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# Introduction

**M**y teaching career began almost 60 years ago in a one-room rural elementary school. I was clueless, but we all survived the year. I taught there for four stimulating years, and the experience gave me an introduction to the range of childhood and early adolescence development that I couldn't possibly have otherwise experienced.

The school, located within a farm and forest area, had a stream flowing behind it. My avid interest in biology meant that we spent a lot of time outside studying the ecology of the area—probably at the expense of *book learning*. Because we had a bus, and I was the driver, we could also easily go on field trips to other interesting places. We had an enjoyable time, and the students I met in later years had gone on to good lives. I reconnected with a dozen of them recently when I was invited to participate in the community's centennial celebration. I thus have no regrets or apologies for my befuddled professional beginning.

The area is now decidedly suburban—houses, malls, and four-lane streets. Children play in tended parks. State school standards are presumably being assessed in large, well-equipped schools.

World War II had ended five years before I became a teacher, and the United States had embarked on a post-war building boom during which the German Autobahn morphed into the U.S. Interstate Highway System, and various wartime technological advances eventually led to television, computers, and video games.

What we didn't understand at the midpoint of the 20th century was how a brain and much of the rest of biology worked. Childhood infectious diseases were a threat, and most learning disabilities were an enigma. DNA was discovered four years after I completed my degree in biology and wandered into teaching.

Our understanding of teaching and parenting were similarly rudimentary, although folks had been doing both for millennia. We could observe and try to shape the behavior of children with combinations of rewards and punishments, but adults were never sure if the young developed because of—or despite—their efforts.

As I approach the end of my career, I can't help but realize how different the world is for 21st-century parents and teachers who are now beginning the challenges I faced as a father and educator in the middle of the 20th century.

I don't agree with the common tendency to reflect on the past as idyllic and the future as terrifying. What I did then was pleasant enough for me to stay with it, but if I had to begin adult life anew, being a 21st-century parent and teacher would be an even more stimulating and optimistic challenge—and mostly because we know so much more about the underlying biology and neurobiology of childhood and adolescence.

## CHILDHOOD IN HUMAN LIFE

We're individuals within a social species, and most of us live in a democratic society. The first 20 years of our life are devoted to mastering the knowledge and skills that are necessary for an effective sense of self, harmonious relationships with family and friends, and effective citizenship within a democratic society. As autonomous productive adults, we then practice what we learned and help yet another generation become competent human beings. This book will thus focus on the knowledge and skills that adults need in order to nurture the next generation—their own children and the children of others.

Although we have the same basic brain throughout our life, it continually adapts itself to new biological and environmental

circumstances. Our brain's initial 20-year developmental trajectory moves it from potential to prepared competence levels during two distinct decade-long stages: childhood and adolescence. Our body/brain must be reared within a sheltered nurturing environment during its vulnerability in utero and in childhood, and then during adolescence it must be encouraged to gradually move toward the appropriate and effective autonomous thought and action that is expected of adults.

Adults protect children. They educate them about how the world works, and they make the decisions for them that their immature brains aren't yet equipped to make. Family and school are central to this process.

Adults mentor adolescents. They provide them with opportunities to make the kinds of nonthreatening decisions that will enhance their subsequent ability to make appropriate, more complex adult decisions. Peer relationships become increasingly important to adolescents. Unconditional love and positive role modeling from committed significant adults are very important throughout both developmental decades.

Although children often grouse about adult requests and decisions, they can't survive on their own and so are much more compliant than adolescents—who are reaching for autonomy. Their necessary basic trust in adult judgment thus allows them to observe and learn from appropriate adult behavior, but it also makes them vulnerable to various forms of adult misbehavior that can impair their development. Societies have therefore developed parental back-up systems. Extended family, teachers, social workers, coaches, scouting leaders, religious guides, police, and others combine their efforts to help ensure that children are properly sheltered and nurtured. The ancient aphorism "It takes a village to rear a child" is apt.

## THE BOOK'S FOCUS AND ORGANIZATION

This book is a companion to my earlier book, *The Adolescent Brain: Reaching for Autonomy* (2007). It is directed principally to educators and parents, but it is also meant for other adults who work with children. It will combine information about

child and cognitive development with general but practical suggestions on how to enhance childhood. Since caregivers confront a myriad of specific nurturing challenges, general guidelines are more useful in a book like this than specific activities that are directed to only some of the readers. Thus, think of any specific suggestions in the book as akin to seasoning in cooking—added *flavor* within the book's principal focus on the nature and role of childhood in human life.

An important corollary audience is the children with whom the adult readers interact. Children are fascinated by their own brain systems and processes, and they need to understand them. We don't have a history of providing children with this kind of information because it has only recently emerged. For example, we teach students how to read but not how and where reading occurs within their brain or why reading is biologically and culturally important. I believe that a functional understanding of the neurobiology of a system or behavior enhances its mastery. The many nontechnical explanations, metaphors, and analogies in the book were thus developed for relatively easy transmission to children, who have a very limited understanding of biology.

Chapters 1 through 4 will focus on the underlying biology of childhood—providing nontechnical explanations of the body/brain systems that develop during pregnancy, infancy, and childhood. As indicated above, parents, educators, and other adults have effectively reared children for millennia with practically no understanding of the neurobiology of childhood, but this fascinating information is now becoming available—and it can enhance the nurturing behavior of informed adults.

Our brain is awesomely complex, but it also has an elegant functional simplicity. It's thus possible for people with a limited understanding of biology (and this includes children) to develop a functional understanding of basic brain systems and processes. As this scientific information is increasingly affecting public policy and practice, it's especially important now that citizens who nurture children understand the underlying biology of childhood.

Chapters 5 through 12 will focus on childhood experiences that can enhance or delay development. These include those that maintain and enhance their body/brain, begin the search toward self that occurs during childhood, and make and maintain personal and technological relationships within and beyond their family. These chapters will draw on the rich existing literature of parenting and teaching that is now incorporating new discoveries in genetics, the cognitive neurosciences, medicine, and other related areas of biology.

The book's Glossary will define technical terms (identified in **bold** the first time they appear in the text), and the Appendices will provide more technical explanations of selected brain systems for those who wish it. The References and Resources section will suggest useful supplementary print and electronic information.

I've explored many of the concepts and themes in this book during my long career as a teacher and writer—and especially during the past decade through my monthly column in the *Brain Connection* website. It's thus been interesting to revisit and update what I had written over the years and to realize how much our understanding of childhood, parenting, and teaching has advanced during my professional career.

My principal mentors in my life have sequentially been my parents, my siblings, my wife Ruth, our seven children—and now our 20 grandchildren, who have given me yet another marvelous perspective of childhood. I was fortunate that my career paralleled such a wonderful time of discovery in the cognitive neurosciences because I could thus learn through personal and print contacts from those who made the discoveries that will profoundly affect how we perceive life and learning. I've further had the opportunity to work with many valued colleagues and editors who helped me to find my professional voice. Thanks to all of you.



# 1

## Nature and Nurture

*From Past to Present*

**M**ost animals begin life with all or most of their survival systems functional. Their independent life thus begins immediately or shortly after birth. Humans are a notable exception. We're basically helpless at birth and for a long time afterwards. The principal reason is that, because our three-pound adult brain is much larger than our mother's birth canal, we're born with a one-pound basic brain that can traverse the canal, but can't regulate an independent life.

During its initial 20-year post-birth development, our brain adds two pounds of mass and accompanying capabilities. This moves us from being not much more than a wet noisy pet in infancy to the functional autonomy that's characteristic of adults. A variety of cultural systems that range from the informality of parenting to the formality of classroom instruction nurture this extended development.

We've long been curious about the nature and proper maintenance of life and about the relative roles that our genetic heritage and early experiences play in determining

what we become. The commonly used terms for these factors are *nature* and *nurture*. Nature tells us how to *become* a human being. Nurture shapes our environment and development—and so tells us how to *behave* like a human being. The two concepts thus combine species membership with cultural and individual identity.

As these related issues are central to understanding childhood, and are the subject of considerable scientific research, let's begin our exploration of childhood with them.

### THE NATURE OF LIFE

Life is an elusive concept—except that it exists in space and time and requires energy to maintain it. Although space, time, and energy seem like simple, straightforward concepts deeply embedded within human language, all three create contentious cultural controversies related to our understanding of the nature and maintenance of life.

Space in human life is basically about objects and locations. We mentally represent these as nouns, qualify them with adjectives, and locate them with spatial prepositions (such as *under*, *over*, and *within*). A key current spatial issue in biology focuses on where life exists. Is it a property of the entire organism, or does it reside within organs, tissues, cells, or complex molecules such as **DNA**?

Time in human life is basically about events. We mentally represent these as verbs, qualify them with adverbs, and locate them with temporal prepositions (such as *before*, *during*, and *after*). Key current temporal issues in biology focus on the beginning and ending of life. Are embryonic stem cell research and cloning appropriate? Are capital punishment and assisted suicide appropriate?

Energy in human life is basically about nutrient intake and cognitive arousal and focus beyond basal levels. Our **emotion** and attention systems process arousal and focus. A key current issue focuses on the source of life's energy. Is it centered within self-organizing biological systems that seek