

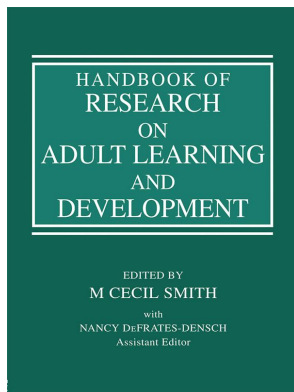
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Publisher: *Routledge*

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## **Handbook of Research on Adult Learning and Development**

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### **A Brief History of Research and Theory on Adult Learning and Cognition**

Publication details

<https://www.routledgehandbooks.com/doi/10.4324/9780203887882.ch16>

Dennis Thompson

**Published online on: 07 Nov 2008**

**How to cite :-** Dennis Thompson. 07 Nov 2008, *A Brief History of Research and Theory on Adult Learning and Cognition from: Handbook of Research on Adult Learning and Development* Routledge  
Accessed on: 29 Nov 2023

<https://www.routledgehandbooks.com/doi/10.4324/9780203887882.ch16>

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HANDBOOK OF  
RESEARCH  
ON  
ADULT LEARNING  
AND  
DEVELOPMENT

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First published 2009  
by Routledge  
270 Madison Ave, New York, NY 10016

Simultaneously published in the UK  
by Routledge  
2 Park Square, Milton Park, Abingdon, Oxon OX14 4RN

This edition published in the Taylor & Francis e-Library, 2008.

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*Library of Congress Cataloging in Publication Data*

Handbook of research on adult learning and development / edited by M Cecil Smith with Nancy DeFrates-Densch.

p. cm.

Includes bibliographical references and index.

1. Adult learning—Research—Handbooks, manuals, etc. 2. Adult education—Research—Handbooks, manuals, etc. I. Smith, M Cecil. II, DeFrates-Densch, Nancy.

ISBN 0-203-88788-3 Master e-book ISBN

ISBN 10: 0-8058-5819-9 (hbk)  
ISBN 10: 0-8058-5820-2 (pbk)  
ISBN 10: 0-203-88788-3 (ebk)

ISBN 13: 978-0-8058-5819-8 (hbk)  
ISBN 13: 978-0-8058-5820-4 (pbk)  
ISBN 13: 978-0-203-88788-2 (ebk)

# A Brief History of Research and Theory on Adult Learning and Cognition

*Dennis Thompson*

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When one examines the research on cognitive aging and the theory on adult learning, one is essentially looking at two different fields which to a large extent developed independently of one another, but today form much of the knowledge base of adult cognitive development. This chapter will seek to explore the history of these areas of inquiry beginning with the pre-scientific era, then will turn to the period ranging from the early 1920s to the 1950s, and then look in more general terms at the modern era. The focus will be on offering a picture of the road traveled leading to where we are today. Attention will be paid to the people, the research, the theory, and some of the dynamics behind what took place.

## Early Contributors to the Study of Adult Learning

The scientific study of aging is often said to have begun with Adolphe Quetelet (1796–1874) but there was much work that had been underway by that time. Frederick Zeman (1979) lists literally hundreds of references devoted to the study of aging published before Quetelet. Most of these early reports were made by physicians who were interested in the study of extreme longevity. However, some of this early work conducted by physicians examined cognitive change in old age as well as physical well-being.

One of the physicians to write on cognitive development was Benjamin Rush (1745–1813). Rush who lived in Philadelphia also happened to be Benjamin Franklin's personal physician and refers to Franklin in his later years in several places in his writing. As a tribute to his contributions, Rush appears today as part of the logo of the American Psychiatric Association. Rush includes a chapter on old age in Volume One of his four volume *Medical Inquires and Observations* (1805). In it he makes observations on the aging process, and makes recommendations on ensuring a long life. The sample consisted of observations of his patients aged 80 and above observed over a five-year period. In many ways Rush's observations seem quite modern. One point that he makes in several places in his observations is that older persons benefit from mental activity as much as do younger people. In a section which he labels "Moderate Exercise of the Understanding," he argues that literary people, who he believed to be among the most mentally active, live longer than others. But he goes on to argue that any occupation which is intellectually stimulating will bring about similar benefits. Later in his discussion he presents the case of Jonathan Swift (1667–1745) as an example of his point. According to Rush, Swift refused to use glasses in his old age—which made it impossible for him to read. Gradually, he also withdrew from most of his social contacts. Rush observed that these events "left his mind without its usual stimulus: hence it collapsed into a state of fatuity" (p. 442).

He made a number of observations on memory. He argued that while memory was the

first faculty of the mind to fail, “understanding” remained more stable with age. He cites a conversation that he had with Anthony Benezet (1713–1784) in which Benezet provided an argument that failing memory was an advantage:

You read a book (said he) with pleasure but once, but when I read a good book, I so soon forget the contents of it, that I have the pleasure of reading it over and over; and every time I read it, it is alike new and delightful to me. (as cited in Rush, 1805, p. 441)

In his history of aging, Birren (1961) cites Adolphe Quetelet as the first to produce and to participate in a quantitative psychology of aging. Quetelet was born in Ghent, Belgium in 1796 and received the first doctorate in science from the University of Ghent in 1819 in mathematics. Following his degree, he became interested in probability and began work on what is today known as the normal curve. In 1835 Quetelet published *A Treatise on Man and the Development of his Faculties. On Man*, as it is sometime known, is a marvelous and extensively referenced book. Quetelet was well read on the demographic data of the time, and frequent citations are provided to support his arguments and observations.

Containing data dating back to the 1690s, Quetelet provides us with some of the earliest statistical data that we have on human beings. Individuals interested in the demographics of the aging process will find much of interest here. He reviewed available mortality data in relation to age, gender, urban and rural location, as well as other demographics. Quetelet, however, wanted to go beyond an analysis of the “physical quantities of man” as he put it. In introducing his chapter on the intellectual qualities of man he wrote that:

An appreciation of the physical qualities of the average man does not present any real difficulty, whether we can measure them directly or whether they only become appreciated by their efforts. It is not so with the moral and intellectual qualities. Indeed I do not know that any real person had thought of measuring them. (p. 73)

In his section on the development of intellectual faculties, he sought to “determine the period in which memory, imagination, and judgment commence, and the stages through which they successively pass in their progress to maturity, then having established the maximum point, we may extend our inquires to the law of their decline” (pp. 72–73). He added that the methods used would need to be objective, and would need to be generalizable across locality.

In order to accomplish this, he presents an analysis examining the relation of age to the production of French and English drama among a group of 71 playwrights. Quetelet argued that very few of the playwrights were producing work before age 25. But by the late 20s, productivity “manifests itself very decidedly” and “continues rigorous until towards the 50th or 55th year” (p. 75). After that there is decline in productivity, especially for works which were judged by Quetelet to be of the greatest artistic success. What is particularly interesting about Quetelet’s work is that at one point in the discussion he included an adjustment for longevity of the playwrights. Quetelet reasoned that since some playwrights in his sample lived longer than others, he conducted a subsequent analysis that divided the number of works produced at a certain age by the number of playwrights still living to produce them. By doing this, he found that productivity lasted

longer into the older years than was indicated in his initial analysis. In his arguments, he anticipates far more modern analysis (see, for example, Dennis, 1966 and Lehman, 1953).

Birren (1961), in his analysis, argues that Quetelet and his late 19th century colleague Sir Francis Galton (1822–1911) were among the first to question the fatalistic concept popular in the early 19th century under which it was believed that while it was acceptable to study the physical world in terms of natural laws, human behavior could not be acceptably looked upon as a consequence of identifiable biological and social determinants. Quetelet discusses the difficulty that arose after the publication of his first edition in 1835. In the Edinburgh English language translation published seven years later in 1842, Quetelet added a detailed preface responding to criticism of the first edition of his book. Because he had sought to identify biological and social determinants behind human behavior, he saw himself as having been accused of denying free will by some and of being a fatalist by others. He felt that the study of the anatomy of man had become an accepted science and called for a time in which the study of the “moral anatomy” of man would be equally accepted.

Birren (1961) writes that if we are looking for an individual following Quetelet who engaged in the purposeful gathering of psychological measurements of development and aging, that individual is certainly Galton. In 1884 Galton established an “anthropometric laboratory” at the International Health Exhibition in South Kensington, London. From this location over the course of a year, 9,337 individuals were tested. A similar laboratory which operated for several years was established in the Sciences Galleries of the South Kensington museum in 1888. In total, these laboratories provided data on approximately 17,000 individuals, with an approximate age range of 11 to 84 years.

For three pence, participants were measured on a variety of physical and functional measures. Physical measures included head length, head breadth, standing height, height to top of knee, arm span, length of lower arm, length of middle finger, and weight. Functional measures included strength of hand squeeze measured by a denominator, vital capacity, visual acuity, highest tone that could be heard, a variety of reaction time measures, and a number of tactile sensitivity measures. Chief among Galton’s arguments was the belief that large brains were related to strong mental powers and these were related to a large head, long arm span, strength, rate of movement, visual acuity, and lung capacity.

Galton’s data from the anthropometric laboratory were first published in 1885. Here Galton tells us that his observations were based on 4,726 adult males and 1,637 adult females (age not specified). But while Galton’s report may be the first to specifically study large numbers of adults, Galton had relatively little to say regarding age changes or age differences across the adult years. In fact, in only two places in the report are specific age differences discussed. A table of breathing capacity reveals data by age and gender. Peak capacity came at about age 30 for both genders with capacity declining about 16% in males and 19% in females by age 55. While he does not provide specific age related data on the subject, he comments on the relationship between breathing capacity and other physical measures such as hand squeeze. Perhaps this report is best remembered as first demonstrating the relationship between age and hearing, noting a significant age related decline in hearing high frequencies. Oddly, the age related decline was greater for females than males, exactly the opposite of most contemporary analyses. Some years later, Galton in describing these results, cites a Dorsetshire proverb, “that no agricultural labourer who is more than 40 years old, can hear a bat squeak” (as cited in Pearson, 1914).

Johnson and colleagues (1985) have argued that Galton understood the relationship between the stability of a statistic and sample size, and while he solved the problem of large scale data acquisition, the problem of analyzing his huge data set was not adequately solved during his lifetime. It was not until the 1920s that Galton's large data set was analyzed in any meaningful way. Perhaps in the best known of these reports, Ruger and Stoessiger (1927), analyzed Galton's data and presented growth curves regarding each of a number of attributes for over 7,000 male subjects. In their report they presented growth curves for Pull, Grip, Swiftness of Blow, Sense of Perpendicularity, Error of Bisection and Error of Trisection for individuals aged between 22 and 42. Decline in scores across these several measures was small, averaging approximately two and one half percent. Slightly later, Elderton and Moul (1928) performed similar analysis on 1800 female subjects. Ruger (1933) and Ruger and Pearson (1933) presented age corrected intercorrelations among a number of Galton's measures. All of these reports were based on the first of Galton's laboratories. A detailed analysis of the second laboratory in the South Kensington Museum can be found in Johnson, McClearn, Yuen, Nagoshi, Ahern, and Cole (1985).

One of Galton's most significant contributions was the opening up of the psychology of aging to objective study. But Galton had no students to carry on his work, and the opening up of the psychology of aging did not exactly occur overnight. Indeed, both Birren (1961) and Irving Lorge (1940) argued that very little occurred following Galton's work until the 1920s. While this statement is perhaps true as a general summary, it is certainly not the whole story. Edmund Sanford at Clark University presented what is arguably the first statement on the life span by an American psychologist in a lengthy article published in 1902. Moreover, Thorndike (1928) cites over 35 references which addressed adults as subjects published between 1896 and 1920.

### Modern Contributions to the Study of Adult Learning

When the transition did come, it came quickly. The 1920s was a period of rapid development in the field, not quite like anything which had occurred before. Within a six-year period, from 1922–1928, the foundation for the field which remained up to the beginning of World War II had been laid. Take, for example, the fact that in 1922, G. Stanley Hall published *Senescence* followed by Eduard Lindeman's *The Meaning of Adult Education* in 1926, Harry Hollingworth's *Mental Growth and Decline* in 1927, Edward Thorndike's *Adult Learning* in 1928, and the organization of the Stanford Later Maturity Studies under Walter Miles, also in 1928. Indeed by the time that Floyd Ruch developed his bibliography for use at the Stanford studies in the early 1930s, the available references had burgeoned to nearly 150 entries.

What might have led to this growth of interest? One explanation might simply be the growth of developmental psychology as a whole during this same period. A statement in Dale Harris' *The Concept of Development*, published in 1957, was that there were only three psychologists in a 1919 survey who identified themselves as developmental. By the early 1930s, however, the field had grown so rapidly that two major handbooks had been published each containing two volumes.

But there are other explanations for the growth of interest in adulthood and aging. Much of the early growth of the field of aging had to do specifically with cognitive aging. It would seem that one possible explanation for the growth of the psychology of aging had to do with the emerging interest in better and more widely distributed adult education.

### **Role of American Universities**

Psychology's interest in adulthood and aging may have had several facets. For one, universities began to see their mission as more than educating the few who could afford to attend college. One way this change was expressed was the development of the university extension program. The concept of the university extension program was originally borrowed from England with the first decade of transfer to the United States occurring in the 1880s. Up to this time, American college teachers had been making their knowledge available to the general public, primarily through the use of individual talks and lectures. The pioneer exponent of university extension in America was Herbert Baxter Adams (1850–1901), an historian at Johns Hopkins. In the middle 1880s Adams began to talk and write about the university extension that he had observed in England. What Adams saw in university extension was an alternative to the fragmentation and discontinuities of subject matter inherent in presentation of single lectures unaccompanied by any other discipline than voluntary attendance.

But the British model of extension was still based on education for an elite few. An Americanized version involving education for large numbers did not take shape until the years just before World War I. The new tone was most effectively formulated by Louis E. Reber (1858–1948), director of the extension service at the University of Wisconsin. By 1907 he was able to argue:

Right or wrong, you will find here a type of University Extension that does not disdain the simplest forms of service. Literally carrying the university to the homes of the people, it attempts to give them what they need—be it the last word in expert advice; courses of study carrying university credit; or easy lessons in cooking and sewing. University Extension in Wisconsin endeavors to interpret the phraseology of the expert and offers the benefit of research to the household and the workshop, as well as to municipalities and the state. (as cited in Grattan, 1955, p. 193)

A second emerging factor had to do with the changing view of apprenticeship and the emerging concept of vocational education. In colonial times what we now call vocational education was covered by home training and apprenticeships, and these sufficed until the end of the eighteenth century. But as techniques of production changed in the 19th century, the domestic apprenticeship system declined in importance, and as the home ceased to be something of a self-contained economic unit, its teaching function narrowed. Yet the need for vocational training continued. But there was no direct and easy road to the institutionalizing of vocational training.

The net result was to help establish adult education as a legitimate activity of the public school system, with the greatest change coming in the 1920s. As late as 1917, several states continued to have laws actually prohibiting the use of public funds for the education of adults. But with World War I, a new factor emerged with fear of the unassimilated immigrant growing at a feverish pace. Out of a mixture of fear and patriotism, there was generated enough concern to do something helpful for the immigrant working through the process of assimilation. One result was the Smith-Hughes Act, the first federal law in the field of vocational education, and signed by President Wilson in 1917. Among other provisions, it provided resources which were useable in public school adult education programs. The result was a rapid expansion of adult education programs offered through the public schools throughout the 1920's. As evidence, for example, Hendrickson (1943) found that during this period the number of cities reporting housing adult



education programs reached a peak in 1928, and the numbers enrolled continued to climb until the early years of the Great Depression.

A third factor was the development of programs offered through the YMCA. The YMCA had initiated education programs in the 1850s by offering libraries and reading rooms. By the 1880s it had shifted its emphasis to classes. For some years the emphasis was on elementary school subjects, but by 1895 the focus began to shift to vocational and technical training for adults. Development after 1900 was particularly rapid. So elaborate and extensive did YMCA education become, that a movement to obtain academic recognition for it led to the development of colleges and universities. Northeastern University in Boston is an example of a university that began out of a YMCA program as is Youngstown State University in Youngstown Ohio.

So here we have a number of factors that came together all at about the same time, which placed an emphasis on the education of adults. As this occurred, psychologists too began to address the needs of adults. Thorndike (1928), on the first page of his book *Adult Learning*, specifically mentions psychology's responsibilities to address, "Adult education in all its multifarious forms. Public evening schools, education departments of the Young Men's Christian Association [and] other philanthropic agencies for the welfare of adults" (p. 1). We will turn again a little later in this chapter to the development of theory on adult learning. For now we will look at how the science of aging within psychology developed.

### **The Transition to a Science of Cognitive Aging**

Perhaps the best known work from the 1920s was G. Stanley Hall's *Senescence*. Published after his retirement from Clark University at the age of 78, it represents the author's awareness in his old age of the need for a science of gerontology. In arriving at this realization, Hall writes about the state of affairs in the early 1920s:

Wishing to know myself as old, I subjected myself upon my retirement to the examination and tests of some half dozen medical experts for eyes, ears, heart, lungs, digestive tract, kidneys, and even sex but was surprised to find out how hard it was to do so. A strong minority of my impulses preferred the ignorance that is often bliss. There are no mental tests of generally recognized validity above the teens, so we have no criteria for determining psychological age for even the elderly, while psychoanalysts refuse on the express authority of Freud to take on patients over forty. When it was well over, I was glad...I realized anew, however, that there are no gerontologists, as there are experts for women, children, etc., and that barring acute attacks I must henceforth, for the most part, be my own physician. (Hall, 1922, p. 196)

Hall recognized the superficiality of regarding aging as merely a period of decline. He argued that senescence like adolescence had its own "feeling, thought, and will," as well as its own psychology. Hall anticipated Daniel Levinson (1978) in speculating on the existence of a mid-life transition, and using his questionnaires, a technique that he had brought from Germany in his youth, proceeded to explore a number of issues about aging. Oftentimes his conclusions parted from popular opinion. For example, it was commonly assumed that older people, approaching death would become more fearful and hence more religious. Hall believed from his questionnaire data that people do not necessarily show an increase in religious interest, nor do they show any fear of death. He felt that almost the opposite holds: That fear of death appeared to be a young man's

concern. Gradually following Hall's lead, psychologists began to turn their attention to research in aging and much of this work was focused on cognitive aging. Let us first turn to Edward Thorndike.

Thorndike (1928), in his book *Adult Learning*, cites dozens of previous studies in the subject area. But much of this literature suffered from one of two limitations. If age groups were compared on some variable, the age range was generally limited, with few participants over the age of 35. Much of the available literature, however, simply examined one group of adults and attempted to make an argument about the capabilities of the group being studied. Some of this literature still reads as a bit of fun. For example, Thorndike cites one of his own studies which measured the improvement of 28 adult graduate students, aged 25 to 30, in multiplying mentally, without help of pencil or paper, a three digit number by a three digit number. The task was to perform 95 multiplication problems such as  $657 \times 964$ ,  $398 \times 367$ , and  $476 \times 479$ . In the results, he reported that the graduate students in his study when, given seven hours of practice, could reduce the time in performing the task by forty percent. Many years later Owens (1966) used a time-lag design to conduct an analysis regarding change in cognitive performance in the North American culture spanning the time from approximately 1900 to the 1960s. Owens concluded that one skill that has been emphasized significantly less over time in that culture is mathematical ability.

That same year, 1928, saw the beginning of the first research program in aging. To a very large extent its emphasis was on cognitive aging. This was a project called the Stanford Later Maturity Studies under the direction of psychologist Walter R. Miles (1885–1978). What the Stanford Later Maturity Studies provided was the first program in the psychology of aging, using controlled experimental designs, with subjects representing a wide range of ages. In fact, the age range used in some of the research is remarkable even by today's standards. Take, for example, the fact that Miles designed experiments with an age range of 6 to 95 years, in which all of those subjects were compared on the same set of tasks.

Several factors came to play in the formation of the Stanford studies. As has already been mentioned, G. Stanley Hall had set the stage with the publication of his book *Senescence* in 1922. Miles seems to have been very influenced by Hall's book, taking detailed notes and frequently referring to its content in his public lectures on aging.

By the mid-1920s, research on time, fatigue, and work, using adults as participants, had become popular in industry. During his career Miles was very much interested in this subject area. He was particularly drawn to practical problems involving everyday situations. Apparently a newspaper article published in a New York City paper in 1922 caught his attention. The article was about the transition that was taking place regarding milk delivery in that city. At about that time, milk delivery in New York had passed from horse drawn vehicles to motorized trucks. The point was made in the article that middle-aged workers as young as 40 had difficulty in making the adjustment, older workers had even more difficulty, while the youngest workers learned the new task quickly. This interested Miles, and the subject area became one of the first to be studied in the Stanford studies (Jack Botwinick, personal communication, July 1980).

It should also be pointed out that the coming economic depression had affected California earlier than the rest of the country, increasing employment difficulties in the San Francisco area for older workers. As such, there was interest at Stanford in addressing the needs of these workers. In addition, it was anticipated that Miles' work on aging would supplement the longitudinal work on gifted children that Terman had begun in 1921 (Miles, 1967).

Miles, along with Lewis Terman (1877–1956) who was chair of the psychology department at Stanford, had originally applied for funds from the Social Science Research Council, a major avenue of support at the time. In their application, Miles and Terman outlined a “program of psychological research on the later period of maturity” in which over 50 topics of investigation of perceived importance for the new field were presented. These topics spanned sensory development, psychomotor functions, learning and memory, intelligence, fatigue, emotional and personality development, psychiatric issues, along with a series of proposed sociological and anthropological investigations (Terman & Miles, April 4, 1928). Specifics regarding the extent of funding needed were left very general in this document, but towards the end of their argument, they suggested \$20,000 to \$25,000 a year for 10 years. Funding was denied.

Such an ambitious request, particularly as an initial proposal, with so little justification as to how funds would be spent, may seem rather strange today, but it is important to point out that, beginning in the early 1920s, the Laura Spellman Rockefeller Memorial had been providing large long-term block grants to universities for the purpose of developing programs on research in child development. Generally, these block grants could be spent as the researchers best saw fit. While during its existence (1918–1929), the Laura Spellman Rockefeller Memorial did not provide funds for research on aging (although it did provide some funds for adult education), it was the major funding source in developmental psychology at the time (see Smuts, 2006, for a detailed discussion of the Memorial’s work).

Nevertheless by the summer of 1928, Terman and Miles—while still requesting funds for their general project—outlined three specific studies for investigation during the first year. These included E. K. Strong’s investigation on changes of interests with age, an investigation on eye movement during reading using elderly subjects, and a series of small scale investigations of psycho-motor ability (Miles, August 16, 1928). This proposal requesting \$2,500 in start-up funds was denied, but on the grounds that the research fell more within the field of natural science than of social science (Letter to Terman, Wesley C. Mitchell, September 21, 1928).

By October of 1928, the Stanford group had changed their strategy, arguing for funding of a series of studies of practical importance to industry and in November of that year the Maturity Studies were supported by a \$10,000 grant from the Carnegie Corporation. But the reviewers of Miles’ grant proposal raised a number of questions regarding the feasibility of the new adventure (Miles to Woodworth, August 18, 1928). One question to be dealt with concerned the motivation of participants. To some degree, it was felt that the participants in these studies would be far more motivated to perform well in the lab than on the job, and this, therefore, would not provide a very useful indication of the competencies of workers in the work place. A more pressing and far less theoretical problem had to do with the procurement of participants. This proved to be more difficult than expected.

In their first attempt, an assistant was hired to canvass the Palo Alto area offering individuals aged 50 and over the premium wage of \$1.00 an hour to participate. This approach failed badly.

The second idea was to make use of students in Palo Alto high schools. The first task was to find out which students had parents and grandparents living in the community. These students were introduced to the study and were asked to persuade their parents and grandparents to take part in the study. This proved more popular than the house to house canvass, but was not successful enough to provide adequate data (see Birren, 1961, for a discussion).

Subsequently, they hit upon a third approach. Miles was to approach various community organizations, meeting with the board of each group. The new strategy was that each community group participating would receive an honorarium for each individual sent for testing. Moreover, the honorarium would be based on the age of the participant, with 2 cents paid for each year of the participant's age. Thus, an organization would receive \$1.44 for an individual participant of 72 years. By the time of the first study (March to August 1930), approximately \$1,400 was distributed.

An additional problem involved procuring enough male participants. For some time, Miles had been offering a supplement of 25 cents for each male subject. But this was only partially successful, and the problem had grown more serious by the second of the two Stanford studies (April to June 1932). By May of 1932, only 125 of 500 participants tested up to that time were male. So, it became necessary to supply bonuses of up to \$25.00 to organizations that could supply males who could be tested and included in the data base.

Also associated with Miles in the Maturity Studies were Lewis Terman (1877–1956), Edward K. Strong (1884–1963), and Calvin Stone (1892–1954), all Stanford faculty. Terman was to continue his studies of the gifted, and these lasted long after the termination of the program. During Terman's lifetime, there were three sets of follow-up investigations of the original 1921 sample. There was one in 1925, a set collected between 1940 and 1945, and a third set collected between 1950 and 1955. At the time of the third testing, participants averaged 44 years of age. It was found that most participants remained close to the 99th percentile on intelligence, and there were increases in performance since the previous testing at all educational and occupational levels, in all grades of ability, and at all ages. The data indicated that not only do the mentally superior hold their own, but actually increase in intellectual status (Terman & Oden, 1959).

Strong was to study interests of adults as they changed with development. By 1931, he had tested 2,340 individuals aged 20–40. His data can still be used to support modern continuity theory in that he found that older adults had no more or no fewer interests than do young adults. But also supportive of some aspects of disengagement theory, he found that activities that involved others, such as playing bridge, decrease in popularity, while activities that one can do alone such as reading increase in popularity (Strong, 1931).

Calvin Stone was to work on the maze learning ability of aged rats. This was viewed as very valuable, as learning ability could be studied without the confounds of "cross sections" as the term was used at the time, as was the case with humans. Generally, Stone found very little age related decline in his rats. However, he did argue that older rats tended to become rigid, making repeated errors he called "perseverative" errors, made even when feedback provided that the incorrect choice was being made (Stone, 1929). This concept of rigidity can be seen in more modern research on learning with aged rats (see, for example, Goodrich, 1972) and with people (Botwinick, 1973).

Miles (1931) studied a wide range of subjects on a series of psychomotor and reaction time tasks. He found that age decline with reaction time was greatest on the simplest tasks, such as raising and lowering a finger from a resting position. But slightly more difficult tasks, such as responding to a stimulus that would signal that a response was to be made showed far less decline. He interpreted his results to mean that because decline appeared to be greatest on the easiest tasks and least on the more cognitively demanding tasks, age change in the central nervous system appeared to be modest. While Miles' conclusions are not supported by modern research, the issue continues to be of considerable interest (see, for example, Salthouse, 1985).

Finally, there needs to be some mention of the milk truck drivers that had Miles' attention in the early 1920s. There were five dissertations that resulted from the Stanford studies. The first of these was Floyd Ruch's dissertation conducted in 1930. Ruch, working under Miles' direction, compared the performance of three age groups with forty participants in each group. These groups included a young group (aged 12–17), a second of middle-aged (aged 35–58) and one of older people (aged 60–82). The first of three tasks, consisted of word pairs such as walk-car or white-pink. A task called Nonsense Words consisted of items such as  $E \times G = Z$  and a third list, Interference Materials had items such as  $3 \times 5 = 25$ . Ruch found all age groups did relatively well on the first task. But the difference between the age groups grew greater with the Nonsense Words and grew even greater with the Interference Materials. Ruch concluded that adults do best with learning tasks in which they can draw from past experience and in which that past experience does not interfere with the new task.

Following the conclusion of the Stanford studies, Miles gave his presidential address before the American Psychological Association based on the results of his work at Stanford. He wrote the chapter presenting the research contributions of psychology in the first edition of Vincent Cowdry's *Problems of Aging* (1939), perhaps the most significant work on aging to be published before World War II. But, during the war, his attention turned to defense research and Miles did not again play a major role in aging research.

### **The Classic Aging Curve**

One of the most researched areas of inquiry in the history of psychology has been on the stability of intelligence test scores across the lifespan. Botwinick (1973) noted that at least 1,500 publications had appeared on the subject up to that time. Most of the work had been cross sectional and a common finding was that IQ peaked in the early 1920s before beginning a progressive decline. This set of findings became known as the classic aging curve, and was believed to have had its foundation dating back to the very earliest literature. David Wechsler (1958), for example, in his classic work, *The Measurement and Appraisal of Adult Intelligence*, argued that experimental evidence for the concept began with Galton.

The research community began to focus on the question with the Army Testing Program during World War I. Briefly summarized, when the United States entered the war on April 6, 1917, the Society of Experimental Psychologists was meeting at Harvard. Robert Yerkes arranged a special session to discuss the contributions that psychologists might make to the war effort. By August 9, Yerkes was given an appointment to organize psychological examinations that would be used to select and grade recruits for the Army. Progress was rapid and by December 24, the Surgeon General ordered that all drafted men would be tested with the newly developed group intelligence tests named the Army Alpha for those who were literate and the Army Beta for those who were illiterate or who were not English speaking. The program was extensive and when the testing program ended on January 31, 1919, a total of 1,726,966 individuals had been tested.

It is frequently argued in more contemporary accounts that intelligence data taken from Army recruits during WWI reaffirmed Galton's data of 40 years earlier. Schaie and Willis (1996) state that data taken during WWI from administering the Army Alpha was interpreted to mean that intellectual functioning peaked in childhood, as early as age 13. In another volume from recent times, Achenbaum (1995) argued that Thorndike's review of the Army Alpha and other early data reaffirmed the "curvilinearity" of intelligence test scores across the adult life span.

The case is, however, that early researchers on the subject, including Thorndike and the authors of the Army Alpha data, were well aware of the limitations of cross-sectional data, and were in fact making no such claims regarding the relationship between age and IQ. In fact, in chapter 12 of his book *Adult Intelligence* Thorndike (1928) dismisses the Army Alpha data by arguing:

Almost nothing has been known concerning the curve of intelligence in relation to age...In the Army Tests the older man did less well, but there is good reason to suppose that they were a selection of the relatively less intelligent. In the infantry, especially, the old sergeants of the regular army who were made captains and lieutenants would be duller than the young college and business men from the officers' training camps. (p. 155)

That this was not a personal interpretation on Thorndike's part can be seen in the excerpt from Yerkes (1921) original publication of the Army Alpha data:

The dependence of intelligence upon age of adults is a theoretical problem of great interest upon which, however, the results of the psychological examination of the Army can throw little light. It is possible to draw up tables of intelligence ratings and age as reported on the examination blank...[but] here is still no way of saying to what extent it reflects a fundamental dependence of intelligence upon age or to what extent it may be caused by the selective process always at work...If among the older men only the more intelligent sought to be officers...or if, on the contrary, among the older men only the poorer professional men could leave their businesses to enter the Army...then we should find a very positive relation of one sort or another between intelligence and age in the Army.... (p. 813)

At the same time, other researchers were beginning to experiment with more sophisticated designs. In an early study, W. B. Pillsbury investigated a sample of 58 subjects divided into four age groups (16–19, 20–24, 25–29, and 30–35 years). Tested longitudinally over a period of 5 to 9 years, all four cohorts showed an increase of at least 8 points on Army Alpha test scores (unpublished data, as reported in Thorndike, 1928, p. 157).

Researchers during this period were finding other reasons to be cautious with their age-related intelligence data. Some of the methodological difficulties that researchers had to overcome at this early date are interesting to relate today. One of the issues frequently discussed concerned the motivation of participants. Jones and Conrad (1933) attempted to address this problem by inviting participants to the town hall of several New England villages where a feature film would be shown. Following the film, the strategy was to administer the Army Alpha. The result was a disaster with most of the town's people opting to go home. Subsequently, the methodology was changed in that an intermission would occur at a strategic location in the evening's presentation. At that point the tests were administered. While this proved much more successful, some still declined. For those individuals, attempts were made to contact them a second time for testing at a later date. Those who declined on the second occasion were contacted on yet a third occasion. Each of these two additional waves of solicitation resulted in a few additional participants. In their analysis, Jones and Conrad reported that intelligence test scores were far more stable across age with the original "hall" tested sample. Greater rates of decline were demonstrated for the second wave of subjects, and greater still for those who participated following the third round of requests. It is one of the first studies

in the aging literature to report that the volunteer participant as we know him or her in our research may not be entirely representative of the adult and aging population as a whole.

In another sense, however, the results of Jones and Conrad (1933) directly support those of Yerkes, Thorndike, and others. That is to say, researchers realized early on that even with healthy participants the nature of the individuals being tested, and the designs being used, had even a greater effect on the stability of intelligence scores across age than did the effect of age by itself. By the late 1930s, methodological problems of cross-sectional analysis were understood well enough for Pressey, Janney, and Kuhlen (1939) to make reference to limitations to the methodology in several sections of their book, including the chapter on intelligence (see, for example, pp. 172–173).

If first generation researchers such as Thorndike, Yerkes, and others were aware of the limitations in their data in charting age related change, how did the concept of a classic aging curve get started? Hilgard (1987) suggests that the start may have come with the work of Mark May (1891–1977). May, who is best remembered for his work with Hugh Hartshorne (1885–1967) on an early set of investigations on moral development, had served in the Army during WW I as a lieutenant and had worked with the research staff on the Alpha data. May compared the results of the Army Alpha with scores from the Stanford-Binet, which had been administered during the course of standardization of the Army tests. The result was that the mental age (MA) of the American soldier as computed with the Stanford-Binet was between 13 and 14 years. Some years later, May attempted to clarify the issue by explaining the peculiarities of the mental age concept, and the unintended consequences that had been done. (See Hilgard, 1987, pp. 478–480, for an account.)

These data appear in chapter 11 of the Army report (Yerkes, 1921). While it is not clear whether May actually authored it, this chapter too has been interpreted in different ways. The authors of the chapter begin by arguing that there has been much public interest in the question, “How intelligent is the Army?” (p. 785). In attempting to address this question they defend the “transmutation” of Army Alpha scores into mental age because the concept of mental age was, in their reasoning, more familiar than the scales of the Army Alpha. While they made no statements regarding age differences and IQ scores for the Army recruits, it is here that they conclude that, “...the principal sample of the white draft, when transmuted from alpha and beta examinations into terms of mental age, is about 13 years (13.08)” (p. 735).

But here too the authors are far more cautious than they are often given credit for. This caution can be seen in the following excerpt from the introductory section of chapter 11:

It is customary to say that the mental age of the average adult is about 16 years.... We can hardly say, however, with assurance that these recruits are three years mental age below the average ... The draft ... is highly selected at the upper end by reason of the fact that men of higher intelligence become officers without being drafted or constituted the greater part of the group of professional and business experts that were exempted from draft because essential to industrial activity in the war. It is impossible to guess the extent of this selection with respect to intelligence.... Undoubtedly the intelligence of the draft is somewhat lower than that of the country at large. (Yerkes, 1921, p. 785)

It is clear from their report that they were well aware of the influence of education on

intelligence test scores. Later in the same chapter, for example, they present data indicating that the median educational attainment of the white draft (on which the 13.08 MA was based), was 7.7 years (Yerkes, 1921, p. 795, Table 347). In the previous chapter, chapter 10, they report a correlation of .75 (p. 780, Table 325) between alpha scores and education. Seen in these terms, the average MA of 13 should not have been surprising, although this specific point was not made.

Apparently because of the public interest in the issue, these data, often taken out of context, almost immediately raised a storm of controversy. They were the subject of the first paper in the famous Lippmann-Terman debate published as a series of six articles and letters in the *New Republic* in the fall of 1922. Earlier that year, Lothrop Stoddard, a Harvard Ph.D. had published *The Revolt Against Civilization*. Stoddard in an emotional display ranted,

Probably never before has the relatively scarcity of intelligence been so vividly demonstrated. It strikingly reinforces what biologists and sociologists have long been telling us: That the number of really intelligent persons is small, and that the great majority of even the most civilized populations are of mediocre or low intelligence....” (1922, pp. 68–69)

In the October 25, 1922, issue of the *New Republic*, Lippmann tore into Stoddard’s contentions calling them incorrect and nonsense. But in presenting his argument, Lippmann missed an important point. Instead of recognizing that the reported MA of 13 years was not surprising given the educational attainment of the average recruit, Lippmann choose to attack the fact that there were now two estimates of the mental age of adult Americans. One, an MA of 16, was based on the typical sample used to develop the Stanford-Binet published in 1916. One problem with this, as Lippmann saw it, was that this group was limited to a few hundred participants living in California. The other estimate, an MA of 13, was based on approximately two million recruits entering the Army during World War I. Who are we to believe, Lippmann asked, a few hundred Californians tested in 1913, or a sample of 1,700,000 men when determining what constitutes an average adult intelligence score. Lippmann’s point was that both estimates could not be correct. Quick to defend his standardization process, Terman (1922) replied that there were several tests that had actually been given to Army recruits in World War I, and that they all agreed that the average score earned by draftees was less than the average fourteen year old school child. Interestingly, Terman goes on to say that psychologists “were not entirely agreed” as to how this fact should be interpreted.

But others were, in fact, clear on how the data should be interpreted. Harry Hollingworth, in his 1927 text *Mental Growth and Decline*, explained that the average individual,

would leave school in the eighth grade, with a working knowledge of the fundamentals’ a smattering of local geography, a bit of history, and a few elementary facts of physiology...Upon being given intelligence tests of the standard sort involving literate performance, the score would not significantly exceed that which would be made by average adolescents at their fourteenth year. (p. 276)

Hollingworth went on to describe the kind of performance that would be expected from an eighth grader on the Binet. That is to say that if intelligence tests correlate closely with school success, and if the average American leaves school after the eighth grade, then they would be expected to perform on tests of intelligence, such as the Stanford-Binet,



with about the same performance capabilities as a thirteen or fourteen year old, or in other words, the average eighth grader.

It may be the case then that the hysteria that resulted from equating Army Alpha data with Stanford-Binet scores set the stage for some of the misunderstandings that followed. If so, it is unfortunate that Lippmann and Terman could not have been more successful in clarifying some of these issues to the general public. What is clear is that several of the first generation psychologists working with life-span intelligence data were well aware of the problems of interpretation and even some of the causes of these difficulties.

### ***The Psychology of Aging During the Second World War and Afterwards***

Before World War II, other research was being conducted internationally. In Vienna, Charlotte Bühler (1893–1974) and her students studied age changes in values and the progression of individuals toward their life goals by utilizing biographical data. Tachibana in Japan was conducting work on mental testing and productivity in industrial settings as early as the 1920s. An English language summary of the work can be found in Tachilana (1959). Also, see Riegel (1958, 1959) for a review of the German literature on aging dating back to the mid-1920s.

Following World War II, events in America began to move quickly. The Gerontology Research Center of the National Institutes of Health began in 1940, but was not active until 1946. At the same time, the Gerontological Society of America, the American Geriatric Society, and the Division of Maturity and Old Age of the American Psychological Association were founded. Sidney Pressey, who 10 years earlier had published the first textbook on life-span psychology, founded the division and served as its first president when it met for the first time in 1947. He saw the work of the new division in the following terms:

We in this division are concerned with a range of years three times that of childhood and youth. During which there are changes probably in total more complex and more controllable ... this division should continue ... until psychologists do think developmentally about the years after 20 as well as the years before, and until problems of adult life which much need study from that point of view are so dealt with. It has contributions to make, to psychology and to human welfare. (Pressey, 1948, p. 109)

At the University of Cambridge, the Nuffield Unit for Research into Problems of Aging was established in 1946. The research of this unit was oriented toward the experimental analysis of the relationship between age and skill. Welford reported the results of these post-WWII studies in *Aging and Human Skill* in 1958.

A review of the rapid expansion of research on the psychology of aging can be found in Riegel (1977). In his review, Riegel argued that the number of articles and books doubled with an interval of 8.3 years for the whole period from 1873 to 1972. That is, after the first publication in 1873 (that he had in his files) there were two publications by about 1881, four at about 1890, and 4,096 by 1972 (p. 93).

### **Adult Education and Adult Learning Theory**

At about the same time that the Stanford Later Maturity Studies were being organized, the origins of adult learning theory were under development. And for some of the same

reasons—one of which was interest in addressing needs and problems faced by individuals in the work force. And another reason was that the adult education movement was funded—as were the Stanford studies, by the Carnegie Foundation. Here is some background.

Up to the mid-1920s, adult education was confined to local organizations such as Chautauqua, a cultural organization founded in the 1870s in western New York, or national organizations that focused on a specific mission such as the National Association of University Extension founded in 1915. But no attempt had been made to organize all the people and organizations interested in adult education into a single national effort.

The initiative to create a national umbrella organization for adult educators was taken up by Frederick Keppel (1875–1943) who had become president of the Carnegie Corporation in 1923. He had been dean of Columbia College from 1910 to 1917 and had also served on the university's Administrative Board of Extension Teaching during the same time period. Keppel was also well acquainted with James Russell (1864–1945), dean of the Teachers College, who had pioneered extension at Columbia and who also had become very sympathetic to developing a larger effort in adult education. In June of 1924, Keppel organized an "Advisory Committee on Adult Education to the Carnegie Corporation" with Russell as chairman. Out of the board's work came the first meeting of the American Association of Adult Education held in Chicago in March, 1926. (See Burrell, 1954, and Grattan, 1955, for a more detailed discussion.) One of the founding members of the board that brought this chain of events about was Eduard Lindeman. He was to become one of the most influential theorists to emerge from this period and had interests in both labor education and adult education.

Eduard Lindeman (1885–1953) was born in Saint Claire, Michigan to Danish parents. His father had escaped a German prison during the Prussian Danish war (1864) immigrating to America where he became a salt mine worker. Both of Lindeman's parents died by the time he was 10. During his developmental years, he supported himself with a variety of odd jobs including agriculture and shipbuilding. Without a high school diploma, Lindeman entered Michigan Agricultural College (now Michigan State University in East Lansing) in 1907 classified as a "subfreshman." Most biographers believe that he had only limited English literacy skills at the time (see, for example, Konopka, 1958). By the time he graduated in 1911, he had become editor of the college newspaper, and married the daughter of the chairman of the Department of Horticulture.

His academic career began with a rough start. From 1919 to 1921, he was director of the Sociology Department of the North Carolina College for Women but, due to unorthodox teaching methods (largely self-directed teaching groups) and his liberal political views, he was forced to leave. Subsequently, he was offered a teaching position at the New York School for Social Work (later the Columbia University School of Social Work). He remained on the faculty from 1924 to 1950.

Throughout his career he had a sympathetic understanding of the working class. For example, in 1911 he became editor of the *Gleaner*, an agricultural journal that stood for the interests of small farmers. Under his editorship, the *Gleaner* advocated principles of mutual cooperation and citizen participation in public affairs.

He was very much interested in the place of education in the labor movement which was robust in the United States and Europe in the mid-1920s. He had attended the Trade Union Congress in London in 1925, but was particularly influenced by the Frankfort Academy of Labor, an organization affiliated with the University of Frankfort-am-Main. In 1927 Lindeman, in collaboration with Martha Anderson, wrote *Education Through Experience*. The work was essentially a description and interpretation of the methods used

by the Academy of Labor in Frankfort. Early in their report is a section titled “Andragogy” which they had adopted from the original “Andragogik.” For Anderson and Lindeman andragogy became the core of adult education. Other works written by Lindeman on adult education included an entry in the *Encyclopedia of the Social Sciences* (1930), an oft-cited but unpublished manuscript, *What is Adult Education* (1925), and his major work, *The Meaning of Adult Education* (1926).

In these works, Lindeman identified four rather broad assumptions about adults and learning. The first of these spoke to the need for relevance. Lindeman argued that adults are motivated to learn as they experience needs and interests. For Lindeman, these were the units for organizing adult learning activities. Second, as he saw it, adults were interested in applying their learning to real life situations. Other assumptions made by Lindeman spoke to the nature of the adult learner. For one, he saw adults as having a desire to be self-directing. The role of the teacher was to facilitate a process of mutual inquiry rather than to transmit knowledge. Also, Lindeman believed that individual differences increase among people with age, and therefore adult education must make optimal provision for differences in style, time, place, and pace of learning.

Lindeman was a friend of John Dewey and Lindeman’s emphasis on life situations and not subject matter may have been due to Dewey’s influence. Brookfield (1987) notes that Lindeman anticipates critical theorists such as Freire and Mezirow by suggesting in 1925 that adult education is a process in which the adult learns to become aware of and evaluate his or her experience. For Lindeman, adult education is part of a process in which adults understand and interpret their experiences, and through which one is enabled to comprehend the social forces shaping one’s conduct. The idea of analyzing one’s experiences to achieve independence from social and political forces is a recurring theme in adult education. Arguing along similar lines in the more modern era, Paulo Friere (1974) adopts the term *conscientisation* to describe the process whereby people come to understand that the way they view the world, and their place in it, has been shaped by social forces in their life space which may or may not be in their own best interests. More recently, Jack Mezirow (1991) argues that a central task of adult education is to assist adults to reflect critically on their internalized values, and assumptions. Brookfield (1986), however, argues that both Freire and Mezirow developed their theories more or less independently of Lindeman. Directly influenced by Lindeman was Malcolm Knowles.

Knowles (1913–1997) grew up in Montana, the son of a veterinarian. He enrolled in the Fletcher School of Law and Diplomacy at Harvard, graduating with a B.A. in 1934. His initial intention was to enter into the diplomatic core, but there was a long wait for positions in the State Department in the mid-1930s. Instead, he began his career with the New Deal era National Youth Administration (NYA) in Massachusetts where the focus of his work was with unemployed young adults. At that time, Eduard Lindeman was director of training for the Works Progress Administration and he also supervised training for the NYA. Lindeman became Knowles’ mentor and they formed a life long relationship. Knowles later said that Lindeman’s *Meaning of Adult Education* became his chief source of information for a quarter of a century (Knowles, 1989).

After World War II, Knowles sought additional training in adult education earning his Ph.D. in 1960 from the University of Chicago. While at Chicago, Knowles was directly influenced by psychologist Carl Rogers. During that period, Rogers was developing his theory of client centered therapy, and he was in his own thinking becoming increasingly humanistic in orientation. (See Rogers, 1970, for an interview of him regarding how his views changed during the course of his career.) Knowles was particularly struck by

Rogers' three characteristics of an effective counselor. These included unqualified positive regard for the client, an orientation to empathize and to think and feel with, rather than about, the patient, and authenticity to behave as a therapist as a real person rather than out of a pre-determined role.

Knowles wrote his major work, *The Modern Practice of Adult Education: Andragogy vs. Pedagogy*, in 1970. In it he expands on Lindeman's earlier thinking and reintroduces the concept of andragogy which had lain dormant since the 1920s. Ten years later the book came out in a new edition, but with the subtitle changed to "*From Pedagogy to Andragogy*." His thinking was further expanded in 1984 in the book *Andragogy in Action*. In these works Knowles identified andragogy as including five basic assumptions about the characteristics of adult learners:

1. Adults move from a dependent personality to an increasingly self-directed human being.
2. As adults mature, they accumulate a growing body of experience that serves as an increasingly important resource and foundation on which to base new learning.
3. As adults age, motivation for learning is increasingly focused on life tasks, issues, and challenges.
4. As a person ages, focus changes from postponed application of knowledge to current application.
5. Adult learning is problem centered rather than content centered.

Tennant (2006) sees Knowles' most important contribution is the expansion of the concept of self-directed learning. Knowles (1975) identified self-directed learning as a process:

In which individuals take the initiative, with or without the help of others, in diagnosing their learning needs, formulating learning goals, identifying human and material resources for learning, choosing and implementing appropriate learning strategies, and evaluating learning outcomes. (p. 18)

Knowles maintained that self-directed learners enter into learning with more purpose and ownership of the learning experience. This is not only very motivating, he maintained, but leads to a more effective learning experience coupled with long term retention.

More recently, both Brookfield (1986) and Mezirow (1991) have reformulated the idea of the self-directed learner to include an additional concept of critical awareness. For them, a self-directed learner is able to accurately identify "authentic" needs which are accomplished through processes of critical reflection and critical thinking. Critical thinking is defined by Brookfield (1986) as the experience of carefully questioning concepts that are accepted as part of common sense or of the natural state of affairs by the majority.

In response to critics (e.g., Brookfield, 1986), Knowles acknowledged in his later writing that andragogy and pedagogy are not necessarily a distinct dichotomy in which one process is appropriate for adults and the other for children. Rather, he saw andragogy as appropriate for some children and pedagogy as a process through which some adults continue to learn effectively. He did continue to argue, however, that adults in the majority of situations benefit from self-directed learning as he described it, and benefit from being facilitated to move in that direction. For a very interesting late career interview

in which he discusses his early thinking and the evolution of his views, see Knowles (1994).

### A Few Parting Thoughts

The research and theoretical lines presented in this chapter continue to develop at an accelerating rate. Self-directed learning continues to be an important area of interest. Some of the more recent areas of interest include the concepts of self-monitoring, which involves the capability of recognizing accurately when one competently knows new material, and the concept of motivation which involves the capability of carrying to completion the task at hand. Recently, Ackerman (1998) laid the foundation for some of the research on the role of motivation in adult learning, and Thompson and Zabucky (2005) have discussed some of the recent developments in cognitive self-monitoring research.

The research line begun by Miles (1931) on the question of whether there is general slowing of the central nervous system or whether there are specific localized mechanisms continues to be widely discussed. Research has been conducted to date to indicate that there are specific factors as well as general processes associated with the slowing of behavior with advancing age. Whether this slowing is a primary cause of age differences in cognitive processes is a significant question that continues to be researched. A recent review can be found in Hartley (2006).

The research on intellectual change has known many developments of its own. In recent years researchers have turned their attention to new constructs such as wisdom (see Ardelt & Jacobs, chapter 25, this volume). One of the more active teams has been that of Paul Baltes and his colleagues. They define wisdom as an expert knowledge system with which, if present, permits individuals to exercise insight and judgment. To display wisdom one must have knowledge of one's own strengths and weaknesses as well as management strategies that can be used to maximize gains over losses in a wide variety of decision making endeavors. Baltes and his colleagues also argue that, while wisdom does show an increase with age across adulthood, it can be displayed by individuals across the adult age spectrum (Baltes & Staudinger, 2000).

And then there are areas of research that our ancestors could only have imagined. The neurosciences have added a new chapter in the exploration of cognitive aging. To a certain extent, this has arisen out of a need for more accurate diagnosis and treatment for individuals suspected of suffering from pathologies of aging such as Parkinson's disease and Alzheimer's disease. But the work in this area is increasingly contributing to our understanding of memory processes in normal aging as well.

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