

# Book Reviews

## The Infant Brain

**The Neuropsychology of Development.** A symposium. ROBERT L. ISAACSON, Ed. Wiley, New York, 1968. xii + 180 pp., illus. \$8.95.

A time-honored method for investigating the relation between the brain and behavior is to observe the effects on behavior of injury to the brain. In general, experimental work of this kind has been done with adult rats and cats or with prepubertal primates; the ages of immature subjects are often given in the description of the experimental procedure, but are rarely mentioned again. However, data have been accumulating for a number of years indicating that results obtained with lesions at maturity may not be replicated when the lesions are made in infancy. With a few notable exceptions, most physiological psychologists have treated these findings as mild embarrassments, as second-class facts that are better omitted from serious discussions of localization of function. As is the fashion these days, these minority facts are now demanding to be heard, and *The Neuropsychology of Development* is a symposium marshaling some of them, and confronting workers in this field of investigation with the problems to be faced.

The first and last papers consist primarily of reviews of the literature. The other three papers present results, mostly not previously published, of research carried on in the authors' own laboratories. Four of the papers deal specifically with a comparison of the effects of brain lesions made at different stages of development, and it is this that I shall focus on, although the title of the symposium indicates that the subject was conceived of more broadly.

The general problem of why a lesion produces a particular effect under conditions A and not under conditions B has plagued both clinicians and experimentalists in the form of recovery of function after brain injury, or delay in the manifestation of effects, or the sparing sometimes observed after two-stage operations. There are undoubtedly many ways in which performance impaired by a lesion may be improved; one obvious possibility is that the or-

ganism finds ways of doing a task that do not require the lost function. Of greater theoretical interest are the alternative possibilities that improvement occurs because (i) there is vicarious functioning such that one part of the brain can take over functions that it did not mediate before, or because (ii) when a system is partly, but not completely, destroyed, reorganization of the remaining portion of the system occurs, which then mediates the lost function. It is this latter position that Lashley espoused in his paper (1933) on the integrative functions of the cortex, and it is this position that seems consistent with the more recent data on the sparing observed after lesions in infant animals, although this view will have to be supplemented to encompass the complex effects associated with early lesions.

The experimental analysis of the specific problem of the effects of lesions in infancy began (in the United States) about 30 years ago. At that time, Kennard reported that motor cortex lesions in infant monkeys produced much less impairment in motor function than did later lesions; Beach reported that maternal behavior in rats was less impaired by cortical lesions made in infancy than by lesions made in adult animals; and Tsang reported that visual perception and maze learning were less impaired by infant lesions in the rat than by comparable adult lesions. Shortly after these reports, Hebb interjected a new note into this general problem by proposing, on the basis of an analysis of intelligence test scores in humans, that infant lesions produce general impairments in intelligence, in contrast to the selective impairments produced by adult lesions. Despite the provocative state of the problem—that infant lesions may be associated with lesser impairment in some functions but with greater impairment in intelligence—little direct experimental work ensued. In addition to the difficulties in interpreting human data, the Zeitgeist was oriented toward the broad problems of the localization of function and the development of behavioral techniques to investigate such problems; the question of differences between early and late lesions seemed a small problem that might

even disappear when progress was made on the big questions of the day.

The problem did not disappear, but merely lay dormant for close to 20 years. Several studies then appeared indicating that sparing of perceptual functions with infant lesions of primary sensory areas appeared for somesthesia and audition as well as for vision. Further, data began to appear for complex behavior akin to problem-solving, and here again, sparing of function followed the infant lesion in experimental animals. These new data led Harlow to propose that sparing of function with early lesions would occur primarily for functions that were not yet fully developed, and he and his colleagues provided a first approximation to a Gesell developmental schedule for monkeys in order to test this hypothesis. (Plausible though Harlow's hypothesis may seem, in the absence of data it could be argued equally plausibly that it is the well-developed skill that is less vulnerable to the effects of injury, as may be the case for adult injuries.) The present symposium reports a large part of the recent work on the effects of infant lesions on learned tasks of various kinds, but has relatively little to say concerning perceptual and motor functions.

The first paper, the only one not dealing with the effects of lesions, discusses the role played by steroid hormones in infancy in organizing the neural substrate mediating sexual behavior in the adult. Valenstein's paper is excellent, although similar reviews of this material have appeared recently, and it does present a few new data on some of the behavioral effects associated with masculinization of the female by androgen administration in infancy. Psychologists in particular will be interested in the data indicating that some of the nonsexual behavior patterns which distinguish the sexes (more rough-and-tumble play in juvenile males than in females) are less related to the sex of the organism defined genetically than to the "sex" of the neural substrate, defined by the presence or absence of androgen in infancy.

Isaacson and his colleagues, working with hippocampal lesions, rather forthrightly take the view that the effects of infant lesions point not to a simple trend toward sparing of function but rather to a pattern of functioning, as indicated by both anatomical and behavioral observations, that differs from that produced by late lesions. Histological evaluation of animals with infant

lesions shows some unusual anatomical configurations, as well as less destruction than expected, and raises the question of whether infant brains with lesions are capable of growth not seen in normal brains. On the behavioral tasks, a comparison of infant and adult lesions revealed the expected sparing for one task, equal impairment on another task, and a different pattern of performance for a third aspect of behavior. These observations gain in strength when it is seen that each is supported by one or the other of the next two papers.

Harlow and his colleagues present a detailed and complex analysis of the effects of frontal lesions, made at five different ages, on two well-studied tasks. As predicted, sparing appeared for delayed response, with increasing deficit appearing with the later lesions; most unexpectedly, the learning-set task appeared to be impaired, the more so the younger the age at injury (cf. Hebb's conclusions on intelligence in humans). Because of difficulties in interpreting some of the results, Harlow *et al.* conclude that the data neither confirm nor deny Harlow's hypothesis concerning the relation between age at injury and impairment, but suggest, at least, that any theory of localization of function must give serious consideration to the age variable.

Kling and Tucker, working with combined lesions in their analysis of frontal lobe function, also report that a delayed-response task showed the expected sparing but that a related task, delayed alternation, did not. More interestingly, the sparing on delayed response depended not on the vicarious function of unrelated cortical areas but on the integrity of the caudate nucleus, which has cortico-topic connections with the prefrontal lobes. These authors discuss the problems of rearing infants with different lesions, and mention some interesting observations on motor performance after extensive lesions of various types, but the brief descriptions are tantalizing rather than substantive.

In a broad-ranging paper in which a psychologist looks at the data available from developmental neurology, Lenneberg undertakes the difficult assignment of assessing the effect of age on the outcome of disorders of the central nervous system at the human level. Perhaps because of the attempted breadth, the paper is very superficial (with a disproportionately large number of references to nonprofessional journals), but there

are nevertheless two points to be gleaned from the discussion. First, Lenneberg notes that there are pathological changes in the brain associated with injury in infancy for which there are no good parallels in the adult. Second, perinatal lesions of the motor system produce symptoms that change with development (also reported by Kennard for monkeys); as Lenneberg says, the child "grows into his symptoms" (p. 165). This observation suggests that the nature of the impairment may be related to the developmental level at which the observations are made, a point raised somewhat parenthetically by Kling and Tucker and indirectly related to the problem raised by Harlow *et al.* of the confounding of age at injury with age at testing.

The papers presented in this symposium indicate a considerable development in thought from the rather vague notion that the infant brain is plastic. Sparing still seems to be the salient effect, and it is likely that much of the sparing will ultimately be accounted for by neuronal growth and reorganization within a physiological system, as implied in several of the papers. (Ex-

citing results have already begun to appear delineating the nature of such growth and reorganization.) An explanation for greater impairment after infant injury will probably have to be sought through an analysis of psychological processes, perhaps along the lines suggested by Hebb in his analysis of the factors in intelligence. A question that has not yet been raised, but must be considered in developmental studies, is whether the course of development after infant lesions is influenced by the nature of the organism's interaction with the environment. If sensory input normally plays a role in the maintenance and development of sensory systems during the neonatal period, is such input necessary for neural reorganization to take place after infant lesions? Can impairments be reduced by educative procedures? Such questions, of obvious theoretical and practical significance, are more likely to be answered now that serious efforts are being directed toward an analysis of the consequences of lesions in infancy.

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## African Societies: Authority and Advancement

**Social Theory and African Tribal Organization.** The Development of Socio-Legal Theory. KENNETH S. CARLSTON. University of Illinois Press, Urbana, 1968. xi + 462 pp. \$10.

A common characteristic of American academic culture is a wish to accentuate the positive. This is particularly noticeable to American scholars who, having been nurtured in the comparatively gentle and supportive seminars found in most U.S. universities, suddenly find themselves confronted by British colleagues many of whom are not reluctant to be red in tooth and claw. Our native tradition is to begin any discussion or critique with strong praise for the relatively sound parts of the position under consideration and only then, having made obeisance to a dominant value, to turn to the attack.

If I were resolved to follow this tradition, I would have to begin this review of Carlston's new book by examining his discussions of 13 African societies. This part of his book occupies 282 of the 439 pages of text and represents an enormous amount of

reading and synthesis on the author's part. One of the reasons given for including these ethnographies is to make the results of scattered and sometimes rather opaque reports of original research on African tribal peoples available to Western readers, and if this is taken to apply only to "general" readers Carlston achieves the objective fairly well despite some questionable omissions and some episodic failures to pick up what seem to be obviously important aspects of the societies and cultures whose descriptions he digests for us.

An example of such an omission is provided by the treatment of the Nayakusa of East Africa. Perhaps the most important single point in the political organization and religion of this society is that the members of the royal group, who occupy all chiefly and certain priestly positions, control the powers that bring or withhold fertility, while the commoners, from among whom come all village headmen and certain other kinds of priests, uniquely have the powers to kill or sicken with witchcraft or to prevent witchcraft