

In contrast, one Western view of inhibition (stemming largely from Sherrington's work) is based on the hypothesis that two types of nerves or synaptic terminals abut on the somata of motoneurons (or other central neurons) with diametrically opposed effects. Direct evidence for this has been found in the form of electrical recordings from microelectrodes placed in single motoneurons. Excitation has been found to cause a nonpropagated reduction in transmembrane potential ("depolarization") which, if sufficient, initiates a propagated spike, whereas inhibition causes an increase ("hyperpolarization"). Wedensky's block has been associated with a stable reduction in membrane potential resulting from prolonged stimulation, injury, anoxia and so forth, accompanied by both a lowered threshold of activation and a lower margin of safety for spike initiation (since reduction of membrane potential below a critical level will prevent propagated spikes from occurring at all). It is generally regarded as a type of fatigue. These concepts have been elaborated in a variety of conditions and preparations, both vertebrate and invertebrate, leading to the accumulation of a large body of physicochemical data in their support. None of these data are described or even mentioned (page 553). The long discredited Bernstein hypothesis of membrane potential is briefly discussed (page 508) with the valid reservation that semipermeable membranes have not been adequately demonstrated to exist in cells; in other respects, the treatment of electrophysiology is about 25 years out of date.

Pavlov achieved considerable success in describing operational types of inhibition (for example, extinction, differentiation, and delay) as well as stages in the inhibitory process—that is, the "equalization," "paradoxical," and "transmarginal" phases—but his followers seem to be unable clearly to distinguish these types from fatigue (page 554) or from each other: "Not every manifestation in the cerebral cortex can be regarded as transmarginal inhibition, otherwise each extinguished or differentiated stimulus, because of its non-reinforcement, would have to be considered as exceeding the strength limit. . . . But this in no way means that the various cases of inhibition differ in nature and that transmarginal inhibition is a very special state. Pavlov was inclined to regard all cases of inhibition, in their essence, as manifestations

of a single process inseparably connected with the process of excitation" (page 638). Inhibition is conceived in some cases as "protecting" nerve cells from fatigue, an unusual instance of introjection of a value term, but one used by Pavlov and, hence, sanctioned.

In view of these multiple omissions, one may well ask wherein the undoubted effectiveness of such a limited system might lie. The answer seems to be that the conditioned reflex technique is a means of precise description and prediction rather than of understanding. It is a symbolic language used to describe behavioral patterns without recourse to theory. On the one hand it does not lead to the joining of physiology with physics and chemistry, which ultimately must afford the basis for explanation. On the other hand it does not require the use of tenuous behavioral concepts such as motivation, reward, punishment, emotion, or memory in order to describe complex patterns of somatic and visceral activity. These and related concepts have alienated many physiologists and have contributed to the present schism between Western physiology and psychology, although they have been productive in the laboratories of those wise enough to use them carefully, and doubtless some day will constitute a valid premiss in the argument between objective and subjective experience.

The roots of this over-simplification would seem to lie in the naive epistemology Pavlov bequeathed to his collaborators, which, apparently, has not been altered in any way in the 24 years since his death. The study of physiology involves the attempt to answer the question about an organ, "How does it work?" To a Soviet physiologist this appears to mean, "What is the observed correlation (law) of events?"; whereas to his Western counterpart it more often means, "What is the major premiss (law) by means of which one event can be said to follow logically from another?" For example, if asked, "How are the eyes moved in nystagmus?" a Western physiologist might attempt to describe a putative imbalance between the vestibular, cerebellar, and oculomotor nuclei, whereas the Russian answer appears to be simply "back and forth" (page 696). Each answer has its virtues. The persistent application of the notion of causality in a simple pragmatic sense has permitted the Russians to amass a vast and consistent literature emphasizing the correlations of input with output of the

body. The Cartesian mechanistic approach in the West has produced an equally vast literature emphasizing the effects of direct manipulation of the brain (stimulation, ablation, and application of drugs), marked as much by its variety and flexibility as by its uncertainty and confusion. Essentially, we have not found the physicochemical principles of neural activity, whereas the Russians have not seriously sought them. However, the current 7-year plan for physiology as presented in a recent editorial by D. A. Biriukov in the *Sechenov Physiological Journal of the USSR* calls for precisely this goal. Moreover, this text does not adequately reflect the exceptional vigor and technical competence displayed by Soviet neurophysiologists in their recent publications. Their work will merit careful appraisal in coming years, and this text provides an essential basis for that study.

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The Rites of Passage. Arnold van Gennep. Translated by Monika Vizedom and Gabrielle L. Caffee. University of Chicago Press, Chicago, Ill., 1960. 198 pp. \$4.50.

Although van Gennep, one of the original group of Durkheimian sociologists, lived until 1957, this book, originally published in 1908 but not previously translated into English, is the sole basis for his considerable international reputation as a theorist in the field of comparative religion.

Van Gennep saw the life of any individual in society as being marked by a series of transitions from one social status to another: from youth, to maturity, to old age; from single to married; from childlessness to motherhood; from life to death, and so forth. And for each of these events there are, in all societies, special ceremonies whose function it is to enable the individual to pass successfully from the status he is leaving to the one he is attaining.

Such rites of passage—birth ceremonies, marriages, initiations, funerals, rituals of arrival and departure—can, in turn, all be analyzed in terms of their three major subphases: rites of separation, symbolizing abandonment of the old status; rites of transition, symbolizing an interregnum, "social death" period during which the individual is

suspended between the old and new statuses; and rites of incorporation, symbolizing the achievement of the new status. A Brahman youth's ritual bath before initiation as a novice is an example of a rite of separation, a girl's seclusion during her first menses of a rite of transition, and sexual hospitality to a visiting stranger of a rite of incorporation.

In support of his thesis, van Gennep quotes a great variety of material, much of it unreliable, from peoples all over the world. But despite his uncertain scholarship, his generally "botanizing" approach to the categorization of religious practices, and his total failure to deal with the social and cultural contexts from which his examples are drawn, van Gennep offers, in his concept of an underlying pattern of withdrawal, isolation, and return which is common to all passage rituals, a valuable theoretical insight into the dynamics of religion in both psychological and sociological terms.

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Heavenly Clockwork. The great astronomical clocks of medieval China. Joseph Needham, Wang Ling, and Derek J. de Solla Price. Cambridge University Press, New York, 1960. xv + 254 pp. Illus. \$12.50.

This is a history, but not a mere chronological account, of the clock in China, from the time of the later Han dynasty (about A.D. 120) through the beginning of the Ming dynasty (about A.D. 1600). The volume, organized in a way which is unusually revealing of the processes by which the authors' research was accomplished, occasionally gives the reader a feeling almost of participating in the research. Beginning with the elaborate astronomical clock of Su Sung (1086-94), which has been mentioned but not fully analyzed in earlier literature, the authors have searched the dynastic histories and encyclopedias, with which Chinese literature abounds, in an endeavor to determine, first, the earliest evidence of such a device in Chinese history and, second, the reasons for the regression in Chinese horology which made it possible for the Chinese to be so impressed with the clocks brought in by the Jesuits in the 16th century. Their search for an an-

swer to the first question leads to Chang Hêng (fl. 120-140), a well-known mathematician and astronomer who is already recognized as an inventor (probably the first) of an instrument for indicating earthquakes. It would appear that the Chinese version of that critical element of the clock, the escapement, was a device demonstrably related to the water clock and, hence, plausibly descended from that older device.

The quest for an answer to the second question is necessitated by the evident impression on the part of both the Jesuits and "the majority of Chinese" that the clock was a new thing in China at the end of the 16th century. The authors conclude, provisionally, that clock-making had not actually ceased, but had been reduced to "a minor industry" 250 years prior to the arrival of the Jesuits, a victim of the attempt of the Ming to efface certain luxuries of the previous dynasty, among them the clocks (page 141). As is acknowledged, this conclusion leaves for further research the actual condition of the "minor industry" when the Jesuits came.

Perhaps the most challenging aspect of this book is its suggestivity concerning the rationale of horology. It appears that Chinese clocks, until late in the 13th century, were principally concerned with the representation of astronomical motions and not with the visual indication of time. The authors suggest a connection between the invention of the "powered celestial globe as a calendrical computer" and the determination of the imperial succession by state astrology (pages 172-73). They conclude with a brief attempt to relate the story they have unfolded to horology in India and the West.

I have mentioned only a few of many intriguing points raised in this remarkable book, which I presume to be a by-product of the first two authors' *History of Science and Civilization in China*. Much of the citation in the present work is to the unpublished volume 4 of that *History*. But it is nonetheless an impressively self-contained piece of scholarship, admirably illustrated and written in a sprightly style that overcomes the drag of an inevitably cumbersome, critical apparatus. Scholarship and elegance of presentation are not often more successfully combined.

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The Nation's Children. vol. 1, *The Family and Social Change*. 252 pp. vol. 2, *Development and Education*. 242 pp. vol. 3, *Problems and Prospects*. 242 pp. Eli Ginzberg, Ed. Columbia University Press, New York, 1960. Paper, 3 vols. for \$6.50; cloth, \$4.50 each.

In discussing plans for the 1960 golden anniversary White House Conference for Children and Youth, the Conference Steering Committee faced the need for materials to be presented to the delegates to serve as a basis for the discussion that would be "charting directions for the next decade." The feasibility of stimulating research in the multiple areas affecting children and youth in time for use by the conference was rejected; instead, it was decided that the Committee on Studies should invite distinguished experts in a variety of fields to write essays on subjects of current concern about youth today. The essays were to be written for the educated layman, "to strive for balance and eschew extremes."

The collected articles have been published in three volumes, edited by Eli Ginzberg, chairman of the Committee on Studies of the White House Conference. The result is a most interesting panorama of the nation's problems and tasks in regard to our young people.

The first volume deals with some of the social changes affecting family life, such as the new suburbia, urbanization, prosperity, health gains, population increase, changing family role definitions, cultural shifts, increased leisure, and developments in the religious field. The contributors show how these changes influence the family and affect the way youth today see their world. For instance, financial security is shown as creating a sense that one's personal future is safe; this leads to the feeling that one does not have to delay marriage to pursue a career. This picture is also affected by the reduced health hazards in childhood illnesses. With these new forces at work, marital and parental roles and functions are changing. The interplay of these factors is graphically described by the specialists who contributed to this volume.

Development and Education, the second volume, focuses on "the analysis of the gap between our aspirations and our accomplishments in preparing young people for life from three vantage points: how the gap came to be, what can be done to narrow it, and the