

MIND

ALERT



**INTELLECTUAL FUNCTIONING IN ADULTHOOD:
GROWTH, MAINTENANCE, DECLINE, AND MODIFIABILITY**

2005 SPECIAL LECTURE BY K. WARNER SCHAE AND SHERRY L. WILLIS

A JOINT PROGRAM OF
THE AMERICAN SOCIETY ON AGING
AND METLIFE FOUNDATION

On the cover: Lucile Wiggins, the first centenarian in the Seattle Longitudinal Study, relaxes in the home she shared with her younger sister in Bellingham, Wash. Lucile, who was in excellent health until one week before she passed away of a stroke at age 102, participated in the Seattle Longitudinal Study for more than 40 years. Photo by Charles Fick.

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INTRODUCTION

Cognitive fitness in late life is determined by a number of factors over the life course. By studying thousands of people over long periods of time in the Seattle Longitudinal Study, husband-and-wife research team K. Warner Schaie and Sherry L. Willis shed light on the differences between elders who maintain their intellectual functioning into late life and those whose cognitive abilities decline.

In the lectures transcribed in this booklet, Dr. Schaie offers data on the developmental influences throughout the lifespan that affect intellectual functioning; in addition, he discusses how such data can be used for the early detection of the risk of late-life dementia. Dr. Willis outlines her research on how intellectual functioning in late life can be modified through cognitive training. She also explains why certain leisure activities contribute to better cognitive fitness in late life.

Dr. Schaie and Dr. Willis presented these lectures in March 2005 at the Joint Conference of the American Society on Aging and the National Council on the Aging as part of the MindAlert Program. Sponsored by the American Society on Aging and MetLife Foundation, MindAlert is dedicated to sharing the findings of the latest research on maintaining and enhancing cognitive function in later life.

Also included in this booklet are profiles of the winners of the 2005 MindAlert Awards, which recognize programs that promote mental fitness in older adults, as well as an annotated list of past MindAlert monographs.

INTELLECTUAL FUNCTIONING IN ADULTHOOD: GROWTH, MAINTENANCE, DECLINE, AND MODIFIABILITY

DR. K. WARNER SCHAIE AND DR. SHERRY L. WILLIS

Dr. Schaie: I began my career wondering about the fact that I could observe some old people who were the very font of wisdom and others who were pretty decrepit, uninteresting folks. Puzzling over these very different life courses, I decided that the only way to try to understand the reasons for those differences would be to follow the same people over long periods of time. And so I started out, as everybody does, with a cross-sectional study for my dissertation research—but I continued following people in my study over time. Some of my classmates, all of whom are retired by now except for me, claim that I

bility of modifying the course of intellectual functioning as we get older, through cognitive training.

METHODOLOGICAL ISSUES

The issues I want to deal with are the differences between normal and pathological aging, the problem of cross-sectional data vs. longitudinal data, the issue of cohort and generational differences in level of cognitive abilities and the rate of change of those abilities, and population vs. family studies. Typically, people have thought of aging as a downward spiral: That is, some people think of aging as losing a marble a day, or a neuron a day, causing inevitable decline. Some people would argue that our brains have so many connections, so much extra capacity, that this model of aging can't be accurate. People lose a lot more brain tissue in accidents, for example—much more than what is lost with aging—and they do just fine. So perhaps much of the decline in cognitive ability with aging may well be due to disuse.

But there's also another issue, and that's obsolescence. As it turns out, successive generations have functioned at higher and higher cognitive levels, and though you may not decline at all from the level you had as a young adult, you may no longer be competitive with the younger generation—that's obsolescence. You can also think of aging as development, because adults are agents of their own development—they can adopt healthy or unhealthy lifestyles; they can engage in stimulating activities or be couch potatoes. And then there is the issue of successful vs. unsuccessful aging. Some people gain wis-

People who are too rigid don't do very well in late life because old age requires a lot of flexibility.

didn't get it right in the first place and so I had to continue doing it over and over again. But in doing it over and over again—next year the study will be 50 years old—I think we've learned quite a few things, some of which Dr. Willis and I want to share with you.

I want to talk about a number of issues that need to be understood to see how intellectual functioning changes over the life course: methodological issues; the growth, maintenance, and decline of cognitive functioning, as well as developmental influences throughout the lifespan that affect it; and how longitudinal data of the kind that Dr. Willis and I have collected can be used to contribute to the early detection of risk of late-life dementia. Then, Dr. Willis is going to spend quite a bit of time telling you about the possi-

dom with experience and function quite adequately until the very end of life. Others just stick to the familiar and veer away from interesting things in life—they want to maintain routines and tend to have rigid personalities. People who are too rigid don't do very well in late life because old age is a period of very rapid change that requires a lot of flexibility.

Two kinds of data have been used to characterize intellectual development in terms of aging. One type of study looks at age differences, or what we might call inter-individual variations across groups—that's when we take people at one point in time and compare people of different ages. In gathering such cross-sectional data, we have no idea whatsoever whether a particular older person was ever at the level of the younger person we're using for comparison, so it's really in a way comparing apples and oranges: We don't know about people's specific life histories. On the other hand, if we really want to understand how people change over their life course, we must look at age changes—*intra-individual* changes over time that occur within groups. Then there's also the issue of generational differences. In our research, we have observed important changes across generations, which can be studied either in populations or in biologically related individuals—we've actually done both.

THE SEATTLE LONGITUDINAL STUDY

In the Seattle Longitudinal Study, which forms the basis of what I have to tell you, we've looked at cognitive changes and cognitive differences with age, we've examined the antecedents of individual differences in aging, we've tried interventions to slow cognitive aging, we've studied generational differences, and we've done studies within families. In fact, we have covered three generations in our familial studies: We have some mid-

dle-aged and young people in our study for whom we have data at the same ages for both a parent and a grandparent. We've also worked on the early detection of dementia.

Our conceptual model argues that you cannot understand intellectual functioning *per se* unless you understand the various influences that affect it. These influences include issues of heritability—in other words, what genetic predispositions for cognitive ability or decline are inherited—

Six abilities represent most of what is generally described as human intelligence:

verbal ability, spatial orientation, inductive reasoning, numeric ability, perceptual speed, and verbal memory.

the effect of personality styles, current family environment, and socioeconomic status; and the influence of chronic disease on cognitive ability as people age. We've looked at cognitive ability and aging in terms of two different end stages, by studying late-life cognitive functioning and by looking at the neuropathology found in autopsy—a good many of the older participants in our study have allowed us to study their brains after their death.

Six abilities represent most of what is generally described as human intelligence: verbal ability (vocabulary), spatial orientation (the ability to identify where you are in three dimensions), inductive reasoning (the basis of problem-solving ability), numeric ability, perceptual speed, and verbal memory (the ability to recall what you have read). We have multiple tests for all of these abilities; following are some examples of how we go about measuring them. For verbal ability, we use a simple vocabulary test—participants are



given a word and asked to find the one that's most like it. For spatial ability, we ask people to rotate in space some abstract or familiar object, such as the letter F. We studied problem solving and reasoning by asking participants to find the principle in a series—for example, given a letter series, people must find the letter that continues the series. And for numeric ability, we asked people to check addition and subtraction problems.

We have followed individuals in our study to get longitudinal data, and we've also brought in new samples of people ages 25 to 81 at each point in our study for cross-sectional information. Cross-sectional age differences that we observed at our last data point show very few age differences in verbal ability and numeric ability in people of different ages, but intensive differences that are almost linear in nature for all of the other abilities. The problem with these cross-sectional data is that they do not take into account where people started from, whether they were

Some abilities decline with age, but no particular ability declines for every person.

strong or weak in certain abilities to begin with. As we gathered more and more data from people over time, we were able to estimate the longitudinal changes that occurred within individuals, and there we found a very different story. The longitudinal data suggest that there is actually some gain in cognitive functioning from young adulthood through midlife, on average, and that in fact anybody who shows decline prior to age 60 probably has some neuropathology.

We still find age differences in cognitive ability with the longitudinal data: After the 60s, decline is at first very minimal—but it increases steadily as people move into their 80s. But even in the high 80s,

there are significant differences in cognitive ability: For example, the data show that verbal ability remains at a fairly high level while numeric ability suffers a very substantial decline. The reason we didn't see this effect in the cross-sectional data—which showed no significant change in numeric ability with age—is that while most abilities have shifted across generations positively, numeric ability has actually declined as people rely increasingly on hand calculators and the like. In other words, the overall decline in numeric ability in cohorts of younger generations made the numeric ability of older generations look stronger in old age than it actually is.

DEVELOPMENTAL INFLUENCES ON INTELLECTUAL FUNCTIONING

If you think that everybody changes in the same way over time, the following is a cautionary tale. We've found that almost any pattern you might want is represented in the data, from virtual stability to very dramatic change—and we've found good reasons for this. But one has to be very careful in looking at the resulting averages as being really characteristic of any single individual. The other interesting question that people ask is, if one ability goes, does everything go? Well, we have data on the cumulative risk of decline for five different abilities for at least six points in time several years apart. (See Figure 1.) As it turns out, chances are that by age 60 or so everybody will decline on some ability. But virtually nobody has declined on all five abilities even when they're in their 80s. So it's not like everything goes as we age, but some things go—and we think mostly those things go where you have not had any opportunity or good reason to practice those particular skills. We can conclude, then, that patterns of aging are very individual. Some abilities, on average, decline with age, but no particular ability declines for every person.

Here's an interesting exercise for trying to figure out when you are going to experience the first decline on a particular ability. The time when people show a decline in a particular ability on average happens in the 60s—somewhat later on verbal ability, somewhat earlier on spatial ability. But other variables also determine whether cognitive decline is going to happen in the 60s for you as an individual. For example, if you are a woman, you get a credit of approximately five years, meaning you are going to experience a decline five years later than the overall average for the total population. If you are highly educated, you get about a year's credit for every year of education above the average education of the population.

On the other hand, if you have declined in flexibility—in other words, if you have become more rigid during the seven years prior to the assessment, you will get a negative credit because rigid people tend to show decline in cognitive abilities earlier than flexible people. If you have experienced above-average success in your life, your individual decline is going to occur later. Many of you may find that you are not likely to experience a decline until very close to your death or maybe not even then, because you're very likely to die before you are going to experience significant decline. The educated portion of the population always has this advantage.

Why is it that people are so different in their patterns? One of the things we've learned from our longitudinal studies is that people have different experiences, and we have characterized some that are favorable for maintenance of intellectual functioning. Some of these experiences

are a function of genetics: For example, if you do not have any cardiovascular or other chronic disease, you're going to be much at advantage in maintaining cognitive function. Also, if you live in favorable environmental circumstances—that is, you have above-average education, occupational pursuits that involve high complexity, above-average income, and intact families—all of those things are plus points that are likely to help you maintain intellectual function in late life.

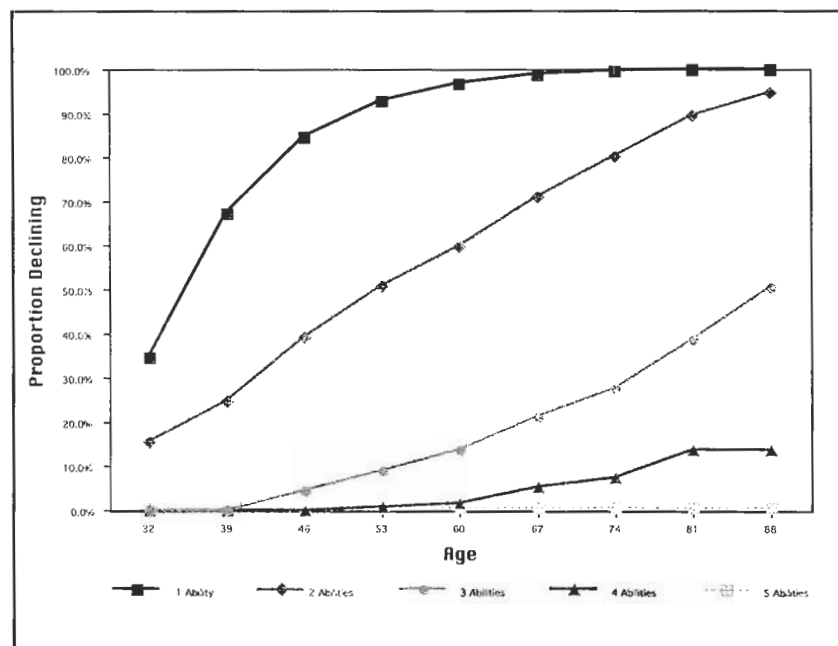


Figure 1. Cumulative risk of decline of one or more of five mental abilities at ages 32 to 88. Source: Schaie, K. W. (1989). "The hazards of cognitive aging." *Gerontologist*, 29: 484–493. Reproduced by permission of the Gerontological Society of America.

Furthermore, involvement in activities characteristic of an intellectually stimulating environment is a favorable factor: People who have extensive reading habits, travel, and attend cultural and educational events, for example, are also at an advantage. And as I mentioned earlier, having a flexible personality style at midlife has a positive effect on maintaining cognitive ability. Another interesting factor is being married to an intelligent spouse. In our study, we followed a number of married

couples over a long period of time. It turns out that married couples' intellectual performance converges over time: The spouse with lower cognitive functioning early in the marriage moves in the direction of the higher-functioning spouse, cognitively speaking. So the bottom line is that you should marry someone who's smarter than you are. High levels of perceptual processing speed are also an advantage, and being satisfied with one's accomplishments is a plus point. So those are things that distinguish people who function very well into old age as opposed to those who decline.

GENERATIONAL EFFECTS

Now, what about the issue of trying to deal with generational differences, of sep-

they are in the same age range. When you do that, you can plot the cumulative advantage—or disadvantage—that successive generations have. Our data show some gain over a seven-year period—substantial gain for some abilities—and loss for others, notably for numeric ability and verbal ability. That is, right now one of the reasons why old people look like they have not declined on verbal ability may very well have to do with the fact that they're at an advantage at this age with respect to later-born cohorts, who may have started out with less verbal ability.

One of the things that over the last century has gone up virtually linearly is what we call inductive reasoning, or the basis for problem-solving skills, and we

think that has to do with changes in educational practice where discovery methods rather than rote learning are emphasized, and also because the accessibility of information has grown dramatically. On the other hand, numeric ability is a function where rote learning is clearly essential, and giving up rote learning altogether is probably a bad educational mistake. For example, if you don't have some basic numeric ability, then you're in trouble—you won't even be able to tell whether the answer in your calculator really is probable or not. These societal changes obviously are

very important and are linked to generational effects on cognitive functioning.

Some of the changes that have occurred over generations are protective in a sense, but others cause more risk—like the prevalence of obesity, which has increased the risk of cardiovascular disease and diabetes, which have a negative effect on

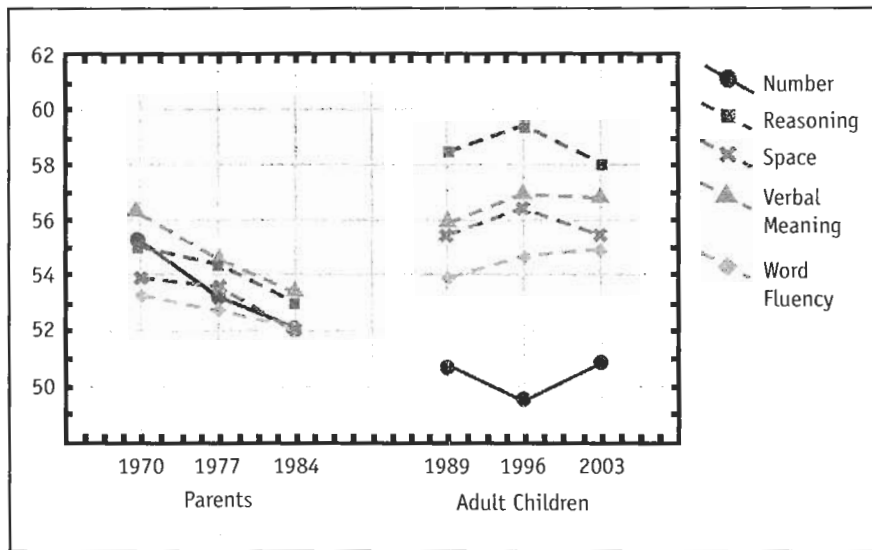


Figure 2. Cognitive change in biologically related individuals based on 14-year data. Source: Data from the Seattle Longitudinal Study (Schaie, 2005).

arating them from age differences? The only way that can be done is by studying successive generations over the same age range, because then you're holding age constant, so you can tell whether people's differences stem from their generational level or not. To do so, you've got to have samples from different generations of individuals who are followed over time when

cognitive ability. And so we have a trade-off. One of the things that we suspect is very likely to occur is that individual variability within the same generational cohort is going to increase because of economics—the increasing gap between the rich and the poor means the ability of people to have access to more protective factors for cognitive function, as well as to be better able to combat the risk factors for cognitive decline, will vary widely.

It's important to understand that there are generational differences in cognitive level, but it's also important to think about the possibility that perhaps it is reasonable for people to stay in the workforce a little longer. The basis for this argument is that successive generations not only have become more able, but also the rate of cognitive decline with age has slowed down. Looking at a group of individuals over the same age range—and I purposely chose people from ages 60 to 74 because that's the most probable range in which one might argue for people staying in the workforce longer—it turns out there really hasn't been all that much slowing of cognitive ability. But these data are from unrelated people, so this result is not as satisfactory as it could be.

We can study generational effects even more precisely by acquiring data sets from biologically related individuals so that we can hold constant at least part of the genetic variables. And we've been able to do that—we now have something like 500 pairs of related individuals on whom we have data at relatively close ages. When we plot the same data for people who are biologically related, we see a lot more evidence for a slowing of the overall rate of cognitive aging. The level of cognitive ability for the children we studied is up above that of their parents, but also the

parents declined during that period, between ages 60 and 67. For the younger generation, except for numeric ability, the abilities seem to be either stable or still going up at that age range. We've very recently finished compiling this data over a

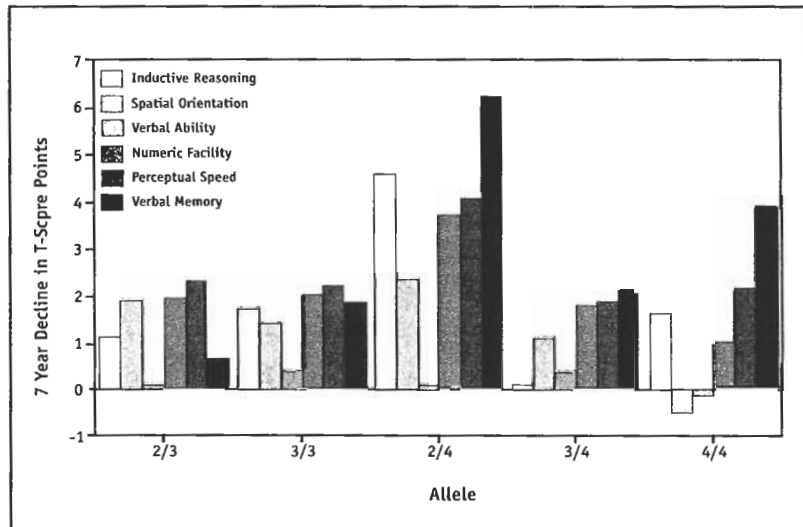


Figure 3. Cognitive change over seven years by Apo-E allele type. Source: Data from the Seattle Longitudinal Study (Schaie, 2005).

14-year period; it looks like for the next seven years, from ages 67 to 74, there's less of a decline for the younger generation than was true for their parents at the same age. (See Figure 2.) So from that point of view, people could delay retirement and stay in the workforce longer.

EARLY DETECTION OF DEMENTIA

In conclusion, I want to say just a little bit about early detection of dementia. When I started this Seattle Longitudinal Study, nobody knew much about Alzheimer's disease, so I didn't learn about Alzheimer's disease when I was going to school. But it turns out that the kind of data we have are very relevant to the early detection of risk for dementia because we can look back and see whether we could have identified people who now have become clinically diagnosable. We had neuropsychologists screen our population—

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all community-dwelling elders ages 60 and older—and we could find only about two-and-a-half percent who were probably impaired and another four-and-a-half percent who were borderline; there was a larger group, about 22 percent, that had something going on, but we couldn't quite put our finger on it—these older adults probably should be monitored to keep track of their cognitive health.

We also were able to get information on Apo-E, the gene that is supposed to be associated with Alzheimer's disease. There are six possible Apo-E genotypes, with the presence of the E-4 allele being linked to the disease in a dose-dependent manner. We found that a fair portion of our sample

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(about 25%) have one E-4 allele, but very few people have two (less than 3%). The E-2/2 combination was omitted because of its low frequency of occurrence in our sample—people with this combination tend to die early, so they don't get Alzheimer's disease because they never get to old age. When we look at the seven-year cognitive change by allele type, we find that it's the people who have an E-2/4 or an E-4/4 allele combination who are more likely to decline, particularly on memory. (See Figure 3.) These are people who are not impaired and have not been diagnosed, but they may be on the way.

We've also been able to get some very interesting data from the people who let us do autopsies. We have cognitive data for two women over a 35-year period for whom autopsies were conducted shortly after the last time we assessed them,

when they were in their late 70s. One lady had what was described as one of those super-clean brains at autopsy, with no tangles or plaques; the other had all the classical neuropathological symptoms of Alzheimer's disease. It appears that we can go back to our data about 14 years before people get clinically diagnosed with dementia and identify individuals who might be at risk for the disease. We can do that from the kind of assessment that's done in the normal community-dwelling population. I think that's very important, because if we ever get to the point of having some prophylactic medications for dementia, then we certainly want to know who is at risk so they can take the appropriate preventive measures.

Given this overview of some of the things we've learned in our studies of normal aging, I now want to hand things over to my colleague, Dr. Willis, who is going to tell you about what we've done, particularly under her guidance, to try to see if we can slow cognitive aging in the normal population.

Dr. Willis: I'd like to talk to you about our work on cognitive training, or staying mentally active. Now, there are a lot of reasons for staying mentally fit in old age. One of the most important is we know that mental ability is related to independent functioning—the ability to read one's medication labels, plan nutritious meals, drive—all of these are related to the cognitive abilities Dr. Schaie has told you about. Another interesting finding from longitudinal research is that higher functioning on cognitive activities appears to be protective against cognitive impairment; that is, researchers have found that more highly educated people have less likelihood of Alzheimer's disease and dementia, or experience it at a later age.

We don't know exactly why this effect occurs, but there are several hypotheses

about why cognitive activity or education may be protective against late-life dementia. One is that continuing to challenge oneself cognitively into old age may have a direct impact on brain development, contributing to dendritic growth and structural changes in the brain. Another possibility is that if one continues to stimulate the brain and its mental abilities, one reaches a higher level of cognitive function—so one has further to decline before one does reach a critical threshold in Alzheimer’s disease or other dementias. We think we see Alzheimer’s occurring later in people who have remained cognitively active because they had a higher level of cognitive functioning earlier in the lifespan.

The other possibility to explain the protective nature of mental fitness against dementia is compensatory activities. We know that higher levels of education are associated with higher levels of verbal ability, as well as higher levels of numeric ability—what we call crystallized abilities—and these may compensate for some of the losses that one experiences in spatial ability or even memory with age. We know memory is highly related to verbal ability because some of the strategies we use to remember are verbal in nature. Again, people whose brains can compensate for losses in some abilities—fill in the gaps, so to speak—will have a higher level of cognitive functioning overall, which seems to be protective. So maintaining mental fitness in old age is a good idea no matter what the specific mechanism of protection against Alzheimer’s turns out to be.

In addition, people who are more highly educated, functioning at a higher level, feel a greater sense of empowerment. They’re more willing to take on challenging tasks; they persist at challenging tasks, and—because they have confidence in themselves—they will more often take on

new tasks. For all these reasons, staying mentally fit is very important in old age.

INTERVENTION STUDIES OF MENTAL FITNESS

A number of different approaches have been used in the study of staying mentally competent into old age. Observational studies, including longitudinal studies, are the type that Dr. Schaie has talked to you about. What I’m going to be talking pri-

Abilities that show relatively early decline when people are in their 60s include reasoning, spatial orientation, processing speed, and memory.

marily about are intervention studies, which are experimental studies in which you take a group of elders and administer a baseline assessment, do an intervention with them followed by a post-test, then follow them for some period of time to see if there’s maintenance in the training techniques. We’ve been lucky in the Seattle study—in addition to this pre-test, treatment, post-test design, we have longitudinal data on participants prior to the intervention, so we know whether they had declined or not prior to the intervention we did.

I’m going to tell you briefly about some of our cognitive training research, as well as a newer approach to intervention called collaborative learning. Collaborative learning involves pairs of individuals getting together and learning without a trainer—I’m going to discuss some research we’ve done using older couples. Finally, there’s the whole issue of leisure activities: Are some of the pastimes that people engage in for fun related to cognitive functioning?

The majority of work on cognitive training, both our own and the work of others, has focused on abilities that show relatively early decline when people are in their 60s: reasoning, spatial orientation, processing speed, and memory. There are huge individual differences, but these abilities are the ones that are more likely to show average decline at the earliest

One very astute older woman said to my trainer,

“Honey, let’s get this straight—is it your problem or my problem we’re gonna solve?”

ages. The most common paradigm in the past for doing cognitive training studies from a research perspective is studying individuals working with a trainer, either one-on-one or in small groups.

In our own work on community-dwelling older adults, we focused on two abilities that we had already examined in the Seattle Longitudinal Study: inductive reasoning and spatial orientation. Inductive reasoning is being able to see a pattern in a series of numbers or letters or some other kind of information and the ability to use that pattern to solve other problems. Spatial orientation is the ability to orient oneself in space. This ability is very important for reading a road map, for example, or for looking at a diagram of a building and figuring out how to get to a specific room.

COGNITIVE TRAINING: METHODS AND DATA

We conducted five one-hour, one-on-one training sessions in each participant’s home; the training procedures used the typical educational techniques of teaching people strategies, then giving them practice on problems, offering feedback, and modeling solutions. In one of our training studies on inductive reasoning, we looked at people’s scores in this ability from 1970

to 1984, then did training with them in 1984 and tested them again. We classified people based on whether or not they had declined in ability or had remained stable during the 14 years prior to training. Some people showed relatively little change over the 14-year period, but we saw a precipitous decline for others. One of our questions was, is training in a particular ability effective with people who have declined vs. people who have not declined?

The good news is that both those who remained stable and those who had declined over the prior 14-year period showed significant improvement as a result of the training—and what’s very interesting is that the decline group got almost back up to where they were 14 years prior to training. So we have at least partial remediation of decline in ability as a function of training. The other good news—particularly important, perhaps, for keeping people in the workplace—is that old dogs can indeed learn new tricks. As a result of training, the elders in the stable group are functioning at a higher level than they were even 14 years previously.

Dr. Schaie told you about cohort differences based on generation—people start at different levels of ability based on their birth cohort. The question is, do all of these cohorts experience cognitive training effects? The data show that indeed they do, but what’s interesting is that the cohort effects remain. Even though all of the participants in our study experienced training gain, the training—at least at the level we offered—was not effective in wiping out the cohort differences in ability level.

Now, some caveats. The kind of training that we did originally in the Seattle Longitudinal Study is very effective, because it remediates training deficits, works in different cohorts and is maintained years later. We followed these people over seven years after training and still saw group dif-

ferences between people who had been trained and those who had not been trained on a specific ability. So there are a lot of positive things about this training. However, people with serious cardiovascular disease usually show fewer training effects than those without, so the effectiveness of cognitive training has its limits. In addition, this type of training is very expensive and very time consuming. We did one-on-one training in each individual's home to get a maximum effect, but it would be prohibitive to administer that kind of training to a national sample or to older adults in general. So the search now is for other ways of providing training to individuals for cognitive stimulation.

One of the things we ask ourselves is, when we do the traditional kind of training where we bring in a trainer for just five one-hour sessions, how can we provide additional cognitive stimulation? Rather than this traditional, intensive one-shot method, what we need is what I call the drip method. The drip method involves continual stimulation throughout the environment in the context in which people live, over longer periods of time.

How can we provide that? We could use technology to provide that kind of continual cognitive stimulation, but another way is to use people who are in the older adult's environment. And one of the people who is in that environment is the spouse, at least for a number of older people. Based on this thinking, one of the first ways we moved beyond traditional training was to look at what we call collaborative learning in older couples. We gave them the train-

ing material to use by themselves in their homes, without a trainer; this research was done in collaboration with Dr. Jennifer Margrett, who was a postdoctoral student in our lab.

COLLABORATIVE LEARNING

We had a control group that got no training, we had couples where each spouse was assigned to work alone, and we had a third group where the couples worked together on the training material. Couples were randomly assigned to the three conditions. In terms of immediate

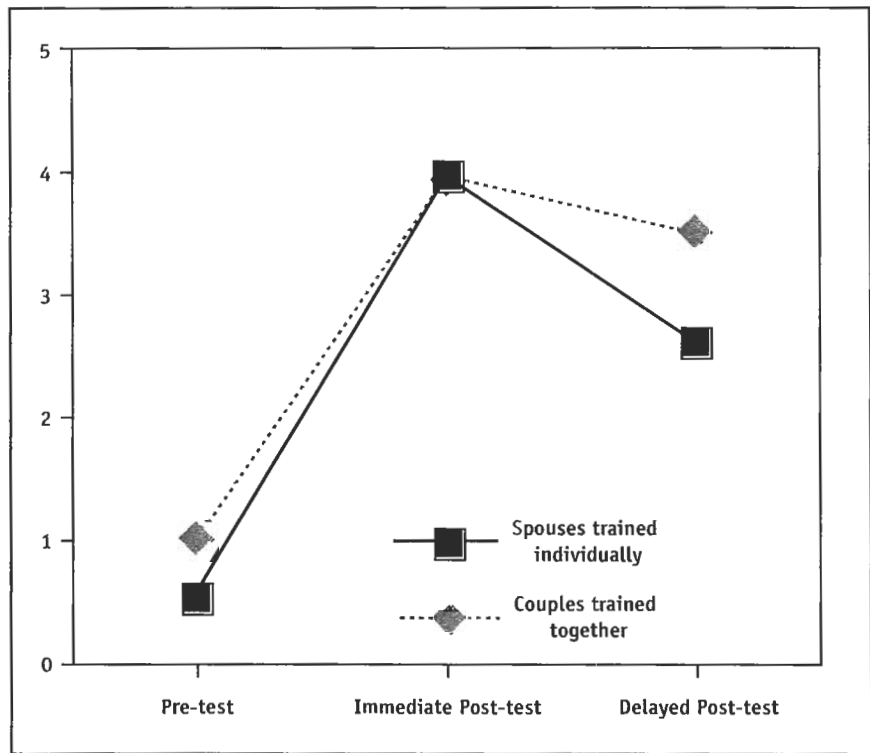


Figure 4. Collaborative learning in older couples. Source: Unpublished data from the Seattle Longitudinal Study.

post-test, we found that both the individuals who trained alone and the couples who trained together significantly improved compared with the control group, but there was no real difference in training effects between the couples trained individually and the couples trained together.



Now, this result is positive in the sense that these people are learning this material without a trainer, through self-instruction. We followed up six months later, and found that the couples who trained together showed greater maintenance of the strategies they learned than the people who trained individually. (See Figure 4.) We take this outcome to mean that if you train people together—and it doesn't have to be spouses, it could be peers—people serve as reminders and reinforcers of the training effect for each other even after the formal training program is over.

When we started this research, we went to older people in central Pennsylvania where we live and we introduced the cognitive fitness training by telling them that we were going to train them how to solve

It's usually in the 70s or even early 80s before we see significant decline in community-dwelling elders on activities of daily living.

problems. One very astute older woman said to my trainer, "Honey, let's get this straight—is it your problem or my problem we're gonna solve?" That was something like 30 years ago, and we're still trying to answer that question. We know that basic problem-solving abilities, such as reasoning and spatial ability, are very important in maintaining independent functioning and efficacy in old age, but how do they relate to what people actually do in their everyday lives, like making meals, taking medicine, driving, shopping at the supermarket or using a telephone? People who provide services to elders talk about these activities of daily living and instrumental activities of daily living, which are considered critical to being able to function independently in our society.

How do the basic abilities that we've studied in the Seattle Longitudinal Study—

verbal ability, spatial orientation, inductive reasoning, numeric ability, perceptual speed, verbal memory—relate to being able to do these tasks of daily living? Typically, the way the instrumental activities of daily living are measured is just by asking people whether they can use the phone or take their medicine independently, for example. But we wanted a performance-based measure. So for each of the domains of activities—health and medications, finances, household, telephone and communications, transportation, shopping, food preparation—graduate students and I found materials that older adults use in their everyday lives and developed problems related to these materials.

For example, a very simple problem would be showing an older adult a medication label and asking how many doses of medicine can you take in 24 hours, with the answer available right there in the instructions. But we could also pose a more difficult problem like, "Mr. Jones is a heavy smoker who has a terrible cough; what should he do?" To solve this problem, you have to read the warning on the medication and realize that Mr. Jones should probably see a doctor after a certain amount of time rather than continue to take this medication. This more difficult kind of problem requires putting different pieces of the information together to solve it, a process called combinatorial reasoning.

So the question is, do these basic abilities that Dr. Schaie has been examining in the Seattle Longitudinal Study underlie the ability to do these kinds of everyday tasks? And what do we know about age-related changes in these everyday tasks as related to the basic abilities, and what's the hope of enhancing people's ability to handle everyday cognitive tasks? Longitudinal data for reading short documents, such as a prescription drug label vs. lengthy documents, such as an income tax form, show a slightly longer period of stability on these

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everyday tasks than on basic abilities like reasoning or spatial orientation. So the good news is that it's usually in the 70s or even early 80s before we see significant decline in community-dwelling elders on activities of daily living.

But why would the capacity to do these activities stay stable when testing specific abilities shows decline? Because when you give people a test like we designed to understand medicine-bottle labels, you find that these everyday tasks are cognitively complex, meaning they involve multiple abilities. To read and understand a prescription drug label, for example, you need verbal ability, mathematical ability, memory, and speed of processing. We think that's why we see longer stability with age for everyday problem-solving than for the basic abilities, because multiple abilities are involved—and, as Dr. Schaie showed you, nobody declines on all six abilities at once.

Therefore, some compensation may be going on—if you have a deficit in reasoning ability, for example, you can stay stable on everyday activities longer overall because your other basic abilities are still strong. So that's the interesting point. But it makes doing cognitive training on everyday tasks much more challenging, because it means not focusing on any one ability but trying to enhance all of these abilities, which all seem to be related to performance of everyday tasks.

We have found some preliminary evidence that training on basic abilities, such as reasoning ability, is related to a subset of everyday tasks. We've found that people who improved their reasoning ability through training did better on our tests of everyday problem-solving related to meals, household, transportation, and use of the phone. And, interestingly, we found that people who got training with spatial ability did better on management

of finances. When we look back at the material, much of the financial material is in a graph, chart, or schedule format, and we think that spatial ability helps people read those graphs—going down the column and across the row, for example. So we have some evidence that training on these basic abilities does transfer to everyday problem-solving. Another challenge related to this training would be setting priorities on the abilities and activities of most importance to each individual, and training people accordingly.

LEISURE ACTIVITIES

Now, what about leisure activities? Do we know anything about people who work crossword puzzles or jigsaw puzzles and how such leisure activities relate to these very basic abilities? Indeed, fluid ability—which involves reasoning, memory, and

Basic abilities are related to leisure activities like game-playing and doing crossword puzzles.

spatial orientation—and crystallized ability, which involves verbal ability and numeric ability, have relatively good correlations with these types of leisure activities. The relationship with abilities varies by type of leisure activity: Doing crossword puzzles is more related to verbal ability, doing jigsaw puzzles to spatial ability, and the frequency of game playing is associated with proficiency. What we see in people who do jigsaw puzzles is that the spatial component reflected in fluid ability is particularly strong.

We've found that about 25 percent of the older adults in our samples regularly do crossword puzzles, but 40 percent to 50 percent don't ever do those kinds of things. And we found that proficiency in basic abilities is fairly good both in those



who do crossword puzzles and in those who do jigsaw puzzles—though for jigsaw puzzles, particularly for people ages 75-plus, the proficiency is somewhat lower. So, although we have not done research using jigsaw puzzles or crossword puzzles as a form of intervention, we think there is some solid evidence that certain leisure activities are related to cognitive functioning and could be used as a form of cognitive stimulation.

SUMMARY

The majority of community-dwelling, nondemented older adults can, through brief training, improve their cognitive ability, remediate prior decline, and maintain the training effects for several years. In everyday tasks that involve multiple abilities and are cognitively complex, age-related declines occur somewhat later than decline for basic abilities—possibly because of the multiple abilities involved. Also, there's some evidence that reliable

training gain on basic abilities is associated with enhanced functioning on everyday tasks. Couples can improve basic ability through self-directed instruction, and there does seem to be a connection between the quality of marital relationships and the efficacy of collaborative learning.

And basic abilities are related to leisure activities like game-playing and doing crossword puzzles—activities that have the advantage of being cognitively challenging while being enjoyable, so people are more likely to persist in doing them. Keep in mind that chronic health conditions may affect elders' ability to keep mentally fit, and pathologies such as dementia impose serious limits on the use of these kinds of interventions. And even healthy elders show individual differences in their response to training in basic cognitive abilities. However, we believe that such cognitive training can have very positive effects on mental fitness and quality of life for most community-dwelling elders.

ABOUT THE AUTHORS



K Warner Schaie, Evan Pugh Professor of Human Development and Psychology at The Pennsylvania State University and former director of the Penn State Gerontology Center, is regarded as one of the foremost scholars in the field of adult development and aging. Dr. Schaie holds a Ph.D. in psychology from the University of Washington, where he is an affiliate professor of psychiatry and behavioral science. Since 1956, he has directed the Seattle Longitudinal Study, one of the most extensive psychological research studies of intellectual performance in older adults. Data from the several thousand people who have participated in the study show that most adults maintain their mental abilities well into their 60s—disproving scientists' earlier belief that intelligence peaks in adolescence, then steadily declines.

Dr. Schaie has authored or edited 45 books and more than 250 scholarly publications on the psychology of aging, and has made substantial contributions to research methodology in the field of adult development and aging. His landmark paper, "A General Model for the Study of Developmental Problems," originally published in 1965 in *Psychological Bulletin*, has been widely cited. In addition, he has served as editor of the *Journal of Gerontology: Psychological Sciences*.

A fellow of the Gerontological Society of America and the American Psychological Association, as well as past president and council representative of the APA Division of Adult Development and Aging, Dr. Schaie received the APA Distinguished Scientific Contributions Award in 1992. He also received the Kleemeier Award in 1987 from the Gerontological Society of America for distinguished research contributions; the Method to Extend Research in Time (MERIT) award from the National Institute on Aging in 1989; honorary doctorates



in 1997 from Friedrich-Schiller University in Jena, Germany and in 2002 from West Virginia University; and the 2001 Mensa Education and Research Foundation Lifetime Achievement Award.

Dr. Schaie has been a visiting scientist at a number of universities and institutes, most recently in 2002 at the University of Geneva. His lifelong research interests focus on cognitive and personality development and modifiability from young adulthood to advanced old age, influences of health on behavior, and methodological issues in the developmental sciences.

Sherry L. Willis, who holds a Ph.D. from the University of Texas at Austin, is a professor of human development at The Pennsylvania State University. Funded by the National Institute on Aging for more than 25 years, Dr. Willis' research focuses particularly on developing and evaluating training programs to help older adults compensate for age-related declines. She also looks at practical intelligence—how people solve everyday problems, such as understanding the instructions on prescription drug labels. Dr. Willis recently was funded for a five-year study of midlife predictors of cognitive impairment in old age, a project that received a MERIT award from the National Institutes of Health.

From 1993–94, Dr. Willis was president of the American Psychological Association's Division of Adult Development and Aging, and she holds fellow status in two divisions of the American Psychological Association, as well as in the Gerontological Society of America. She was honored in 1992 by The Pennsylvania State University College of Health and Human Development with the Pattishall Distinguished Research Award. In 1999, she was awarded Penn State's Faculty Scholar Medal for Outstanding Achievement, and in 2001 she received the Pauline Schmitt Russell Distinguished Research Career Award from the College of Health and Human Development of The Pennsylvania State University.

Dr. Willis serves as a reviewer for *Neuropsychology, Cognition, and Aging, Psychology and Aging, Clinical Gerontologist*, and *Journals of Gerontology: Psychological Sciences*. She is a coauthor, with K. Warner Schaie, of the textbook *Adult Development and Aging*, now in its fifth edition. She is also the author or coauthor of numerous journal articles and chapters related to cognitive training in elders. Dr. Willis' most recent interest has focused on cognitive development in midlife. She has coedited two recent volumes on midlife: *Middle Adulthood: A Lifespan Perspective*, with Dr. Mike Martin, and *The Baby Boomers Grow Up: Contemporary Perspectives on Midlife*, with Dr. Susan Whitbourne. With Dr. Schaie, she has been closely involved in the Seattle Longitudinal Study, which has been following participants for almost 50 years.

2005 MINDALERT AWARDS

The ASA-MetLife Foundation MindAlert Awards were established to recognize innovations in mental fitness programming for older adults. Inspired by research showing that cognitive decline is not inevitable in aging, these awards recognize programs, products or tools that promote cognitive fitness in later life. The entries are judged for their innovation, their basis in research, demonstration of their effectiveness, their potential for replication and the extent to which they are accessible to diverse populations of elders. The awards are given in three categories:

- Programs that enhance mental fitness for older adults in general
- Programs that enhance mental fitness for elders with cognitive impairment
- Learning programs for older adults

The winners of this year's awards were recognized at the Joint Conference of the American Society on Aging and the National Council on the Aging held in Philadelphia March 10–13, 2005. For more information on the MindAlert program, visit www.asaging.org/mindalert.

PROGRAM FOR GENERAL MENTAL FITNESS

Mental Fitness for Life: Seven Steps to Healthy Aging

Simon Fraser University
Vancouver, British Columbia

A team of older adults from Century House, a senior recreation center on the west coast of Canada, worked with a facilitator and a researcher to develop the Mental Fitness for Life program. The team came to define mental fitness as a condition of optimal functioning achieved through regular exercise and a healthy lifestyle that includes setting personal goals, engaging in creative thinking,

learning and stimulating memory, speaking one's mind, and thinking positively.

This research provided the basis for developing and piloting the eight-week Mental Fitness for Life program for adults ages 50 and older, and culminated in the book *Mental Fitness for Life: Seven Steps to Healthy Aging* (Bull Publishing, 2006). In keeping with the title, the final step for program participants is to develop a personal mental fitness program for life.

Contact: Sandra Cusack, Simon Fraser University, 515 W. Hastings St., Vancouver, British Columbia, Canada V6B-5K3; (604) 291-5177; scusack@sfu.ca; Wendy Thompson, 3790 Gerry St., Richmond, British Columbia, Canada V7E-2T5; (604) 275-0091.

PROGRAM FOR ELDERS WITH COGNITIVE IMPAIRMENT

TimeSlips

Center on Age and Community
University of Wisconsin, Milwaukee

The TimeSlips method is a storytelling technique that encourages people with dementia to develop and enhance their communication skills by creating stories based on imagination rather than reminiscence. The National TimeSlips Project, headquartered at the Center on Age and Community at the University of Wisconsin, Milwaukee, offers training in the method to paid and unpaid facilitators in dementia care settings.

TimeSlips storytelling groups conducted in adult day programs showed positive outcomes for participants, who were less agitated and communicated more on the days of storytelling. With a grant from the Commonwealth Fund, TimeSlips has established six regional training bases across



the United States and has embarked on a quantitative study of the method in 20 long-term care facilities.

Contact: Anne Basting, Center on Age and Community, University of Wisconsin—Milwaukee, P.O. Box 413, Milwaukee, WI 53211; (414) 229-2732; basting@uwm.edu.

LEARNING PROGRAMS FOR OLDER ADULTS

Understanding Age-Related Memory Loss and Dementia

S. Oregon Research and Extension Center
Oregon State University, Central Point

Learning through volunteer endeavors can stimulate cognitive function for older adults in meaningful ways. Understanding Age-Related Memory Loss and Dementia is a two-hour workshop that provides instruction to Meals-on-Wheels volunteers, who deliver food to homebound older adults.

The program provides practical, easy-to-use information on healthy aging—an effective tool for addressing the age-related memory problems of many of the meal recipients. Drawing from current research, the information provided in the workshop vividly demonstrates how various lifestyle choices—such as good nutrition—have the potential to positively or negatively affect memory in elders.

Contact: Sharon Johnson, Oregon State University, Southern Oregon Research and Extension Center, 569 Hanley Rd., Central Point, OR 97502; (541) 776-7371, ext. 210; s.johnson@oregonstate.edu.

VOCAL: Voices of Community Action and Leadership

Westchester Public-Private Partnership
for Aging Services
Mount Vernon, New York

A nonpartisan advocacy education program, VOCAL is designed to involve older

adults and youth in the political process. The program helps maintain the essential mental fitness of participating elders and encourages their continued involvement in the civic life of their communities. Through a selection of topical workshops chosen with the input of participants, VOCAL rouses interest in and gives information on current issues that concern older adults.

Skills training sessions focus on key areas of speaking, writing, leadership, and coalition-building. Community partners from local organizations, clubs, businesses, and agencies generate programs that address the interests and needs of diverse populations.

Contact: Reva Greenberg, Westchester Public-Private Partnership for Aging Services, 9 S. First Ave., 10th Floor, Mount Vernon, NY 10583; (914) 472-4551; revag@optonline.net.

AWARDS REVIEW COMMITTEE

The American Society on Aging expresses gratitude to the review committee for their work in assessing the MindAlert award submissions:

James Birren, Center on Aging, University of California, Los Angeles; **Dean Bleivins**, Central Arkansas Veterans Health Care System, North Little Rock, Ark.; **Sandra Cusack**, Gerontology Research Centre, Simon Fraser University, Vancouver, British Columbia; **Deanna Eversoll**, University of Nebraska, Lincoln; **Barbara Ginsberg**, My Turn Program, Kingsborough Community College, Brooklyn, N.Y.; **Rebecca Goodman**, Osher Lifelong Learning Institute, University of Hawaii at Manoa, Honolulu; **Darby Morhardt**, Cognitive Neurology and Alzheimer's Disease Center, Northwestern University Feinberg School of Medicine, Chicago; **Kathy Porsella**, Evergreen Society, Johns Hopkins University, Columbia, Md.

ABOUT THE MINDALERT PROGRAM

The MindAlert Program seeks to disseminate research and innovative practices that address the steps that older adults can take to maintain and enhance cognitive and mental functions in their later years. The program, established by the American Society on Aging (ASA) in 2001 and supported with funding from MetLife Foundation, has the following components:

- An annual MindAlert lecture and monograph, which impart the latest research findings on maintaining and enhancing cognitive function in late life.
- The ASA-MetLife Foundation MindAlert Awards, which honor innovative community-based programs that translate research into practical activities that promote cognitive health in elders.
- A Web-based clearinghouse of resources related to maintenance and enhancement of cognitive and mental functioning in late life.
- A curriculum on promoting cognitive health that aging-services and healthcare providers can implement in a wide variety of settings with older adults.
- A trainers bureau and train-the-trainers program to facilitate the implementation of cognitive vitality programs in such settings as senior centers, adult learning programs in community colleges, and park and recreation programs.

For more information about the MindAlert program, including its Web-based clearinghouse of resources on mental fitness, visit www.asaging.org/mindalert, or contact the American Society on Aging at mindalert@asaging.org.

THE AMERICAN SOCIETY ON AGING



The American Society on Aging is the largest association of professionals in the field of aging in the United States. Founded in 1954, ASA seeks to promote the well-being of older adults and their families by enhancing the abilities and commitment of those who work with them. To that end, ASA sponsors a wide variety of conferences, networking opportunities, and Web-based training. The organization also publishes a quarterly journal, a bimonthly newspaper, seven quarterly newsletters, and an e-mail newsletter for its members. To obtain more information on ASA or to join, call (800) 537-9728 or visit www.asaging.org.

MetLife Foundation

MetLife Foundation, established in 1976 by the Metropolitan Life Insurance Company, has been involved in a variety of aging-related initiatives. Since 1986, the foundation has supported research on Alzheimer's disease through the MetLife Foundation Awards for Medical Research and has contributed more than \$9.5 million to efforts to find a cure. In addition, the foundation has provided support for a traveling exhibit on memory; a public-education video for use by caregivers and families of people with Alzheimer's disease; and support for healthy-aging projects addressing issues of caregiving, intergenerational activities, health and wellness programs, and volunteer opportunities. MetLife Foundation supports health, education, civic, and cultural programs throughout the United States. For more information about the foundation, visit www.metlife.org.



PAST MINDALERT SPECIAL LECTURES

The annual MindAlert monographs from 2001 to the present are available on the American Society on Aging website at www.asaging.org/mindalert as free, easily downloadable PDF files. Past monographs:

GOOD NEWS ABOUT THE AGING BRAIN!

Nationally known brain researchers Marian Diamond and Arnold Scheibel describe their groundbreaking studies of brain function and the optimistic implications for successful aging. (2001)

BRAIN HEALTH FROM 1 TO 100

Paul Nussbaum, a leading clinical neuropsychologist, describes what he refers to as a health promotion opportunity of unprecedented stature: the ability to foster our own brain wellness for healthy, functional aging. (2002)

CENTENARIANS: LESSONS ON LIVING LONG AND LIVING WELL

Head of the renowned New England Centenarian Study, Thomas Perls shares the findings of his research and talks about how we all can make our later years healthy, vital ones. (2003)

UNITING THE HEART AND MIND: HUMAN DEVELOPMENT IN THE SECOND HALF OF LIFE

Gene Cohen, a pioneer in the field of creative aging, explains the implications of his four developmental stages of late life and how these phases represent a richly creative period, full of personal growth and societal engagement. (2004)

Does intellectual ability change uniformly throughout adulthood or are different patterns of ability present over the lifespan? What accounts for individual differences in age-related changes in cognitive ability, especially in late life?

Can cognitive decline with increasing age be reversed by educational intervention? In this monograph, Dr. K. Warner Schaie and Dr. Sherry L. Willis discuss their findings from the Seattle Longitudinal Study, which spans three generations and almost 50 years.

MetLife Foundation

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