

# Early Reading Development Newsletter

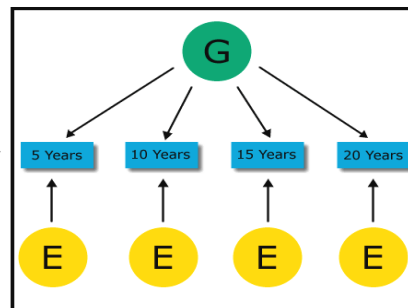
## How Genes and Environment Influence Us

Genetic and environmental factors influence the way we behave, think and relate to the world around us. Genetic factors are traits that have been passed down in the genes, from our parents and their parents before them. These include physical features like height and eye color, and personality characteristics such as shyness, addictive behavior, and risk taking. These factors tend to remain relatively stable throughout our lives.

Environmental factors are elements outside of ourselves that we interact with on a daily basis. These include

family, teachers, friends and neighbors, as well as our physical location and the effects of possible hardships we endure. Depending on our genetic makeup, we will deal with these environmental influences in different ways.

The figure below explains what we are finding regarding the influence of genetics and environment on our behavior.



The G (genetic factors) tends to inform our behavior at every age, whereas the E (environment) is largely age specific. For example, let's say Jim goes to a school that is very easy. He doesn't have to try hard and gets good grades.

Then Jim's family moves to a new town with a more difficult school. Now Jim has to try very hard but doesn't get good grades.

Jim's intelligence (influenced by G) hasn't changed, but his environment (E) has.

At the Institute for Behavioral Genetics, we study many ways that environment and genetics influence our lives. Our current research has shown that there are specific genes that are related to specific behaviors, including reading ability and disability. Thanks to your participation in projects such as these, we are coming to a greater understanding regarding the complex factors that shape who we are.

## Early Reading Development Project Overview

We are recruiting same-sex twins in their final preschool year, generally at age four, in order to identify genetic and environmental influences on literacy development. We begin at the preschool stage for two reasons: One is to study those aspects of development already known to predict how well children progress in reading and spelling once they go to school; the second reason is that if we only worked with older children we could not be sure how much the reading levels they have already attained might influence results on other processes we are interested in. We then follow the children through the first three years of school, assessing

literacy growth and related aspects of development, especially in spoken language.

We use twins because they can help us separate the effects of genes and the environment on whatever we are studying, in our case literacy development. Monozygotic, or "identical," twins share all of their genes. Dizygotic, or "fraternal," twins share, on average, half of their genes, the same way non-twin siblings do. If some aspect of behavior (or health, or whatever we are studying) is largely influenced by a person's genetic make-up, then monozygotic twins will be very similar to each other and more alike than dizygotic twins. If it is largely influenced by the envi-

ronment which twins share as they grow up, the home and school for instance, then monozygotic twins will again be very similar to each other but no more alike than dizygotic twins, who will of course also be very similar to each other. If the behavior is largely influenced by factors that are unique to each individual, that is neither genes nor the environment that the twins share exert much influence, then neither type of twin will be much like their co-twin. The twin method lets us estimate the mix of these various influences on whatever characteristic we are studying.

### Some Processes We Assess:

- **Phonological awareness:** The ability to recognize sounds and patterns in speech, including rhyme and alliteration.
- **Print awareness:** Familiarity with the names and sounds of letters in books.
- **Learning Memory:** Ability to remember stories, recall patterns and remember strings of unrelated words.
- **Vocabulary:** Knowledge of the names of various objects, both familiar and less familiar.
- **Grammar:** Ability to apply the rules of language, such as the use of plural nouns.



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Longitudinal Study of  
Early Reading Development



## Results from the Preschool and Kindergarten Phases

Three of the groups of measures, phonological awareness, learning/memory, and verbal fluency, have been identified as moderately influenced by a child's genetic makeup. In each case, around 50% of the differences among children can be attributed to genetic differences. There is an influence of the home and preschool environment on these abilities as well, but not as substantial as the effects of genes. In contrast, measures of language processes such as vocabulary, grammar, and print awareness show major effects of the shared environment and more modest effects of genes. Differences among children seem to reflect something about the language they

are hearing and seeing at home and preschool.

For all of these measures, there is also evidence for the influence of factors that are unique to each child –that is, neither due to genes nor the home/preschool environment that the twins share. We are unsure of what these factors are at this stage in the process.

With the Kindergarten phase we see reasonably substantial effects of genes and more modest effects of shared environment on how quickly and accu-



rately children can read lists of words, on verbal fluency, and on phonological awareness. Spelling is about equally influenced by genes and the shared environment. We do not yet have sufficient data to analyze the results for the ability to understand passages of text, perhaps the most critical aspect of reading. We also emphasize that these results are tentative because as yet we have only a relatively small number of children with full results. In this branch of science, one needs substantial numbers to feel secure about the results.

## What the Results Mean

What our data tell us so far is that there is a mixture of genes, the home/school environment that children share and individual environmental factors at work. This is true of many aspects of human life, such as physical health and mental health. The fact that genes have a role at all is no reason to be pessimistic about the prospects of

someone who starts out life with a less than optimal genetic makeup for a particular characteristic even though we cannot modify our genes. There are many cases where good management of the environment can overcome a potential problem.

In the case of literacy development, good management will include enrich-

ing the child's early language environment, well targeted and well delivered teaching in school and the early identification of children at risk for developing reading difficulties. We believe that our project will contribute to each of these goals, particularly as it is helping us refine our ideas of which environmental factors are most important.

## Thank You for your Participation!

We would like to thank you for your time and commitment to the reading study. Currently, there are 489 pairs of twins enrolled in the Longitudinal Twin Study of Early Reading Development. The same reading research is taking place in Australia (224 twin pairs) and in Norway (140 twin pairs), using the same measures and sampling procedures as our U.S.

study. All three countries are working in collaboration to collect and analyze data in this important research.

There is some potentially exciting news for the future of the reading study. We are waiting to hear if we have received funding to see the twins after they have finished 4th grade. At that time there will be an increased emphasis on the twins' read-

ing and listening comprehension, and on their print exposure. This will provide important new evidence regarding the genetic and environmental causes of individual differences and disabilities across this critical period of early reading development. We hope to hear soon about this funding.