Typical and Atypical Child and Adolescent Development 2
Genes, Fetal Development and Early Neurological Development
This concise guide offers an accessible introduction to genes, fetal development and early brain development. It integrates insights from typical and atypical development to reveal fundamental aspects of human growth and development, and common developmental disorders.

The topic books in this series draw on international research in the field and are informed by biological, social and cultural perspectives, offering explanations of developmental phenomena with a focus on how children and adolescents at different ages actually think, feel and act. In this succinct volume, Stephen von Tetzchner explains key topics including: Genetic inheritance, evolution, heredity and environment in individual differences, fetal development, prenatal stimulation, methods of studying the brain, brain development, early and later plasticity, and brain organization and atypical development.

Together with a companion website that offers topic-based quizzes, lecturer PowerPoint slides and sample essay questions, Typical and Atypical Child and Adolescent Development 2: Genes, Fetal Development and Early Neurological Development is an essential text for all students of developmental psychology, as well as those working in the fields of child development, developmental disabilities and special education.

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The content of this topic book is taken from Stephen von Tetzchner’s core textbook *Child and Adolescent Psychology: Typical and Atypical Development*. The comprehensive volume offers a complete overview of child and adolescent development – for more information visit www.routledge.com/9781138823396
The *Topics from Child and Adolescent Psychology Series* offers concise guides on key aspects of child and adolescent development. They are formed from selected chapters from Stephen von Tetzchner’s comprehensive textbook *Child and Adolescent Psychology: Typical and Atypical Development* and are intended to be accessible introductions for students of relevant modules on developmental psychology courses, as well as for professionals working in the fields of child development, developmental disabilities and special education. The topic books explain the key aspects of human development by integrating insights from typical and atypical development to cement understanding of the processes involved and the work with children who have developmental disorders. They examine sensory, physical and cognitive disabilities and the main emotional and behavioural disorders of childhood and adolescence, as well as the developmental consequences of these disabilities and disorders.

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Typical and Atypical Child and Adolescent Development 2

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Stephen von Tetzchner
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Introduction

Development can be defined as an age-related process involving changes in the structure and functioning of humans and other species. Humans are complex beings who differ in many ways, differences that are related to biology, experiences and culture. The three parts in this topic book present two core developmental issues (genes and environment in development and brain development) and one developmental phase (the fetal period). They build on the models of development and the developmental way of thinking presented in Book 1, *Theoretical Perspectives and Methodology*. The three parts include both typical development, which is the most common course, with unimpaired functions and ordinary individual differences between children, and atypical development, which represents various degrees of unusual or irregular development, including the development of children and adolescents who have characteristics that fulfill the diagnostic criteria for one or several disorders, such as hearing impairment, autism spectrum disorder or anxiety.

Human development to maturity stretches over about 20 years, and most individual differences in physical and mental features and abilities do not emerge directly from a particular biological or environmental factor but rather as a result of interaction effects, where biological and environmental factors are moderated by one or several other factors. For example, the bases for children’s early temperament are present at birth, but how children react in different situations and their development of personality traits depend on the positive and negative features of the environment. Importantly, this is not a one-way process: children are influenced by and influence their environments. Development is thus a transactional process, characterized by reciprocal influences between the child and the environment over time. The
reader may find it useful to read Book 1, *Theoretical Perspectives and Methodology*, or the corresponding chapters in the complete book before reading the present book.

**Part I Genes, Evolution, Heredity and Environment** is about the basic processes of development. The genetic basis for human traits and abilities is the result of evolutionary processes (phylogeny). Knowledge about the genes’ functions is crucial for understanding of the evolution of general human characteristics as well as abilities and traits that vary between people. Genes both enable and constrain development. They control reproduction and the overall structure of humans, and the transference of genes from parents to offspring contributes to biological continuity over generations. However, genes vary across individuals and they are therefore an important source of individual differences in development (ontogeny). Some gene variants do not support normal development, or represent vulnerability for developing physical or mental disorders. For example, the probability of developing anxiety disorder is higher when other family members present with this disorder. Inheritance is prominent also in everyday explanations of children’s development: parents often claim that particular physical characteristics or personality traits are inherited from the father or from the mother, or from the grandfather or grandmother. However, developmental processes require environments with properties that enable development. Parents and other adults are concerned with the effects that a child’s environment may have on his or her development, learning and well-being. In general, children are adaptable and show positive development in different environments, and some cope and show resilience in spite of growing up in environments with war or other forms of violence and atrocities that may hinder positive social experiences and learning.

Many studies seek to assess the role of individual genes and the relative influence of genes and environment on particular aspects of development, for example language, intelligence or emotional regulation. However, the main developmental issue is rather how genes and environment interact, how differences in a gene’s DNA, nutrition and other features of the physical environment, and the social environment together influence these aspects of development. Neither genes nor environmental factors alone can explain the course of development: both are needed, and the scientific and practical problem is how they influence development. The state of the knowledge of this process will affect societies’ possibilities of promoting positive development and reducing the risk of negative developmental outcomes.
There is increasing knowledge about the genetic bases of many disorders, but there is still no consensus regarding the precise role of nature and nurture in most abilities. How influences from genes and environment interact in development is still one of the most discussed issues in many areas of developmental psychology.

Clinical child and adolescent psychology is seeking to understand the biological and experiential bases for deviant development as well as resilience. Insights into the opportunities and constraints implied by a child’s genes and environment are the basis for designing early and later intervention and training. The question of nature and nurture for various abilities and skills thus has significant practical implications.

Development starts when the sperm unites with an egg cell. *Part II Stimulation and Activity During Fetal Development* presents the giant developmental steps taking place over this period of about 40 weeks (when the child is born at term). The fetal period is unique with the transformation from a single cell to a human baby. It is a busy time, with regular periods in which the cells build the various parts of the body and functions start to merge, but it also includes periods where the development of the fetus is particularly vulnerable to disease or biochemical exposure. Much of the development in the fetal period is concerned with what is common to all humans, that is, with building a baby that can live and develop outside the mother’s womb: breathing independently and being nourished through the mouth instead of through the mother’s blood. At birth, the baby is ready to meet the physical and social world as an individual – although not yet an independent human being.

The developmental processes in the prenatal period are of great scientific interest because they enable the more interactive developmental processes after birth. The prenatal processes are biological rather than psychological and lay the foundation for perceptual, motor, cognitive, emotional and social development (see other topic books). However, even in this phase, the genetic basis does not alone determine a child’s development; the genes and stimulation from the environment work together. The fetus develops sensory organs that start to function and an emerging motor control that develops further after meeting the gravitational forces of the outside world. The prenatal experiences and developmental processes may influence the course of development after the child is born.

The function of the central nervous system is an integrative part of developmental psychology. *Part III Brain Development* is about the development of the brain and the many functions processed in the
brain. In spite of advanced technological developments, it is still difficult to find the way among the 86 billion nerve cells and their connections. In addition to measuring blood flow and electric currents in the brain, observations of children’s actions, thinking and emotions are necessary for investigating brain functions.

The brain is central to all processes involved in children’s adaptation and learning, both during the fetal phase and later. Experiences, learning and memory are represented in the brain in different ways. Compared with other species, the human brain is large relative to the size of the body, and the size of the human brain is one reason for the exceptional abilities and survival of human beings, and complex human societies. The brain has a biological basis that has developed through evolution and is transferred to the next generation through the genes. For the genes to have an impact on abilities that are grounded in the functioning of the brain, the genes’ DNA must have an effect on processes that govern the development of the brain. Moreover, it is not a direct genetic influence: brain development depends on experience and activity and, like most developmental processes, is the result of interactions between genetic and environmental factors. Any minor or major new skill, experience or insight involves the organization of neuron groups and neurological processes. An individual’s experiences may affect the thickness, height, length and weight of parts of the brain.

At birth, the brain is ready for the next phase of development. The development of brain structures and functions depends on experiences, and postnatal experiences differ qualitatively from the prenatal phase in the womb. It is an essential part of development where the brain structures and functions are becoming more fixed with age. For example, when the brain has developed the brain structures for the first language or languages, later languages have to be learned with the help of these structures. From a neurological perspective, early and later language learning are thus different processes.

Brain development illustrates both the complexity and the flexibility of human development. Insights into sensitive periods in postnatal development, such as the ease of learning language in the early compared with later years, are important both for understanding the significance of the child’s experiences in different phases of development and as a basis for developing early childhood intervention.

Knowledge of the issues presented in this topic book is significant for applied developmental science. Insights into the developmental
possibilities and constraints presented by a child’s genes can imply a need for particular intervention measures. The fact that experience is important for brain development contradicts the belief that atypical development is predetermined, and it is a strong argument for providing early and later interventions to children showing developmental difficulties. In fact, habilitation and rehabilitation are based on the assumption that medical, educational and psychological measures will change the child’s environment in a broad sense and thereby moderate or prevent a negative developmental course that a genetic mutation or chromosome abnormality might imply without such measures.

Some of the terminology used in developmental psychology may be unfamiliar to some readers. Many of these terms are highlighted in the text and can be found in the Glossary at the back of the book.