Journal of Gerontology & Geriatric Research

Hsieh, J Gerontol Geriatr Res 2015, 4:2
DOI: 10.4172/2167-7182.1000211

Commentary Open Access

The Importance of Aging Brain Research

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Rec date: Feb 28, 2015; **Acc date:** Apr 27, 2015; **Pub date:** Apr 30, 2015

Introduction

Population aging is now progressing rapidly in almost all societies worldwide. Nowadays, the issue of global aging is just as serious as the issue of global warming. The proportion of people of 65 years and older is estimated to rise rapidly from 15% in 2009 to 26% in 2039, and the ratio of older adults versus the productive population will increase from 25 to 49% [1]. Moreover, in most developed countries the average life expectancy has increased from about 45 years old in 1840 to above 75 years old in 2000 [2]. Global aging has many critical socio-economic and health consequences, including the increase in the old-age dependency ratio, and the occurrence of cognitive impairment and dementia. It thus presents challenges for public health as well as for economic development. World Health Organization (WHO) and Alzheimer's Disease International (ADI) jointly published a report in 2012, "Dementia: a Public Health Priority", claiming that the number of people living with dementia worldwide is currently estimated at 35.6 million, and this number will double by 2030 and more than triple by 2050. Hence, we as researchers, specifically as cognitive neuroscientists, bear some responsibilities in answering the questions like "Can science slow our aging process, or help us age better?" That is why aging research is timely and very important now.

Among various approaches in aging research, I would vote brain research as a priori approach. One of the main reasons is that the outcome of the brain research may be useful in developing effective intervention programs particularly for cognitive aging. A number of translational brain research has provided effective treatments for impaired cognition in various diseases, such as attention deficit hyperactivity disorder (ADHD), schizophrenia, depress, etc. Yet, relatively fewer research has focused on such translational brain research in aging [3] which I think is timely and important. Two important issues in aging brain research should be also noted. First, one should not overlook cultural influence on brain and cognitive aging [4]. So far, aging studies have mostly been conducted on Western populations, raising doubts about the universality of age-related changes. Many culture-sensitive factors, including genetics and the environment (e.g., lifestyle, diet, stress, bilingualism, religion and so on) could have modulated the aging trajectory. For example, a recent press release by Kaiser Permanente (2013) has shown that compared to Asian-Americans, Native Americans were 64 percent more likely to develop dementia and African-Americans were 44 percent more likely. The difference was due to the fact that almost 20 percent African-Americans and Native Americans were diagnosed with dementia during the 10-year study [5]. On the other hand, Stephen Katz (2005) has advised the gerontology research to take cultural effect into account since aging is an integral feature of our existence as biological creatures and as a social construct or discourse. As Katz raised in the Introduction of his article, "Would we really wish the biological, geological, or cosmological orders of existence neither to age, nor change in time, not regenerate themselves through cycles of birth and death?". Based on his idea, the goal of gerontology is "to determine the conditions and contexts in which an individual's adaptation to aging is either facilitated or limited". In an even more recent conference, the International Convention of Psychological Science (ICPS), 2015, some researchers in the symposium of "Psychology in an economic world: cognition, brain, behavior, and development in socioeconomic contexts" chaired by Daniel Cervone have highlighted the impact of socioeconomic factors on psychological development and functioning (such as how wealth and poverty affect thought, emotion, and action throughout our lives). Hence, indigenous aging research is needed in order to clarify biological vs. environmental factors in brain and cognitive aging in the future.

The second issue concerns how individual differences in cognitive functions are, especially cognitive control related to aging. Despite there have been existing various theories delineating age-related deficits in cognitive control, literature has shown heterogeneous patterns of age effects. That is, sometimes the elders show deficit in behavioral performance. Sometimes the elders show no deficit in behavioral performance. Why would there be discrepant findings? Were there any mediating factors, such as age-related brain compensatory responses? The answer is yes [6-8]. Furthermore, individual differences happen to be one of the key factors in such compensatory responses. Hence, the conventional group averaging statistical approach can no longer be satisfactory in understanding true age effect. Rather, an effective approach to deal with the issue of individual differences is to implement formal cognitive models developed in mathematical psychology [9]. The bridge among three different scientific disciplines (experimental psychology (behavioral data), mathematical psychology (formal cognitive models), and cognitive neuroscience (neuroimaging data) will provide key insights in cognitive aging.

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