



Preview Of A Birth

Fetal Development



Stage 1
Fertilization

Stage 2
Zygote
1st Week

Stage 3
Embryo
2-7 Weeks

Stage 4
Fetus
8 Weeks To Birth

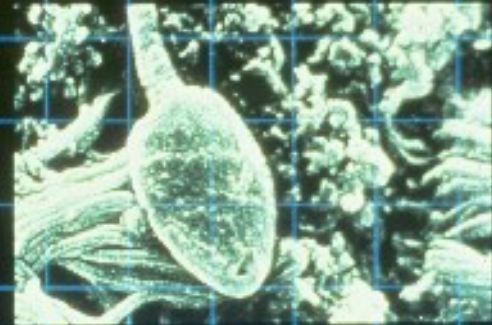
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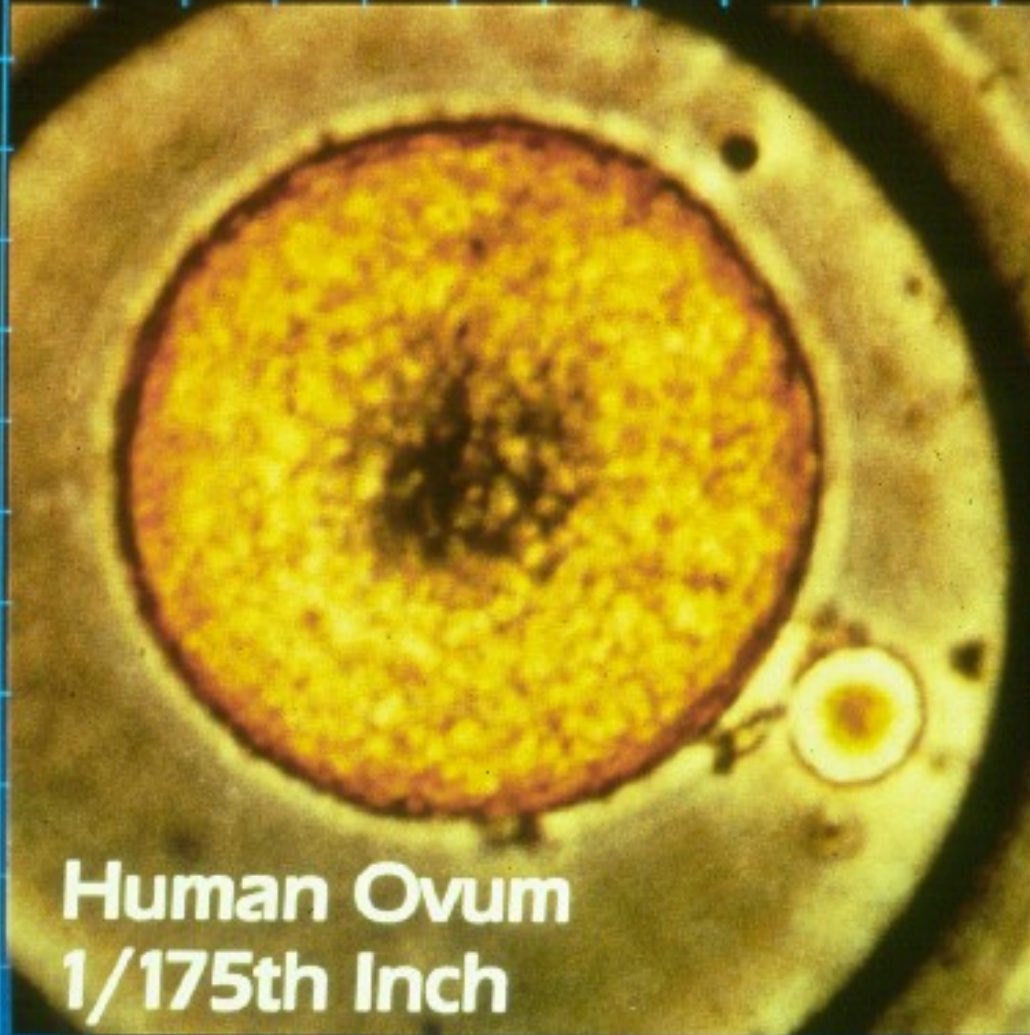
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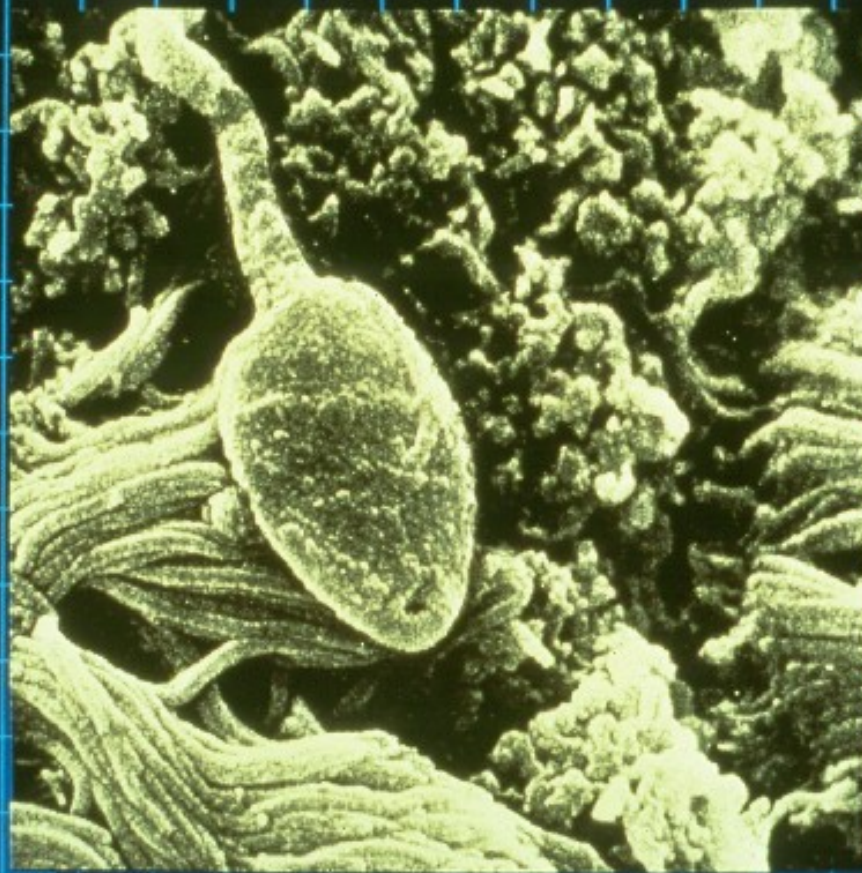


All the eggs necessary to populate the entire world would fit into a cookie jar.



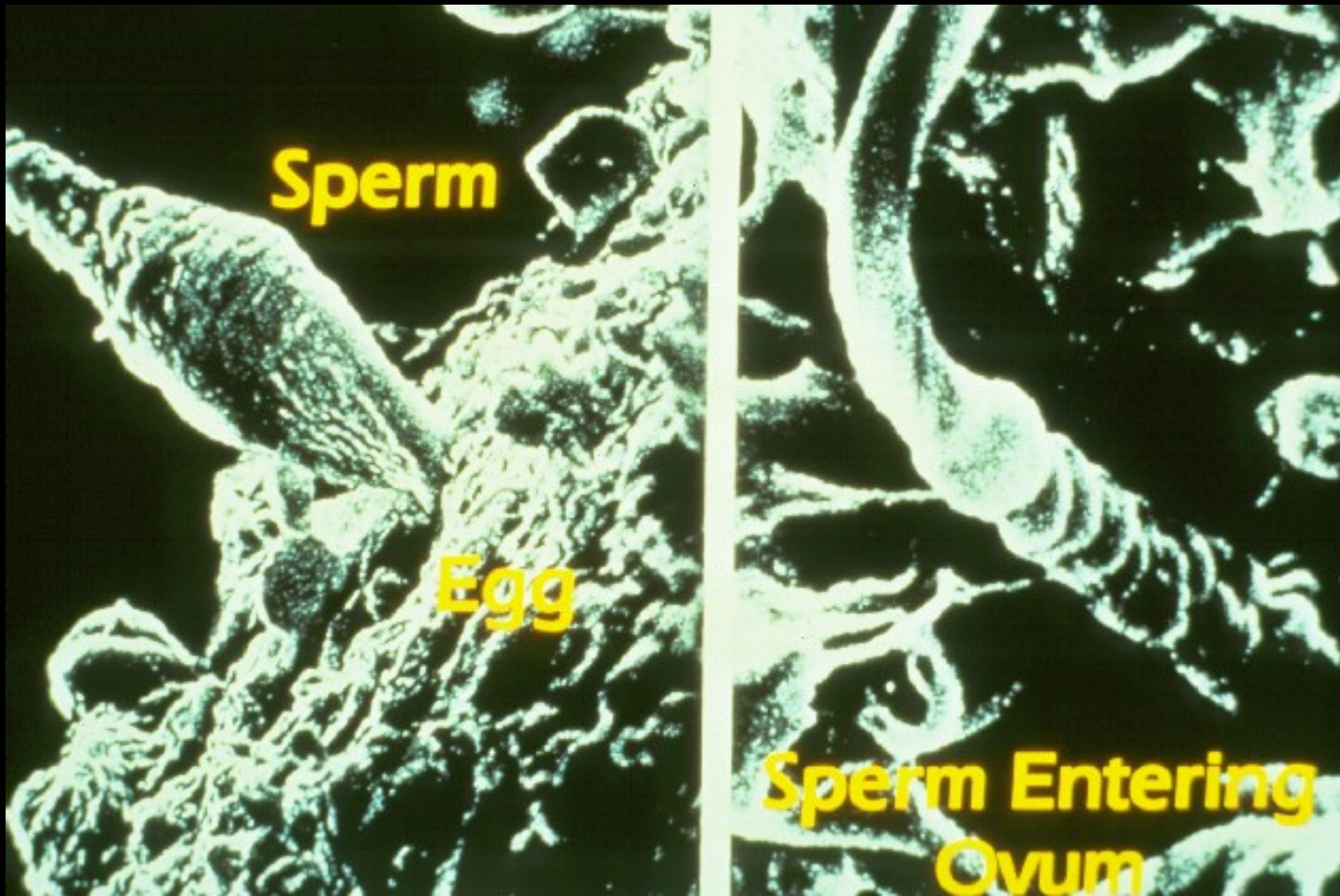
Human Ovum
1/175th Inch

During sexual intercourse, between 300 million to 600 million sperm are deposited in the vagina. They survive 24 to 48 hours. All the sperm necessary to populate the entire world will fit into a thimble.



Microscopic Image Of Human Sperm

Over 2,000 sperm may find and surround the egg but only one will be allowed to enter. The egg releases a substance that prevents other sperm from entering. After the sperm unites with the egg, it is called a zygote.



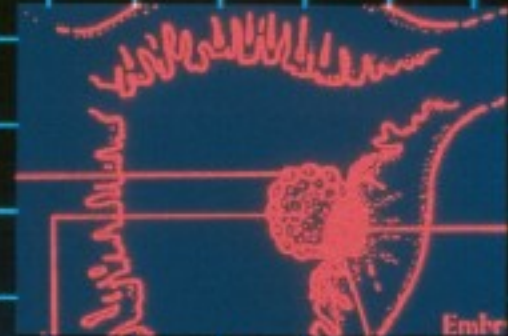
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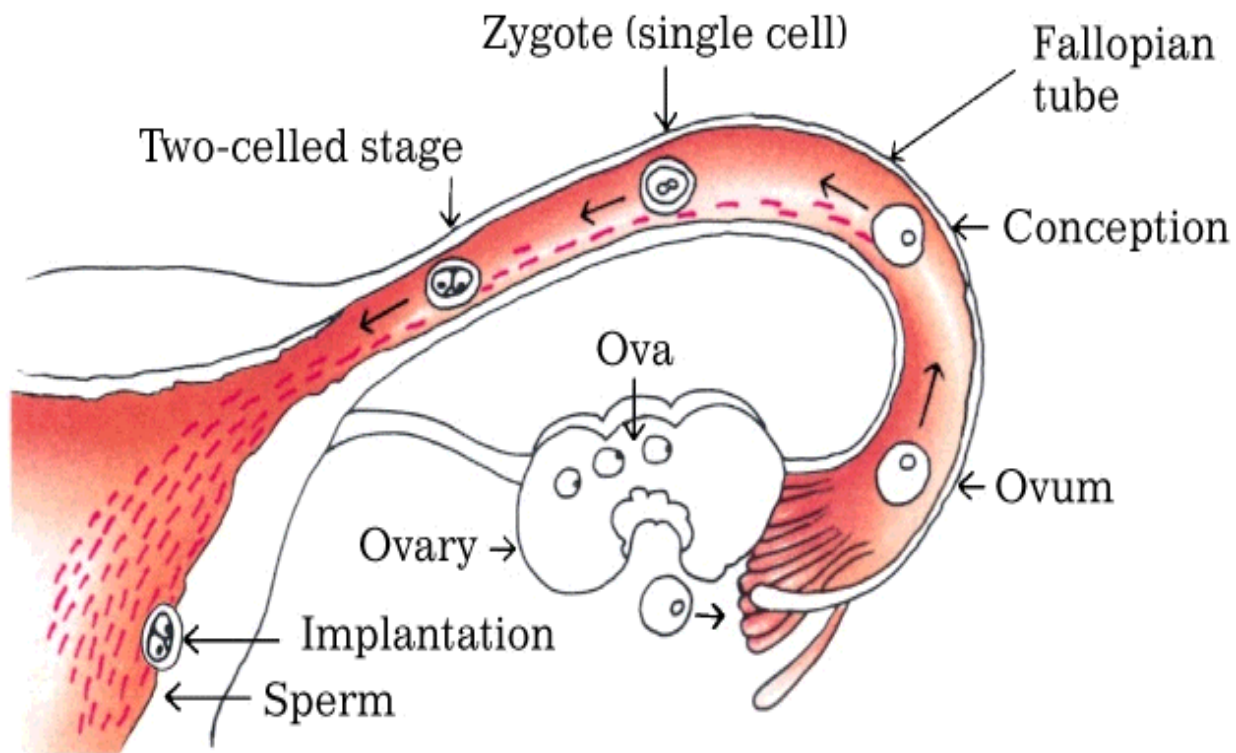
Stage 4
Fetus
8 Weeks To Birth



Zygote Cell Division

4.5 Days
107 Total Cells
8 Will Become The Embryo
99 Will Become The Supporting
Structures, i.e. Placenta, Amniotic Sac
And Umbilical Cord

On average, it takes the zygote between 5 to 14 days to travel down the fallopian tube to the uterus. Fallopian tubes are about the size of a hair bristle and 4 inches long. Once the zygote implants itself into the uterus, it becomes known as an embryo.



Fetal Development

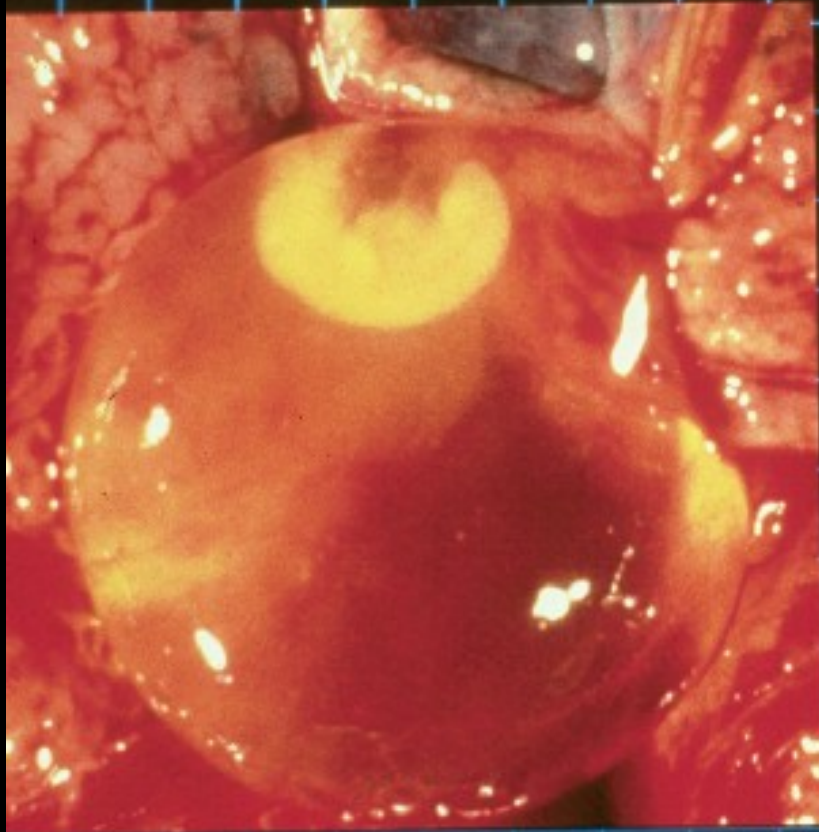
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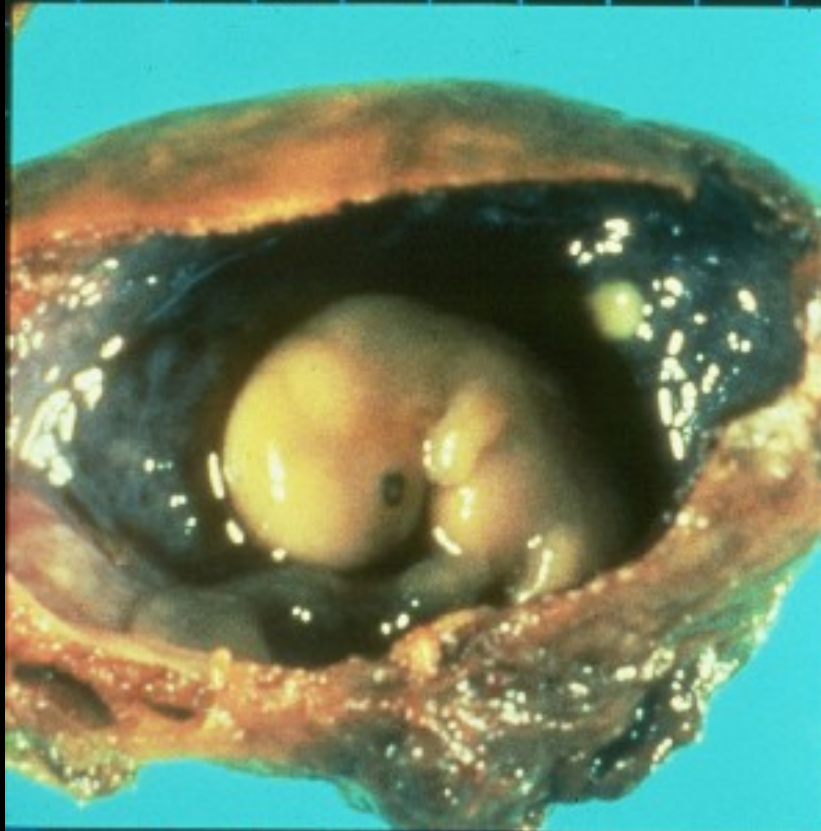
Stage 4
Fetus
8 Weeks To Birth





Embryo At 3 Weeks

- **Heartbeat
At 22 Days**
- **Leg and Arm
Buds Appear
At 26 Days**



5 Weeks

- **Heart Output At 40 Days Is 20% Of An Adult**
- **40 Pairs Of Muscles Present**

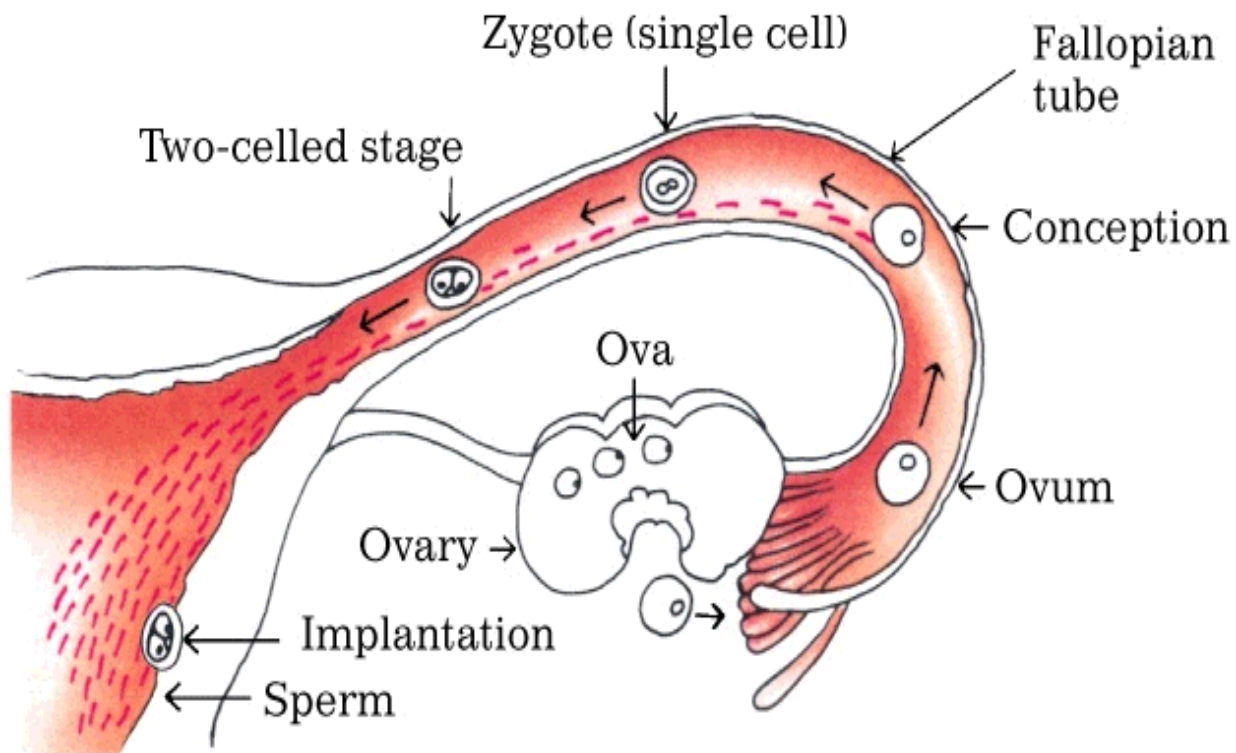
Close-up of a 5 week embryo.



An embryo removed from the fallopian tube in a tubal, or ectopic, pregnancy. The ectopic rate in the USA in 1987 was 16.8 per 1,000 pregnancies, up from 4.5/1000 in 1970. By 2002 it had risen to 19.7/1,000.



On average, it takes the zygote between 5 to 14 days to travel down the fallopian tube to the uterus. Fallopian tubes are about the size of a hair bristle and 4 inches long. Once the zygote implants itself into the uterus, it becomes known as an embryo.



A 7 week embryo is about $\frac{3}{4}$ of an inch long. You can see the ribs, which at this point are cartilage. Calcification is still several weeks away.

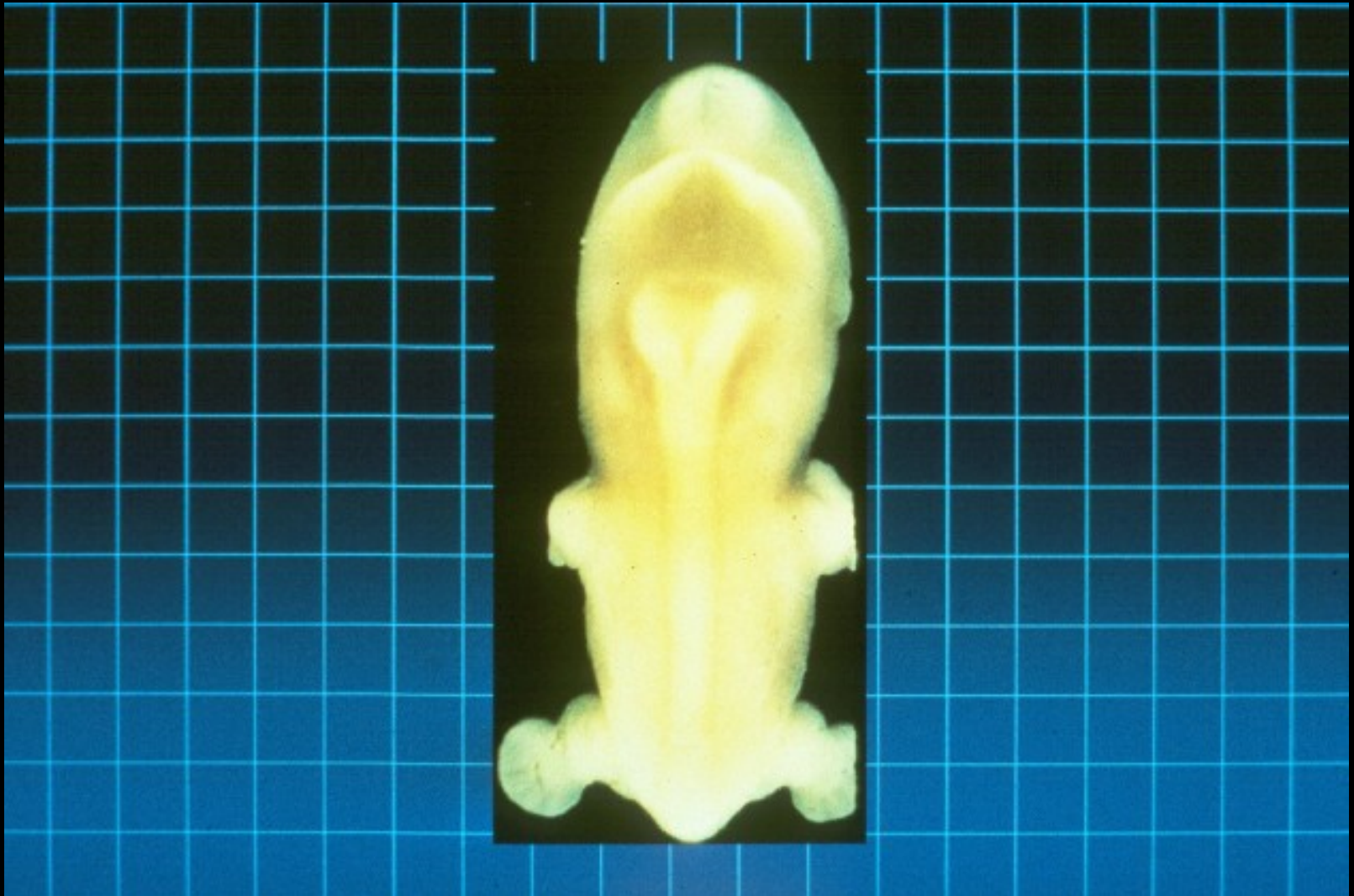


At 7 weeks the embryo only weighs 1/30th of an ounce.



7 Weeks

Back view of 7 week embryo. Notice the development of the spinal cord.





7 Weeks

- **3/4 Inch Long**
- **Nerves & Muscles Work Together For First Time**
- **At 43 Days Brain Wave Patterns Can Be Recorded**

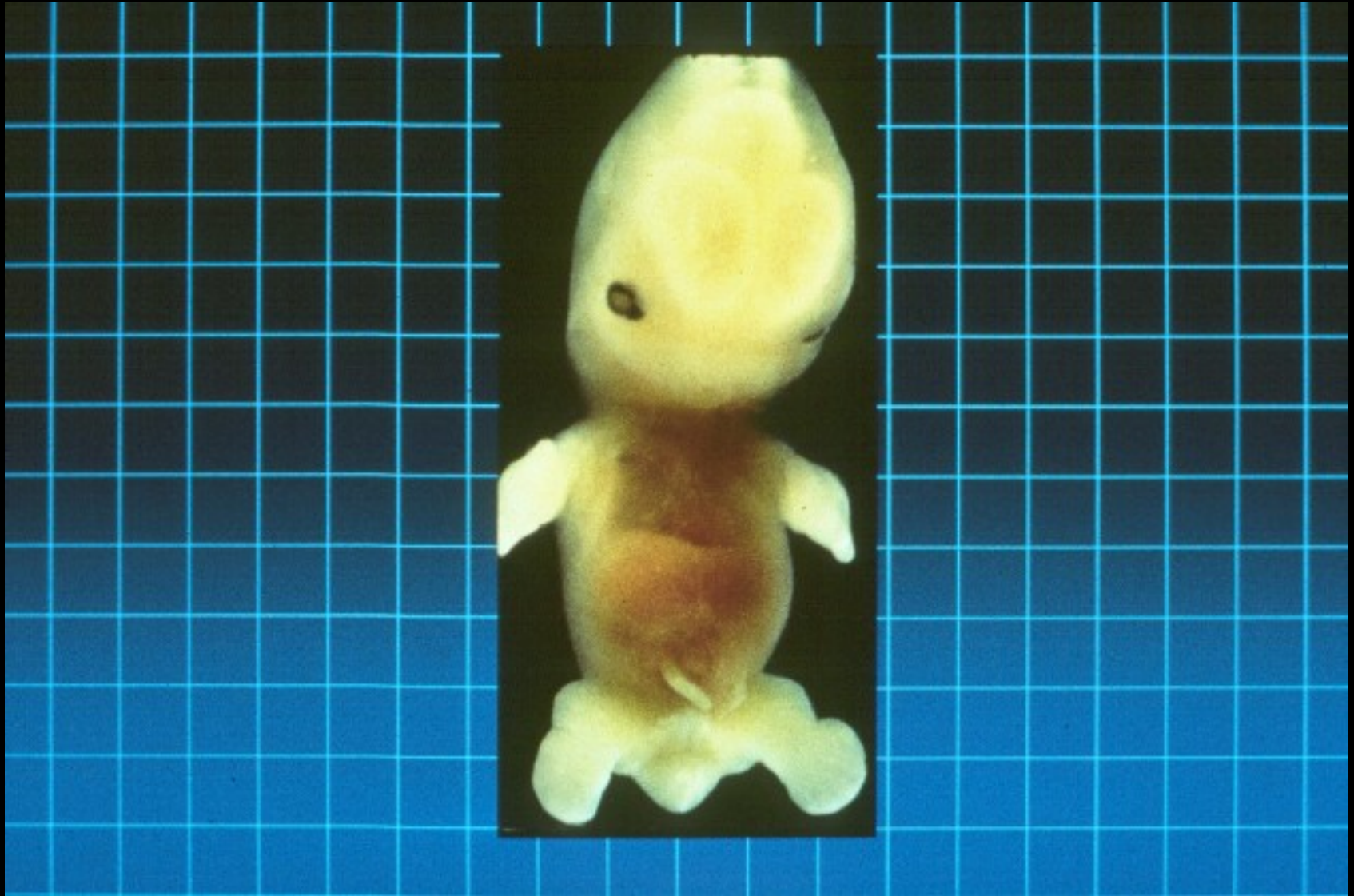
Close-up of 7 week eyes. This is about 40x the actual size. Gluey ridges are beginning to form. The eyes will be sealed shut until the 6th month.



The dark area of the eye is the pigment of the retina as it is forming. At this stage, the nose and all of the facial features are flat.



Front view of 7 week embryo. By this time the fingers and toes become separate entities. At 50 days after conception, all internal organs and external structures are identifiable. Both hemispheres of the brain are clearly seen in this picture.





8 WEEKS

- **All Organs Functioning — Stomach, Liver, Kidney, Brain**
- **Lines In Palms Of Hands**
- **From This Point Until Age 23 Years — All Future Development Is The Result Of Refinement & Increase In Size**

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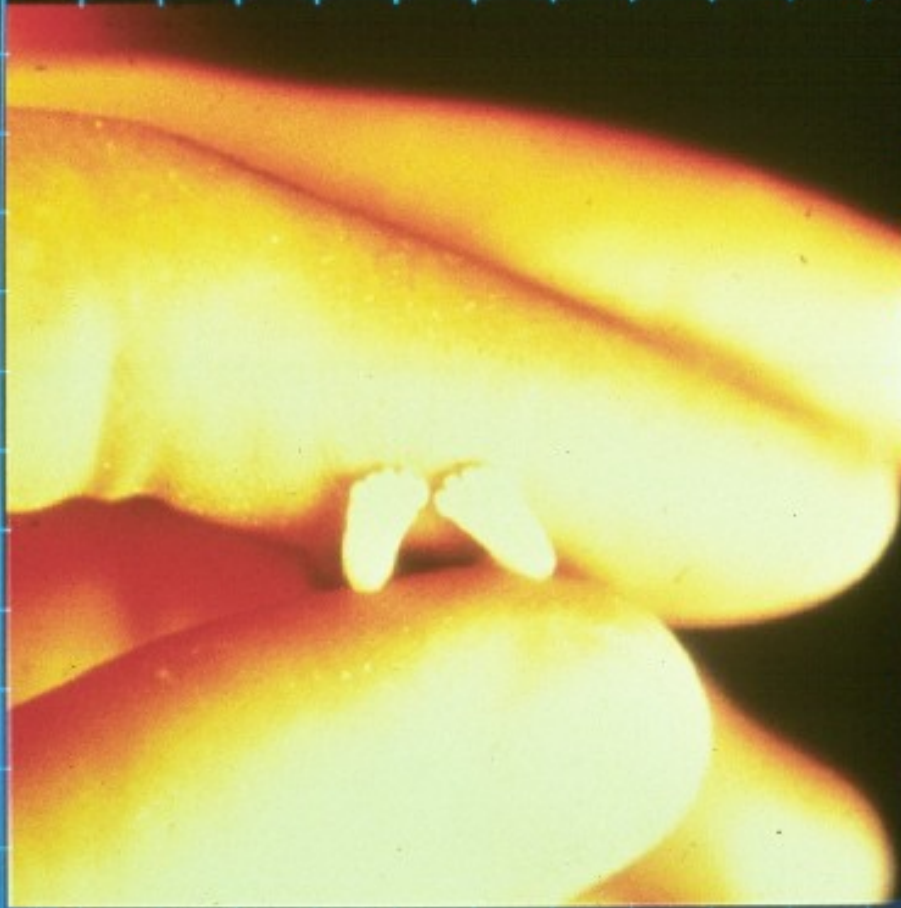
Fetus At 2 Months



8 week male fetus.



These are 10 week-old feet.



By 10 weeks, the fetus is highly responsive to touch. Cartilage is calcifying to become bone.



12 week fetus. Note the placenta and umbilical cord.



By this time, the fetus is about 3 inches long and does everything from urinate to hiccup.



Close-up of 12 week fetus.



Notice the development of the muscles.



3½ Months

At 16 weeks, the skin has the texture of the mucus membranes in your mouth. The fetus is now about 6 to 8 inches long.



4 Months

By this stage the fetal heart circulates 25 quarts of blood through the body per day. The first thin transparent layer of skin begins to replace the protective membrane.

4 MONTHS



At about 4 months, most mothers can feel their babies kicking.



Here is a 17 week hand. Notice the loose skin.



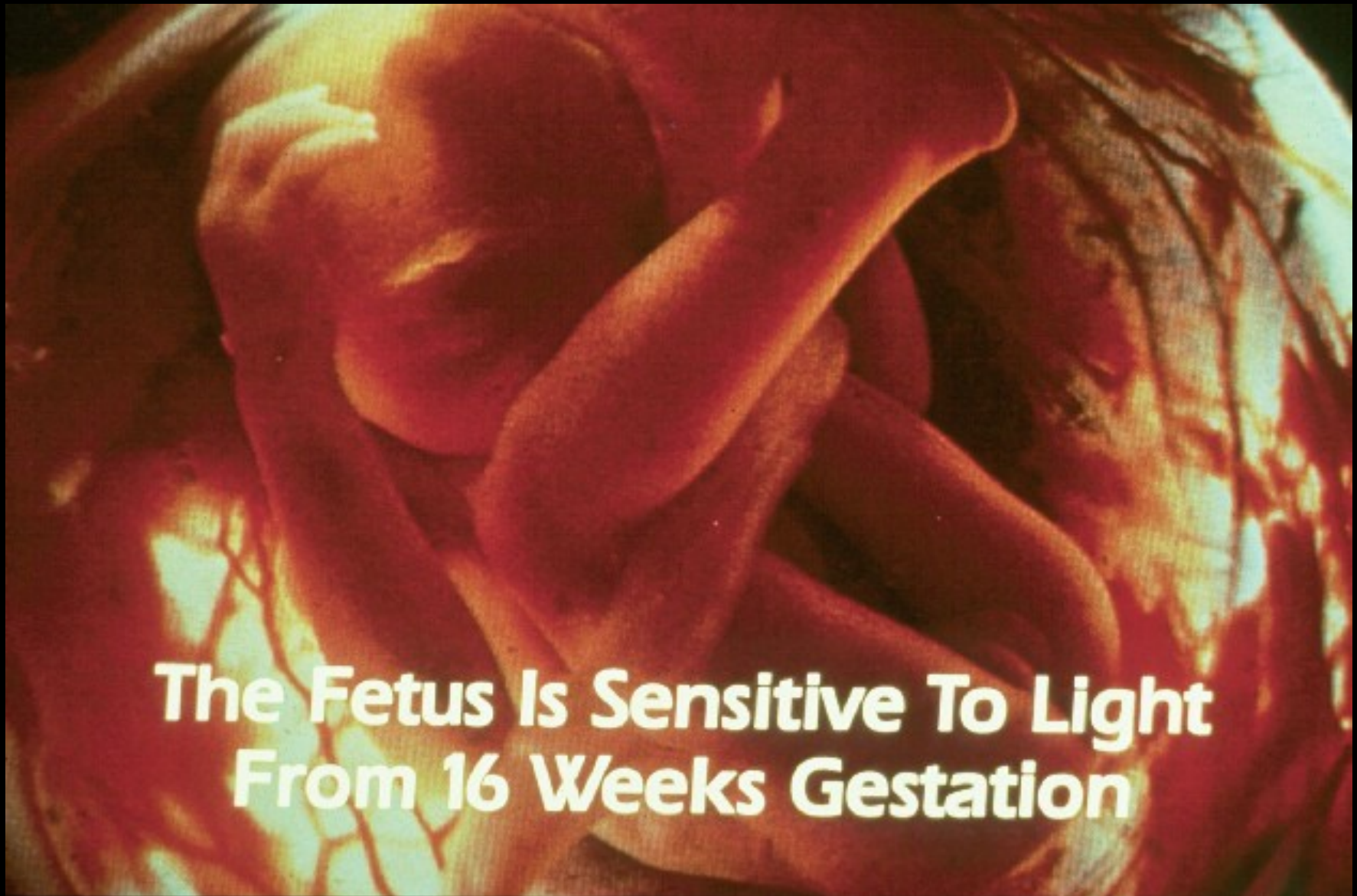
18 week fetus sucking her thumb.



Notice the development of the blood vessels at 18 weeks.



This is a live shot (fetoscopy) taken with a wide angle lens inside the mother.



5½ Months

4 Months
1 Week




Following are some detailed structures present at this time.

5½ Months



Notice the hair, eyebrows, and eyelids.



A close-up photograph of a developing fetus's face at 27 weeks gestation. The image shows the skin texture, the developing nose with two nostrils, and the mouth. The lighting is warm and focused on the facial features.

**At 27 Weeks The Developing Fetus
Has Established The Ability To Hear**

17 week hand.



Notice the cuticles and toenails.



Footprints are used for identification for newborns in some hospitals.





Photography

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TABLE 4.5 Criteria and Scoring of the Apgar Scale

Score	Color	Heartbeat	Reflex Irritability	Muscle Tone	Respiratory Effort
0	Blue, pale	Absent	No response	Flaccid, limp	Absent
1	Body pink, extremities blue	Slow (below 100)	Grimace	Weak, inactive	Irregular, slow
2	Entirely pink	Rapid (over 100)	Coughing, sneezing, crying	Strong, active	Good; baby is crying

TABLE 4.2 Vulnerability During Prenatal Development

The Germinal Period

At least 60 percent of all developing organisms fail to grow or implant properly and thus do not survive the germinal period. Most of these organisms are grossly abnormal.

The Embryonic Period

About 20 percent of all embryos are aborted spontaneously, most often because of chromosomal abnormalities.

The Fetal Period

About 5 percent of all fetuses are aborted spontaneously before viability at 22 weeks or are stillborn, defined as born dead after 22 weeks.

Birth

About 31 percent of all zygotes grow and survive to become living newborn babies.

Age of Viability – the age (around 22 weeks) at which a fetus may survive outside the mother's uterus if specialized medical care is available.

Fetal weight normally doubles in the last trimester of pregnancy with about 2 pounds gained in the last 3 weeks. Consequently,

- Preterm infant – a baby born 3 or more weeks early
- Small for gestational age (SGA) a baby whose birth weight is significantly lower than expected, given the time since conception.

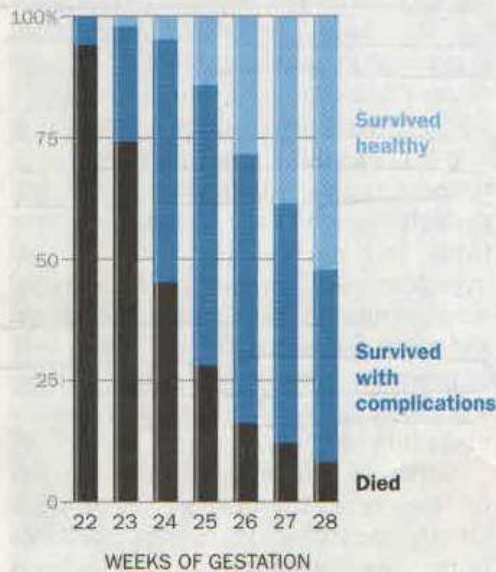
Preterm Survival Rates

- 22 weeks = 5%
- 23 weeks = 26%
- 24 weeks = 56%
- 25 weeks = 76%
- 32 weeks = >90%

Preterm Statistics

SURVIVAL RATES

Until Week 28, most surviving babies face brain, lung, intestinal and eye problems



4 million

BABIES WERE BORN
IN THE U.S. IN 2010

478,790

OF THOSE WERE BORN BEFORE
37 WEEKS' GESTATION

462,408

OF THEM SURVIVED
AT LEAST A YEAR

Sources: Centers for Disease Control and Prevention; March of Dimes; National Perinatal Information Center; American Academy of Pediatrics; National Institutes of Health
TIME graphic by Emily Maltby and Lon Tweeten

LEVELS OF NEONATAL CARE

LEVEL I

Basic care

Nurseries that cater to healthy, full-term babies. They stabilize preterm infants to transfer them out.

LEVEL II and III

Specialty care

Facilities that can aid sick and premature babies. Level III NICUs may perform some surgeries.

LEVEL IV

Surgical care

NICUs capable of performing complex surgeries like repairing congenital heart defects.

Preterm Complications

Saving Little Lives

Medical advances have improved survivability and long-term health for babies born as early as 22 weeks

BRAIN Blood vessels that are not yet fully developed may bleed into fluid-filled areas of the brain.

To reduce swelling and relieve pressure, a tube in the brain can drain excess fluid.

LUNGS Without a protein called surfactant, tiny air sacs may collapse.

Artificial surfactant and air-delivery devices can help keep airways open.

SKIN With little fat, skin is thin and more transparent. It may also be yellow from jaundice.

Incubators help babies who are born without a protective fat layer stay warm.

EYES Abnormal blood-vessel growth in the eye can lead to blindness.

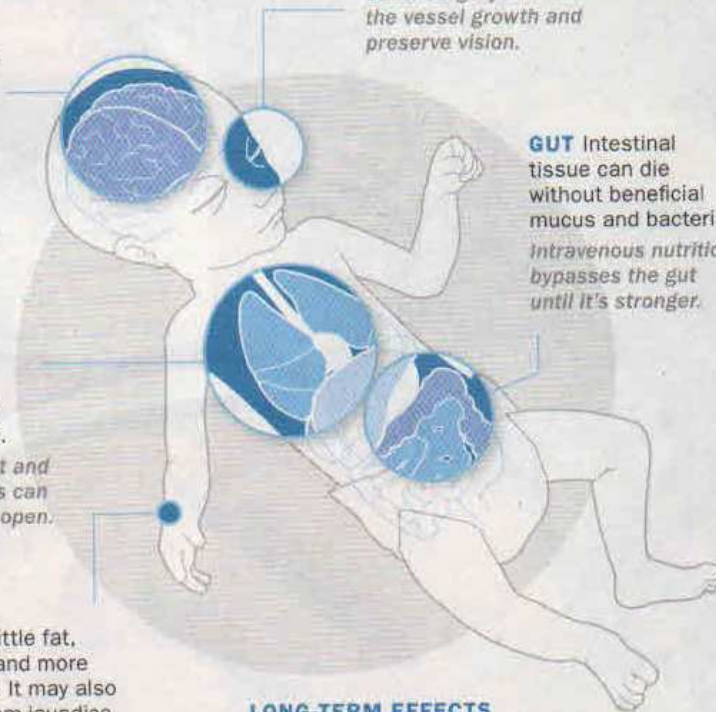
Laser surgery can halt the vessel growth and preserve vision.

GUT Intestinal tissue can die without beneficial mucus and bacteria.

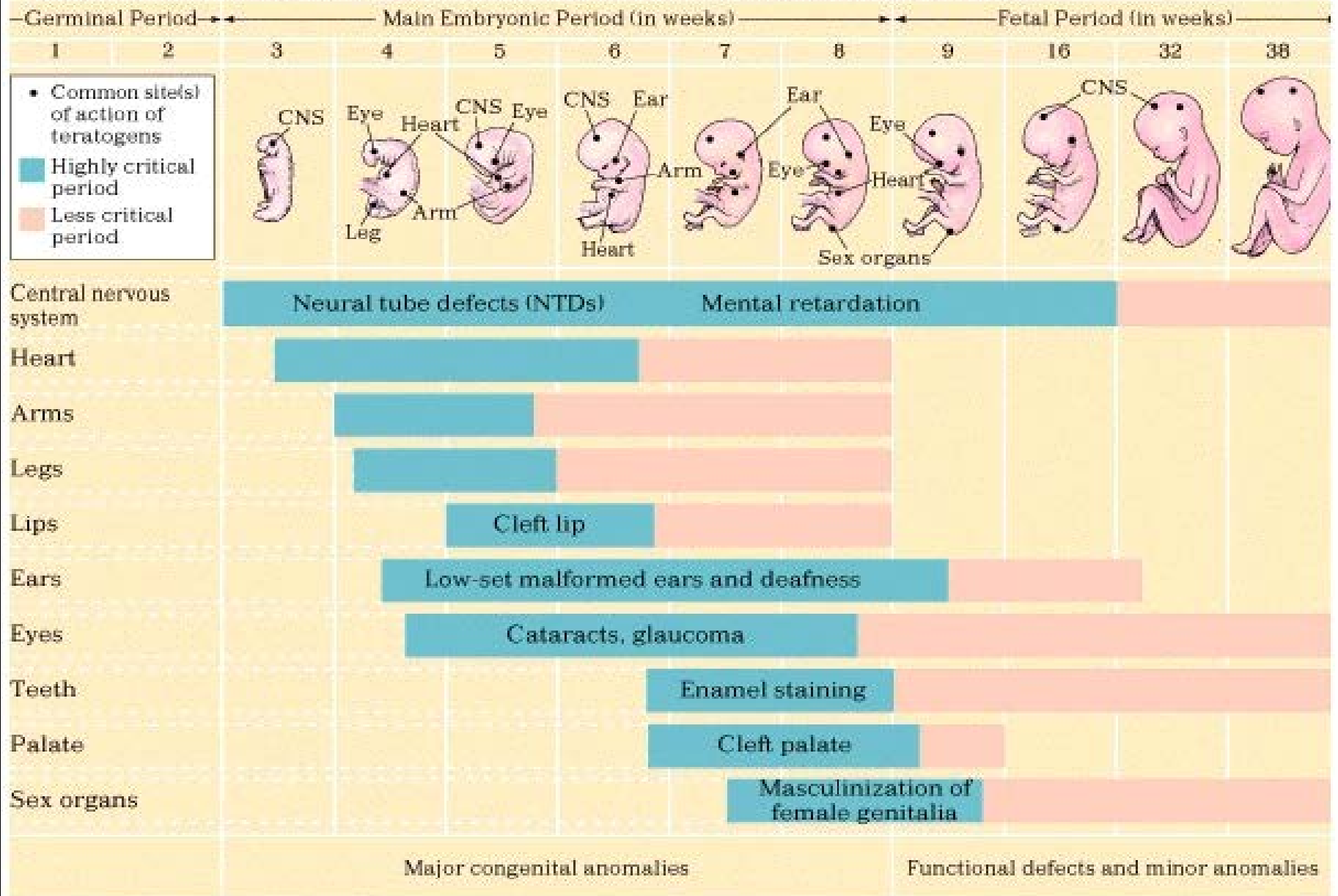
Intravenous nutrition bypasses the gut until it's stronger.

LONG-TERM EFFECTS

Babies born too early may face developmental delays later. They may also have lingering vision, hearing, cardiac and respiratory problems as children and adults.



Birth Defects from Teratogens: Time of Exposure and Effects on Major Organs



Source: Adapted from Moore & Persaud, 1998.

table 4.3

Effects of Psychoactive Drugs on Prenatal Development

Drug	Usage	Effects
Alcohol	3 or more drinks daily, or binge drinking of 5 or more drinks on one occasion, early in pregnancy	Causes fetal alcohol syndrome (FAS). Symptoms include a small head, abnormal facial characteristics (wide spacing between the eyes, a flattened nose and a narrow upper lip, unusual eyelids, and missing skin indent between nose and upper lip), overall growth retardation, learning disabilities, and behavior problems (including poor concentration and impaired social skills).
	More than 1/4 oz. of absolute alcohol a day	Causes fetal alcohol effects (FAE). FAE does not observably affect facial appearance or physical growth, but it affects brain functioning. The first sign is noisy, higher-frequency cries at birth. Later signs, on cognitive tests, include lower IQ (by about 5 points).
	Moderate drinking: less than 1 or 2 servings of beer or wine or 1 mixed drink, a few days per week	Probably has no negative effects on prenatal development, although this is controversial.
Tobacco	Maternal smoking early in pregnancy	Increases risk of abnormalities, including malformations of the limbs and the urinary tract.
	Maternal smoking late in pregnancy	Reduces birthweight and size. Babies born to habitual smokers weigh, on average, about 9 oz. (250 g) less than would otherwise be expected, and they are shorter, both at birth and in the years to come. They may have childhood problems, particularly with respiration, and, in adulthood, increased risk of becoming smokers themselves.
	Paternal smoking	Reduces birthweight by about 2 oz. (45 g) on average.
Marijuana	Heavy use	Affects the central nervous system, as evidenced by the tendency of affected newborns to emit a high-pitched cry that denotes brain damage.
	Light use	Has no proven long-term effects.
Heroin		Because of the physiological "highs" and "crashes" of the addiction (such as the reduction of oxygen, irregular heartbeat, and sweating and chills that occur during withdrawal), heroin causes slower fetal growth and premature labor. (See also methadone, below.)
Methadone	Later in pregnancy	Moderates the effects of heroin withdrawal during pregnancy but is as addictive as heroin. Heavily addicted newborns require regulated drug doses in the first days of life to prevent the pain and convulsions associated with sudden opiate withdrawal.
Cocaine		Causes overall growth retardation, problems with the placenta, and specific learning problems in the first months of life. Research on long-lasting effects is confounded by the effects of poverty and the ongoing addiction of the mother. The major concern is in language development (Lester et al., 1998).
Solvents	Especially early in pregnancy	Causes smaller heads, crossed eyes, and other abnormalities.

Overall sources: Larsen, 1998; Lyons & Rittner, 1999.

Alcohol (Marboffe, 1996; Nugent et al., 1996; Streissguth, 1997); tobacco (Eskbenazi et al., 1995; Kellen, 1997); Kandel et al., 1994; Li et al., 1999); marijuana (Lester & Dreher, 1988); methadone (Schneider & Hans, 1996); cocaine (including crack) (Hurt et al., 1990); solvents (glue, other inhalants) (Arnold, 1997).

TABLE 4.4

Teratogens: Effects of Exposure and Prevention of Damage

Teratogens	Effects on Child of Exposure	Measures for Preventing Damage
Diseases		
Rubella (German measles)	In embryonic period, causes blindness and deafness; in first and second trimesters, causes brain damage	Get immunized before pregnancy
Toxoplasmosis	Brain damage, loss of vision, mental retardation	Avoid eating undercooked meat and handling cat feces, garden dirt
Measles, chicken pox, influenza	May impair brain functioning	Get immunized before pregnancy; avoid infected people during pregnancy
Syphilis	Baby is born with syphilis, which, untreated, leads to brain and bone damage and eventual death	Early prenatal diagnosis and treatment with antibiotics
AIDS	Baby may catch the virus. If so, illness and death are likely during childhood.	Prenatal drugs and cesarean birth make AIDS transmission rare
Other sexually transmitted infections, including gonorrhea and chlamydia	Not usually harmful during pregnancy but may cause blindness and infections if transmitted during birth	Early diagnosis and treatment; if necessary, cesarean section, treatment of newborn
Infections, including infections of urinary tract, gums, and teeth	May cause premature labor, which increases vulnerability to brain damage	Get infection treated, preferably before pregnancy
Pollutants		
Lead, mercury, PCBs (polychlorinated biphenyls), dioxin, and some pesticides, herbicides, and cleaning compounds	May cause spontaneous abortion, preterm labor, and brain damage	Most common substances are harmless in small doses, but pregnant women should still avoid regular and direct exposure, such as drinking well water, eating unwashed fruits or vegetables, using chemical compounds, eating fish from polluted waters
Radiation		
Massive or repeated exposure to radiation, as in medical X-rays	In the embryonic period, may cause abnormally small head (microcephaly) and mental retardation; in the fetal period, suspected but not proven to cause brain damage. Exposure to background radiation, as from power plants, is usually too low to have an effect.	Get ultrasounds, not X-rays, during pregnancy; pregnant women who work directly with radiation need special protection or temporary assignment to another job
Social and Behavioral Factors		
Very high stress	Early in pregnancy, may cause cleft lip or cleft palate, spontaneous abortion, or preterm labor	Get adequate relaxation, rest, and sleep; reduce hours of employment; get help with housework and child care
Malnutrition	When severe, may interfere with conception, implantation, normal fetal development, and full-term birth	Consume adequate vitamins and minerals, especially folic acid, iron, and vitamin A; achieve normal weight before getting pregnant, then gain 25–35 lbs (10–15 kg)
Excessive, exhausting exercise	Can affect fetal development when it interferes with pregnant woman's sleep or digestion	Get regular, moderate exercise



Teratogens	Effects on Child of Exposure	Measures for Preventing Damage
Medicinal Drugs		
Lithium	Can cause heart abnormalities	Avoid all medicines, whether prescription or over-the-counter, during pregnancy unless they are approved by a medical professional who knows about the pregnancy and is aware of the most recent research
Tetracycline	Can harm the teeth	
Retinoic acid	Can cause limb deformities	
Streptomycin	Can cause deafness	
ACE inhibitors	Can harm digestive organs	
Phenobarbital	Can affect brain development	
Thalidomide	Can stop ear and limb formation	
Psychoactive Drugs		
Caffeine	Normal use poses no problem	Avoid excessive use: Drink no more than three cups a day of beverages containing caffeine (coffee, tea, cola drinks, hot chocolate)
Alcohol	May cause fetal alcohol syndrome (FAS) or fetal alcohol effects (FAE)	Stop or severely limit alcohol consumption during pregnancy; especially dangerous are three or more drinks a day or five or more drinks on one occasion
Tobacco	Increases risk of malformations of limbs and urinary tract, and may affect the baby's lungs	Stop smoking before and during pregnancy
Marijuana	Heavy exposure may affect the central nervous system; when smoked, may hinder fetal growth	Avoid or strictly limit marijuana consumption
Heroin	Slows fetal growth and may cause premature labor; newborns with heroin in their bloodstream require medical treatment to prevent the pain and convulsions of withdrawal	Get treated for heroin addiction before becoming pregnant; if already pregnant, gradual withdrawal on methadone is better than continued use of heroin
Cocaine	May cause slow fetal growth, premature labor, and learning problems in the first years of life	Stop using cocaine before pregnancy; babies of cocaine-using mothers may need special medical and educational attention in their first years of life
Inhaled solvents (glue or aerosol)	May cause abnormally small head, crossed eyes, and other indications of brain damage	Stop sniffing inhalants before becoming pregnant; be aware that serious damage can occur before a woman knows she is pregnant
<p>Note: This table summarizes some relatively common teratogenic effects. As the text makes clear, many individual factors in each pregnancy affect whether a given teratogen will actually cause damage and what that damage might be. This is a general summary of what is known; new evidence is reported almost daily, so some of these generalities will change. Pregnant women or women who want to become pregnant should consult with their physicians.</p> <p>Sources: Briggs et al., 2008; R. D. Mann & Andrews, 2007; O'Rahilly & Müller, 2001; Reece & Hobbins, 2007; Shepard & Lemire, 2004.</p>		

>> **Response for Nutritionists** (from page 105) Useful, yes; optimal, no. Some essential vitamins are missing (too expensive), and individual needs differ, depending on age, sex, health, genes, and eating habits. The reduction in neural-tube defects is good, but many women don't eat cereal or take vitamin supplements before becoming pregnant.

The Stages of Pregnancy: First Trimester Emotions

- Emotional state during pregnancy varies according to several factors:
 - Women who desire the pregnancy are less anxious than women who do not.
 - Low income is associated with depression during pregnancy.
 - Women with a supportive partner are less likely to be depressed.
 - In the first trimester, women's anxieties often center on concerns about miscarriage.

The Stages of Pregnancy: Second Trimester

- Physical problems include constipation and nosebleeds.
- **Edema** (water retention and swelling) in the face, hands, wrist, ankles, and feet may be a problem.
- **Colostrum**, a thin amber or yellow fluid, may come out of the nipples beginning about the 19th week.

The Stages of Pregnancy: Psychological Well Being

- Psychological well-being is greater among women who:
 - have social support
 - have higher incomes
 - experience fewer concurrent stressful life events

The Postpartum Period: Emotions

Postpartum depression is characterized by:

- depressed mood
- insomnia
- tearfulness
- feelings of inadequacy
- fatigue

Causes of Postpartum Depression

- Physical exhaustion, including low levels of estrogen and progesterone
- Feeling overwhelmed with responsibilities of parenthood
- Financial issues associated with giving birth and acquiring all the things that will be needed to care for a baby
- Being estranged from the baby's father
- Initial feelings of ambivalence toward the baby (“I must be a horrible mother”)

Drs. K & K's Goofy Idea

- In the 1970s, pediatricians Marshall Klaus & John Kennell popularized the idea that there is a “critical period” or “sensitive period” in the minutes & hours immediately after birth, during which the mother & infant should bond to each other.
- No scientific evidence for the sensitive-period-for-bonding hypothesis.