ESSENTIALS OF LIFE-SPAN DEVELOPMENT

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BIOLOGICAL BEGINNINGS

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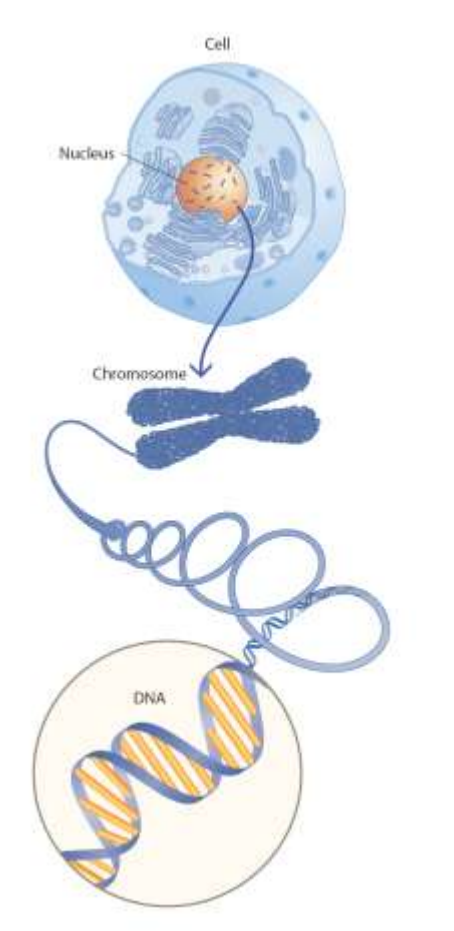
CHAPTER OUTLINE

- Genetic foundations of development
- The interaction of heredity and environment: The nature-nurture debate
- Prenatal development
- Birth and the postpartum period

GENETIC FOUNDATIONS OF DEVELOPMENT

- Human life begins as a single cell
- Nucleus of each cell contains chromosomes
  - **Chromosomes**: Threadlike structures made up of deoxyribonucleic acid
  - **DNA**: A complex double-helix molecule that contains genetic information
- **Genes**: Units of hereditary information, are short segments of DNA

FIGURE 2.2 - CELLS, CHROMOSOMES, DNA, AND GENES



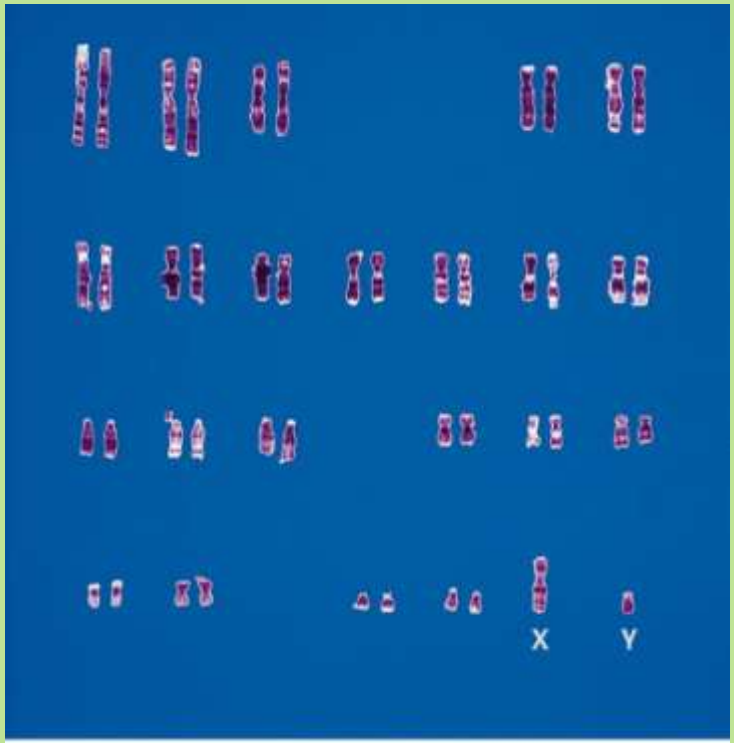
GENETIC FOUNDATIONS OF DEVELOPMENT

- Human genome consists of many genes that collaborate:
  - Both with each other and with nongenetic factors inside and outside the body
- Activity of genes is affected by their environment
- Stress, radiation, and temperature can influence gene expression
- Exposure to radiation changed the rate of DNA synthesis in cells

GENES AND CHROMOSOMES

- Mitosis, meiosis, and fertilization
  - **Mitosis**: Reproduction of cells
  - **Meiosis**: Cell division that forms sperm and eggs (gametes)
  - **Fertilization**: A stage in reproduction when an egg and a sperm fuse to create a single cell, called a zygote
    - **Zygote**: A single cell formed through fertilization

FIGURE 2.3 - THE GENETIC DIFFERENCE BETWEEN MALES AND FEMALES



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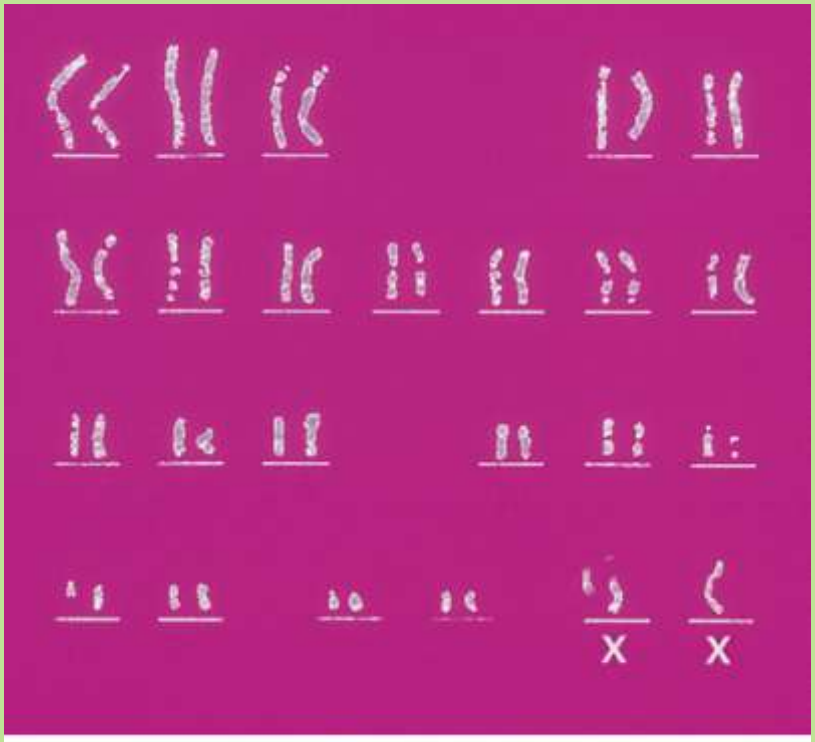

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GENES AND CHROMOSOMES

- **Genotype**: Genetic heritage
- Susceptibility genes - Make the individual more vulnerable to specific diseases or accelerated aging
- Longevity genes - Make the individual less vulnerable to certain diseases and more likely to live to an older age
  - **Phenotype**: Way an individual's genotype is expressed in observed and measurable characteristics

GENETIC PRINCIPLES

- Dominant and recessive genes principle
  - One gene of a pair always exerts its effects (dominant), overriding the potential influence of the other gene (recessive)
- Sex-linked genes
  - When a mutated gene is carried on the X chromosome, the result is called X-linked inheritance

GENETIC PRINCIPLES

- Polygenic inheritance
  - Polygenically determined by the interaction of many different genes
  - Gene-gene interaction - Studies that focus on the interdependence of two or more genes in:
    - Influencing characteristics, behavior, diseases, and development

FIGURE 2.4 - SOME CHROMOSOME ABNORMALITIES

Name	Description	Treatment	Incidence
Down syndrome	An extra chromosome causes mild to severe retardation and physical abnormalities.	Surgery, early intervention, infant stimulation, and special learning programs	1 in 1,900 births at age 20 1 in 300 births at age 35 1 in 30 births at age 45
Klinefelter syndrome (XXY)	An extra X chromosome causes physical abnormalities.	Hormone therapy can be effective	1 in 600 male births
Fragile X syndrome	An abnormality in the X chromosome can cause mental retardation, learning disabilities, or short attention span.	Special education, speech and language therapy	More common in males than in females
Turner syndrome (XO)	A missing X chromosome in females can cause mental retardation and sexual underdevelopment.	Hormone therapy in childhood and puberty	1 in 2,500 female births
XYY syndrome	An extra Y chromosome can cause above-average height.	No special treatment required	1 in 1,000 male births

SEX-LINKED CHROMOSOME ABNORMALITIES

- Klinefelter syndrome
  - Genetic disorder in which males have an extra X chromosome, making them XXY instead of XY
- Fragile X syndrome
  - Genetic disorder that results from an abnormality in the X chromosome, which becomes constricted and often breaks

SEX-LINKED CHROMOSOME ABNORMALITIES

- Turner syndrome
  - Chromosome disorder in females in which either an X chromosome is missing, making the person XO instead of XX, or part of one X chromosome is deleted
- XYY syndrome
  - Chromosomal disorder in which the male has an extra Y chromosome

GENE-LINKED ABNORMALITIES

- Phenylketonuria (PKU)
  - Metabolic disorder that, left untreated, causes mental retardation
- Sickle-cell anemia
  - Blood disorder that limits the body's oxygen supply
  - Can cause joint swelling, as well as heart and kidney failure

GENE-LINKED ABNORMALITIES

- Cystic fibrosis
- Diabetes
- Hemophilia
- Huntington disease
- Spina bifida
- Tay-Sachs disease

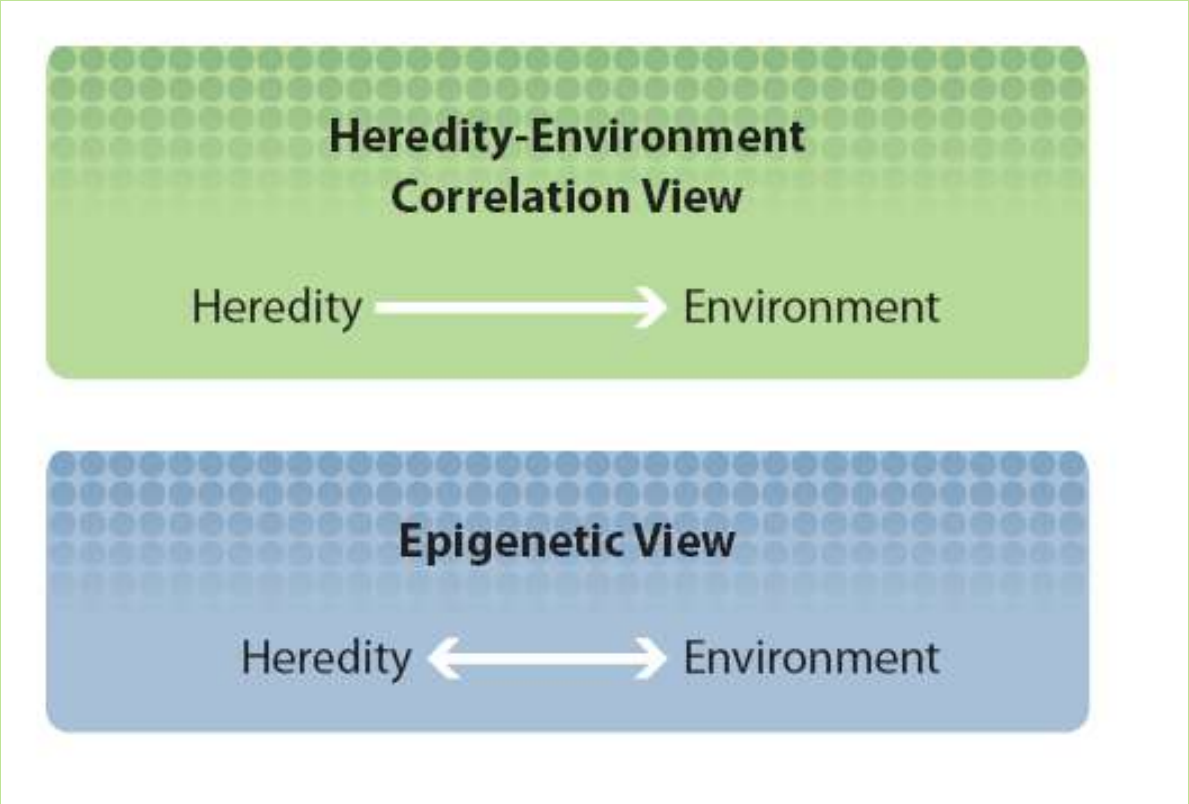
BEHAVIOR GENETICS

- Seeks to discover the influence of heredity and environment on individual differences in human traits and development
  - **Twin study**: Behavioral similarity of identical and fraternal twins is compared
  - **Adoption study**: Seek to discover whether, in behavior and psychological characteristics, adopted children are:
    - More like their adoptive parents, who provided a home environment
    - More like their biological parents, who contributed their heredity

EPIGENETIC VIEW AND GENE × ENVIRONMENT (G × E) INTERACTION

- **Epigenetic view**: Development is the result of an ongoing, bidirectional interchange between heredity and environment

FIGURE 2.6 - COMPARISON OF THE HEREDITY - ENVIRONMENT CORRELATION AND EPIGENETIC VIEWS



HEREDITY-ENVIRONMENT INTERACTION: THE NATURE-NURTURE DEBATE

- **Gene X environment (G X E) interaction**: Interaction of:
  - Specific measured variation in the DNA
  - Specific measured aspect of the environment

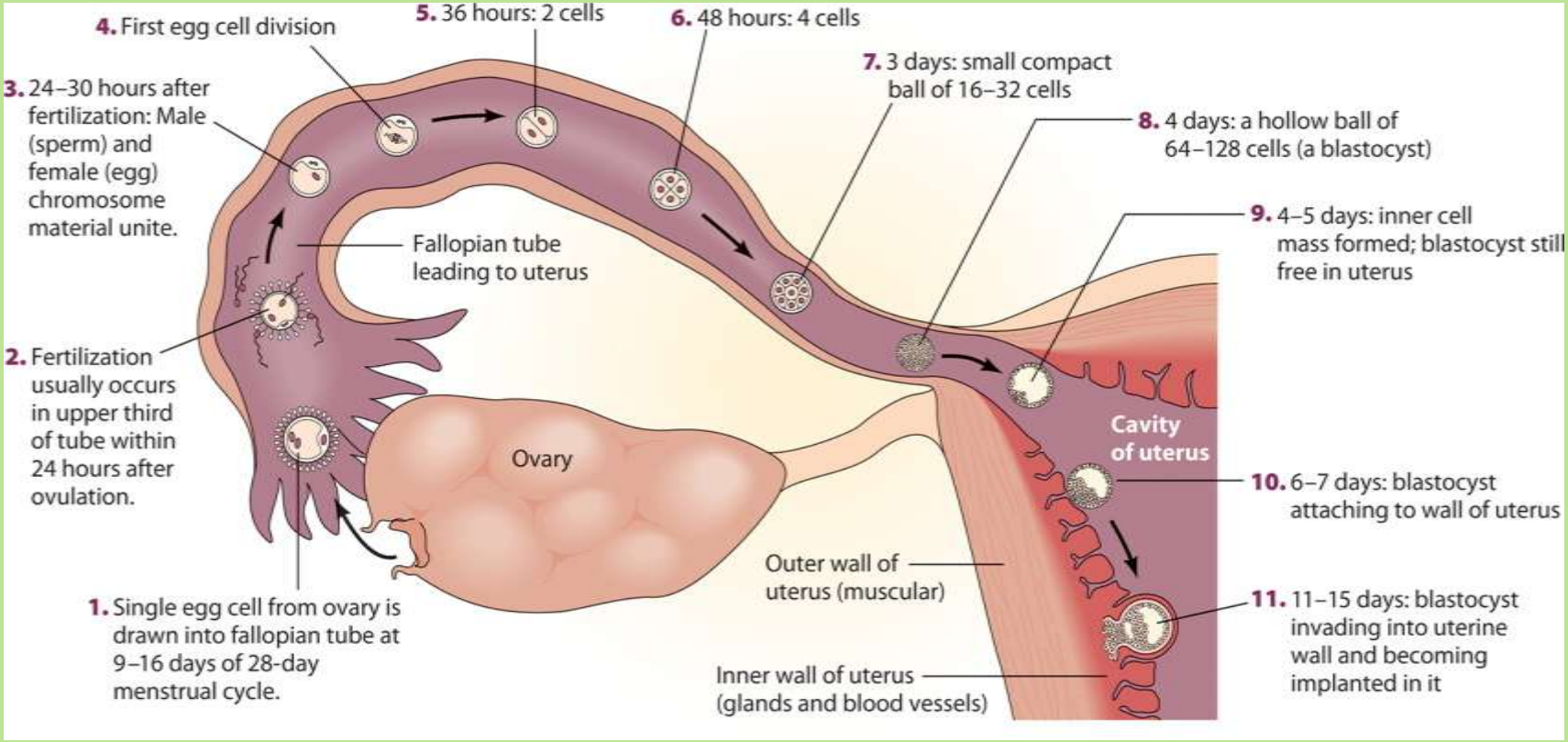
CONCLUSIONS ABOUT HEREDITY-ENVIRONMENT INTERACTION

- Relative contributions of heredity and environment are not additive
- Complex behaviors have some genetic loading
  - Gives each individual a propensity for a particular developmental trajectory

THE COURSE OF PRENATAL DEVELOPMENT

- **Germinal period**: Takes place in the first two weeks after conception
  - Includes:
    - Creation of fertilized egg (the zygote)
    - Cell division
    - Attachment of the multicellular organism to the uterine wall

FIGURE 2.7 - MAJOR DEVELOPMENTS IN THE GERMINAL PERIOD



THE COURSE OF PRENATAL DEVELOPMENT

- **Embryonic period**: Occurs from two to eight weeks after conception
  - Rate of cell differentiation intensifies
    - Support systems for cells form
    - Organs appear
    - **Organogenesis**: Name given to the process of organ formation during the first two months of prenatal development

THE COURSE OF PRENATAL DEVELOPMENT

- **Fetal period**: Extends from two months after conception until birth in typical pregnancies
  - Lasts about seven months
  - Growth and development continue their dramatic course during this time

PRENATAL TESTS

- Amneocentesis samples amniotic fluid. Between 15th and 18th week
- Ultrasound sonography: high frequency sound waves used.
- Chorionic villus sampling: small sample of placenta is removed during 10th–12th week.
- Maternal blood screening identifies pregnancies with elevated risk for birth defects. 16th-18th week (can tell about issues such as spina bifida & down syndrome

INFERTILITY AND REPRODUCTIVE TECHNOLOGY

- Infertility - Inability to conceive a child after 12 months of regular intercourse without contraception
- In vitro fertilization (IVF) - Eggs and sperm are combined in a laboratory dish
  - Fertilized egg is transferred into the woman's uterus

HAZARDS TO PRENATAL DEVELOPMENT

- General principles
  - **Teratogen**: Any agent that can potentially cause a birth defect or negatively alter cognitive and behavioral outcomes
- Prescription and nonprescription drugs

HAZARDS TO PRENATAL DEVELOPMENT

- Psychoactive drugs
  - Caffeine- with animals premature labor, preterm delivery, reduced fertility, and increase the risk of low-birth weight offspring
  - Alcohol
    - **Fetal alcohol spectrum disorders (FASD)**: A cluster of abnormalities and problems that appear in the offspring of mothers who drink alcohol heavily during pregnancy
  - Nicotine- **respiratory problems. SIDS. ADHD. low birth weight.**

    Possible nicotine withdrawal (found in one study)

HAZARDS TO PRENATAL DEVELOPMENT

- Cocaine- **low birth weight, length, & head circumference, impaired motor development, neurological and cognitive deficits**
- Methamphetamine- **Infant mortality, memory deficits, and developmental and behavioral problems**
- Marijuana- **problems with memory, depression, lower intelligence**
- Heroin- **withdrawal symptoms, tremors, irritability, and motor problems, ADHD**

HAZARDS TO PRENATAL DEVELOPMENT

- Incompatible blood types-**Mom is Rh- Dad is Rh+= Baby Rh+ (Mom's antibodies can start to attack the baby as a foreign object)**
- Environmental hazards
- Maternal diseases
- Other parental factors
  - Maternal diet and nutrition
  - Maternal age
  - Emotional states and stress
  - Paternal factors

BIRTH AND THE POSTPARTUM PERIOD

- The birth process - Occurs in three processes
  - First stage is the longest
    - Uterine contractions are 15 to 20 minutes apart at the beginning and last up to a minute
  - Second birth stage - When the baby's head starts to move through the cervix and the birth canal
    - Terminates when the baby completely emerges from the mother's body
  - Third stage - Afterbirth
    - Placenta, umbilical cord, and other membranes are detached and expelled

BIRTH AND THE POSTPARTUM PERIOD

- Childbirth setting and attendants
  - Who helps a mother during birth varies across cultures
    - Midwives
    - Doulas - A caregiver who provides continuous physical, emotional, and educational support for the mother before, during, and after childbirth

METHODS OF CHILDBIRTH

- Medication
  - Analgesia - Used to relieve pain
    - Include tranquilizers, barbiturates, and narcotics such as Demerol
  - Anesthesia - Used in late first-stage labor and during delivery to block sensation in an area of the body or to block consciousness
  - Oxytocin - Synthetic hormone used to stimulate contractions
  - Pitocin is the most widely used oxytocin

METHODS OF CHILDBIRTH

- **Natural childbirth**: Method in which no drugs are given to relieve pain or assist in the birth process
- **Prepared childbirth**: Includes a special breathing technique to control pushing in the final stages of labor
  - As well as more detailed education about anatomy and physiology
  - Lamaze method
- Cesarean delivery - The baby is removed from the uterus through an incision made in the mother's abdomen

THE TRANSITION FROM FETUS TO NEWBORN

- Birth involves considerable stress for the baby
- If the delivery takes too long, the baby can develop anoxia
  - A condition in which the fetus or newborn has an insufficient supply of oxygen
  - Can cause brain damage

THE TRANSITION FROM FETUS TO NEWBORN

- **Apgar scale**: Widely used to assess the health of newborns at one and five minutes after birth
  - Evaluates infants' heart rate, respiratory effort, muscle tone, body color, and reflex irritability

Score	0	1	2
Body Color	Blue, pale	Body pink, extremities blue	Entire body pink
Heartbeat	Absent	Slow – less than 100 beats per min.	Fast – 100 to 140 beats per min.
Reflex Irritability	No response	Grimace	Coughing, sneezing, crying
Muscle Tone	Limp and flaccid	Inactive, weak, some flexion of extremities	Strong, active motion
Respiratory Effort	Breathing for no more than 1 min.	Irregular and slow	Breathing good with normal crying

LOW BIRTH WEIGHT AND PRETERM INFANTS

- Conditions that pose threats to many newborns:
  - Low birth weight infants - Weigh less than 5 pounds at birth
    - Very low birth weight newborns - Weigh under 3 pounds
    - Extremely low birth weight newborns - Weigh under 2 pounds
  - Preterm infants - Born three weeks or more before the pregnancy has reached its full term
  - Small for date infants (small for gestational age infants) - Birth weight that is below normal when the length of the pregnancy is considered
- Incidence and causes of low birth weight - Varies considerably from one country to another

LOW BIRTH WEIGHT AND PRETERM INFANTS

- Consequences of low birth weight - More health and developmental problems than normal birth weight infants
  - Learning disability
  - Attention deficit hyperactivity disorder
  - Breathing problems such as asthma
- Nurturing includes:
  - Kangaroo care
  - Massage therapy

1pound 13 oz

THE POSTPARTUM PERIOD

- The period after childbirth or delivery that lasts for about six weeks
  - Or until the mother's body has completed its adjustment and has returned to a nearly prepregnant state
- Physical adjustments
- Emotional and psychological adjustments