

Teratology

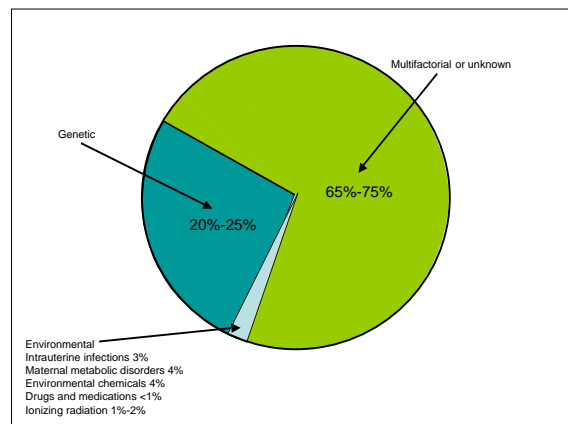
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Teratology

- The study of abnormal development in embryos and the causes of congenital malformations or birth defects

Birth Defects

- Observed in 3% of newborns
- Observed in another 3% of children later
- May or may not be outwardly visible
- Etiology: genetic and environmental



Major and Minor Anomalies

- Major anomalies: life/health threatening
- Minor anomalies: cosmetic
- The greater the number of minor anomalies, the greater the likelihood of a major anomaly
- Certain minor anomalies suggest specific major anomalies

Down Syndrome



Turner Syndrome



Trisomy 13

- Midline defects (cleft lip and cleft palate)
- Central nervous system malformations
- Micro-ophthalmia
- Congenital heart disease
- Poor growth

Trisomy 18



Achondroplasia

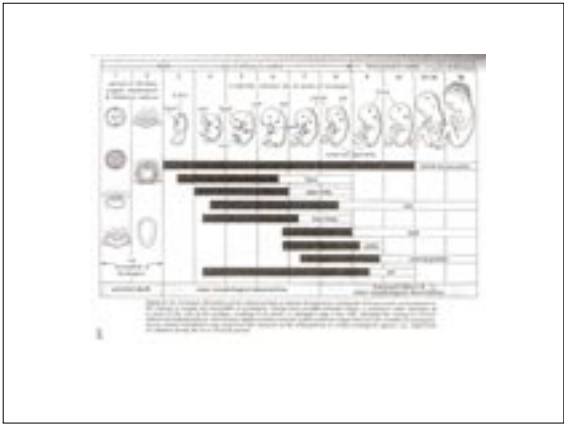


Inborn Errors of Metabolism Causing Birth Defects

- Smith Lemli Opitz
- Congenital disorders of glycosylation
- Fatty acid oxidation disorders

Teratogens

- A chemical, infectious agent, physical condition, or deficiency that, on fetal exposure, can alter fetal morphology or subsequent function
- Teratogenicity depends upon the ability of the agent to cross the placenta
- The embryo is most susceptible to teratogenic agents during periods of rapid differentiation



How are agents determined to be teratogenic ?

- Anecdotal data in humans
- Data from animal studies

Effect of Exposure Depends on Timing

- All or none effect early
- Effect of organogenesis during embryonic development
- Effect on size and function during fetal development

Organ	Organ Development
Brain	Neural tube formation, proliferation of neural stem cells, migration and differentiation of neural cells, synaptogenesis, myelination
Heart	Heart tube formation, proliferation of cardiac progenitor cells, migration and differentiation of cardiac cells, heart looping, septation, valve formation
Eye	Eye field formation, proliferation of retinal progenitor cells, migration and differentiation of retinal cells, lens formation, vitreal body formation
Ear	Ear field formation, proliferation of otic vesicle cells, migration and differentiation of otic cells, ear canal formation, ossicle development
Limbs	Limb bud formation, proliferation of limb bud cells, migration and differentiation of limb bud cells, limb bud outgrowth, digit formation
Respiratory	Respiratory bud formation, proliferation of respiratory bud cells, migration and differentiation of respiratory bud cells, lung bud outgrowth, branching morphogenesis
Intestine	Intestinal tube formation, proliferation of intestinal stem cells, migration and differentiation of intestinal cells, gut tube outgrowth, gut tube descent
Genital	Genital bud formation, proliferation of genital bud cells, migration and differentiation of genital bud cells, genital tube outgrowth, genital duct formation
Urogenital	Urogenital bud formation, proliferation of urogenital bud cells, migration and differentiation of urogenital bud cells, urogenital tube outgrowth, urogenital duct formation
Reproductive	Reproductive bud formation, proliferation of reproductive bud cells, migration and differentiation of reproductive bud cells, reproductive tube outgrowth, reproductive duct formation
Endocrine	Endocrine bud formation, proliferation of endocrine bud cells, migration and differentiation of endocrine bud cells, endocrine tube outgrowth, endocrine duct formation
Immune	Immune system development, proliferation of immune cells, migration and differentiation of immune cells, immune system maturation
Neuroendocrine	Neuroendocrine development, proliferation of neuroendocrine cells, migration and differentiation of neuroendocrine cells, neuroendocrine system maturation
Reproductive system	Reproductive system development, proliferation of reproductive system cells, migration and differentiation of reproductive system cells, reproductive system maturation
Endocrine system	Endocrine system development, proliferation of endocrine system cells, migration and differentiation of endocrine system cells, endocrine system maturation
Immune system	Immune system development, proliferation of immune system cells, migration and differentiation of immune system cells, immune system maturation
Neuroendocrine system	Neuroendocrine system development, proliferation of neuroendocrine system cells, migration and differentiation of neuroendocrine system cells, neuroendocrine system maturation

Nicotine

- IUGR
- Premature delivery
- Neurocognitive development

Fetal Alcohol Syndrome

- Characteristic facial features
- Congenital heart disease
- Growth deficiency
- Behavioral/neurocognitive deficits

Fetal Alcohol Syndrome



Tetracycline

- Yellow/brown teeth
- Decreased bone growth

Fetal Hydantoin Syndrome

- Intrauterine growth retardation
- Microcephaly, mental retardation
- Distal phalangeal hypoplasia
- Specific facial features

Retinoic acid

- Craniofacial dysmorphisms
- Cleft palate
- Thymic aplasia
- Neural tube defects

Thalidomide Syndrome



Congenital Rubella



Congenital CMV

- Intrauterine growth retardation
- Micromelia
- Chorioretinitis, blindness
- Microcephaly
- Cerebral calcifications, mental retardation
- Hepatosplenomegaly

Ionizing Radiation

- Affects brain development at 10-18 weeks of gestation a HIGH dose
- No evidence of effect of exposure associated with typical diagnostic studies

Maternal Hyperglycemia

- Congenital heart disease
- Renal, gastrointestinal, and central nervous system malformations such as neural tube defects

Babies of Mother's with PKU

- Mental retardation
- Low birth weight
- Congenital heart diseases



Threshold Effect-Multifactorial

