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A Kymograph and Its Use

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—— bolteri, Deitz, Iowa City.
—— rufipes, Lec., Iowa (Dietz).
—— subguttatus, Deitz, Iowa (Angell).
—— ligatus, Deitz, Iowa (Angell).
Pseudanthonomus facetus, Deitz, Iowa (Angell).
Tychuis sordidus, Lec., Iowa (Casey).
Ceutorhynchus cyanipennis, Ill., Iowa City.
Baris dolosa, Casey, Iowa (Casey).
—— confinis, Lec., Iowa City.
—— transversa, Say, Iowa (Casey).
Pseudobaris angustula, Lec., Iowa (Casey).
Nicentaus ingenuus, Casey, Iowa (Casey).
Centrinus falsus, Lec., Iowa (Casey).
Limnobaris deplanata, Casey, Keokuk (Casey).
—— confinis, Lec., Iowa (Casey).
Idiostethus ellipsoideus, Casey, Iowa (Casey).
Catapastus conspersus, Lec., Iowa (Casey).
Euryssobia echidna, Lec., Iowa (Casey).

Calandridæ.

Cossonus subareatus, Boh., Eddyville (Shimek*).

Scolytidæ.

Hylesinus opaculus, Lec., Iowa City.
Phlœotribus frontalis, Zimm.. Iowa (Leconte & Horn).

A KYMOGRAPH AND ITS USE.

BY W. S. WINDLE.

The science of physiology in its present condition owes much of its advancement to the skillful manipulation of cunningly devised apparatus. Without the successful invention of delicate mechanical appliances many of the profound researches of Foster, Du Bois, Raymond, McKendrick, Martin and others would never have been possible. It must be granted, however, that invention and skill in manipulation have been supplemented by clear and comprehensive interpretation of results obtained, and it is to the latter that most credit is due. In emphasizing the value of scientific apparatus and its use, we recognize the imperative need of a fundamental knowledge in anatomy, histology, chemistry and physics, which the pupil must necessarily possess before entering upon advanced work in the science

of physiology. It is true that the general student versed in these branches may secure a fair working knowledge of physiology simply from a good text, supplemented by ample anatomical demonstrations, complete diagrams and charts. But far more comprehensive will his views of the science be if a well-chosen list of experiments be worked by his own hand in a fully equipped physiological laboratory.

A good proportion of students may usually be found in the college and university who are eager for such work and will pursue it with much enthusiasm, and if properly directed will obtain many satisfactory results. But it is a fact to be regretted that only the few in our larger universities are offered facilities for such a desirable course in this most interesting department of the biological sciences. This condition of affairs is chiefly due to two reasons. First, the expense of proper equipment is larger than most institutions can or desire to bear at present, especially so when other and more elementary subjects must first be provided for. Second, the number of teachers who possess adequate training in physiology is unfortunately limited. But it is gratifying to note the recent increase in this class of instructors since the growing demands for more extended work in physiology have become apparent.

A few days ago it became my interesting duty to examine the catalogues of all the colleges and universities in Iowa, and among other points the comparative courses in physiology were noted. Seven institutions, only, offer work beyond the elementary study. Four of these offer one term of 10–12 weeks, while three submit a well planned course of one semester. That advanced physiology is one of the neglected studies in Iowa colleges is a fact conclusively shown in the above. There is not only a need for decided advancement along this line, but an ample opportunity is found in the urgent demand repeatedly expressed for it by our most progressive pupils. If the financial resources were unlimited such demands would soon be met, but since full supplies cannot be readily offered, the enterprising professor or pupil should not despair, for the requirements may often be met quite satisfactorily by humble methods. Many simple pieces of apparatus may be easily and quickly constructed at a very small expense, that may answer the purpose of others more elaborate and expensive.

Instead of a kymograph or myograph of foreign manufacture, a revolving upright cylinder may be constructed for taking a

continuous record upon paper or smoked surface. With the assistance of a jeweler or other skillful mechanic, this and many other simple devices may be made for experimenting upon muscles, nerves, circulation, respiration, etc., all with but little expense.

During recent work in phsiology at Penn College a recording apparatus became very desirable, and steps were taken to construct an economical one suitable for the occasion. The instrument, which was finally completed by the aid of jeweler, locksmith and tinner, cost $7.50. It served its purpose admirably, and because of its extensive utility and easy manipulation, it was deemed advisable to submit a detailed description of the machine with the hope that it may assist some one, or be the means of exciting interest in such instruments and calling out suggestions for their improvement.

The kymograph, as the instrument is termed, consists essentially of a firm stand upon which two cylinders are mounted in an upright position. The larger cylinder is connected with a clock train so that it may be made to rotate upon its axis at different velocities, varying from one-half to three revolutions per second.

The stand is of one and one-half inch poplar; length, sixteen inches; width, twelve inches. It rests upon four legs which are seven inches in length. The cylinders are held upright one inch above the stand, by means of a small steel pillar, from which an arm extends to the upper ends of the axis of each. The cylinders are hollow and light, constructed of sheet brass bent upon and soldered to brass frames at each end. Through the centers of these frames the axes extend so as to project one inch or more beyond the ends of the cylinders. The small cylinder is five inches high and three inches in diameter. It is placed near the front side of the stand, with the lower end of its axis resting in a brass socket, the upper end held by the horizontal arm in such a way that it can be rotated easily. The larger cylinder is five inches in depth and six inches in diameter. The upper end of its axis is supported by a horizontal arm, while the lower end connects by means of a joint with a shaft which extends through the top of the stand to the clock train below. This clock train is a part of an eight-day movement. The steel spring communicates by a train of three wheels, with an adjustable fan, attached to a three-sixteenth inch shaft, which extends below the brass frame. See plate V

The fan consists of two veins of sheet brass two by one and one-half inch, arranged upon a horizontal shaft, so that they may be turned edgewise to the air to admit of very rapid motion, or flatwise to admit of very slow motion. The movement of the large cylinder is further controlled by means of a lever, which may be applied against a smaller wheel in the train. When applied the machine stops running readily. A number of improvements are contemplated which will increase the number of uses for which the instrument is adapted. It will then, in all probability, possess many points of superiority over the foreign instrument.

In plate V the instrument is represented as a kymograph. A chronograph pen should be represented below the mercury manometer. A roll of paper four inches wide is supported on a pivot near the end of the stand opposite the large cylinder. The paper is then passed round the smaller cylinder to be fastened by a wire clamp to the larger. When the machine is in motion the paper is slowly drawn round the smaller cylinder and wound about the larger. In addition to the study of normal pressure of the blood, records of other interesting and instructive experiments, may be secured as in the following:

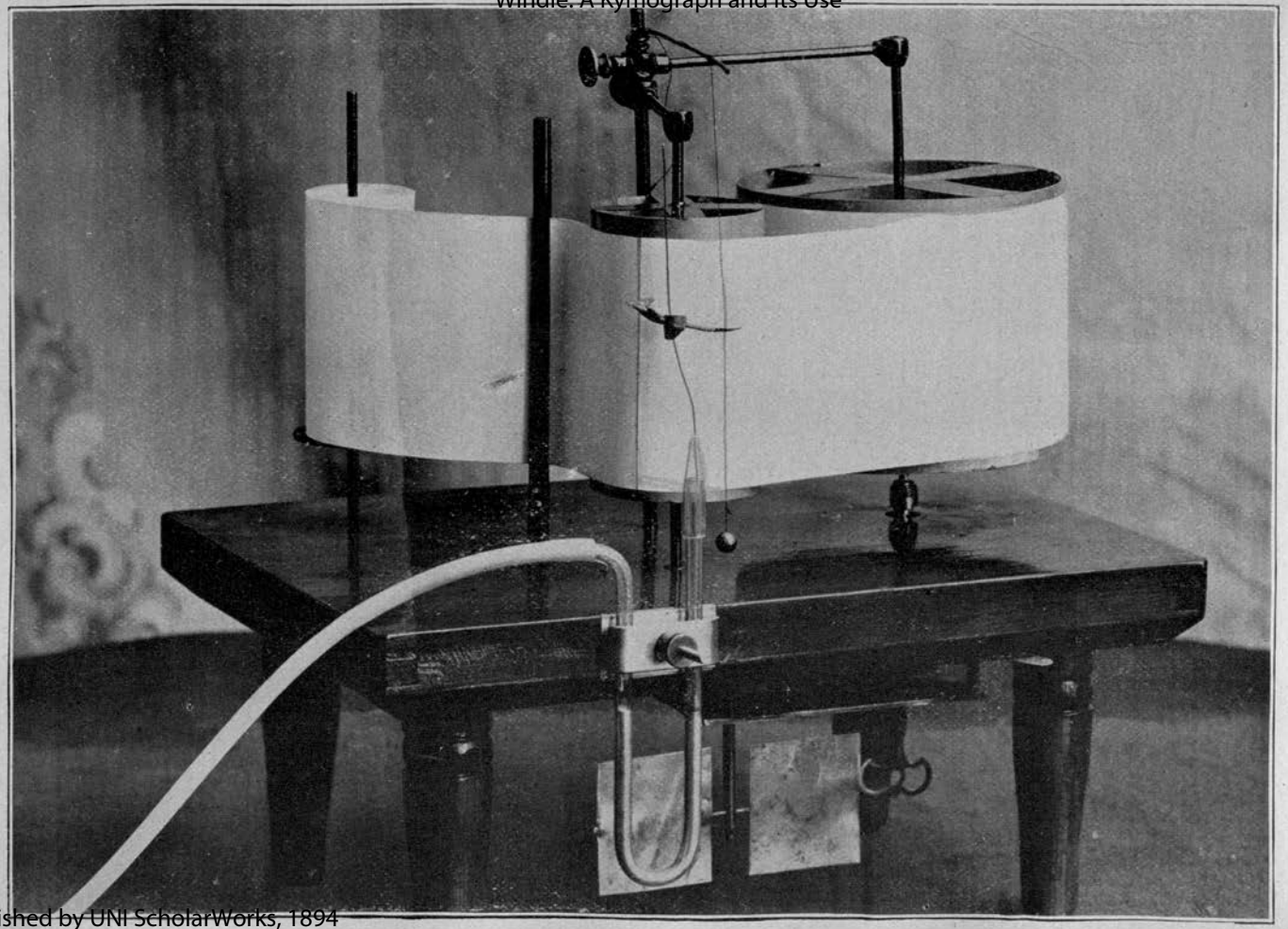
1. Effect of stimulating the depressor nerve.
2. Effects of stimulating the vagus nerve.
3. Effects of severing one or both vagus nerves.
4. Effect of various poisons upon the circulation.

To use the instrument as a pneumograph or myograph, all parts may be removed from the top of the stand except the larger cylinder and its support. This cylinder is then taken from its position, covered with smoked paper, then replaced, ready for use in the study of respiration as muscularation. With Marly's tambour the instrument becomes a pneumograph and records may be taken of:

1. Movements of various regions of the chest in normal respiration.
2. Effect of cutting or stimulating the vagus nerve.
3. Effect of cutting or stimulating the laryngeal nerves.

Effects of negative and positive ventilation also are recorded by proper levers, etc.

The single cylinder with smoked surface forms a good myograph, when experiments like the following may be performed:



1. Effect of various stimuli upon motor nerve or curarized muscle, as thermal, mechanical, electrical and chemical.
2. Effect of electrical stimuli of varying intensities.
3. Effect of repeated stimuli—followed by tetanus.
4. Result of continued fatigue.
5. The "Maker" shock compared with the "Break."
6. Conditions affecting degree of muscular contraction, as amount of resistance, temperature, poisons, etc.

Numerous other uses will occur to the student in advanced physiology, in which the recording apparatus will be of service.

To some it may be interesting to note that the tracings upon smoked paper may be preserved indefinitely, by carefully removing it from the cylinder, and passing it through an alcholic solution of white shellac, then allowing it to dry. If the tracing thus preserved be oiled, it becomes thin enough to be used for printing blue print copies of it.

VOLATILITY OF MERCURIC CHLORIDE.

BY ABBOTT C. PAGE.

[Abstract.]

Solutions of mercuric chloride were evaporated on a water bath with the following results:

SOLUTION.	AFTER ADDITION OF	EVAPORATED TO	LOSS OF $HgCl_2$.
A 50 cc	.....	dryness	.0133 grm
A 50 cc	50 cc water	25 cc	.0036 grm
A 50 cc	20 cc dil HCl	25 cc	.0063 grm
A 50 cc	1 grm KCl	dryness	.0008 grm
A 50 cc	1 grm plus 50 cc water	25 cc	.0002 grm
B 12.5 cc	.0354 grm KCl plus 2 cc HCl	5 cc	.0001 grm

Solution A contained .2322 gram mercuric chloride in 50 cc, and solution B .1295 gram in 12.5 cc. The author considers that these results indicate the probable existence of the compound K Hg Cl_3. H_2 O.

