

weight, skin-fold thickness, and musculature in favor of children from high social and economic status families. By the time they reach adulthood, much of the difference is reduced or even cancelled. Social and economic factors are most evident among males. In fact, most environmental influences seem to affect males more strongly than females. The reasons for such differences are unclear.

Psychological Stress

There is considerable evidence that extreme stress can slow physical growth and development. The mechanisms involved in such effects are unclear, although stress may negatively affect the secretion of growth hormones. A cluster of factors like maternal care, social isolation, parental substance abuse, and sexual abuse are linked to psychological and emotional ill health. Recent research has also indicated that some children are genetically predisposed to stress and respond to it in an extreme and prolonged manner that results in restricted growth.

Pollutants

Physical growth is sensitive to several pollutants, including lead, air pollution, certain organic compounds, and tobacco smoke. Of course, pollutants are somewhat unavoidable in the modern world, but levels of pollution vary considerably, and so its effects will be different among different groups. To take only one example, smoking by the mother during pregnancy is well known to affect both birth weight and an infant's subsequent growth. It also seems that living in a home with smoking parents is related to reduced height and weight throughout infancy and childhood. The insult to weight seems to be corrected as the individual moves toward adolescence; the deficit in height is probably never made up.

CONCLUSION

Physical growth is essentially a biological process, but it is affected and constrained by the environments in which it takes place. The interaction of biological and environmental factors accounts for the great variation in growth that is evident among both individuals and whole populations. It also influences the development of other physical characteristics, such as movement skills.

Growth is an important, if often overlooked, aspect of human development. Its centrality is most evident during the periods of infancy and childhood, when

physical changes make available a wide range of new behaviors and experiences. Physical growth and development affect the way individuals perceive themselves and how others perceive them. Growth also gives visible clues of an individual's stage of overall development and of that individual's state of health and well-being. As such, it warrants attention by all of those interested in human development.

—Richard Bailey

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PIAGET, JEAN (1896–1980)

The Swiss psychologist and renowned scientist in cognitive psychology, Jean Piaget is arguably best known for formulating his influential theory of childhood cognitive development. Piaget was the oldest child of Rebecca Jackson and Arthur Piaget, an academic in the field of medieval literature. Piaget studied the natural sciences at the University of Neuchâtel and by the age of 21 had published 25 articles on mollusks. In 1918, he was granted a doctorate degree in biology and began pursuing his interest in incorporating empirical methods into the field of genetic

epistemology—the study of the development of knowledge.

Following graduation, Piaget studied psychoanalysis and experimental methodology at the University of Zurich and then at the Sorbonne in Paris. It was in Paris that Piaget collaborated with Alfred Binet and Theodore Simon to construct intelligence tests for children. As such, Piaget observed many of the errors that children made on intelligence tests and began to notice possible sequential steps involved in children's cognitive development.

Piaget viewed cognitive development as a result of the interaction between the individual and the environment. His perspective contrasted with two other dominant views of cognitive development, one positing that cognitive development derived from innate abilities, and the other positing that children's minds were blank slates that passively acquired knowledge from the environment.

Piaget proposed that children progress through four stages of cognitive development that follow an invariant order: (1) the sensorimotor stage (newborn to 2 years), in which infants understand their world through direct actions; (2) the preoperational stage (2–6 years), in which children begin to represent people, objects, and events in an illogical and egocentric manner in their minds; (3) the concrete-operational stage (6–12 years), in which children logically reason about concrete events in the world; and (4) the formal-operational stage (beyond age 12), in which children are capable of abstract and hypothetical thinking. Piaget emphasized that children's minds are not necessarily immature versions of adults' minds; rather, children's cognitive processes qualitatively differ from those of adults.

Overall, Piaget's formulations of cognitive development have yielded major insights into the child's mind. Despite the fact that his theory has been fairly criticized by contemporary researchers, Piaget's ideas have had a lasting effect on the field.

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See also Cognitive Development, Concrete Operational Period, Fluid Intelligence, Theories of Development

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POLYCHLORINATED BIPHENYLS (PCB)

Polychlorinated biphenyls (PCBs) are a class of organochlorine chemicals that were discovered to be teratogenic in two mass human poisoning incidents due to contaminated cooking oil in Japan in 1968 and in Taiwan in 1978. The acute illness was termed *Yusho* in Japan and *Yu-Cheng* in Taiwan, for "oil disease." The onset of acute symptoms of PCB exposure in adults is delayed after exposure by a month or more. The symptoms of acute PCB exposure include chloracne (a rash with blackheads and acne-like eruptions), fatigue, nausea and vomiting, swollen eyelids, disturbed vision, numbness and pain in the limbs, and altered liver function. Prenatal exposure to PCBs and related chemicals (dibenzofurans and dioxins) in the contaminated cooking oil in Japan and Taiwan caused birth defects including mental retardation, misshapen fingernails, discolored skin, abnormal eye secretions, natal teeth, and dental malformations.

After the discovery of the teratogenic effects of PCBs in these poisoning incidents, prospective longitudinal studies were begun of low-level exposure to PCB residues in food. One longitudinal study found that prenatal exposure to much lower concentrations of PCBs from residues in food (Lake Michigan sport fish) is associated with suboptimal neurological functioning in infancy, lower performance on an infant memory test (the Fagan Test of Infant Intelligence), lower performance on attention and memory tasks in childhood, and lowered intelligence quotient (IQ) and reading test scores in late elementary school. More highly exposed children were slightly smaller, indicating that physical growth is also altered. Research controversies have centered on the replicability of the results, whether PCBs themselves are responsible for the effects as opposed to other contaminants that occur in the presence of PCBs, and what PCB congeners (chemical variants) may actually be responsible for the observed effects.

Other prospective longitudinal studies of PCB and organochlorine chemical exposure in Europe and the United States have largely replicated the results of the study of Lake Michigan fish eaters. In addition, findings indicate that children prenatally exposed to higher