rather strongly provoked. Its fangs are intact.

With the aid of two assistants, Mr. Ledieu, who kept the head out of mischief, and Mr. Bunch, who manipulated the apparatus, it was possible to secure a fairly accurate short time record. A Deprez marker, together with a suitable time indicator, was adjusted to trace upon a smoked drum. With one method of recording a small mesh cap of copper wire was fitted over the rattles and connected with a flexible wire through a battery, the marker, and a curved brass plate. Touching the wire cap to the brass plate completed the circuit. With slight provocation vigorous movement resulted and the writer would hold as far back from the tip of the tail as possible and still be able to direct the tip so that it would strike the plate with each complete vibration. Fearing that the cap might be heavy enough to retard the motion, we tried again using a double strand of very fine copper wire wrapped twice around the rattles bringing this wire in contact with the plate as before. The average time of fifty-three consecutive vibrations, with the first method, was 30σ (1σ.001 sec.) with a mean variation of 10σ. The corresponding result for twenty-five vibrations by the second method, was 28σ, with a mean variation of 3.5σ.

To the writer two surprises are contained in this record, the first being the relatively great variability in rate of movement, the extremes ranging from about 10σ to 50σ. After attention was directed to the variations in speed, they become marked even to the unaided ear, although no distinct rhythm can be detected.

The second unexpected result is that the pitch of the tone produced does not depend upon the speed nor upon the constancy of the tail vibration but upon the natural resonance of the rattles themselves. The pitch of this tone, as determined by two musicians with a very keen sense of pitch, and checked with accurately tuned forks, is between C and C♯; the tone is expressed, therefore, by about 128 to 135 vibrations per second. Very marked changes in rate of tail, from the fastest that could be produced by marked provocation, to the almost quiescent state, did not cause a fluctuation of the pitch beyond this approximate half-tone. The tone itself is exceedingly complex however, and it might conceivably vary with the number and size of the rattles. It was possible to detect, but not to identify, certain overtones.

The popular impression that the rattler uses his rattles as a warning that he is about to strike is regarded by Mr. Dill as quite erroneous. This snake, when striking normally does so first and rattles afterward, if at all. It will, for instance, strike at a bird placed in the cage, rattle, then strike again. It appears that the rattle is rather to terrify than to warn. It is also used as a defensive mechanism. The instinct to vibrate the tail is not peculiar to the rattlesnake, but is common to many other species, as, for instance, to the non-venomous king snake and the blue racer.

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A TICKET TO ST. LOUIS

I am a schoolmaster. I am not earning a living for myself and family, though my position is counted a good one. I shall be a schoolmaster till I die: I have chosen teaching as my service, and am too old to change. My three sons will not be schoolmasters.

Before the war I was able to make ends meet. I could then devote all my time and energies to the duties of my position. Then came increase of passenger rates, and a war tax added, and I and my family have since stayed home. I even bought several liberty bonds and my children bought war savings stamps at the beginning.

Then came also increased freight rates and of cost of food, and I and my boys began gardening. Then came also increase of wages and decrease of competence in artisans, and I and my boys began doing our own repair work —carpentry, plastering, roofing, ditch-digging, etc. But, staying always home, and raising beans, and fixing spouts is not what I am paid for doing, nor does it get the best results from the long training I have had. And ever since the close of the war I have been vainly hoping to be allowed to devote my time again to my

teaching and research; for I am first and last a schoolmaster.

The war having ended more than a year ago, I thought I should like to go to the meeting of the American Association for the Advancement of Science at St. Louis, to meet my colleagues from the other universities and to talk over plans for the future. Now at the last the poor old decrepit U. S. Railroad Administration, which, I verily believe, has done more than any other single agency to increase the cost of living, decides that this association is not educational! Therefore, its members are not entitled to the reduced fare previously granted to those attending "meetings of religious, charitable, educational, fraternal, or military character." This, the equivalent of 2 cents per mile, which was full fare before the war, may be granted for truly educational gatherings, such as those of public kindergartners; but it is not for such as we are: we pay 3 cents per mile with a war tax added, or we help the railroads by staying at home.

Such is the judgment of a high official in that administration (Mr. Gerrit Fort, assistant director), who is doubtless provided with a salary adequate to support him and his family while he renders such decisions. Hear him: "The term 'educational' taken in its broad sense could be construed to cover a very large number of conventions. It was necessary, therefore, to restrict its definition, and this was done by confining it to those conventions having to do with elementary education, such as meetings of school-teachers."

This is the last straw!

SCHOOLMASTER

SPECIAL ARTICLES

THE PROTECTIVE INFLUENCE OF BLOOD SERUM ON THE EXPERIMENTAL CELL-FIBRIN TISSUE OF LIMULUS[1]

IN the preceding communication we showed that the solutions of different salts, which are constituents of blood serum or seawater, differ in their effect on the cellfibrin tissue and that the amount of regenerative outgrowth of the tissue is different in different solutions. If we cover a wound with 5/8 *m* NaCl healing may take place; a small piece of excised placed on a cover-glass and surrounded by a drop of NaCl solution may show a good outgrowth under the conditions of our experiment in which usually a small amount of blood serum was adherent to the piece. However, all of these solutions are inferior to the blood serum of *Limulus*. It was of interest to determine which constituent or combination of substances in the blood serum was responsible for the superiority of the serum, whether it was caused by the balancing action of salts or by another constituent.

Addition of calcium chloride in various quantities to the sodium chloride solution did not improve the latter and usually made it less favorable for the tissue. The addition of seawater in which the inorganic constituents are present in proportions similar to those found in blood serum, prevented an active outgrowth altogether. Inasmuch as it was possible that the alkalinity of the seawater was injurious to the tissue, we used seawater with a hydrogen ion concentration which corresponded to an approximately neutral solution. This did not improve the effect of seawater. The Van't Hoff solution mixture of salts was likewise much inferior to an isotonic NaCl solution. These results made it improbable that the beneficial effect of blood serum was due to inorganic constituents.

This conclusion was corroborated by the effect of the heating of blood serum. Heating the blood serum to 85° for a short time sufficient to coagulate a certain amount of its proteid destroyed the greater part of the beneficial effect of blood serum. Heating this filtered fraction still further to 100° for a short time, and thus producing an additional coagulation, made the blood serum as unfavorable as seawater; such heated and filtered blood serum had still the blue color of normal oxygenated *Limulus* blood. However, how far a proportionality exists between the intensity of heating and of loss of beneficial properties of the serum needs further investigation.

[1] From the Department of Comparative Pathology, Washington University School of Medicine, St. Louis, Mo.