References and Notes

1. See N. Butlin, "Colonial socialism in Australia," in *The State and Economic Growth*, H. G. J. Aitken, Ed. (Social Science Research Council, New York, 1959), for a historical analysis of state economic action.
2. J. D. B. Miller, *Australian Government and Politics* (London, ed. 2, 1958), pp. 200 ff.
3. For a discussion of this point see S. Encel, *Australian J. Politics and History* **6**, No. 1 (1960).
4. The "export of talent" is bitingly discussed by a leading zoologist, A. J. Marshall, in a wartime pamphlet entitled *Australia Limited* (Sydney, 1942).
5. In 1959, the Commonwealth government decided to amalgamate the Australian National University with the Canberra University College, a small teaching institution set up in 1930, most of whose students until recently were civil servants taking part-time courses. The Australian National University, as reconstituted by an act passed in 1960, consists of an Institute of Advanced Studies and a School of General Studies.
6. These and other figures, unless specifically indicated, are drawn from the annual budget papers and from the official *Commonwealth Yearbook*.
7. This problem is discussed by J. Gani and A. Blakers, *Universities Quart.* **1959**, No. 1 (1959) and *Scientific and Technical Manpower in Australia* (Australian Academy of Science, Canberra, 1957).
8. An analysis of the sources of university research funds in Britain is to be found in G. L. Payne, *Scientific and Technological Manpower in Great Britain* (Stanford, London, 1960).
9. D. P. Mellor, in *Official History of Australia in the War* (Sydney, 1957).
10. See G. Sawer, in *The Public Corporation*, W. Friedmann, Ed. (Toronto, 1954), and S. Encel, *Public Administration* **38**, No. 3 (1960).
11. See *Science in Australia* (Australian National Univ., Canberra City, 1951) for a discussion of these and related problems.
12. *Report of the Committee on Australian Universities* (Canberra, 1957), pp. 27–28.
13. See A. G. Lowndes, Ed., *South Pacific Enterprise* (Sydney, 1958), for an account of the company's activities.
14. In 1955 the Institution of Engineers, Australia, surveyed 104 large firms with an annual output of £A500 million, and found that they spent £A1.7 million on research and development; this amount represented 0.3 percent of turnover.

Arnold L. Gesell: "Behavior Has Shape"

"In countless American homes the name of Arnold L. Gesell was better known than that of the President of the United States. And to great numbers of the occupants of those homes Arnold Gesell was a far more important man than the occupant of the White House. . . . His work over many years in the fields of pediatrics and child development paved the way to health and success for thousands, mayhap millions. Dr. Gesell was a pioneer, one who traced uncharted paths to charted conclusions." So commented an editorial in the New Haven *Register* at the time of Gesell's death on 29 May 1961.

The application of his findings to the everyday child in the everyday home was the fruit of half a century's painstaking study—half a century of careful analysis of the behavior patterns of human infants and children as these patterns grew and changed with the child's increasing age.

A single central concept—brilliant in its simplicity and one to which he clung in the face of often strong opposition—was the basis of all of Gesell's work on age levels from fetal ages on through adolescence. This was the concept that developing behavior has as much structure as does the developing physical organism, that behavior develops in a patterned, highly predictable manner, and that it is measurable. "Behavior has shape. Mind manifests itself." These are two statements which his students and colleagues were to hear over and over again.

While environmentalists were going to great lengths to measure the extent to which environmental forces determine behavior and even individuality, Gesell reminded us again and again that "environmental factors support, inflect, and modify, but they do not generate the progressions of development. Growth is an impulsion, and a cycle of morphogenetic events is uniquely a character of the living organism."

Gesell's first work at Yale, in 1911, when he founded his clinic which after several changes of name came to be known as the Yale Clinic of Child Development, was with retarded school-age children. However, at that time he was "in auditory communication at least," as he used to say, with a well-baby clinic across the corridor. And very soon he began to feel that the place to start a study of human behavior was with infants, and with normal infants at that.

And so for 20 years he carried on a painstaking and step-by-step analysis of infant behavior, chiefly as expressed in normatively controlled test situations as these infants responded to simple stimulus objects such as cube and pellet and bell. From this analysis he not only established the fact that infant behavior does develop in a patterned, orderly manner through stages which are alike in quality and sequence (even though not in exact time of occurrence) from child to child, but also described these stages.

Gesell tracked down the patterned behavior changes in infant and child through the age of 16 years—an endeavor which he completed in 1956 with the publication of *Youth: The Years from Ten to Sixteen.* From this base, the application of his findings spread into two widely diversified fields.

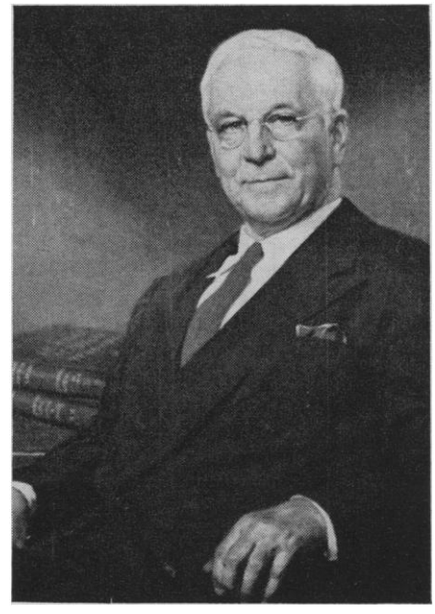
Clinically these findings were applied in the field of practical pediatrics. Gesell was perhaps the first to insist that "development as well as disease lies clearly in the province of clinical pediatrics." It was largely as a result of his untiring efforts that in the early 1940's the American Academy of Pediatrics changed its admittance examination to include a section on the development of infant behavior. Many pediatric clinics now quite routinely give the Gesell Developmental Tests to infants and preschool children in an effort to determine not so much their I.Q. as their D.Q. (developmental level or developmental quotient). In his last ten years at Yale, Gesell and his staff trained pediatricians not only from all over the United States but from all over the world (in fact his work at times found more ready acceptance in European countries than in our own). Gesell considered that the developmental examination was in fact a neuro-

logical examination and that, especially in cases of defect and deviation, it could give a valid indication of how far behavior had developed.

The impact of his work in a second main area stemmed from his direct contribution of a clear and simple description, for parents, of behavior characteristics of successive age levels from infancy through 16 years of age. He described behavior for each age level in terms not only of all the things a child can do at that age but of special characteristics of that age. Noteworthy was his finding that, in accordance with a principle of reciprocal neuromotor interweaving which he emphasized, ages of equilibrium and of disequilibrium, ages of flexion and of extension, ages of inwardized and of outwardized behavior tend to alternate.

Gesell's extreme productivity during an unusually long career (after his retirement from Yale he worked actively as research consultant at the Gesell Institute, founded in his honor in 1950, until he was 78) is evidenced by a bibliography of his writings, which at the time of his death at 80 included well over 400 items. Among his best-known books were *The Mental Growth of the Preschool Child* (1925); *Psychology of Early Growth* (1938); *Atlas of Infant Behavior* (1934); the trilogy *Infant and Child in the Culture of Today, The Child from Five to Ten*, and *Youth: The Years from Ten to Sixteen* (1943–1956); *Embryology of Behavior* (1945); *Developmental Diagnosis* (1941); and *Vision: Its Development in Infant and Child* (1949). These and his many other books were translated into more than two dozen different languages.

His scientific articles covered a wide variety of fields, including retardation, cerebral palsy, cretinism and mongolism, visual deviation, and twinning, as well as behavior of normal infants and children. All, however, dealt with the central theme of the measurable growth of behavior and of behavior deviation.



Arnold L. Gesell

A method of analysis which he did much to further was the use of motion pictures in the study of child behavior. In 1925 he started the collection known as the "Yale Films of Child Development." Pictures were taken in the now well-known Dome, and miles of systematically exposed film, both 16- and 35-millimeter, were gradually made available for the analysis of behavior patterns and for editing and use as teaching and demonstration films. Gesell was also, so far as is known, the originator of the one-way-screen method of observation now so widely used.

The flexibility and wide application of the developmental point of view is evidenced by the fact that it has turned out to be uniquely useful in fields which were scarcely thought of when Gesell began his work—such widely divergent fields as that of vision in infant and child and that of the projective techniques—two areas in which he did a considerable amount of effective work toward the end of his long career.

It was an ironical matter of timing that much of Gesell's work was done against the current of a very different theory of child behavior prevalent in this country during the period of his investigations. The atmosphere at Yale's Institute of Human Relations in the 1930's was hardly favorable to his developmental philosophy, and the emphasis on psychoanalysis that dominated the behavior sciences in the 1940's was no more propitious. This relative isolation from certain groups of his fellow scientists gave strength and unity to Gesell's work but possibly prevented his theories and findings from having the impact on many child psychologists that they had on practicing pediatricians and on the public.

Nevertheless, by 1956 Helen Puner could write in an article that appeared in *Harper's* in March of that year: "Now in the late fifties, 'constitutional factors' and 'the nature of the baby' are being mentioned and written about once again . . . It is beginning to be recognized that Dr. Gesell was correct in his belief that 'personality cannot be understood as a direct reflection of its shaping force . . .' In fact it may easily be that Dr. Gesell's aim—if not his point of view—has not been so much behind the times as ahead. For today it is he, and he alone, who has built up the only systematic body of observations on the development of human behavior and personality."

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