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are many uncontrolled factors in follow-up observations, and the following cases do not demonstrate a causal relation.

Our initial pilot baby, who received active exercise of the walking reflex and opportunities for motor activity beyond the first 8 weeks, walked alone at 7½ months of age. He is now 6 years old and in excellent physical and intellectual condition. He has always showed good coordination—maneuvering a marble with a hockey stick at 14 months and riding a two-wheel bicycle with training wheels at 3½ years of age, for example. He combined as many as three words at 11 months and learned to read and write at 4 years of age. His thorough medical examinations have confirmed his sound physical and intellectual development.

Enough attention has not been given to McGraw's (5) pioneering research on Jimmy and Johnny, which included active exercise of the walking response during the newborn period and extensive training thereafter. She reported that Johnny performed more stepping actions as an infant than Jimmy or any of the other controls (5). Johnny did not walk sooner but showed “. . . greater agility and control . . .” as an infant (5, p. 86) and “. . . superior motor coordination . . .” at 6 years of age (6). X-rays of Johnny's legs showed that his skeletal growth at 32 months was normal (5). The boys were followed in the laboratory for 10 years, and no deleterious effects associated with early exercise were uncovered.

We have discovered some parents who on their own initiative have permitted their babies to walk and stand during the newborn period. One such parent reports that her three well-built babies walked alone at 7, 9, and 11 months. She described them as exceptionally independent infants, deliberate in their actions, intelligent, and rarely pesty. The children are now in their twenties and in sound health.

In general, Gotts's arguments are more conjectural than substantial, more alarming than accurate. For instance, he notes that children who exhibit reflexes “. . . past the time of their normal disappearance often have associated developmental complications. . . .” Our preliminary observations of active-exercise infants indicate that the Moro, grasp, and rooting reflexes disappear normally. Despite the evidence that walking in the active group at 8 weeks is a learned instrumental response, Gotts

assumes that exercise preserves the walking reflex. It is unlikely that the newborn was equipped with reflexes simply to be tested in a neurological examination, although they serve that purpose well. It is possible that the Moro, grasping, walking, placing, and rooting reflexes are vestiges of our past and may have assisted the infant in survival—perhaps by helping him attain proximity to his mother (7).

Finally, we want to emphasize that it is not our desire to encourage all parents to walk their newborns, but to encourage more research on newborn walking.

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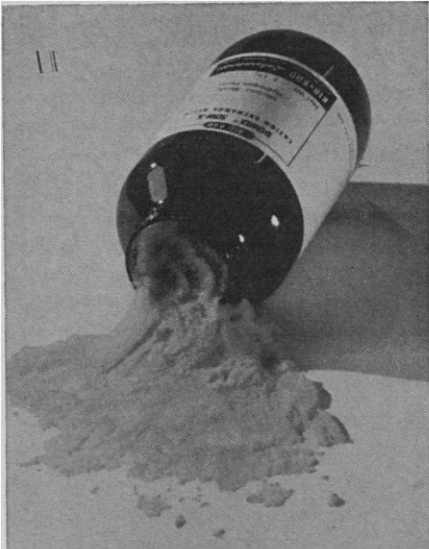
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Graduate Education

Much credit is due Norman Hackerman (Editorial, 4 Feb., p. 475) for tackling some untested dogmas in American academia. It is high time that a serious examination was made of alternative models for graduate education.

Throughout the past two decades, while additions of graduate programs in the most unlikely places were made with the solemn intonation that graduate work and (even mediocre) research were needed to retain or produce the best undergraduate teachers, I asked deans and presidents for any study or evidence that this was true. I repeat my request in your columns. Dozens of small liberal arts colleges—the Wesleyans, Oberlins, Kenyons—managed to



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provide excellent undergraduate education without attempting to involve the faculty in formal (funded) research activities.

Far from being synergistic, the combination of undergraduate and graduate programs in the same institution are generally destructive to both. The highest values sought, the parameters for success, and the reward structures that would optimize the two subsystems are in many cases, incompatible, especially in smaller institutions. Obviously there are persons who are good at both, and these exceptions (like Pauling) are cited to prove that the faculty member is helped in his *undergraduate* teaching by his research activity.

It is time to go beyond Hackerman's call for the study of alternatives to experiments with alternatives. Some 4 years ago, as one of (Pennsylvania) Governor Shafer's science advisers, I suggested that he use part of the large sums going into expanding higher education for the development of all kinds of radically new patterns of education. A detailed model was constructed of semi-autonomous "Graduate Colleges of Interdisciplinary (and mission-oriented) Studies." Such colleges, affiliated with a major university, would couple research with graduate teaching and public service only. The ethos, goals, and reward structure would be directed to the best possible graduate (and post-doctoral) training. Operating on the philosophical basis that it is equally blessed to teach a graduate as an undergraduate student, we might have a clean text of the costs and quality of graduate education in a system designed for it alone.

The alleged high cost of graduate education results from accounting devices to average costs. Terman (1) has provided data on this point. Given operations of a critical-mass size, selected areas of science, applied science and engineering (including all social science fields), and a reasonably stable federal research picture, zeroth order figures show credit-hour costs near average undergraduate costs (chiefly due to the research subsidy). The tragedy of American graduate education is the total lack of institutional and structural innovation.

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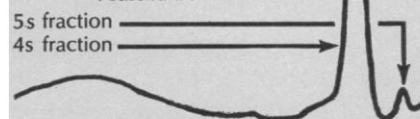
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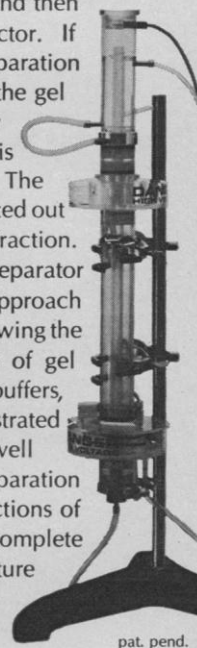
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