

that whereas normal seedlings are very little affected by the drug, other seedlings of an abnormal type were very sensitive to urethane. Specifically, it was found that yarovized or vernalized seedlings are extremely sensitive to even dilute solutions of the drug and the

same was found to be true of seedlings which were irradiated with hard X-rays in doses of 500 r.*

* By courtesy of Dr. Marcus Ostro, Radiologist in Chief, Sinai Hospital, Baltimore.

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An Easily Assembled Pulse-Frequency Recorder.

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Continuous, automatic, kymographic recording of pulse frequency conserves time, recording paper, and workers' patience. The device to be described is easily assembled with ordinary laboratory tools and supplies.

As shown in Fig. 1, a heart-lever fulcrum (F_1) is equipped with a tight-fitting, hollow laboratory straw (carrying lever, L_1) bearing an adjustable counterpoise (WE) on the short arm, and the fulcrum (F_2) of a second straw (contacting lever, L_2) on the long arm. The counterpoise is a weighted heart-lever fulcrum. The fulcrum of the contacting lever is a piece of aluminum (lever) wire, wound about and cemented (Duco) to the carrying lever, and passing as a bearing pin in a horizontal hole through the contacting lever. Into one end of the contacting lever is cemented a soldered-wire slip-yolk (Y) which engages the cross (recording) wire (M) of an ordinary recording mercury manometer. Into the other end is cemented a platinum wire which makes contact (C) with a drop of mercury in a tiny platinum-foil cup soldered onto the fulcrum block of the carrying lever. The long arm of the carrying lever is extended with an aluminum wire shaped (*a*) to serve as an adjustable stop (ST) for the contacting lever, and (*b*) as a lateral friction surface of the carrying lever against a lightly contacting, silk thread (FR) rendered slightly taut by the tension of a rubber band at one end. Contact C closes a circuit between the grounded and insulated (INS) binding posts (BP_1 and BP_2) on the insulation-sheathed

supporting rod (SU). The conducting wire (WI) from the platinum wire must be fine and flexible.

The contacting lever is balanced on its fulcrum by a suitable combination of fulcrum position and lengths of wires inserted into its ends. The entire system is then balanced on the carrying fulcrum by adjustment of counterpoise, WE. Engagement with the manometer thus has no significant influence on the latter's mean recording position.

To facilitate adjustments, universally adjustable clamps are used for mounting the device proper and the rods between which the friction thread is strung. The stop (ST) for the contacting lever is adjusted by bending so that the lever's freedom of excursion does not exceed the smallest systolic excursion of the manometer apt to be experienced (short of terminal cardio-vascular failure). The light tension of the friction thread is adjusted to just hold the carrying lever at the position to which it is brought by the excess of the manometer excursion beyond the contacting lever's short range. Automatic compensation thus occurs to changing mean and pulse pressures.

In present use, this contacter activates, through a standard-type electronic relay, a modification of the "counter-recorder" previously described.¹ The modification consists of branching the power end of the recording

¹ Winder, C. V., and Moore, V. A., *J. Lab. and Clin. Med.*, 1945, **30**, 894.

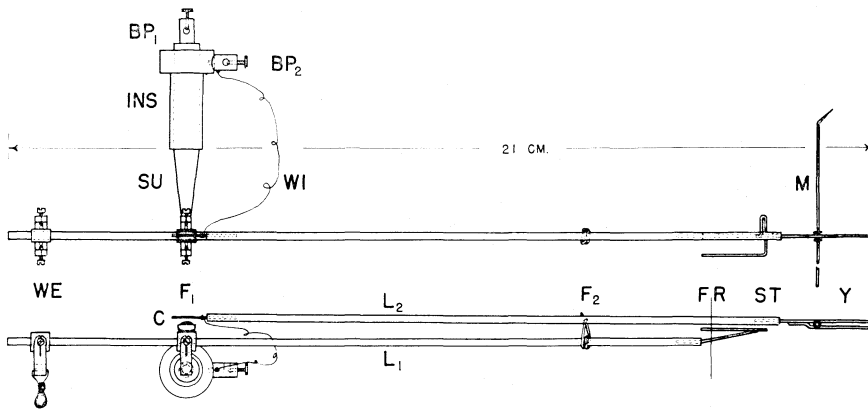


FIG. 1.
Contacting lever system. See text.

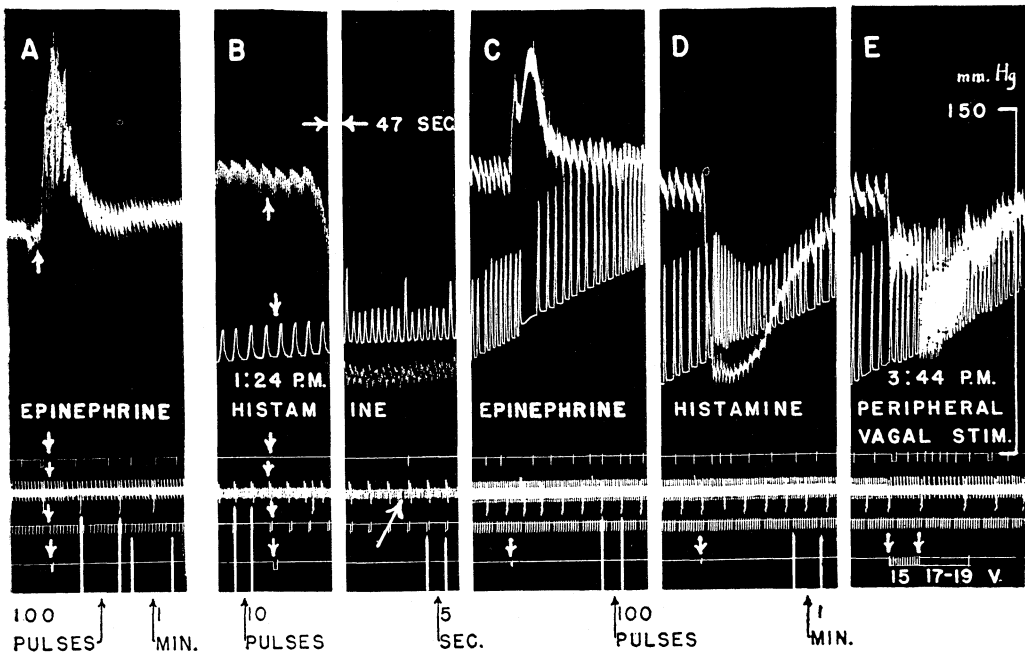


FIG. 2.

Illustrations of pulse-frequency recording under various conditions and recording speeds. *A* is from one phenobarbitalized dog, *B* to *E* from another. Small vertical arrows indicate simultaneous points. Vagus nerves were cut between *B* and *C*. Recordings from below upward are signal, time, pulse frequency, respiratory minute volume, spirometer, and femoral arterial manometer engaging the contacting lever. Large diagonal arrow indicates failure of one individual pulse to register (see text).

lever into three tines which are displaced, respectively, by (a) the ratchet, (b) a notch in the units-wheel, and (c) the lug on the tens-wheel of the counter mechanism. On a single record, individual pulses, tens, and hundreds are thus characterized by suitable amplitudes and/or directions of lever-movement. This summing recorder does not require calibration, and is more compact

and more easily devised than a Zeitschreiber.²⁻⁶ The latter, equally well adaptable to

² Fleisch, A., in Abderhalden, E., *Handbuch der biologischen Arbeitsmethoden*, Urban & Schwarzenberg, Berlin and Wien, 1935, Abt. V, Teil 8, 1935, p. 905.

³ Gesell, R., *Science*, 1934, **79**, 275.

⁴ Gaddum, J. H., and Kwiatkowski, H., *J. Physiol.*, 1938, **94**, 87.

the present contactor, does not require exact reference to a simultaneous record of time, indicates instantaneous changes in frequency, and provides a ready-made graph of the (reciprocal) frequency course. Junkmann's⁷ original Impulszähler falls into the latter category except for *direct* frequency plotting and for lack of instantaneous information.

As illustrated in Fig. 2, with optimal adjustment, the systolic excursions of the manometer are selectively registered during widely and abruptly varying patterns of respiratory pressure waves, pulse pressure, and mean pressure. The limits of fidelity are those of the mercury manometer, as illustrated by the individual unregistered systole in Fig. 2B (arrow), where a very low pulse oscillation was masked by relatively vigorous respiratory waves during histaminic hypotensive dyspnea.

⁵ Druckrey, H., and Uhlig, P., *Arch. f. exp. Path. u. Pharmacol.*, 1941, **198**, 74.

⁶ Genuit, H., and Ruppert, H., *Arch. f. exp. Path. u. Pharmacol.*, 1943, **200**, 684.

⁷ Junkmann, K., *Arch. f. exp. Path. u. Pharmacol.*, 1927, **120**, 314.

The principle of automatic compensation to varying hemodynamics, fully present in the contacting instrument of Genuit and Ruppert⁶ which inspired the present simplification, was lacking in Fleisch's Pulspelotte and partially present in such manner as to operate against sensitivity in Nyboer's⁸ contactor. Electronic cardiometers employing the cardio-electric R-wave are, of course, inherently independent of hemodynamics.

It will be apparent that the contactor described is adaptable to many oscillatory phenomena, with provision of a simple engagement for the contacting lever.

Summary. A simple contacting lever, mounted on a carrying lever and engaged with a mercury-manometer cross-wire, selectively registers systolic pulsations. It is used to activate, through a relay, a simple counter-recorder,¹ improved. Individual pulses, tens, and hundreds (etc.) are characterized by amplitude and/or direction of excursion of a single recording lever. Operation and limitations are illustrated.

⁸ Nyboer, J., *Am. J. Physiol.*, 1933, **106**, 204.

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Alkaline Phosphatase Activity and Basophilia in Hepatic Cells Following Administration of Butter Yellow to Rats.*

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A cytochemical study¹ has been reported previously of the activity of phosphatase (at pH 5.0) in the cytoplasm of motor neurons during their regeneration. A well-defined increase was found to be associated with the

dissolution of cellular basophilic material, chromatolysis, and its regeneration, chromatogenesis.

The alterations in phosphatase activity previously described were in cells which do not divide. It was desirable, therefore, to extend the observations to include regenerating cells in which mitosis can be investigated.

There are presented herewith the results of a study of alkaline phosphatase activity as correlated with basophilia in the hepatic cells of rats fed butter yellow (*p*-dimethylaminoazobenzene) in a diet which renders the liver of the animal susceptible to consequent cancer production.

* Presented at the Fourth International Cancer Research Congress, St. Louis, September 6, 1947. A rather similar study was reported by N. Bucher and A. Glinos at this Congress.

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¹ Bodian, D., and Mellors, R. C., *J. Exp. Med.*, 1945, **81**, 469.