

# Understanding Aging in Down Syndrome: A First Step

## A Research Report

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### Why Was This Study Conducted?

All people, including persons with developmental disabilities, are living much longer than in the past. Given these longer life spans, it is important to better understand the aging process and signs of cognitive decline commonly associated with aging.

Past research has shown that adults with Down syndrome may begin aging much earlier than adults without Down syndrome. Beyond typical forgetfulness, certain changes in memory are the first warning signs of possible dementia in most adults. However, these early warning signs are harder to detect in Down syndrome because many of the memory tests used to predict dementia in general are too demanding for a person with Down syndrome at any age. Communication challenges also can get in the way of using these tests in adults with Down syndrome.

New memory tests are clearly needed in Down syndrome, since the sooner clinicians know when someone is having memory problems, the sooner they can intervene. This approach of “the sooner, the better” is also increasingly voiced by researchers and clinicians who work with Alzheimer disease in the general population.





## How Was This Study Conducted?

This study took advantage of an interesting brain “fun fact”: age-related changes in the brain occur before people see obvious signs of aging in everyday behavior or even on memory tests. Such brain changes develop gradually throughout adulthood, and they correlate with age-related decline in memory and attention.

Study participants with Down syndrome and their family members graciously took part in a study to identify age-related differences in attention and memory. The researchers’ approach was to look at the brain responses of youth and adults with Down syndrome while they viewed simple pictures. They then compared these brain measures to family members’ responses to questionnaires about their family member’s everyday adaptive skills, mood behavior, and possible dementia-related symptoms. This way researchers determined if differences in brain activity were indeed related to possible declines in day-to-day functioning.

The research design was new and powerful. One of its strengths was the use of brain measures called event-related potentials (ERP). ERP refers to a brief change in brain activity in response to a specific stimulus, like a picture or a sound. ERPs are measured with a “hat” made of soft sensors. ERP characteristics typically change with age and provide information about cognitive functioning even when a person does not make any spoken or movement responses. ERPs are especially useful in individuals with intellectual disabilities who may have difficulty completing traditional behavioral assessments that require a spoken or movement response.

Researchers thus reasoned that measuring brain activity during simple attention and memory tasks is an effective way of identifying early signs of aging in individuals with Down syndrome.

One task focused on the brain’s ability to remember new information by comparing brain responses to repeated presentations of a few pictures mixed among other pictures presented only once.

The second task measured attention to expected and unexpected events. Researchers did this by examining the brain’s responses to anticipated changes in orientation of a simple shape as well as to other drawings presented among the shapes.

Because aging in Down syndrome also may involve changes in mood and symptoms of depression, the third task examined the brain’s ability to notice differences among happy, sad, or neutral facial expressions.

The study aimed to answer three main questions:

- Compared to adolescents and young adults with Down syndrome, do older adults with Down syndrome show reduced memory and attention?
- Compared to the younger Down syndrome group, do older adults with Down syndrome show a different pattern of responses to emotional faces?
- Is there a relation between the brain measures of memory and emotion processes and the caregivers’ reports of daily functioning in persons with Down syndrome?

## Who Took Part

Twenty-four families with a family member with Down syndrome took part in the study. The younger group was between 19 and 25 years of age (average age = 20.85 years). The older group was between 35 and 40 years of age (average age = 37.49 years).

The IQ scores of participants were almost identical across older versus younger participants. The average IQ for the group as a whole was 51. The two age groups varied widely in caregiver ratings of mood, irritability, or withdrawal, with somewhat higher scores in the older age group.

Importantly, the everyday adaptive skills of the older group were lower than in the younger group. The older group scored about 15 points lower in their communication, daily living, and socialization skills. Caregivers of older individuals also reported more concerns with possible dementia-related symptoms.

## What Was Learned

Brain responses in two of the three tasks were different between the younger versus the older participants with Down syndrome.

Brain responses of both adolescents and young adults demonstrated better memory of the repeated pictures. This indicated that the brain was able to learn new information even when not requested to do so. By contrast, older adults with Down syndrome did not show the same pattern of brain responses, indicating reduced ability to remember new information.

Compared to older participants, younger participants with Down syndrome were better at maintaining attention to the pictures, or stimuli. They had stronger brain responses to both predictable and unpredictable changes in the expected picture sequence. Brain responses of older adults with Down syndrome did not detect such differences as clearly. They showed just a small change in response to the unexpected events only.

All participants with Down syndrome noticed happy and sad emotional facial expressions among neutral faces. Brain responses to emotional faces showed no significant age-related differences.

Differences in brain responses did not vary with cognitive level. All participants, regardless of their IQ, were able to complete the tasks. However, faster recognition of the repeated pictures was associated with higher adaptive daily living and socialization skills. Better brain recognition of repeated pictures in younger participants also was related to fewer symptoms of dementia, withdrawal, and inactivity.

Age-related changes in attention, learning, and memory have been observed in the typical population. Now comparable



evidence is available for adults with Down syndrome using ERP measures and simple visual tasks that make minimal cognitive and motivational demands.

To briefly recap, what was gained from this study?

- ❑ ERP brain responses can detect age-related differences in cognition and memory in individuals with Down syndrome.
- ❑ Compared to younger participants, ERP memory responses of the older group were slower and less efficient. As the participants' brain recognition of repeated stimuli worsened, they had more difficulties in adaptive skills, withdrawal, and dementia-related symptoms.
- ❑ IQ tests depict overall strengths and weaknesses in problem solving and are not necessarily designed to detect early age-related brain changes in attention or memory in persons with Down syndrome.
- ❑ ERPs are well-tolerated and can play an important future role in treatment studies aimed at improving memory and minimizing cognitive declines in adults with Down syndrome.

## Heartfelt Thanks

We are grateful to the families who took part in this study. Families always have been and will continue to be our partners in discovery. Without their help, we could not advance our society's understanding of how children and adults with and without disabilities grow and learn and change across the life span. They have honored us by the confidence they have shown, entrusting their family members with Down syndrome to take part in this study. We thank them for raising such wonderful individuals and for all the many ways in which they make their lives and the lives of all individuals with disabilities better.

A special thank-you to the Beasley Family for their support of this work and their determination to make a positive difference for individuals with Down syndrome of all ages!

### Questions?

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