AT the annual meeting recently held in New York City the secretary of the American Society of Biological Chemists was instructed to give publicity to the following motion which was passed: "The American Society of Biological Chemists favors the passage of a more stringent food and drugs act, so designed as to afford ultimate protection for the consumer."

IT is reported from the University of Michigan that the university has received as a gift from the Pennsylvania Salt Manufacturing Company, of Wyandotte, Michigan, 2,500 gallons of water which will after treatment produce at least two quarts of "heavy water."

BY the will of the late Mrs. Helen Hartley Jenkins $50,000 is added to the principal of the Marcellus Hartley chair of medicine, which Mrs. Jenkins founded several years ago in the medical department of New York University. Among other public bequests was one providing $2,000 for the training of a nurse for three years in the Department of Nursing and Health at Columbia University and Morristown Memorial Hospital.

THE sixth International Congress on Industrial Accidents and Diseases offers a prize of 1,000 Swiss francs as an award to the author of the best (unpublished) original work on the subject, "The Importance of Previous Physical Condition in Estimating the Sequelae of an Industrial Accident." Physicians in all countries are permitted to take part. Manuscripts must be in hand by December 31, 1934. The award will be made at the time of the seventh congress to be held in Brussels, mid-July, 1935. Those interested should communicate with Dr. Fred H. Albee, 57 West 57th Street, New York City, or Dr. Emery R. Hayhurst, Ohio Health Department, Columbus.

BRITISH INDUSTRIES HOUSE, near Marble Arch, is being equipped as a permanent exhibition center at which wholesale buyers may find, conveniently grouped, many different kinds of British and Empire merchandise. The extensive third floor and the basement have been allotted to a medical section, containing showrooms, showcases and manufacturers' sample and pattern rooms for the display of supplies and appliances used by hospitals, doctors and chemists. The London *Times* reports that the medical center will be officially opened on July 18, to enable delegates to the annual conference of the British Medical Association to be present before assembling at Bournemouth, where their conference will begin the next day. Delegates to the British Hospitals' Association conference in June will similarly be invited to visit the center. It will be run with the guidance of an advisory committee, of which the chairman will be Dr. Alfred Cox, who till 1932 was medical secretary of the British Medical Association.

DISCUSSION

SPIRALITY IN THE GROWTH OF WOOL FIBERS

RECENT issues of SCIENCE contain various references to the spiral habit of growth in organisms.[1] Among the many examples given, in both plants and animals, no mention is made of the hairs of mammals, though in these spirality in one form or another is of general occurrence. Special attention has recently been directed to its prevalence in the wool fibers of sheep, where it is of some industrial significance. Its expression, however, tends to be obscured by periodic reversals in the direction of rotation, resulting from an axial twisting of the fibers superimposed on the fundamental spirality. Moreover, wool fibers are rarely disposed singly, but are aggregated into wavy tufts or staples to the contours of which the constituent fibers closely conform.

The simplest expression of spirality in wool is to be found in the well-known curly tufts which for the most part constitute the coat of the new-born lamb. Some of these are represented in Fig. 1 (a–e), where the close spiral whorls above indicate the prenatal or prototrichial growth, and the more open turns below the early postnatal or definitive growth, the former persisting on the fleece as apical tips to the latter. The first staple, Fig. 1a, is from a five months' South Devon lamb. With the addition of new fibers the simple spiral increases in diameter and pitch from above downwards and passes directly into the definitive part of the staple, which is more openly spiral. The direction of rotation, positive or negative, right- or left-handed, clockwise or counter-clockwise, varies in the different staples, the number one way or the other being about equal, showing it to be a matter of indifference.

Fig. 1b represents a more usual form of staple from the same fleece, where the direction of rotation of the spiral undergoes a reversal about midway. This is shown to be due to the introduction of an axial twist of 90°, which changes the direction of the fibers, so that for a short distance they come to lie nearly parallel with the long axis of the tuft, and at the same time the twist brings into view the other, the minor, axial aspect of the elliptical fibers. It is then fol-

[1] SCIENCE, May 1, 1931; January 13, 1933; March 7, 1933; June 16, 1933; July 21, 1933; October 20, 1933; November 17, 1933.

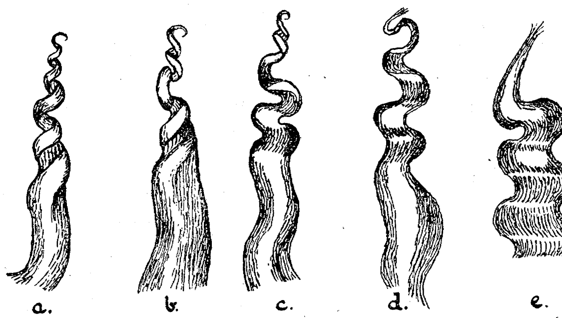

FIG. 1. Birth-coat staples from different breeds of sheep. a, b. South Devon, 5 months' lamb; c, d. Border Leicester, 3 months' lamb; e. Welsh Mountain, new-born lamb.

lowed by another axial twist of 90°, which directs the fibers into a normal spiral again, but with the rotation in a reverse direction, and bringing the major axial aspect into view. In a further type, Fig. 1c, the fibers are spiral above, but do not revert to the spiral below the first reverse; rather, they continue as a series of reversals one below the other on opposite sides of the staple, though usually in different planes. Finally, as in Figs. 1d and 1e, the initial spirality is wanting, and the whole staple consists of a periodic succession of reversals, first on one side and then on the other, though in planes varying in their inclination to one another. The appearance is that of a spiral flattened at different angles along its vertical axis. When the individual fibers of the staple are isolated they present a succession of angular or rounded waves, the so-called crimps, the characteristics of which are of high significance in wool estimations.

The manner of formation of the crimps is a subject of much dispute; but from the above it is manifest that they are to be interpreted as a periodic series of fiber reversals based on a fundamental spirality. By means of the Fiber Rotator, Rossouw[2] has shown that each crest or trough represents a separate reverse and a twist of 180°. This applies in the case of the narrow rounded crests and troughs of the Merino; but where the crests and troughs are broad and angular, as in Figs. 1c and 1d, a twist of 90° occurs at each angle, separated by a longer or shorter fiber interval.

The birth-coat tufts provide an interpretation of the great diversity of form in the later wool growth of the many different breeds of sheep. In such breeds as the Wensleydale and Dartmoor, and in the Angora goat, the staples remain more or less distinct from one another as long curly locks, and retain throughout the original spirality of the foetal coat, with reversals here and there along their length. In the luster breeds, Lincoln and Leicester, the distal part of the staples is largely free and regularly spiral, while the proximal is flattened and in the form of broad reversals, as in Fig. 1e, individual fibers appearing as a succession of wide rounded crimps, strongly inclined to spirality. The fleece of the Merino is compact, but divisible throughout its height into flattened staples, and is the most regularly and finely crimped of all wools. The crimping appears almost uniplanar, alternately right and left, but on close examination is found to approximate in varying degrees to the spiral form; this is especially the case in individual fibers when drawn out singly, and allowed to express their true form, free from any interactions from the other constituents of the staple.

The regular periodicity in the crimping of adjacent fibers permits of their aggregation into distinct groups or staples, in which condition the individual fibers assume a degree of parallelism. But in some breeds no regularity obtains as regards spirality, nor as to the form and occurrence of the crimps; adjacent fibers do not then "fit into" one another, and no stapling takes place. In these cases the fibers interlace with one another, and form an irregular, entangled growth, such as is well seen in the lower part of the fleece of the Mountain Breeds.

The wide distribution of spirality throughout organic nature tends to support the view that it is due to something foundational in organized matter. This is strongly emphasized by Professor W. Seifriz in his article in SCIENCE for October 20, 1933, "More about the Spiral Habit," where he concludes "that the spiral habit, whether in trees, snails or chromosomes, is a fundamental heritable protoplasmic quality." On the other hand, most workers have attempted a specific interpretation for particular occurrences. Thus as regards spirality and crimp in wool Dr. S. G. Barker[3] has advanced a physico-chemical interpretation. Postulating two simple harmonic forces acting at right angles to each other in the follicle, he shows how all the variety of form assumed by wool fibers can be explained. Dr. J. E. Nichols,[4] following suggestions as to differential growth gradients put forth by Professor W. D'Arcy Thompson[5] and Professor Julian Huxley,[6] considers that similar systems may operate within the comparatively restricted growth zones of hair follicles: "It is conceivable that the forces within the follicle required to give rise to the various curved forms of fiber may follow upon dif-

[2] S. D. Rossouw, "A Preliminary Study on the Relationship between Crimp and Contour in Wool Fibers," *Jour. Text. Inst.*, 22: T375, 1931.

[3] S. G. Barker, "The Physical Significance of Crimp or Waviness in the Wool Fiber," *Trans. Faraday Soc.*, 29: 239, 1933.

[4] J. E. Nichols, "Origin of Curls and Twists in Wool Fibers," *Nature*, January 11, 1933.

[5] "Growth and Form," 1917.

[6] "Problems of Relative Growth," 1932.

ferent growth intensities . . . while the disposition and orientation of the follicle in relation to the general growth gradients would affect the direction and magnitude of the forces at play."

It will be admitted that much yet remains to be gained before a complete understanding of the spiral habit is forthcoming, in both its general and particular manifestations. That the crimping of wool represents a periodicity of reversals of rotation, due to a like succession of twists on a fundamental spirality, by no means suggests a simplicity in nature's methods.

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THE TIME CONSTANT

SERIOUS misinformation regarding inductive circuits, contained in a recently published text-book on college physics, appears to justify my calling attention to the facts of the case.

In a circuit containing electromotive force, resistance and inductance the fundamental equation

$$e = ri + l\frac{di}{dt}$$

leads to the Helmholtz equation

$$i = \frac{e}{r}\left(1 - \epsilon^{-\frac{r}{l}t}\right) = i_o\left(1 - \epsilon^{-\frac{r}{l}t}\right)$$

i being the value of the current at the end of t seconds, and i_o the final value. From this it follows that the rate of rise of the current,

$$\frac{di}{dt} = \frac{r}{l}i_o\epsilon^{-\frac{r}{l}t} = \frac{r}{l}\left(i_o - i\right)$$

At the very start, at the moment the circuit is closed, and before the current has an assignable value, we may say $i = o$, and hence at the start

$$\frac{di}{dt} = \frac{r}{l}i_o.$$

Evidently, if this rate of increase should be maintained for $\frac{l}{r}$ seconds the current would reach its final value i_o. This ratio $\frac{l}{r}$, generally called the time constant, is therefore numerically equal to the number of seconds required for the current in reaching its final value if the initial rate of rise should be maintained. This way of regarding the time constant I do not find in any of my books, but I have found it helpful in my teaching experience. Obviously, with a fixed inductance and a fixed ratio between e and r so that i_o is fixed, the rate of rise of current increases as r increases. The curves in the text-book referred to teach exactly the reverse of this truth.

Similarly, in a circuit containing electromotive force, resistance and capacity the fundamental equation

$$e = ri + \frac{q}{c},$$

q being the charge in the condenser of capacity c, leads to the charge q at the end of t seconds

$$q = q_o\left(1 - \epsilon^{-\frac{t}{cr}}\right),$$

q_o being the final charge.

The rate of increase of q, in other words the current flowing into the condenser, is

$$\frac{dq}{dt} = \frac{q_o}{cr}\epsilon^{-\frac{t}{cr}}$$

which becomes $\frac{q_o}{cr}$ at the very start when $t = o$. Obviously, this rate of charging, if continued for cr seconds, would give the condenser its final maximum charge q_o. So here the time constant cr may be defined numerically as the number of seconds in which the condenser would receive its final charge, in case the initial rate of charging should be maintained.

The accurate calculation and plotting of the growth of current in an inductive circuit is rather laborious, but an approximate graph may be easily and rapidly plotted by a method given by C. V. Drysdale in his "Foundations of Alternating Current Theory."

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"'GUNS' OF SENECA LAKE"

"SILENCING the 'Guns' of Seneca Lake" was the title of a discussion which appeared in SCIENCE for April 13, (page 340), having been communicated by Professor Herman L. Fairchild, of the University of Rochester. In it Professor Fairchild offered an explanation of a mystery of sound which, as he states, "has hovered over Seneca Lake, in central New York, for more than a century." This is what is known by the local residents as the "lake guns," an occasional low, dull boom suggesting a distant muffled explosion.

The explanation offered in Professor Fairchild's communication was that Seneca Lake occupies the upper part of a glacially deepened valley which cuts the Oriskany Sandstone at a depth of about 1,450 feet below the surface of the lake, and that the "lake guns" are caused by volumes of natural gas which escape from that porous gas-bearing stratum, find their way upward through the 450 feet of superincumbent glacial drift and ascend rapidly through the