
PART 2: BEGINNINGS

FORMING A NEW LIFE: CONCEPTION, HEREDITY, AND ENVIRONMENT

NATURE AND NURTURE: INFLUENCES OF HEREDITY AND ENVIRONMENT

- Certain rare physical disorders = inherited; phenotypes for most complex traits (health, intelligence, personality) subjects to complex array of hereditary and environmental forces

Studying the relative influences of heredity and environment

- Quantitative = how much heredity and environment influence particular traits = goal of behavioural genetics

Measuring heritability

- Heritability: statistical estimate of heredity contribution to individual differences in specific trait within given population
- Heritability expressed as percentage ranging from 0.0 to 0.1 (100%)
- 3 types of correlational research:
 - 1) Family studies:
 - Measure degree biological relatives share traits and whether closeness of familial relationship associated with degree of similarity
 - Strong correlation = genetic influence inferred
 - Environmental influences cannot be ruled out
 - 2) Adoption studies:
 - Similarities between adopted children and their adoptive families and biological families
 - 3) Twin studies:
 - Compare monozygotic twins (twice as genetically similar) with same-sex dizygotic twins (no more genetically similar than same-sex siblings)
 - When we see monozygotic twins more concordant than dizygotic we see the likely effects of heredity
 - Studies of monozygotic twins separated in infancy and reared apart have found strong resemblance between the twins
- Twin and adoption studies support moderate to high hereditary basis for many normal and abnormal characteristics
- Critics of behavioural genetics claim its assumptions and methods tend to maximise importance of hereditary effects and minimise environmental ones

Effects of prenatal environment

- Co twin control and chorion control studies enable researchers to look at nature and timing of non-genetic influences in the womb
- Co-twin control studies: Compare prenatal development and experiences of one monozygotic twin with that of other (one-person control group)
- Chorion control studies: Focus on prenatal influences by comparing monozygotic twins ~ Monochorionic twins = developed in same sac (therefore similar prenatal development) = share blood and similar hormonal levels which affect brain development = share exposure to infection ~ Dichorionic twins (grow into 2 separate sacs) attached to different parts (1/3 monozygotic, all dizygotic) ~ Monochorionic = more concordant than dichorionic twin in IQ, personality patterns and cholesterol levels

How heredity and environment work together

- Developmental scientists see heredity and environment as fundamentally intertwined, part of a complex developmental system

Reaction range and canalisation

- Reaction range: Range of potential expressions of hereditary trait; heredity can influence whether a reaction range is wide or narrow; advocates of developmental system model prefer to think of a norm of reaction: recognise heredity sets limits, argues development so complex, limits are unknowable and effects unpredictable
- Canalisation: Limitation on variance of expression of certain inherited characteristics – illustrates how heredity restricts range of development for some traits
- Some human characteristics are so strongly programmed by genes that they're said to be highly canalised (little opportunity for variance)
- Certain behaviours develop along genetic 'dug' channels, extreme change required to alter course
- Behaviours that depend largely on maturation seem to appear when child is ready
- Cognition and personality are more subject to variations in experience: kinds of families children grow up in, schools they attend, people they encounter
- Environment plays large part in language development
- A usual/typical experience digs channels for development

Genotype-environment interaction

- Effects of similar environmental conditions on genetically different individuals, genetically similar children often develop differently depending on home environment
- Takes interaction of hereditary and environmental factors, not just one or other, to produce certain conditions

Genotype-environment correlation

- Environment reflects/reinforces genetic differences – certain genetic and environmental influences tend to act in same direction
- Works in 3 ways to strengthen phenotype expression of genotype tendency:
 - 1) Passive correlations:
 - Generally (genetic) parents predispose children toward a trait – provide environment that encourages trait development
 - Passive as there is no control
 - 2) Reactive/evocative correlations:
 - Children with differing genetic make-ups evoke different responses from adults
 - 3) Active correlations:
 - As children get older and have more freedom to choose own activities and environments, they actively select or create experiences consistent with genetic tendencies
 - Niche-picking: tendency to seek out environments compatible with one's genotype ~ explains why identical twins reared apart tend to be quite similar

What makes siblings so different? The non-shared environment

- Genetic differences lead children to need different kinds of stimulation or respond or respond differently to a similar home environment

- Non-shared environmental effects: unique environment in which each child in a family grows up, consisting of distinctive influences that affect one child differently than another ~ parents and siblings treat each child differently; accidents and experiences outside home affect one and not the other
- Behavioural geneticists: "heredity accounts for most of similarity between siblings, non-shared environment accounts for most of the difference" – methodological challenges and additional empirical evidence point to more moderate conclusion: "non-shared environmental effects do not greatly outweigh shared ones; rather, there seems to be a balance between the two"
- Genotype-environment correlations ~ children's genetic differences lead parents and siblings to react differently and treat them differently; genes may influence how children perceive and respond to treatment and possible outcome
- Children mould own environment by choices made – genetic make-up influences these choices ~ children's abilities will develop differently as well as social lives which are accentuated as they grow older and have more experiences outside the family
- Critics of behavioural genetics research say these studies give short shrift to the influence of parenting; some critics point to narrow range of families sampled in some studies and to a lack of direct observation of family life, instead they look to longitudinal studies of effects of parenting practices and direct interventions that seem to foster effective parenting – parental influence contributes greatly to developmental outcomes, independent of hereditary effects or bi-directional processes ~ points to the interrelated effects of parenting, nonfamilial influences, and role of broader context in which families live

Some characteristics influenced by heredity and environment

Physical and physiological traits

- Monozygotic twins look alike and are more concordant than dizygotic twins in risk for medical disorders (hypertension, heart disease etc)
- Obesity: overweight in relation to age, sex, height and body type ~ BMI >95% of growth curve for children of the same age and sex ~ as many as 250 genes or chromosome regions are associated with obesity ~ one key gene GAD2 on chromosome 10 normally controls appetite – abnormal version stimulate hunger and overeating
- Amount of food eaten in particular home social/ethnic group, and amount of exercise encouraged can increase/decrease chances of being overweight

Intelligence and school achievement

- Heredity exerts strong influence on general intelligence and specific abilities ~ experiences count too (enriched/impooverished environments affects development and expression of innate ability) ~ QTL: Many genes, each with its own small effect combine to establish a range of possible reactions to a range of possible experiences
- Evidence of heredity role in intelligence emerged from adoption and twin studies ~ adopted children's IQ's are consistently closer to biological mothers than adoptive parents and siblings ~ monozygotic twins are more alike in intelligence than dizygotic twins (also true of performance on elementary school achievement tests and on National Merit Scholarship exams given in high school – studies yield consistent estimate of heritability: 50-60% for verbal ability, 50% for spatial ability (genetic differences explain at least half observed variation among population members))
- Measured genetic influence increases with age ~ family environment has greater influence on younger children
- Main environmental influences on intelligence occur early in life ~ earliest environment = womb, this prenatal environment accounts 20% similarity in IQ between twins and 5% similarity in non-twin siblings – heritability of IQ <50%
- Influence of genes on intelligence weaker, influence of prenatal environment strong – healthy prenatal environment therefore important

Personality

- 5 major groupings of traits: extraversion, neuroticism, conscientiousness, agreeableness and openness to experience ~ heritability: 40%, environment <34% influence
- Temperament = largely inborn and often consistent over years, though it may respond to special experiences/parental handling – significant genetic influence on activity, sociability and emotionality
- Shyness and boldness are largely inborn and stay with a person throughout life

PREGNANCY AND PRENATAL DEVELOPMENT

PRENATAL DEVELOPMENT: ENVIRONMENTAL INFLUENCES

Maternal factors (from mom)

- Prenatal environment = mother's body ~ everything that impinges on her well-being may alter her unborn child's environment and affect its growth
- Not all environmental hazards are equally risky for all fetuses at all times during gestation
- Teratogenic (birth-defect-producing) factors at one stage have little or no effect earlier or later – timing of exposure to a teratogen, size of dose, and its interaction with other factors may be important ~ vulnerability depends on gene in foetus or mother; fetuses with particular variant of growth gene, called transforming growth factor alpha, have 6 times more risk than other fetuses of developing cleft palate if mother smokes while pregnant

Nutrition and maternal weight:

- Women need to eat more than usual when pregnant (300 – 500 calories a day including extra protein) ~ more gained, less likely to have low-birth-weight babies ~ excessive weight gained is linked with other risks (caesarean delivery necessary) – weight gain is individual (normal recommended weight gain is 15 – 25 pounds)
- Under-nourishment during foetal growth may have long-range effects ~ severe prenatal nutritional deficiencies in the first/trimesters affect the developing brain, increasing risk of antisocial personality disorders at 18 (also link between foetal under-nutrition and schizophrenia)
- Certain nutrients can positively affect cognitive development at birth, mothers with high blood levels of Omega-3 fatty acid DHA (docosahexaenoic), ingredient of breast milk, show better attention abilities at 12 and 18 months ~ DHA found naturally in Atlantic Salmon, Pacific Cod fish and Tuna, also can be taken in the form of supplements derived from algae
- Under-nourished women who take dietary supplements while pregnant have bigger, healthier, more active and visually alert infants
- Women with low zinc levels who take daily zinc supplements are less likely to have babies with low birth weight and small head circumference
- Certain vitamins (A, B6, C, D K) can be harmful in excessive amounts
- Iodine deficiency, unless corrected before 3rd trimester of pregnancy, can cause cretinism, which may involve severe neurological abnormalities or thyroid problems
- Fruit and vegetables are an important source of folic acid/folate ~ important in pregnant woman's diet ~ lack of causes neural-tube defects ~ women of childbearing age are urged to take folate supplements and include it by eating plenty fruit and vegetables even before becoming pregnant since damage from folic acid deficiency can occur in early weeks of gestation

- Obese women risk having children with neural-tube defects, as well as heart defects and other birth defects ~ obesity increases risk of pregnancy complications – miscarriage, still birth, neonatal death (dying after first month of life)
- Being over/under weight before pregnancy is risky ~ having first baby = overweight: still birth or losing baby in first week of life; underweight: dangerously low-birth-weight babies

Physical activity and strenuous work:

- Moderate exercise does not endanger fetuses of healthy women ~ regular exercise prevents constipation and improves respiration, circulation, muscle tone and skin elasticity, all of which contribute to more comfortable pregnancy and an easier, safer delivery and may result in a bigger baby ~ avoid activities that cause abdominal trauma
- Women in low-risk pregnancies can guide own abilities and stamina ~ moderate exercise, not pushing themselves and not raising heart rate above 150 and taper off at end of each session rather than stop abruptly
- Employment: no special hazards ~ strenuous working conditions, occupational fatigue, and long working hours associated with greater risk of premature birth

Drug intake:

- Practically everything ingested makes its way to the uterus ~ including drugs
- Some problems resulting from prenatal exposure to drugs can be treated if presence is detected early enough

Medical drugs	<ul style="list-style-type: none"> ○ Thalidomide (tranquilliser) – stunted/missing limbs, severe facial deformities, defective organs ○ Teratogenic: antibiotic tetracycline, certain barbiturates, opiates and other central nervous system depressants, several hormones including DES (diethylstilbestrol) and androgens, certain anticancer drugs such as methotrexate, accutane (severe acne drug), aspirin and non-steroidal anti-inflammatory drugs ~ should be avoided during 3rd trimester ○ Taking drugs does not always show up immediately: DES was once widely prescribed to prevent miscarriages, the daughters of women who consumed DES, when reaching puberty (1 in 1000) develop rare vaginal/cervical cancer, may have abnormalities of genital tract and trouble bearing children with higher risks of miscarriage or premature delivery; DES sons have genital tract malformations – do not affect fertility ~ DES exposure and testicular cancer are controversial: in rats, early DES exposure lead to long-term adverse effects on testicular development and sperm function, an increase in genital tumours – DES mothers = risk of breast cancer ○ Antipsychotic drugs (manage severe psychiatric disorders) have serious potential effects on foetus including withdrawal symptoms at birth ~ have to discontinue use before delivery date ○ Recommended no medication prescribed for pregnant/breast-feeding women unless essential for child's health – no over-the-counter drugs allowed without doctors consultation
Alcohol	<ul style="list-style-type: none"> ○ FAS (Foetal Alcohol Syndrome): combination of mental, motor and developmental ~ reduces responsiveness to stimuli, slow reaction time, short attention span, restlessness, hyperactivity, learning disabilities, memory deficits and mood disorders ○ Prenatal alcohol exposure = common cause of birth defects – affects portion of corpus collusum (coordinates signals between the 2 hemispheres of brain) ○ 50% women of childbearing age consume alcohol (15% - 20% carry on throughout pregnancy) ○ Alcohol disturbs the infants neurological and behavioural functioning
Nicotine	<ul style="list-style-type: none"> ○ Smoking common among 18 – 19 year olds (pregnant) ○ Low-birth-weight babies, increases risk of miscarriage, prenatal growth retardation, stillbirth, infant death, colic in early infancy and long-term health, cognitive and behavioural problems ○ Increases cancer risk ○ Poor attention span, hyperactivity, anxiety, learning and behavioural problems, perceptual-motor and linguistic problems, poor IQ scores, neurological problems
Caffeine	<ul style="list-style-type: none"> ○ 4 or more cups a day increases risk of sudden death in infancy
Marijuana, opiates and cocaine	<ul style="list-style-type: none"> ○ Birth defects, neurological defects, restless, irritable, convulsions, fever, vomiting and breathing difficulties ○ Babies are born addicted and will suffer effects until age 6 ○ Cocaine – spontaneous abortion, delayed growth, impaired neurological development

Sexually transmitted diseases:

- HIV/Aids ~ can pass through fetuses bloodstream through placenta, breast milk
- Infants born to HIV-infected mom have small heads and slowed neurological development
- AZT (Zidovudine) and ART administration curtails transmission
- Caesarean delivery reduces risk
- Syphilis can cause problems in foetal development; gonorrhoea and genital herpes simplex virus (HSV) can have harmful effects on baby at birth (blindness, other abnormalities or death) – Caesarean delivery decreases risk of transmission

Other maternal illnesses:

- Prospective parents should try prevent any infections (common cold/flu, urinary tract and vaginal infection) ~ treat promptly if contracted
- Screen for thyroid deficiency – effects child's cognitive performance
- Rubella (German measles) if before 11th week causes deafness and heart defects
- Diabetes metabolic regulation (especially in 2nd and 3rd trimesters), unless carefully managed, may affect child's long range neurobehavioral development and cognitive performance
- Toxoplasmosis (parasite harboured in the body of cattle, sheep and pigs, and intestinal tracts of cats – produces no/flu like symptoms ~ in 2nd and 3rd trimester could cause brain damage, severely impaired eyesight/blindness, seizures, miscarriage, still birth or death of baby – avoid infection by not eating raw or very rare meat, wash hands and working surfaces after touching raw meat, peel raw fruit and vegetables, don't dig in garden where cat faeces are buried, don't handle cat litter if possible)

Maternal age:

- Delayed childbearing: >35 miscarriage or stillbirth, premature delivery, retarded foetal growth, birth complications and defects (Down Syndrome); >40 operative deliveries (Caesarean/forceps/vacuum extraction) risk of all birth complications increase in delayed pregnancy – premature and underweight; >50 three times more likely to have very small babies, premature or stillborn
- Multiple births (twins) riskier (normally conceived through assistance of reproductive technology in older women – closely monitored)
- Adolescents tend to have premature/underweight babies ~ their bodies is still absorbing necessary nutrients that are vital for the baby as well

Outside environmental hazards:

- Air pollution, chemicals, radiation, extremes of heat and humidity and other hazards of modern life can affect prenatal development
- Toxic landfills: risk birth defects (childhood cancers)
- Radiation exposure: stunted growth, birth defects, abnormal brain function/cancer later in life ~ cause genetic mutations

Paternal factors (from dad)

- Exposure to lead, marijuana or tobacco smoke, large amounts of alcohol or radiation, DES or certain pesticides results in poor quality sperm (babies born dead, low birth weight and slowed foetal growth)

- Low vitamin C: birth defects and certain types of cancer
- Cocaine use: birth defects
- Smoke: Increased risk of impotence and of transmitting genetic abnormalities; pregnant woman's exposure to second-hand smoke linked to low birth-weight and cancer in childhood and adulthood
- Older (>30) significant source of birth defects: Marfans syndrome (deformities of head and limbs) and dwarfism

BIRTH AND THE NEWBORN BABY

NEWBORNS AND THEIR PARENTS

Childbirth and bonding

- Mother-infant bond: mother's feeling of close, caring connection with newborn
- Ethological approach: behaviour biologically determined, critical/sensitive periods for development of certain behaviours emphasised ~ Lorenz showed how newly hatched ducklings follow the first thing it sees whether member of same species or not = imprinting: "result of a predisposition to learning – the readiness of the organism's nervous system to acquire certain information during brief critical period in early life" ~ this critical period does not exist in humans
- Fathers who did not attend birth can still become emotionally attached and committed to newborn, as with adoptive parents

States of arousal and activity levels

- Newborns show individuality and neurological maturation through sleep and wake patterns ~ an internal clock regulates daily cycles of eating, sleeping and elimination, even moods

State	Eyes	Breathing	Movements	Responsiveness
Regular sleep	Closed, no eye movement	Regular and slow	None, except for sudden generalised startles	Cannot be aroused by mild stimuli
Irregular sleep	Closed, occasional rapid eye movements	Irregular	Muscles twitch, no major movements	Sounds or light bring smiles or grimaces in sleep
Drowsiness	Open or closed	Irregular	Somewhat active	May smile, startle, suck, or have erections in response to stimuli
Alert inactivity	Open	Even	Quiet, may move head, limbs and trunk while looking around	Interesting environment (with people or things to watch) may initiate or maintain state
Waking activity and crying	Open	Irregular	Much activity	External stimuli (hunger, cold, pain, being restrained or put down) bring about more activity – soft whimpering and gentle movements and turning into rhythmic crescendo of crying/kicking/beginning and enduring uncoordinated thrashing and spasmodic screeching

- Changes in state coordinated by multiple areas in brain and accompanied by changes in functioning of all body systems: heart rate and blood flow, breathing, temperature regulation, cerebral metabolism and workings of kidneys, glands and digestive system
- Most new babies wake up every 2/3 hours day and night, have 6 – 8 sleep periods (varying between quiet and active sleep)
- Premature infants – uneven in state of development compared with full-term babies same age – more alert and wakeful, have longer stretches of quiet sleep, more REM in active sleep
- Important to quiet low-birth-weight babies, quiet babies maintain weight better
- 3months: babies are more wakeful in late afternoon and early evening, start sleeping through night
- 6 months: more than half their sleep occurs at night (active 30%) ~ REM decreases steadily throughout life
- Sleep rhythms vary across cultures
- Some new babies are more active than others – temperamental differences that continue throughout childhood and often life
- Babies respond to way caregivers treat them ~ far-reaching effects of kind of person baby becomes

How parenthood affects marriage

- Most parents experience anxiety about responsibility of caring for a child, commitment of time and energy entailed, feeling of permanence that parenthood imposes on marriage
- Affects future sexual relationship = intimate or distant
- Marital satisfaction typically declines, some get stronger, some deteriorate
- Planned pregnancy = unhappier
- Adoptive parents more positive expectations and more satisfying parenting experiences than others