

## Promoting Healthy, Meaningful Aging Through Social Involvement: Building an Experience Corps

By Michelle C. Carlson, Ph.D.



Image courtesy of Experience Corps

*Editor's note: Pathways responsible for higher-order thinking in the prefrontal cortex (PFC), or executive center of the brain, remain vulnerable throughout life—during critical early-life developmental windows, when the PFC fully matures in the early 20s, and finally from declines associated with old age. At all ages, physical activity and PFC-navigated social connections are essential components to maintaining brain health. The Experience Corps, a community-based social-engagement program, partners seniors with local schools to promote purpose-driven involvement. Participating seniors have exhibited immediate short-term gains in brain regions vulnerable to aging, such as the PFC, indicating that people with the most to lose have the most to gain from environmental enrichment.*

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Over the last decade, scientists made two key discoveries that reframed our understanding of the adult brain's potential to benefit from lifelong environmental enrichment. First, they learned that the adult brain remains plastic; it can generate new neurons in response to physical activity and new experiences. Second, they confirmed the importance of social connectedness to late-life cognitive, psychological, and physical health. The integration of these findings with our understanding of individuals' developmental needs throughout life underscores the importance of the "social brain." The prefrontal cortex (PFC) is particularly integral to navigating complex social behaviors and hierarchies over the life course.

In this article, I will briefly articulate how the above findings inform the design of a social health-promotion program, the Experience Corps, which leverages seniors' accumulated experiences and social knowledge while promoting continued social, mental, and physical health into the third age, when a person's life goals are increasingly directed to legacy building. Experience Corps harnesses the time and wisdom of one of the world's largest natural growing resources—aging adults—to promote academic achievement and literacy in our developing natural resources—children—during a critical period in child development. In so doing, older volunteers instill a readiness to learn that may alter the child's trajectory for educational and occupational attainment, as well as lifelong health. At the same time, preliminary evidence suggests that the senior volunteers experience measurable improvements in their cognitive and brain health.

### **The Developing Prefrontal Cortex**

The prefrontal cortex is the brain's planning, or executive, center. It integrates past and present information to predict the future and to select the best course of action. Executive processes generally involve the initiation, planning, coordination, and sequencing of actions toward a goal. While we take these skills for granted, the brain requires considerable resources to navigate unpredictable environments and to integrate the multiple streams of information that each of us calculates hundreds of times per day. We often must flexibly and quickly update plans and priorities and inhibit distracting or irrelevant information in the environment and in memory that may direct attention away from a goal.

The PFC is evolutionarily the newest and largest region of the brain, and its growth over the millennia corresponds to the increasing importance of social behavior to human survival.

Over time, collaboration and negotiation became at least as important to our survival as agility. PFC maturation is not complete until one's early 20s,<sup>1</sup> presumably because the ability to integrate multiple streams of information requires the maturation of physical, linguistic, and emotional sensory networks.<sup>2</sup> The PFC's extended developmental window involves maturation of networks that control attention steadily from childhood to adulthood, allowing us to filter multiple streams of information more efficiently.<sup>3, 4</sup> For evidence, we have only to look at the decisions that adolescents make; teens are often enamored with living in the moment and considering the consequences later. With age and experience, these priorities reverse and thoughts of consequences prevail over the moment.

During the PFC's developmental window, the brain may be particularly vulnerable to insult.<sup>5-8</sup> Early-life brain imaging and cognitive testing studies show that lower socioeconomic status (SES) in children, as measured by family income, is associated with developmental lags in language and executive function and their associated brain structures, like the PFC. We do not yet know if these maturational lags make the brain more vulnerable to the effects of additional insults that accumulate with age, nor do we know how modifiable or reversible these imprints are in a fully developed adult brain.

In addition, we do not yet know whether socioeconomic deprivation in early life leaves a lasting imprint on the developing brain. We have established that birth to age two is a critical period of rapid brain growth and development, and head growth is 75 percent complete by age two.<sup>9</sup> From age two to seven, language typically develops rapidly through spoken and then written expression. As such, there are critical windows of brain and language development that, when nurtured among children of all socioeconomic backgrounds, may lead to long-lasting effects on school success, occupational opportunities, and cognitive and psychological health throughout life, thus reducing economically related health disparities.

The late-developing PFC appears to be more vulnerable than other brain regions. With increasing age come increasing difficulties in executive control. Through longitudinal observation, we have found that components of executive function decline earlier than memory in older community-dwelling adults, and intervention targeting these components may delay and mitigate memory decline that leads to dementia.<sup>10</sup> Consistent with this finding, studies of the aging human brain show that loss of brain volume is greater in the PFC than in posterior areas of the cortex.<sup>11-15</sup>

Healthy aging is not defined simply as the avoidance and management of chronic diseases. Healthy behaviors, including physical activity, social supports and engagement, and cognitive activity, remain important to overall health and prevention of cognitive decline and disability as people age—even into the oldest ages.<sup>16, 17</sup> However, it has proven difficult to motivate older adults to participate in health-behavior change programs, especially for sustained periods of time.<sup>18</sup> According to developmental psychologist Erik Erikson, the third act of life represents an opportunity to use a lifetime of accumulated knowledge—the kind of knowledge that is not easily memorized from books, classroom lectures, or online searches—to find purpose.<sup>19</sup> This type of knowledge comes from decades of interpreting and understanding unpredictable social behaviors in order to predict and shape future rewards—not one's own future, but that of succeeding generations through the legacy of transfer. I will outline here a rationale for valuing these abilities and, in so doing, identify a vehicle by which to maintain cognitive, physical, and social activity throughout life to buffer the effects of age and disease on the mind and body.

### **Reversibility of Cumulative Environmental Risks in Later Life**

Researchers can target the pathways vulnerable to chronic environmental deprivation and disadvantage to reverse long-experienced deficits. Animal models show that enriched environments elicit neurogenesis or synaptogenesis (growth of new neurons or formation of new synapses between neurons) and reduced neuronal death, especially in hippocampal structures important to memory and dementia risk.<sup>20, 21</sup> There is now ample evidence that enriching environments physically, cognitively, and socially promotes the emergence of new neurons in animals throughout life.<sup>22</sup> However, little of this work has been directly translated to human cognitive intervention studies.

The most direct evidence for activity-induced changes in executive function in later life relates to the effects of aerobic walking exercise programs on brain structure and function, measured using magnetic resonance imaging (MRI). Physical exercise produces measurable and reliable improvements in PFC functioning and is linked with larger hippocampal volumes associated positively with memory in aging adults. Using functional magnetic resonance imaging (fMRI), Arthur Kramer and colleagues at the University of Illinois, Urbana-Champaign, observed neurocognitive benefits of an aerobic walking program on the efficiency of executive

function and brain activity in key prefrontal and temporal regions of the brain.<sup>23</sup> The researchers did not observe the same effects in a control group that engaged in only toning and stretching. Consistent with findings from fMRI data, they further found that higher fitness levels were associated with increased hippocampal volume.<sup>24</sup>

Older adults are the group with the most to gain from regular physical activity because of its beneficial effects on a host of health-related outcomes. Unfortunately, they are also the subset of the population with the highest rates of inactivity. Physicians and researchers have had difficulty promoting adherence to exercise programs in any long-term, large-scale way. Scientists have primarily conducted these studies in higher SES populations. Among those with lower SES, neighborhood factors often restrict opportunities for regular exercise.<sup>25</sup>

### **Known Cognitive Benefits of Social and Volunteer Activity**

A growing body of evidence suggests that low social activity in middle-aged and older adults is associated with increased risk for Alzheimer's disease<sup>26</sup> and that mid- and late-life social engagement<sup>27</sup> is associated with better cognitive and physical health and greater longevity.<sup>28</sup> Both social integration and social activity lead to better functioning and reduced risk for decline in cognitive functioning. At the same time, postretirement transitions may reduce opportunities for such activity, due to loss of routine contact with co-workers and increasing tendencies for adult children to live remotely. As a result, opportunities for social activity and engagement become more restricted and sporadic.

Social engagement through volunteer activity has been associated with lower mortality and disability rates and improved self-assessed health and cognition.<sup>29-31</sup> Volunteers also experience slower rates of decline in health and function as well as lower rates of depression. These findings augment an established literature on the health benefits of regular community participation among aging people.

With this information, we face new opportunities for designing programs that enrich and maintain cognitive and brain health as we age. Rather than focusing on ways to protect and buffer the aging brain's inevitable decline, we are liberated in thinking about ways to continue to promote new and shared learning in a variety of contexts, thereby feeding the brain and nourishing the mind. The brain's sensory motor systems are exquisitely designed to detect novelty and change in the environment. Networks in the PFC use this information to

continuously update and revise information about relevant and irrelevant environmental characteristics in order to better predict future risks and benefits. Programs should leverage older adults' strengths—wisdom and world knowledge—to improve abilities that steadily decline with age, including executive function, memory, and mental speed.

The vehicle by which to harness this lifetime of accumulated knowledge and wisdom is the desire to be generative. As originally conceptualized by Erikson, generativity is an expression of our desire to feel that we are fulfilling socially valued, functional roles—the “need to be needed,” to be of some importance to other people, and to “give back.”<sup>19</sup> By nurturing, leading, and promoting the next generation, the generative adult creates products that benefit social systems and promote their continuity.

### **The Experience Corps Program**

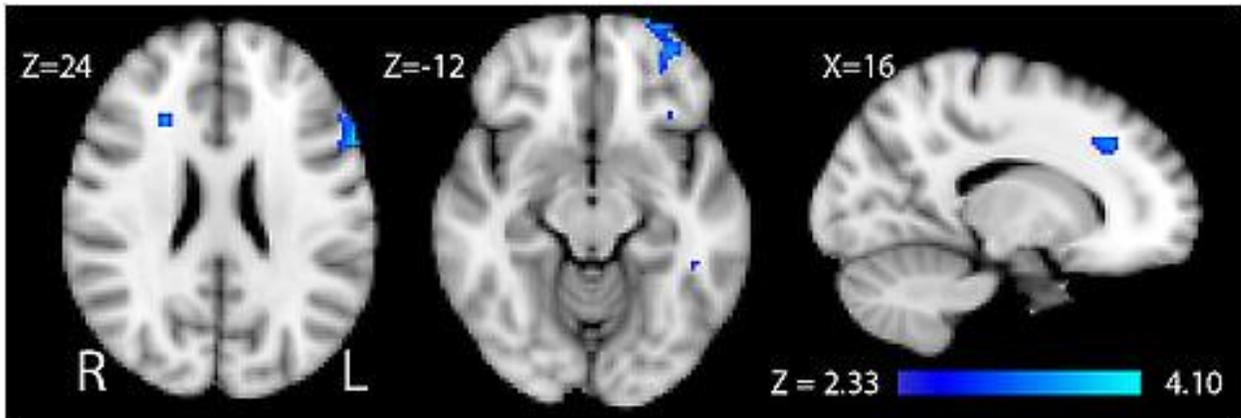
I have outlined some of the research demonstrating the importance of executive functions and the neural pathways that support them to social interaction and independent functioning. These findings collectively argue for the design and implementation of effective cognitive and functional health programs to promote childhood development and maintenance of executive functions and their supporting frontal brain circuits. In youth, the goal can be more than remediating developmental delays; programs can also capitalize on what we know about brain development in enriched environments to excite children about reading—an important vehicle to learning—during the critical arc of brain-behavior development. Similarly, for those in later life, the goal is not only to mitigate cognitive decline and dementia risk, but also to enrich the lives of others. At both ends of life, people remain social organisms. The very pathways by which environmental deprivation adversely affects childhood and adult development and mental health are the same malleable pathways by which to enrich and boost health.

The Experience Corps Program was initially designed and implemented in a national demonstration by Linda Fried, then at the Johns Hopkins Center on Aging and Health and now dean of Columbia's Mailman School of Public Health, and Marc Freedman of Civic Ventures, a think tank focusing on social issues relating to baby boomers.<sup>32,33</sup> The program was further refined and evaluated in a pilot randomized trial in Baltimore in 1999 to 2001 through a research-community partnership with Sylvia McGill and the Greater Homewood Community Corporation.<sup>34</sup>

Experience Corps is a community-based model in which retired adults improve academic and behavioral outcomes of children and become the agents of social health promotion.<sup>35</sup> Dr. Fried envisioned Experience Corps as a vehicle for harnessing the potential benefits of an aging society by investing resources in a societal win-win situation for older and younger generations alike. Within this program, we designed structures that would enhance a critical mass of volunteers in the schools by requiring 1) a significant commitment of volunteer service (15 hours per week), and 2) social support and networks through team training and team service. Because many volunteers live near the schools they serve, physical activity occurs naturally through daily walks to and from, as well as within, the schools. I codesigned volunteer roles to maximally incorporate cognitive activity and exercise of executive functions through flexible shifting between mentoring activities, including supporting children's literacy and math-skill development, assisting in school libraries, and promoting positive conflict resolution. Volunteers also exercise executive functions through collective problem solving with team members and teachers.

In a seven-month, randomized, controlled pilot trial of Experience Corps, we substantially increased rates of walking activity (blocks walked) and improved lower-limb strength<sup>35</sup> and executive functions and memory among community-dwelling older adults who were sedentary and had poor executive function at baseline.<sup>36</sup> The promising short-term changes in physical and cognitive abilities suggested that this type of high-impact activity program is a successful approach to ameliorating executive deficits.

Next, through a six-month pilot brain-imaging study, we examined whether Experience Corps intervened with executive functions and the PFC brain regions that regulate them. We again observed that Experience Corps volunteers, and not controls, showed improved executive function, as well as increased brain activity in the PFC while performing that executive function.<sup>37</sup> These pilot results provide proof of concept for use-dependent brain plasticity in later life and suggest that interventions designed to promote health and function through everyday activity may enhance plasticity in key regions that support executive function. In summary, people at greatest risk for executive deficits showed substantial and clinically meaningful improvements in these and other functions as a result of participating in this program over six months. This suggests that people with the most to lose have the most to gain from environmental enrichment.



Blue marks areas of increased brain activity in the prefrontal cortex following six months of exposure in the Experience Corps program compared to a wait-list control group. The prefrontal cortex is a region important to executive functions that help maintain functional independence. This region of the brain is particularly vulnerable to age-related changes that may predispose the individual to greater risk for age-related dementias, such as Alzheimer's disease.

Similarly, preliminary evidence over one academic year shows that Experience Corps improved academic and behavioral performance in kindergarteners and third graders compared to students at the control schools.<sup>38</sup> Participating schools further observed a 34 to 50 percent reduction in the number of office referrals for behavioral issues. Researchers expect these effects to magnify over multiple years of program exposure and to impact teacher retention and school climate. As part of a large-scale, randomized trial, George Rebok of the Johns Hopkins Bloomberg School of Public Health will evaluate these longer-term effects. Ultimately, we may be able to increase the number of students graduating from high school, thus producing a net gain to society.<sup>39</sup>

In 2006, with funding from the National Institute on Aging (NIA), we initiated a trial of Experience Corps in Baltimore to simultaneously assess the two-year impact of service on volunteers' health and function and on schools and children, as well as the economic impact of the program on health-care utilization among older adults. Within this randomized trial of 702 older adults volunteering in 20 Baltimore City schools, we have incorporated a brain-imaging substudy of 120 participants to better determine whether social and cognitive activities can help buffer and boost the PFC and hippocampal regions important to executive function and memory.

When the Baltimore Experience Corps Trial culminates in December 2011, we will be able to determine the program's effects on older adults' health and on children's academic success. Although we have yet to understand the extent and limits of brain plasticity in response to increased activity, the program's preliminary results over shorter periods of exposure lead us to consider a new generation of real-world interventions that target and enrich activity in daily life in ways that matter to each participant. Physical activity may matter most when it occurs in the service of goals. For our ancestors, that goal may have been outwitting and out-navigating predators; today, that goal may be to feel societally valued. An Experience Corps volunteer captured this point of view best: "I never thought I would be the hero of my own life."

Social health-promotion programs like Experience Corps have the potential to alter the lifelong outcomes for children, adults, and entire communities in a highly cost-effective way. Older adults at high risk for executive dysfunction maintain great potential for brain plasticity and cognitive resilience while serving as highly effective mentors to children during critical periods of brain development and growth. The high degree of enrichment offered by Experience Corps led to immediate short-term gains in brain regions vulnerable to aging. We do not yet know if these short-term effects translate to longer-term benefits, whether this experience can help overwrite or mitigate the imprint of a lifetime of accumulated social and economic disadvantage in aging adults, or whether these volunteers can simultaneously improve children's developmental trajectories and school success.

## **Conclusions**

We no longer view aging as a time of managing inevitable biological declines; it is instead a period of continued development through postretirement social reinvestments and the realization of a purpose-driven life. This revised focus requires us to think differently about health-care systems and policies designed to treat a failing system. By reconfiguring health-care programs and policies to incentivize generative giving, we can capitalize on and value what only a lifetime of experience can provide. At the same time, the data presented here indicate that valuing and exercising life experience will lead to health benefits in brain systems that become vulnerable with increasing age. We now know that these systems, although vulnerable to aging, are the same ones that sought out novelty throughout early and midlife, and they remain plastic and ready to be exercised. We also know that humans are particularly social. This desire to

engage with others may be the vehicle by which to make a social contract with others (be they schoolchildren or peers) to promote activity and brain health in everyday life. As we approach a time when the number of older adults will equal the number of children, this strategy may offer health rewards that outweigh reductionist approaches focusing solely on cognitive or physical exercises.

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