DOCUMENT RESUME

ED 028 817 PS 001 664

By-Eisenberg, Leon
The Social Development of Human Intelligence.
Harvard Univ., Cambridge, Mass. Medical School.
Pub Date Aug 68
Note-21p.; Paper presented at the Seventh International Congress of Mental Health, London, England, August, 1968
EDRS Price MF-$0.25 HC-$1.15
Descriptors-Biological Influences, Evolution, Human Development, Intellectual Development, *Intelligence, Mental Development, Mental Health, Racism, Resources, Social Attitudes, *Social Development, Social Influences, *Social Problems, Social Values

Intelligence makes man unique. To date man's use of this intelligence has been deficient. The deficit lies in the one-sided development of his problem-solving capacity; that is, an enormous growth has occurred in technological capabilities without a corresponding gain in solutions to social problems. This deficit is particularly significant because intelligence is, to a great degree, a product of the social environment. Important to the development of the brain is proper nutrition, a clean environment to reduce the effects of disease, adequate and varied sensory stimulation, and rich adult-infant social interactions. Yet, given the satisfactory development of the brain, the contrast between our intellectual prowess in understanding and manipulating the physical world and our insensitivity to (if not debased judgments of) the social purposes of that manipulation points up the perversion of intelligence. Today the problems for mental health and human development are (1) the Viet Nam war, (2) racism, and (3) the gross inequalities in access to resources between and within nations. (WD)

THE SOCIAL DEVELOPMENT OF HUMAN INTELLIGENCE

by

LEON EISENBERG, M.D.
PSYCHIATRIST-IN-CHIEF
MASSACHUSETTS GENERAL HOSPITAL

and

PROFESSOR OF PSYCHIATRY
HARVARD MEDICAL SCHOOL

PRESENTED AT THE SEVENTH INTERNATIONAL CONGRESS OF MENTAL HEALTH
London, August 1968

THE SOCIAL DEVELOPMENT OF INTELLIGENCE

Intelligence is that characteristic of the human organism that taxonimists have selected as the designation of its uniqueness by assigning the species name: sapiens. In this era of strife within and between nations, of gross inequities in the allocation of resources within and between nations, of runaway increase in human populations and massive uncontrolled pollution of our biosphere, to call our species "wise" would seem the ultimate irony, perhaps even the revenge of the gods for Linnaeus' hubris. Yet we clearly exceed all other animals in our ability to solve those problems we are willing to put to ourselves. The deficit lies in the one-sided development of that problem-solving capacity; namely an enormous growth in its technological capabilities without a corresponding gain in its social qualities.

The failure of our educational insitutions to have devoted equal time to the cultivation of the social roots of intelligence is a consequence of a gross misconception of its nature. Human intelligence is, in fact, a social product; that is, a product of the interaction between men. The misconception of intelligence as an autonomous individual trait has not lacked for leading thinkers to have challenged it; indeed, the challenge goes back at least as far as the French Encyclopedists. But the individualistic view was indelibly impressed upon educational institutions during the period of rapid growth of state supported schools in response to the manpower needs of industrialization. The dominant political model of the nineteenth century depicted national progress as resulting

from the venturesome activity of the individual entrepreneur under a government policy of economic laissez-faire. This model was given a pseudo-biological justification when Spencer, taking from Darwin only the catch phrase "survival of the fittest", managed to misrepresent the very delicate balance of cooperative and competitive factors in ecology as a replica of his own priveleged view of society. (1) That philosophy of industrial capitalism-cum-Spencerism continues to influence contemporary child rearing and schooling.

Let me at the outset set forth a very different set of premises which I believe to be warranted by the available theory and evidence in behavioral science. First, that intelligence develops and does not spring forth full blown at the moment of conception. Second, that its development is a social process, strictly dependent upon the quality and organization of the human environment in which it evolves. Third, that human intelligence is social intelligence; the problems on which it cuts its teeth, the methods it is able to elaborate, and the solutions it creates are set by the social context in which they are posed and solved. And fourth, that these theses, though academic in phraseology, carry revolutionary implications for social policy. The burden of my argument will be their justification.

To say that intelligence develops faces us at once with what is meant by development. (2) The term may be used in a Platonic sense: the changes over time are seen as the realization of that which was immanent from the first; that is, the attainment of an ideal given by

the gods or by the genes, as you will. In this sense, there is in fact nothing new as between adult and infant, merely the unfolding in the former of that whose essence was already fully present in the latter, much as the opening of a rose from its bud. Such a view is incompatible with the concepts of modern biology.

We can agree that nothing can appear in the adult organism, the capacity for which was not present in its genetic complement by definition. But that assembly of genes, while necessary, is not a sufficient condition of development. That is, given an embryo with certain genetic constituents, the transitions that occur over time are dependent on the interactions between those nuclear components and the surrounding cytoplasm of the cell, between the cell and its neighbors, between the organized cell mass of the embryo and its uterine environment, between the uterus and the body fluids of the mother, and between the mother and her physical and social environment. At particular stages in that developmental sequence, certain opportunities as well as certain vulnerabilities are present; before that stage they cannot be induced; after it, they cannot be recouped.

The most convenient illustrations of this principle come from experimental embryology. As the optic cups are extruded from the forebrain, they induce, in the overlying ectoderm, the formation of a crystalline lens. If the optic cups are removed before this stage, the lens fails to form; delayed replacement of optic cups from another embryo will not be successful in inducing lens formation if the time lag be excessive.(3) To take another example, the forerunner of the pancreas becomes deter-

mined as pancreas only if surrounded by mesenchyme. That is, even though the cells of the pancreatic rudiment have all their genes intact, they will not evolve into mature pancreas without a substance supplied by non-pancreatic tissue. Contrariwise, once that influence has been exerted, pancreatic development continues in the absence of further contact with mesenchyme.(4) At the level of systems, the development of fully mobile joints is dependent upon the random activity of muscles that produce the phenomenon we recognize as foetal movements. The regular intra-uterine injection of curare (which produces paralysis of muscles) into pregnant sheep results in the birth of lambs with ankylosed - that is, frozen - joints. (3) Examples need not be multiplied. The point is that development is sequential and interactional - or, as Aristotle termed it, epigenetic.

A second premise underlying my argument has even more ancient Greek roots. It is to be found in the Hippocratic dictum that the brain is the organ of the mind. I do not suggest that mind is fully to be explained by brain but that intactness of brain is a precondition for proper function of mind. Thus, our concern with the development of intelligence must include a concern for the development of brain. Setting aside for the moment phylogenetic considerations, let us consider ontogeny.

There are many biological factors capable of influencing central nervous system development in the foetus and young organism: time limits us to a few that are particularly salient to contemporary conditions. Complications of pregnancy and parturition (such as toxemia, bleeding and prematurity) are associated with brain defects in children who display

clinical disorders that extend from cerebral palsy and epilepsy through mental deficiency and learning disabilities.(5) The "biological" disorders in the mother are class related; the toll increases as the socio-economic scale is descended. Animal studies provide unequivocal evidence that protein deficient diets during pregnancy and lactation impair foetal and infant development and lead to permanent sequellae in adult life. The offspring of mothers so treated never attain the stature of control foster-reared litter mates, exhibit irreversible metabolic defects, and display impaired learning. (6) Clinical and epidemiological data attest to similar phenomena in infants of malnourished mothers and in infants exposed to the twin evils of malnutrition and infection in the first two years of life; witness the ghastly tragedy now taking place in Biafra. Unlike the catch-up that occurs when malnourishment is succeeded by repletion later in childhood, early affliction leads to permanent stunting of stature and performance.(7) Access to food and vulnerability to infection, I need not add, are functions of class and ethnic status. Thus the caste structure of society has major consequences for the biological integrity of the children who grow up in it. The toll is the highest in the underdeveloped nations of the world but the same morally intolerable and technologically inexcusable crippling of children occurs in the underdeveloped areas of so "developed" a country as my own. There is no more telling example of the gap between economic and moral development.(8)

Our abbreviated enumeration of the necessaries for brain development, however, has only begun. The central nervous system requires far more than protection from injury and adequate nutrition; its structures are critically

dependent upon a proper balance between excitation and inhibition for their very maintenance, let alone their maturation. The clearest illustration is to be found in the visual system; retina, optic nerve, geniculate body and striate cortex.(9,10,11) At birth, the retina is already intricately organized. It serves as a visual analyzer; there are cell groups that respond only to horizontal light fronts, others to verticals, still others to obliques, some to fronts moving left to right, others, right to left. Moreover, each eye commands fields of striate cells that it alone can trigger off as well as fields that are bilaterally responsive. Here we have a prime example of apparently autonomous development, for this organization predates visual experience. Yet, and this is its particular salience for my argument, these systems do not persist in the absence of adequate external reinforcement. If one eye of a newborn kitten is deprived of patterned visual input for several months, there is marked shrinkage in the striate fields it is able to excite and the surrender of much of its shared command; these changes persist indefinitely even after all obstruction to vision is removed. These functional changes are accompanied by shrinkage in the cell aggregate of the geniculate body served by that eye. A similar period of restriction later in life has no such effect.

Even more striking is the observation that the impact on the striate field of either eye is greater if only one eye is occluded. With both eyes sealed, there is less interruption of bilaterality. That is, it is not merely stimulation that matters, but pattern and balance as well. This elegant series of laboratory investigations (by Hubel and Wiesel) immediately suggests a clinical counterpart in the syndrome of <u>amlyopia ex</u>

anopsia. In a child with extra-occular muscle imbalance, there is progressive loss in central visual acuity in the deviated eye, such that normal vision cannot be restored if surgical correction of the deviation is delayed beyond the sixth year. This, then, is an example of neural pathways preformed at birth that deteriorate if they are not maintained by postnatal stimulation.

To pursue the visual system as a prototype one step further, we find that visual guidance of placing responses (again in the kitten) does not come about automatically, or even in the presence of passive visual experience, but only when the animal is permitted active exercise of movement and vision simultaneously.(12) These findings hold true for the visual and tactile systems in primates as well. (13,14) We need not here review an extensive literature. Suffice it to say that the alimentation of the brain is to be found in stimulus patterns as well as food stuffs.

If such processes as sensation and intersensory coordination display exquisite sensitivity to environmental contingencies, we can anticipate that higher order psychological functions will be even more responsive. In all vertebrates that have been studied, rearing in a restricted physical environment - which always involves social isolation as well - results in markedly deviant behavior. Songbirds, which in the wild sing in so species-typical a fashion that their songs identify them as precisely as their morphology, will, if reared in isolated sound proof chambers, emit no more than abortive caricatures of their normal lyric.(15) Dogs so reared fail to solve simple barrier problems, whirl in futile circles, and cannot compete against control litter mates reared in domestic environments.(16) In

monkeys so deprived, the mechanics of copulation itself, a process one might have supposed to be innate so fundamental to species survival is it, becomes an almost impossible enterprise; if successfully impregnated, such females function abysmally in mothering their young.(17)

Evolution trades the security of reflex automatisms in exchange for the selective advantage of initially riskier but ultimately more adaptive learned behavior; this process reaches its apex in man. The human infant is born the most immature of animals, with a brain only one fourth its final size. In consequence, the infant is dependent upon adult care-taking for the most prolonged period, but a period during which he is enabled to acquire the behavioral reportoire necessary for successful adult function. Parenthetically, that period is the longer, the more technologically elaborate society into which he is born; culture here has imitated nature.(8) The sensitivity to environmental subtleties, so clearly evident in lower forms, is therefore all the greater in man.

The evidence is clinical rather than experimental but it is compelling in its extent and its consistency. It is reported that King Frederick of Prussia, in his zeal to determine whether the original language of man-kind was Hebrew or Greek, ordered that babies be reared in a nursery without any words spoken to them; his linguistic experiment terminated unexpectedly when the babies languished and died. No one would today "deliberately" raise human infants in deprived environments but our con-sciences are not yet sufficiently nice to keep us from permitting those very conditions to come about by social neglect. Unhappily, therefore, data on the effects of deprivation abound in this age of the great society.

Infants who are reared in institutions staffed by few and inconsistent caretakers display marked retardation on all indices of physical and psychological maturation. If nutrition and cleanliness are maintained at a higher level but without specific enrichment of adult-infant social interactions, the lag in adaptive behavior continues and results in developmental quotients in the defective range.(18) If these conditions are allowed to persist throughout childhood, the youngsters exhibit the psychological stigmata of mental deficiency and become adults who function as poorly as those with intrinsic brain pathology. It is not known with certainty for how long severe psychosocial deprivation can be tolerated by the organism before the functional retardation becomes irreversible. Rapid and apparently complete recovery can occur following adoption into family life by the end of the first year.(19) Similarly gratifying results were obtained in the Skeels study by nursery school enrichment and home placement in the fourth year of life.(20) Other reports have been less sanguine.(21) The earlier the rescue and the more complete the restitutive measures the better is the outcome. We have a moral imperative to prevent stagnation in infancy but we have no less a responsibility to continue efforts at resurrection for the older victim; lest we condemn tens of thousands of children, we dare not draw unwarranted inferrences about irrecoverability on the basis of ethological concepts of critical periods valid for some species but not yet established for man.

Extremity of neglect with its inexorable consequences is of course the limiting case. It obtains for only a minority of children, though it should not be tolerated for a single child, given the means and the

knowledge we have at hand. Epidemiologically, the major problem is far larger number of children who experience psychosocial deprivation in lesser degree than the orphanage prototype but to an extent sufficient to impair developmental acquisition of the full range of cognitive abilities. These are the children of the poor, particularly those of low status ethnic groups. In the United States, those at greatest hazard are the black, the Amerindian, the Mexican and the Puerto Rican, but serious risk is present for Appalachian and other whites in isolated pockets of poverty. Without exception, comparative studies of academic achievement find the children of the poor scoring far less well than their middle class age mates, with the children of the black poor doubly disadvantaged.(22) The gap in school performance becomes progressively greater with ascending age and reaches a crescendo in high percentages of dropping out of school, subsequent unemployability and what society labels as social deviance. It has been fashionable since at least the time of Herbert Spencer to ascribe these soical class discrepancies to differences in biological fitness induced by assortative mating of the less capable. This theory has the peculiar virtues of at once allowing those of us who have made it to glory in our superiority and at the same time of justifying economies in social welfare and educational measures on the ground that we deal with inherent and irremediable defects. This belief persists, perhaps for these self-serving rationalizations, despite the progressive amassing of evidence that the most parsimonious explanation of these differences lies in social experience and that programs of early enrichment minimize, if they do not completely eliminate, the disadvantages associated with low caste.(23)

For the moment, however, let us interrupt our discussion of the ontogeny of cognitive functions and return to an examination of the phylogenetic roots of intelligence. The first hominid on route to homo sapiens was the Australopithecine ape-man whose fossil remains in southern Africa have been dated back some two million years.(24) His bone structures indicate a "habitually bipedal plantigrade primate"; that is, an animal that walked with its two feet flat on the ground.(25) The hind limbs are more sapiens-like than the fore limbs, thus identifying the assumption of the erect posture as the crucial step in freeing the hands for prehensile function. Of particular interest is the presence of primitive stone tools in the same stratum with Australopithecine fossils. If we may draw the inference that these eoliths were of Australopithecine manufacture, then we must conclude that planful tool making occured at a brain size (435-600 cc) no greater than that of contemporary great apes (275-750 cc) and was followed by a three- to four-fold expansion of the brain. Here we depart from Aristotle who argued: "Anaxagoras has said that it is the possession of hands that made man the most intelligent of animals. The probability is that it was because the most intelligent that he got hands." To the contrary, man's prehensile hands increased the adaptive value of brain mutations that enhanced their cunning. The use of tools freed hominids from their dependence upon powerful jaws to masticate plant foods and permitted unfettered expansion of the brain case. Active manipulation of the natural and social world played a crucial role in the further evolution of proto-man.

As to his social world, our evidence is at best inferential but it is internally consistent. Observations of primate colonies in the wild demon-

strate convincingly that social bonds are essential to the survival of the individual; correspondingly, genetic mechanisms that increase the likelihood of exhibiting and learning social behavior are fundamental in primate biology. The young have built-in mechanisms for clinging, rooting and nursing. The stimulus characteristics of the young have attractive value for the adult primate.(26) Nurslings and mothers alike exhibit signs of distress when they are separated. The young are indoctrinated into colony life by mothering, grooming, peer play, and heterosexual activity. They learn the facial, gestural and vocal patterns that serve to maintain a remarkably stable social organization, in which sustained intracolony aggressive behavior is far less common than cooperative, though heirarchically organized, behavior.

This telegraphic account suggests the antecedents of the social patterns in the stone age human societies that have survived into the contemporary era. They remind us that behavioral elements as well as structural ones are vital aspects of our biological heritage. All known food gathering and hunting societies exhibit the following general characteristics: relatively open groups of twenty to fifty members; a kinship ethic that prescribes mutual aid (indeed, food sharing appears to be the sine qua non of the human condition); division of labor by sex and by domestic unit; rules to regulate mating and competition; a craving by each individual for response from his social environment, a craving as fundamental as that for food.

The "intelligence" displayed by the members of hunting and gathering societies is different from, but not necessarily inferior to, our own. They may perform poorly when given tests of abstract geometric ability but

succeed admirably in tracking animals in the wilds, a test most of us would fail - though no Australian or African Binet has yet bothered to standardize it as a basis for arguing the genetic inferiority of Caucasians. The social invention which distinguishes man qualitatively from all other animals, his capacity for language, is a common discovery of all known human societies. Each healthy member of any given society is capable of learning any other language, at least if exposed to it early enough in life. Since only man has language, the capacity for language learning is genetic; what language is learned and how well it is learned is a function of individual social experience. The very possession of language - that is, symbols manipulated by rules of syntax - represents a high order of ability at abstraction. To be handicapped in social function by language impoverished in its vocabulary and its adherence to the grammatical rules of the standard-setting group in society is to suffer severe handicap indeed.

Just as languages differ, so do customs and values. To the Eskimo, the striking of a child was unimaginable; to California Indians, the very concept of war was incomprehensible. In some societies, the gods are malignant and vindictive; for others, benign and loving. The most remarkable characteristic of human behavior is its variability; aggression is no more ubiquitous than is generosity. Freud's dictum(27): "The tendency to aggression is an innate, independent, instinctual disposition in man" is a latter-day Spencerism, perhaps understandable as a pessimistic extrapolation from recent history but in no sense a biologically compelling conclusion. The ends to which intelligence is used are determined by social values just as they are molded by those values. What distinguishes human intelligence is the social context which is the necessary condition for its appearance.

If we are to build our social psychology on biological foundations, as I believe we should, let us do so with regard for the accuracy of the evolutionary generalizations we borrow. When we draw intellectual sustenance from Darwin, let us recall what Darwin (28) in fact had to say: "I use the term Struggle for Existence in a large and metaphorical sense, including dependence of one being on another, and including (which is more important) not only the life of the individual but success in leaving progeny." In man, success in leaving progeny depends upon a complex web of social behaviors to which the biological understructure is man's remarkable capacity for learning. It is arrant nonsense to talk of human nature as though it were a biological invariant (29). Surely, no social order can long survive that denies man's basic biology; hence, the rapid extinction of religious sects that demand celibacy. But the culture can demand the repression of overt aggression, as among Pueblo Indians, or solicit it actively, as among Brazilian Indians, without exceeding man's capacity for compliance. Biological variation does in part account for the differences in behavior within relatively homogenous societies. But whatever differences have been produced in the genetic pools of the major human groups by in-breeding are insufficient to account for the enormous cultural differences between them; these result from the history, the geography, the technology, the organization, and the acculturation patterns of each society. Thus, they are open to change, once a society determines that its existing structures are not fulfilling its aspirations. And this is precisely what is being demanded by the youth of countries as diverse as the United States, France, England, Czechoslovakia, the Soviet Union and

China. We should be profoundly grateful to the young, whose idealism represents the greatest asset for a better future. However tenuous the solutions they have as yet been able to offer us, they have pointed to the inhumanity of societies that make men slaves to machines, that celebrate public slogans which no longer conform to private experience, and that deny to the individual a right to participate in shaping his own life. We have been too ready to make our peace with existing evils.

Because we have not yet displayed the same concern for the social qualities of intelligence as we have for its merely technical attributes, our very accomplishments threaten our survival. Our scientific virtuosity has been put to the service of a nuclear armory now large enough to kill each of us many times over. Our extraordinary accomplishments in farm and factory have produced a glut of plenty in some nations while peoples elsewhere starve to death. Given the rising tide of expectations the world over, no nation of haves will be able to maintain a hegemony over the have-nots except at the cost of military adventure with its growing risk to survival.

The contrast between our intellectual prowess in understanding and manipulating the physical world and our insensitivity to, if not our debased judgements of, the social purposes of that manipulation points up in no uncertain fashion the perversion of intelligence. That which extended man's dominion can become the cause of his extinction, if it be divorced from its social roots. With a shudder, I recall to you Jan Myrdal's searing indictment of Western intellectuals:

> I take it for granted that my readers remember... the final solution of the Jewish question; the Stalin era, the Churchill decision to bomb the civilians, the colonial wars...OAS, the lying politicians, everything. But I want to underline that it has been the European, the Western intellectuals that have led and fulfilled these actions in every phase. We have filled the universities with learned men giving rational motivations and reasonable techniques for every crime. And in every new betrayal we have always been able to supply the demand for hangmen. (30)

The challenge is squarely put. It cannot be evaded. For this Congress on Mental Health to meet without making its position known on these issues crucial to human development is to fail our responsibility as professionals. The development of the mind does not take place in a psychological vaccuum; it is part and parcel of the conditions of life. To pretend that we are or should be neutral, are or should be beyond moral judgements, are or should be concerned with attitudes and not conditions, is to become not agents for man but accomplices in his betrayal.

The central and overriding problem for mental health and human development at this point in time is the Viet Nam war. It has cost tens of thousands of lives, hundreds of thousands of casualties. Resources sufficient to have made Viet Nam a paradise and to have gone a long way toward stemming the pestilence in American cities have been expended in a futile effort to combat ideas by killing people who do, or might, adhere to them. War has been the only condition known to a generation of Vietnamese children. American society has been plunged into a crisis of values; a nation cannot pledge itself to a holy war without having to deny the very humanity of its adversary and by so doing to decrease its own. If the major responsibility for ending that

war rests with the American people - and growing numbers of us are coming to recognize that responsibility - it is nonetheless essential that peoples the world over join in the crusade. The meetings in Paris that occur even as we meet here in London were a reluctant concession to peace sentiment; some of us doubt that they are intended to succeed; they will not, if we mistake promise for accomplishment and lessen our insistent press for its end on behalf of Vietnamese children, of American children, of all children.

The second major barrier to healthy development is racism. Its primary victims are the ethnic minorities who suffer physical insult and psychological assault. But those who are prejudiced and those who tolerate prejudice undergo a warping of their own psychological development, based as it is on a spurious sense of superiority. It rends nations in two and eats into the very fabric of the entire culture. The American crisis of race does not need recounting here; unhappily, racism is no unique American phenomenon. Its most virulent public proclamations may be found in South Africa and Rhodesia but rare indeed is the nation that is free of it, witness the antisemitism in Poland, the savageries against the Ibos in Nigeria, the restrictive immigration laws in England. Here again we who as professionals see the evil consequences of prejudice for oppressor as well as oppressed have a moral imperative to speak out, however unwelcome the message may be and whatever the personal consequences.

The third of the problems lies in the gross inequalities in access to resources within nations and between nations. Here I would remind you of the burden of my address: the cumulative toll of malnutrition, disease, family disruption and educational disadvantage upon mental development. Not only do we face the present misery of the underpriveleged child but

mankind will continue to pay the price in the crippling beyond repair of the future man. The resources now hoarded by the few must be used with generosity for the benefit of all, if any are to survive. Men will not do so while war exsanguinates them and racism blinds them.

Hence stems the order of priorities in which these three great goals of mental health have been listed. Our educational horizons must be expanded so as to include experiences that will enable the young to learn to recognize their dependence upon one another if they are to be motivated to strive for goals grander than personal gain. Such recognition flows precisely from an understanding of the social genesis of our common humanity.

I do not suggest that these goals are easily attained nor that no other significant problems remain. Indeed, history teaches us that each solution brings new challenges in its wake. There is no final state of grace. It is in the very process of striving for social betterment that man makes himself more human. A century ago, Frederick Douglas, a courageous black American who escaped from slavery to become a leader in the movement for the abolition of bondage, wrote: "Without struggle, there is no progress". I call upon you to join in that struggle in the name of children everywhere.

BIBLIOGRAPHY

1. Spencer, H.: Social Statics. London, Williams and Norgate, 1902.

2. Eisenberg, L.: Clinical considerations in the psychiatric evaluation of intelligence in Psychopathology of Mental Development. Zubin, J. and Jervis, G.A. (eds). New York, Grune and Stratton, 1967.

3. Coulombre, A.J.: Steps in embryonic development: Some implications for developmental pharmacology in Drugs and Poisons in Relation to the Developing Nervous System. Public Health Service Publication No. 1791. Washington, U.S. Department of Health, Education and Welfare, 1967.

4. Grobstein, C.: Cytodifferentiation and its controls. Science.: 143: 643-650, 1964.

5. Pasamanick, B. and Knobloch, H.: Retrospective studies in the epidemiology of reproductive casualty. Mervill-Palmer Quart. Behavior and Development 12: 7-26, 1966.

6. Chow, B.F., Blackwell, R.Q. and Sherwin, R.W.: Nutrition and development. Borden Review. 1968. (In press)

7. Cravioto, J., et al: Nutrition, growth and neurointegrative development. Pediatrics 38: 319-372, 1966.

8. Eisenberg, L.: A developmental approach to adolescence. Children 12: 131-135, 1965

9. Wiesel, T.N. and Hubel, D.H.: Effects of visual deprivation on morphology and physiology of cells in the cat's lateral geniculate body. J. Neurophysiol. 26: 978-993, 1963.

10. Hubel, D.H. and Wiesel, T.N.: Relative fields of cells in striate cortex of very young, visually inexperienced kittens. Ibid 26: 994-1000, 1963.

11. Wiesel, T.N. and Hubel, D.H.: Single cell responses in striate cortex of kittens deprived of vision in one eye. Ibid 26: 1003-1017, 1963.

12. Held, R. and Hein, A.: Movement-produced stimulation in the development of visually guided behavior. J. Comp. Physiol. Psychiat. 56: 872-876, 1963.

13. Reesen, A.H.: Effects of stimulus deprivation on the development and atrophy of the visual sensory system. Am. J. Orthopsychiat. 30: 23-36, 1960.

14. Nissen, H.W., et al: Effects of restricted opportunity for factual kinesthetic, manipulative experience on the behavior of the chimpanzee. Am. J. Psychol. 64: 485-507, 1951.

15. Thorpe, W.H.: The ontogeny of behavior in Ideas in Modern Biology. Moore, J.A. (ed). New York, Natural History Press, 1965.

16. Melzak,R.: Effects of early experience on behavior in Psychopathology of Perception. Hoch, P.H. and Zubin, J. (eds). N.Y., Grune and Stratton, 1965.

17. Harlow, H.F. and Harlow, M.K.: The effectional systems in Behavior of Non-Human Primates (Vol II). Schrier, A.M., Harlow, H.F. and Stollnitz, F. (eds). N.Y., Academic Press, 1965.

18. Dennis, W. and Najarian, P.: Infant Development Under Environmental Handicaps. Psychol. Monogr. 71 (7), 1957.

19. Sayegh, Y. and Dennis, W.: The effects of supplementary experience upon the behavioral development of infants in institutions. Child Develop. 36: 81-90, 1965.

20. Skeels, H.H.: Adult Status of Children with Contrasting Early Life Experiences. Monogr. Soc. Res. Child Develop. Serial# 105, 31 (#3), 1966.

21. Goldfarb, W.: Emotional and intellectual consequences of deprivation in infancy in Psychopathology of Childhood, Hoch, P.H. and Zubin, J. (eds). N.Y., Grune and Stratton, 1965.

22. Eisenberg, L.: Reading retardation: I. Psychiatric and sociologic aspects. Pediatrics 37: 352-365, 1966.

23. Eisenberg, L.: Social class and individual development in Crosscurrents in Psychiatry and Psychoanalysis, Gibson, R.W. (ed). Philadelphia, J.B. Lippincott Co., 1967.

24. Dart, R.A.: Australopithecus africanus: The man-ape of South Africa. Nature 115: 195-199, 1925.

25. Napier, J.: The locomotor functions of hominids in Classification and Human Evolution. Washburn, S.L. (ed). Chicago, Aldine, 1963.

26. Rheingold, H.L. (ed): Maternal Behavior in Mammals. N.Y., John Wiley and Sons, 1963.

27. Freud, S.: Civilization and Its Discontents. London, Hogarth Press, 1930.

28. Darwin, C.: On the Origin of Species. A facsimile of the first edition. Cambridge, Harvard University Press, 1964.

29. Eisenberg, L.: Can human emotions be changed? Bull, Atomic Scientists 22: 27-31, 1966.

30. Myrdal, J.: Confessions of a Disloyal European. N.Y., Pantheon Books, 1968.