not assert," says Schelver, "that the original natural man (Naturmensch) came from any species of ape at present known, because I can not support this by positive proofs; and since we know quite as little of the original source of the apes, as of the human family, the apes may represent a degenerate branch of the original stem of the human species. I am acquainted with no distinguishing characteristic, however, which sharply separates the apes from human beings."

" . . . The bodily nature of the human race must, in its origin, completely integrade with that of animals, and it is not improbable that, for example, we may discover hairy quadrupeds with the capacity for becoming human beings. . . . As to lowly origin, man is clearly worthy of all the more honor the lower the creatures from which he was descended."

Language, says Schelver, is a product of culture. "Der mensch hat sie erfunden, selbst geschaffen." The linguistic shortcomings of the apes, it is suggested, may be associated with the possession of vocal sacs which may, as was suggested by Sömmering, act as an impediment to the imitation of sound. These sacs are lacking in man, who, on the other hand, has another organ in a somewhat similar position, namely, the thyroid gland, which is stated to be absent in the apes. At any rate, the thyroid was not mentioned by Camper, and Schelver remarks that it could scarcely have escaped being noticed by so attentive and accurate an observer. Since the apes have vocal sacs, which man has not, and since man has the thyroid, which Schelver is persuaded is absent in the apes—"aber so viel mir bekannt ist," he cautiously adds—the hypothesis is advanced that the mysterious thyroid, whose function was so long sought for in vain, might represent the degenerate vocal sacs of the anthropoids. This conclusion is supported by certain statements concerning the outlet of the thyroid, which rest upon no better foundation than the alleged absence of this organ in the apes. That Schelver should have been led astray in his attempt at homologizing is quite natural when one considers the facts at his disposal. The point of chief interest is that the attempt was made at all.

What caused the human and anthropoid stems to diverge is a problem for which Schelver has no solution to offer. While his evolutionary concepts have much of the vagueness that characterizes the speculations of the earlier transformists, it is clear that he regards man as having a common origin with the higher apes, and that the higher types of animals are derived from lower ones, as is indicated by his reference to the genealogical table of organic life, *"der Stammtafel der ganzen lebenen Schöpfung, . . . die bis an das erste punctum saliens alles Lebens zurückführet."*

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A VICIOUS CIRCLE IN CYTOLOGY

THE existence of rings and sometimes strings of chromosomes has been known for a number of years and apparently first attracted marked attention in the case of the genus Oenothera. This genus is particularly unfavorable for cytological investigation on account of the extremely small size of its nuclei. It has accordingly been unsuitable for working out the fundamental significance of ring formation. Much more suitable material for such investigations is supplied by the monocotyledonous family Tradescantiae, which have been investigated by various American and European cytologists. The conclusion has been reached that the rings of chromosomes, where they occur, are series of univalents which have more or less become confused with one another and pass over to opposite poles in approximate alternation at the metaphase of the reduction or meiotic division. Unfortunately, this statement is palpably incorrect. Apparently it is due to the study of the material by means of excessively thick sections or by the smear method. Both of these procedures have the fault of obscuring important details. The situation in the case of the Tradescantiae has been studied by means of thin sections appropriately developed by approved methods of staining. It has become clear in this connection that the so-called synaptic mates are actually present in Tradescantia as normally elsewhere and that they present clearly the phenomenon of chiasmotypy, a phenomenon to which, by the way, apparently an entirely disproportionate amount of attention has been given in recent years. The pairs of chromosomes become somewhat indistinct in the pachytene stage which follows the advent of pairs. This is a common phenomenon at pachytene and it is amazing that it has not been noticed in this instance. The whole situation, in fact, suggests a surprising superficiality on the part of certain observers which is in marked contrast to the large claims which they have made on the attention of cytologists in general. It is quite obvious that in *Tradescantia virginiana,* for example, the process of meiosis follows perfectly that which is not uncommon in hybrids. The apparent serially arranged, miscalled univalent chromosomes represent in reality a segmented pachytene in which the synaptic pairs are lined up, back to back. This view of the matter harmonizes further with the observations of Hakansson on hybrid Godetias. Here he noted, while the species showed little or no so-called ring formation, that in

contrast this condition was quite often characteristic of the hybrids between species. Muentzing (1932) has more recently called attention to the same tendency in hybrids. There seems to be little excuse for the errors of those who have worked on the cytology of ring formation in the case of Tradescantiae. In the species of Oenothera, however, and in the Onagraceae in general, the formation of pairs in connection with meiosis is very obscure and their separation can in general only be clearly made out at the actual metaphase. The rings and strings in species of Oenothera are also nothing more than persistent pachytenes which become distributed as such to the metaphase plate. It is obvious, if the statements made here are well founded, that the results obtained by Belling, Darlington and Sax in regard to ring formation are without sound foundation in fact.

E. C. JEFFREY

TWISTED TREES AND THE SPIRAL HABIT

THE behavior of organisms is determined by the physical and chemical nature of their protoplasm and by their environment. The relative importance of hereditary material and environment has long been, and probably ever will be, a controversial subject. This is true because both factors always play a part, sometimes one and sometimes the other having the predominant influence. There is also the very natural tendency of an investigator to attach more significance to the point of view represented by his field of work. A student of protoplasm or of genetics will see in heredity a greater influence, and the ecologist will lay emphasis on environment, though the former must be aware of the fact that protoplasm has come to be what it is primarily because of environmental influences working through the ages. The relationship between hereditary reactions and developmental expressions is presented fully and well by Stockard.[1]

It has occurred to me that a protoplasmic interpretation of the twisting of tree trunks might be a logical view of this interesting behavior concerning which there has been much discussion on the pages of SCIENCE.[2-6] Certain observers[2,4,5], see in the prevailing direction of the wind an explanation of the twisting of tree trunks. Persistent winds might well bring about a twisting of the trunk, in support of which is the fact that trees exposed to the wind often assume an oval shape. There is also the report that twisted trunks rarely occur in the heart of a forest.[4]

Several years ago this subject was again brought to my attention by my friend, Mr. Philip Sawyer, of New York, who told me of the twisted trunks of trees (conifers) along the trail up Mt. Audubon in Boulder County, Colorado. The degree of twist varied considerably, from a very gradual one to a complete twist within a distance equal to twice the diameter of the tree. The clockwise twist was the more usual. The reverse twist was infrequent and occurred among the others. This last remark of Mr. Sawyer's increased my belief that tree trunks twist because of an innate tendency to do so and not because of environmental factors. I was, therefore, very much interested in the recent report by Herrick[6] on twisted trees in the forests of Louisiana. He examined 1,527 trees, of which 364 (23 per cent.) were straight grained, 811 (53 per cent.) showed a right-hand twist, and 352 (24 per cent.) showed left-hand twisting. He observed further the condition of the roots of 57 trees that had been uprooted. Of these, 31 (5 per cent.) showed twisting to the right, 7 (12 per cent.) showed left-hand twisting and 19 (33 per cent.) were straight. He adds that if prevailing winds were the cause it would be expected that the limbs on the one side of a tree would twist in one direction and those on the opposite side would twist in the opposite direction. Actually, however, the limbs of any one tree always twist in the same direction. Herrick, therefore, concludes that as there is both right and left-hand twisting in tree trunks of the same locality, and as the twisting of limbs is in the same direction on all sides of the tree, and as roots also show twisting, winds can not be the cause. Mr. Laurence Moyer adds the old apple tree as another common example of tree trunk twisting.

It is the purpose of the present paper to suggest that the twisting of tree trunks is but one manifestation of a wide-spread tendency in organisms to grow and move spirally, a tendency due to a heritable protoplasmic quality and not to environmental factors.

The formation of spirals is not limited to living things. Crystals show both right-hand and left-hand growth. The precipitation of salts in gels, which goes by the name of the Liesegang phenomenon, is ordinarily rhythmic, resulting in the production of concentric rings, but occasionally a perfect spiral is produced, for which there is no adequate explanation. Organisms, from the lowest to the highest, give various indications of a spiral habit. Schaeffer[7] reports that Amoeba travels in a spiral when moving along a thin glass rod or within a fine capillary tube. The spiral may be to the right or to the left for varying lengths of time, and may alternate frequently, although a species is predominantly to the left or to the right. The shells of mollusks are striking examples of the spiral habit in organisms. Both Mr. Sawyer and my colleague Dr. Zirkle reminded me of this.

1 "The Physical Basis of Personality," 1931.
2 SCIENCE, February 13, 1931.
3 *Ibid.*, March 27, 1931.
4 *Ibid.*, May 22, 1931.
5 *Ibid.*, January 29, 1932.
6 *Ibid.*, November 4, 1932.
7 SCIENCE, July 10, 1931.