But there are even better reasons for patenting new ideas whenever possible, and for the discoverer or inventor holding the patent himself. He can push it with more knowledge and energy, and can control it for the general welfare more effectively, than can the financial officers of a university. There is an opinion imputed to Emerson to the effect that the inventor of even a better mouse trap, although he hide in a cabin deep in the forest, will find that the world will beat a wide path to his door. I understand that it is doubtful whether Emerson ever said or wrote anything of the sort. He was a sensible man of considerable experience with new ideas; and certainly this statement is utterly contrary, in the large majority of cases, to actual experience. Inventions, like all other new ideas, have generally to be forced on conservative mankind. It would be easy to point to many inventions and other applications of discovery now saving large numbers of lives that would not yet be in use without advertising and the efforts of salesmen. Without commercialization a large part of all the scientific ideas that are now in constant and active use in our daily lives would be locked in books on the dusty shelves of university libraries. It is properly the business of the creative scholar to see to it that, if possible, his ideas serve mankind in his own generation.

But an even stronger duty rests on a discoverer or inventor. He should see to it that his idea or invention is not misused. He should control it. He should find one or more high-grade concerns to develop it. He should afford them at least such little protection as a patent gives against cut-throat competition, after they have spent money to put the invention into practical form and have made a market for it. Without some assurance of such protection it is difficult to get an idea developed and commercialized. The inventor should so far as possible prevent the sale of inferior or harmful imitations.

Often the investigator or inventor will be unable to accomplish all this. But at least he can do it better than the financial officers of a university. Their responsibilities and duties are sufficiently trying just now without this addition.

In this matter, as in all the other relations of scholars to their universities, it should always be assumed that members of university faculties are men of the highest character. Any new practise, rule or regulation that involves even the smallest imputation to the contrary, or that in any way impairs scholarly freedom, will tend rather to diminish than to insure the maintenance of scholarly ethics and faculty morale. Regulations impair ethics.

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UNIVERSITY PATENTS

DR. ALAN GREGG has done a notable service not only to research in medicine but to scientific research in general. John Maynard Keynes has recently said that nothing is more important than that we should get rid of the profit spirit in modern life. His opinion applies more definitely to research than to any other social or human activity. As a matter of history, the scientific discoveries that have ultimately inured to the benefit of society either financially or socially have been made by men like Faraday and Clerk Maxwell who never gave a thought to the possible financial profit of their work. They were driven on by the spirit of curiosity, and that alone should animate workers in scientific laboratories. The moment that research is utilized as a source of profit, its spirit is debased. The state's and the individual's interest in its support is necessarily weakened, and the most glorious characteristic of modern science is debased. There may be a few who will think that Dr. Gregg is treading on their toes. If so, let the "galled jade wince."

ABRAHAM FLEXNER

MATURATION DIVISIONS IN TRADESCANTIA, RHEO AND OENOTHERA

IN a recent communication Dr. Belling,[1] whose sudden and untimely death is a great loss to biology, has made comments on my recent short article in SCIENCE for January 13, 1933 (pp. 49–50). His courteous criticisms seem to turn on the definition of a univalent chromosome. This may conveniently be described as a single (that is not paired with another) chromosome of the first meiotic division. Consequently neither the so-called bivalents nor their constituents can logically be called univalents. According to the results of a number of investigators, in *Tradescantia virginica,* there are found two kinds of chromosome pairs (the so-called synaptic mates), namely, ring pairs, which resemble those generally seen in meiosis in favorable objects, such as Allium, Lilium, etc., and by contrast a varying number of so-called rod pairs. The ring couples are regarded as parasynaptically mated side by side, while the rod bivalents are believed to represent chromosomes paired telosynaptically end to end. We have thus the truly remarkable paradox of the chromosomes of the same species in the identical meiotic division, conducting themselves in fundamentally different fashions. The conception of telosynapsis or end-to-end pairing has long been in growing disrepute, particularly among geneticists. Favorable material seems to show clearly that the meiotic so-called bivalents are primitively always in relation side by side. My extended and somewhat

[1] SCIENCE, 77, p. 260, March 10, 1933.

comprehensive investigations, covering a wide range of both plants and animals, appear to make it clear that the side-by-side pairs are invariably present in the primary meiotic division. *Tradescantia virginica* presents no exception in this respect. Although the profile view of the metaphase seems to show the contrasting ring and rod bivalents, the polar aspect, which appears to have been neglected by other investigators, makes it clear that the two are identical and only represent the face and lateral views of identical structures.

Further, in *T. virginica,* the so-called zygotene or zygonema phase can always be seen at the appropriate stage. Since this stage is properly regarded as the precursor of the side-by-side bivalents (the so-called parasynaptic mates), its presence automatically excludes the possibility of end-to-end pairs of chromosomes (telosynaptic mates). There is thus an additional reason for regarding all the chromosome pairs of *T. virginica* as side-by-side mates and *none* of them as end-to-end mates. Following a sound practise in cytology and transferring these results to the interpretation of the less clear conditions presented by the genus Rheo and certain species of Oenothera, it becomes obvious that the pairs of consecutive homologous segments present in the persistent spireme in these cases in reality represent so-called parasynaptic bivalents, strung out in a longitudinal series. Thus, if we were to arrange the vertically elongated bivalents found at metaphase in Allium or Lilium end to end they would accurately correspond to the strings of chromosomes found in the three genera as discussed in the present connection.

E. C. JEFFREY

LOCAL ELECTRIC ANESTHESIA

IN the issue of SCIENCE for February 24, 1933, is an interesting article, "A Method of Outlining Cutaneous Nerve Areas," by Professor Thompson and Dr. Inman, of the University of California, in which an important use of anesthesia from an alternating current is described and discussed.

During the summer of 1892 I worked with A. E. Kennelly, chief electrician of the Edison Laboratory at Orange (later professor of electrodynamics at Harvard), studying the effects of alternating currents and the huge magnets there upon the human body. Professor Kennelly and I published a paper on "Some Physiological Experiments with Magnets at the Edison Laboratory."[1]

We noted that summer that anesthesia and analgesia could be produced by alternating currents above 2,000 vibrations, though this was not alluded to in the paper mentioned.

[1] *New York Medical Journal,* lxi: 729–732. 1892.

However, in an article[2] of mine in the *American Medical and Surgical Bulletin* appeared the following paragraphs, which I have just copied from the *Bulletin* at the Academy of Medicine Library:

> Several years ago Mr. Kennelly and I experimented at the Edison Laboratory with the sinusoidal current. The results of these experiments have never been made public, for lack of time, until the present moment. We established one singular and interesting fact, which is of therapeutic value, and which I will detail here. The experiments were tried upon Mr. Kennelly, Dr. Charles E. Atwood, one of the assistants at the Vanderbilt Clinic, who kindly aided me, and upon myself. The same results were obtained in each of us. Applying one pole to a nerve trunk, say at the wrist, and another at an indifferent point, there were no perceptible effects as long as the vibrations were below 2000 per second. When we reached that point the parts supplied by the nerve beneath the pole became anaesthetic, so that pricking with a needle or knife, or touching the part, was not perceived. Both the anaesthesia and analgesia were so marked that an incision might have been made without the consciousness of the individual operated upon. The higher the rate of vibration the more noteworthy was this effect. Our apparatus did not permit of our going beyond 3000 vibrations per second. * * * The return of sensibility was instantaneous on interruption of the electric current. Doubtless small operations might be performed by this new method of local anaesthesia. As yet the procedure is in its infancy.

In the autumn of 1892 after this summer work at Orange I asked the surgeons in the surgical department of the Vanderbilt Clinic to be on the lookout for some simple case on which the newly found electric anesthesia could be tested. I was testing it out for various nervous disorders in the Nervous Department of the Vanderbilt Clinic, where I was chief of clinic, with Professor Allen Starr. In a few days Dr. Percy Turnure brought in a young woman with a painful felon of the left forefinger which was exactly suitable for the purpose. The electric anesthesia was quickly produced and Dr. Turnure lanced the finger tip. The operation was apparently painless, though as soon as the current was removed sensation returned, with of course such pain as would be natural after any similar incision.

So far as I know this was the first operation under that type of local anesthesia.

About 1902 Leduc in France began writing articles on electrical anesthesia.

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SELF-STERILITY IN NEMESIA

SEVERAL years ago, working in the greenhouse at Princeton University, I undertook to study the genetic

[2] *Am. Med. and Surg. Bull.* ix: 765–808. 1896.