## Luteotrophic Activity of Human Growth Hormone (Raben)

I HAVE developed an assay for the measurement of luteotrophin in hypophysectomized adult mice which depends on the increase in the weight of a damaged horn of the uterus (formation of deciduomata). Mice were hypophysectomized on the first day of dioestrus and 48 h later the endometrium of the right horn of the uterus was injured. The animals were injected daily for 5 days with a preparation of luteotrophin commencing immediately after hypophysectomy and killed on the sixth day. The response was recorded as positive if the weight of the damaged horn was at least 11 mg greater than the weight of the control horn. The results were expressed as the percentage of animals with a positive response and a probit transformation was used for parallel line assays. Details of this method will be published shortly.

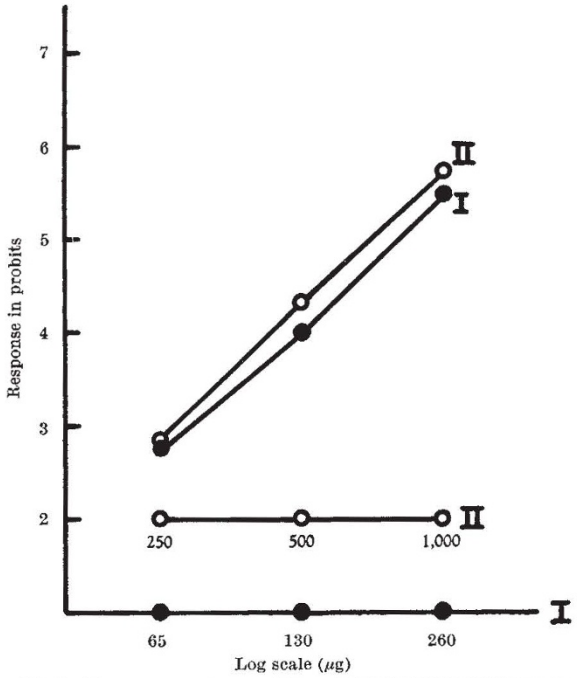


Fig. 1. Dose-response curves of human pituitary growth hormone and of bovine prolactin. I, bovine prolactin, Armour Laboratories, Lot No. *D* 14083-2*B*; II, human pituitary growth hormone (Raben)

Human growth hormone prepared by the Raben method gave the same effect in hypophysectomized mice as the bovine prolactin, Armour Laboratories, Lot No. *D* 14083-2*B* (assumed potency, 20 I.U./mg). In positive responses the difference in weight between the two horns varied from 14·5 mg to 37·4 mg with human growth hormone and from 14·7 mg to 70 mg with bovine prolactin. The doses for human growth hormone were 250, 500 and 1,000 μg per animal and for the bovine prolactin 65, 130 and 260 μg. The potency of human growth hormone was 29 per cent (95 per cent fiducial limits 17–51) of the reference substance. The results are given in Table 1 and Fig. 1. These figures are in keeping with those previously obtained by the dioestrus method[1] and are of the same order as the results published by Ferguson and Wallace[2].

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[1] Kovačič, Nada, *Nature*, **193**, 984 (1962).
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## A Physiological Basis for the 'Optimum' Level of Energy Expenditure

THE level of oxygen consumption, compared with the maximum intake, at which an individual can work safely for 6–8 h, from month to month, has been variously defined. The Max Planck Arbeitsphysiologie Institute group in Dortmund support the idea that the rate of oxygen intake equivalent to the "Pulsdauerleistungsgrenze" (a heart-rate of about 120 beats/min) is the safe limit. The sole basis of this criterion is that, in their experience, the heart-rate continues to rise and does not remain in a steady state when the level of oxygen consumption has caused the heart-rate to exceed 120 beats/min. The "Pulsdauerleistungsgrenze" is said to occur at about 30 per cent of the individual's maximum level of oxygen intake[1]. Christensen *et al.*[2] have a sounder, even if empirical, basis for their safe limit. They found that men engaged on hard manual work, such as lumberjacking, on high financial incentives, do not, in general, work at a level which exceeds 50 per cent of the maximum level of oxygen intake.

Neither of these criteria has a real physiological basis. An objective and sound physiological basis for the optimum level of work would be the level of oxygen consumption, compared with the maximum oxygen intake, at which the rate of supply of oxygen by cardio-respiratory mechanisms to working muscles no longer balances the rate of expenditure of energy, and anaerobic metabolism commences in working muscles. Increase in blood lactate, alone, is not a reliable index of anaerobic metabolism; Huckabee has demonstrated that 'excess' lactate, derived from the ratio of total-body lactate to pyruvate, is the only reliable measure of anaerobic metabolism[3]. This communication deals with the level of oxygen intake, compared with the maximum, at which 'excess' lactate appears in 6 young Bantu males highly trained on a bicycle ergometer.

These subjects were tested at work-levels from 2,000 ft. lb./min to 11,000 ft. lb./min on a bicycle

Table 1. RESULTS OF AN ASSAY OF HUMAN PITUITARY GROWTH HORMONE USING THE ARMOUR PROLACTIN LOT NO. *D* 14083–2*B* (BOVINE) AS A STANDARD

| Preparation | Design of assay | No. of animals | Potency of unknown per cent of standard | 95 per cent fiducial limits | Index of precision $\lambda$ | Regression $g$ | Validity tests: Parallelism $t$ | Parallelism $P$ | Linearity: Standard $t$ | Standard $P$ | Growth hormone $t$ | Growth hormone $P$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Human growth hormone | 3 : 3 | 37 | 29 | 17–51 | 0·2 | 0·182 | 0·23 | 0·9–0·8 | 0·17 | 0·9–0·8 | − 0·17 | 0·9–0·8 |