly observations and also from the readings of a thermograph at a temporary station near by. Referring to the figure of 58° C. (136° F.) on Sept. 13, 1922, he notes that it occurred during a period of south-west winds and almost cloudless sky. He evidently accepts the reading as correct.

I was aware of Hellmann's criticism, but in view of the above summary, and the fact that Prof. Eredia is a competent meteorologist, I concluded that the high readings were probably due to the nature of the surroundings rather than to any defect of instruments or screen. An analogous case in England was described by Miss E. H. Geake (*Meteorological Magazine*, 61, p. 78; 1926). The lowest screen minima at Garforth, Yorks, are 15°-25° F. lower than those at surrounding stations, and this is entirely due to the local exposure!

The maximum at Azizia is only 2° F. higher than that at Death Valley, California (see NATURE, vol. 126, p. 81; 1930), which is accepted as correct by the U.S. Weather Bureau. Both stations are in depressions in arid sub-tropical regions, and both maxima are isolated readings, for the 225 stations in California for which data appear in the *Monthly Weather Review* for July 1913 do not show any other maximum exceeding 119° F. To complete the parallel, both are criticised by Hellmann as too high. To my mind, the fact that the two maxima are so nearly identical is a reason for accepting both of them.

THE COMPILER.

#### Ball Lightning.

A CASE of globular or ball lightning was reported to me at East Hampton last summer, and I had an opportunity of questioning an eye-witness and investigating the premises. This account has value only for comparison with other cases, and I presume someone is making a collection of reports of this nature and studying the conditions under which the phenomenon occurs.

A large modern summer residence was struck twice within fifteen minutes. The owner was standing at a window watching the approaching storm, which came up over the ocean. He states that the flashes struck in the water, coming nearer and nearer, like advancing shell-fire; then a flash to the sand dune between his house and the ocean, another in the intervening field a hundred yards from the house, and a few seconds later he found himself 'coming to' in a dazed and very shaky condition. The chimney had been struck and blown to pieces, and his arm was resting on the mantelpiece over the fireplace. He saw no flash and heard nothing, though he did not fall. Fifteen minutes later, a second bombardment commenced, and a flash struck and melted the telephone wire just outside the house, following the wires into the cellar under the kitchen, and apparently dissipating its energy among a maze of criss-crossing bell wires and furnace pipes below the kitchen floor. The thin asbestos covering of one of the pipes had been burst open in places as if by small charges of an explosive.

The ball discharge appeared in the kitchen in the centre of the room (just over the furnace pipes), about three feet above the floor, and within three or four feet of the cook, who was standing up and facing the point at which it appeared. She told me that it appeared just after the thunder crash, was yellow like a flame, about five inches in diameter, and was spinning like a top. She was very positive about the whirling, and was looking down on the thing at very close range. I asked her whether it faded away or exploded. She said, "I didn't wait to see—I jumped for the cellar door and ran down the stairs"! There was no sound of an explosion. She also stated that the room was full of a smoky haze when she returned, and that there was a strong smell. I asked her whether it was 'like sulphur' (the popular description), and she said, "No, it was acid-like." This suggests an oxide of nitrogen. No marks of the flash could be found in the kitchen, but there had evidently been a heavy electrical disturbance below the floor. The cook was near enough to the ball to touch it, and it is regrettable that she neglected the opportunity of making a valuable contribution to our knowledge of this mysterious electrical phenomenon! I think that I should have reached for it, but am not sure.

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#### Separation of Antibodies from the Serum Proteins.

ANTIBODIES are as a rule associated with serum proteins. In view of both the high theoretical and clinical importance, a large amount of work has been done in order to obtain protein-free antibodies. The failure of these endeavours has led to the assumption that antibodies are either themselves proteins or that they are in some way closely bound to proteins.

In experiments carried out with diphtheria antitoxin and antityphoid serum, we have succeeded in obtaining active antibodies chemically free from proteins. These results were obtained by the method of adsorption and specific elution developed in their recent