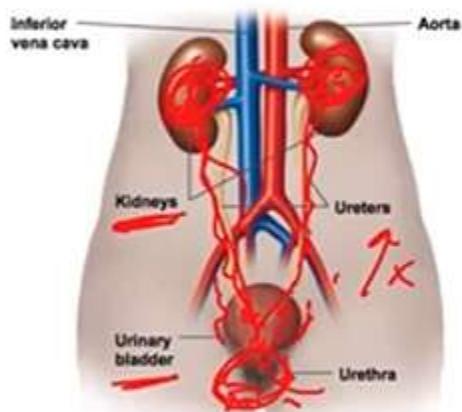


Structure and Function

- Urinary system
 - Kidneys
 - Ureters
 - Bladder
 - Urethra
- Ureters have valves
 - Prevent backflow of urine to kidneys
 - Protects kidneys from lower UTIs
- Urine has antimicrobial properties
- ~~Flushing action also remove pathogens.~~



Normal Microbiota

- Urine is sterile
- Can be contaminated by microbiota of skin at urethra
- Predominant bacteria in vagina
 - Lactobacilli
 - Generates lactic acid
 - Keeps pH low (3.8-4.5)
 - Inhibits other growth



"Urine is sterile. You can drink it."
--Fight Club

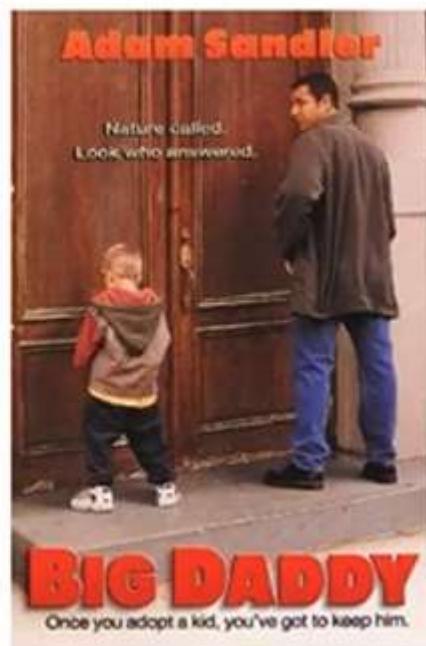
- Generates lactic acid
- Keeps pH low (3.8-4.5)
- Inhibiting other growth
- Yeast (*Candida albicans*)
 - Found in 10-25% of women

"Urine is sterile. You can drink it."

--Fight Club

Diseases of the Urinary System

- Urethritis
 - Inflammation of urethra
- Intestinal bacteria predominate UTI
 - Most infections caused by *E. coli*
- Rate of UTI in women is 8x men.



Diseases of the Reproductive System

- STI (sexually transmitted infection)
- >30 microbes can cause
- 15 million new cases annually in US



annually in US

- Many treated with antibiotics
- Or prevented by condom use.



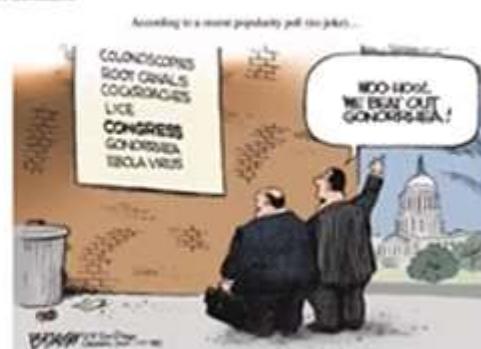
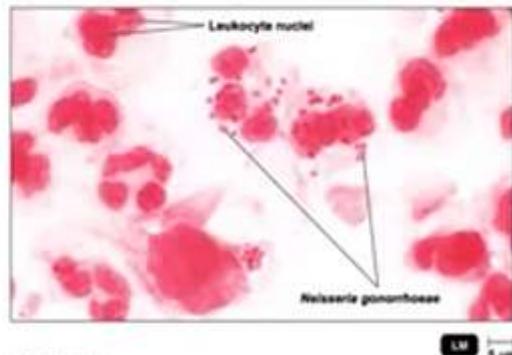
Pelvic Inflammatory Disease (PID)

- Collective term for bacterial infection of female pelvic organs
 - Uterus, cervix, uterine tubes, ovaries
- Symptoms:
 - Lower ab pain, discharge, fever, chills, painful urination
- Can lead to infertility
- Usually results from coinfection of N. gonorrhoeae and C. trachomatis.



Gonorrhea

- aka: the clap
- Causative agent: *Neisseria gonorrhoeae*
- Gram negative diplococcus
- most common reportable communicable disease in US
- Cells attach to mucosal cells of epithelial wall via fimbriae
- Invades urethra (men) and cervix (women)
- Triggers inflammation, pus formation
- Coinfection with Chlamydia.



Gonorrhea

- Men
 - Painful urination
 - Discharge of pus
- Women
 - Often asymptomatic
 - But can spread to uterus or fallopian tubes
 - Can contribute to pelvic inflammatory disease (PID)
- Eyes of infant can be infected during birth
 - Ophthalmia neonatorum can result in blindness
 - Antibiotics placed in eyes of newborn.



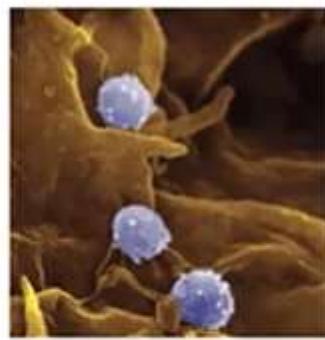
Gonorrhea

- Treatment
- No vaccine
 - No effective adaptive immunity
 - Exhibits antigenic variability
- Ceftriaxone (a cephalosporin)
- Also treat for Chlamydia (tetracycline).



Chlamydia

- Signs and symptoms
- Males: mild, painful urination, inflammation of epididymis
- Females: usually asymptomatic, abdominal pain
 - Can lead to PID
 - 5x as many reported cases than men.



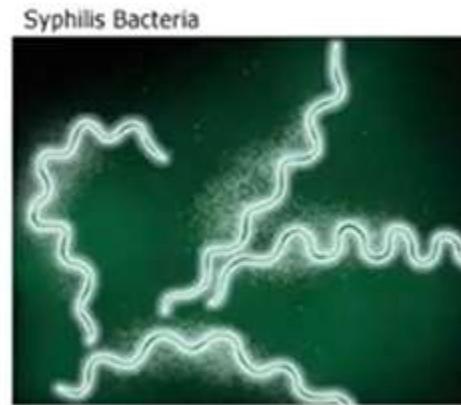
Chlamydia

- Treatment:
 - Susceptible to tetracyclines
- No vaccine.



Syphilis

- Causative agent:
- *Treponema pallidum*
- Gram negative spirochete
- Lacks enzymes to build many macromolecules
- Relies on host
- Slow generation times: 30 hours



Syphilis

- Sexually transmitted
- from spirochete-containing lesions of skin or mucous membranes
 - (genitals, mouth, rectum)
- Progresses through several stages.



Syphilis

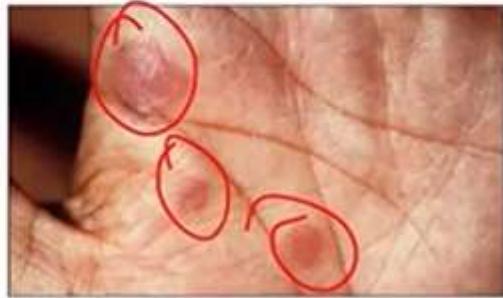
- Primary Stage
 - Initial sign is small, hard-based chancre
 - Appears at site of infection (2-10 weeks)
 - Painless
 - Fluid is highly infectious
 - Heals in a few weeks.



(a) Chancre of primary stage on a male in genital area.

Syphilis

- Secondary Stage
 - Characterized by skin rashes
 - Notably on palms and soles
 - Lesions of the rash contain spirochetes
 - Highly infectious
 - Can last 2-6 weeks
 - Spontaneously heals
 - Symptoms subsides, can enter latent period
 - No symptoms, not infectious
 - Most cases do not progress beyond latent stage.



(b) Lesions of secondary syphilis rash on a palm; any surface area of the body may be afflicted with such lesions.



(b)

Syphilis

- Primary and secondary stages not disabling
- Tertiary Stage
 - 25% of untreated cases progress here
 - May occur 10-20 years after infection.



(e) Gummas of tertiary stage on the back of an arm; gummas such as these are rarely seen today in the era of antibiotics.



Alphonse Capone

Syphilis

- Tertiary
 - Characterized by gummas
 - Progressive inflammation
 - Appear as rubbery masses of tissue
 - Especially skin and bones
 - Not infectious
 - Neurosyphilis
 - Parts of CNS affected
 - Dementia, seizures
- Antibiotics makes Tertiary Stage rare
 - Penicillin, tetracycline.



(c) Gummas X Tertiary stage on the back of an arm; gummas such as these are rarely seen today in the era of antibiotics.



→ Alphonse Capone

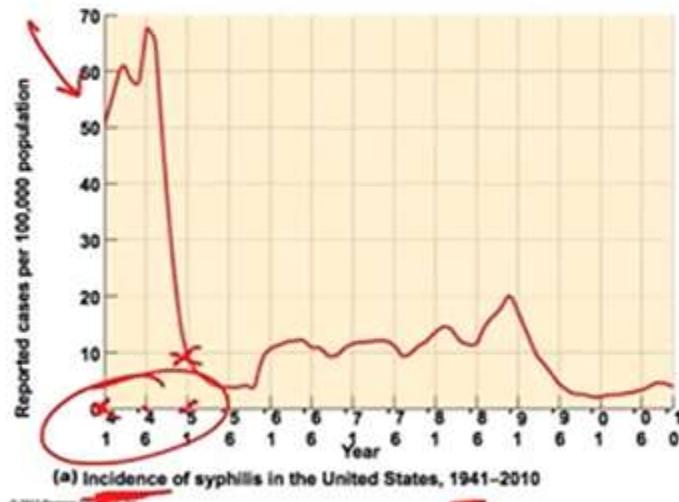
Syphilis



- Congenital Syphilis
 - Transmitted across placenta to fetus
 - Damage to mental development
 - Most common when pregnancy occurs during latent period
 - During primary or secondary
 - Likely to produce stillbirth
 - Treatment with antibiotics during first two trimesters can prevent.

Syphilis

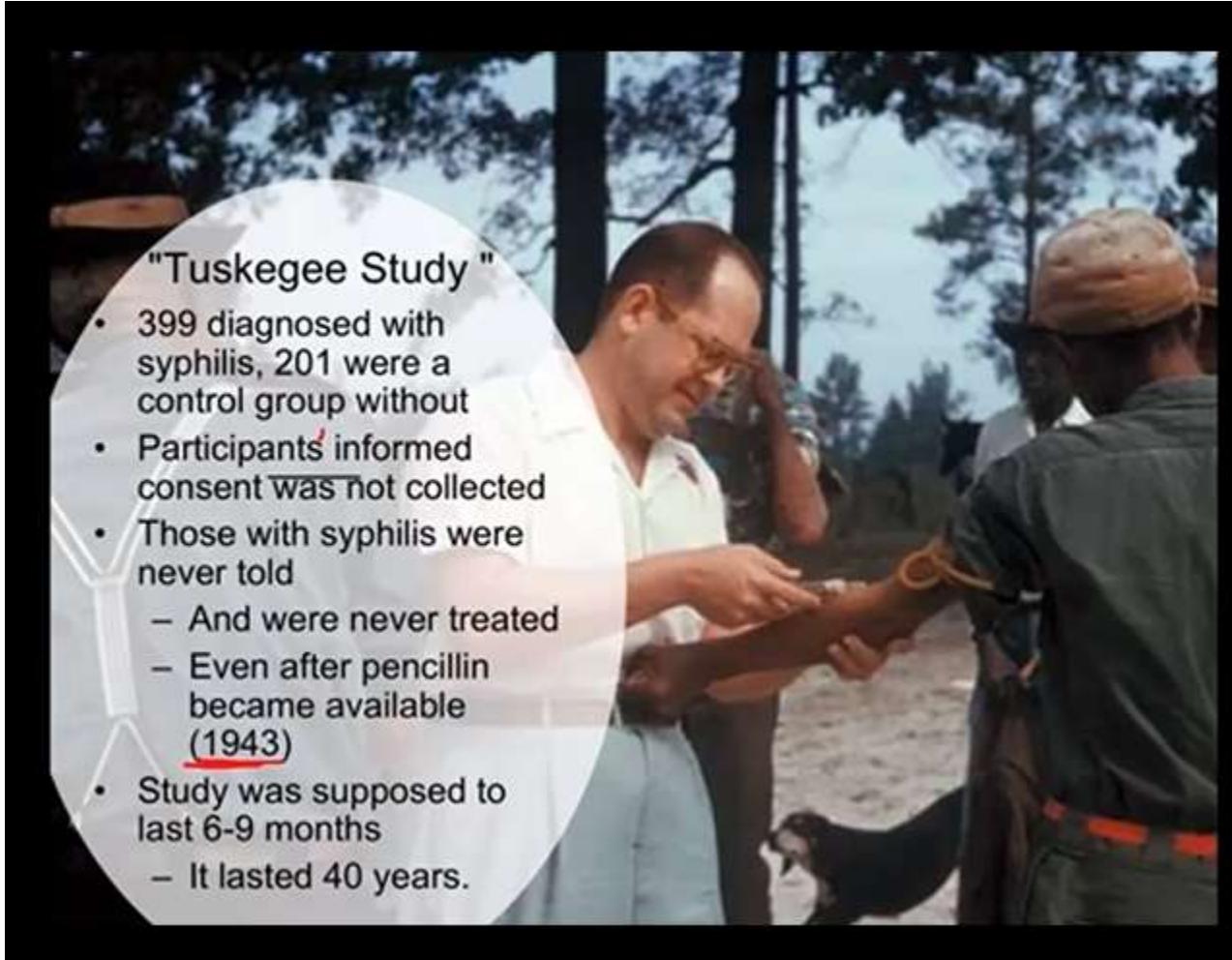
- Treatment
 - Penicillin
 - Effective at all stages
- Prevention
 - Condoms
 - Early diagnosis
 - No vaccine.



"Tuskegee Study of Untreated Syphilis in the Negro Male"

- 1932

- The US Public Health Service conducted a secret experiment
 - To study the progression of syphilis- without treatment
- Fliers in Macon County, Ala promising "colored people" treatment for "bad blood"
 - Free meals, physicals, burial insurance
- 600 men signed up
 - All were black, most were poor.



"Tuskegee Study"

- 399 diagnosed with syphilis, 201 were a control group without
- Participants informed consent was not collected
- Those with syphilis were never told
 - And were never treated
 - Even after penicillin became available (1943)
- Study was supposed to last 6-9 months
 - It lasted 40 years.

"Tuskegee Study of Untreated Syphilis in the Negro Male"

- 1972 AP story exposed the study
- 1973 class action lawsuit
 - \$10M out of court settlement
 - US govt promised lifetime med benefits and burial services
- 1997 Pres. Clinton issues apology to 8 remaining survivors.

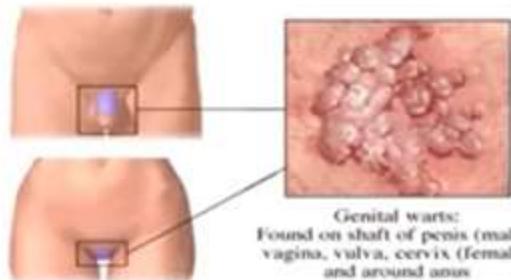


Genital Warts and HPV

- Causative agent:
- Human Papillomavirus
- Non enveloped DNA virus
- >200 different types; 30 infect genital tract
- Transmitted skin-to-skin or sexual contact
- Infects squamous epithelial cells.

Genital Warts and HPV

- Visible genital warts
 - HPV-6, and HPV-11
- Most common worldwide STI
- Most are benign
- Some cause cancer
- HPV-16, HPV-18 cause 70% of cervical cancer
 - But also oral, anal, and penile cancer.



Genital warts:
Found on shaft of penis (male),
vagina, vulva, cervix (female)
and around anus

HPV and Cancer

G₁ S G₂ M

- Virus produces proteins E6 and E7
- Bind and interfere with p53
- p53 = tumor suppressor
 - It detects mistakes made in cell cycle
 - Arrests growth.



HPV and Cancer



- Treatment
 - No cure
 - Most HPV infections resolve spontaneously
 - Topical medications for warts or ablation
- Pap smears: important screening tool for cervical cancer ↵
 - Within 3 years of first partner or by age 21.

Pap smear:
cells are scraped from the cervix
and examined under a microscope
to check for disease or other problems

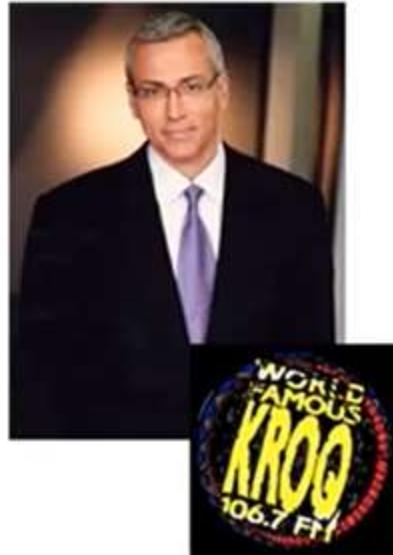


Cervix viewed
through speculum
with patient in
lithotomy position

HPV and Cancer

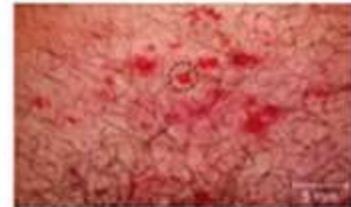
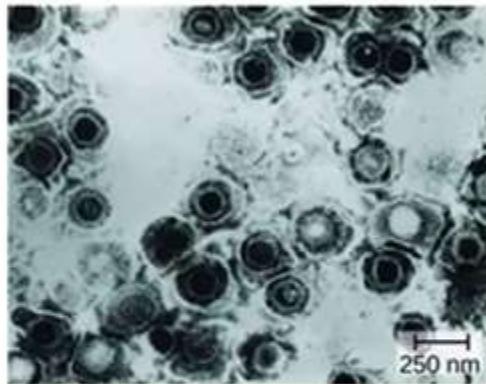
- Vaccine
- Cervarix
 - Protects against ~~most~~ cervical cancer (HPV 16, 18)
- Gardasil
 - Protects against genital warts (HPV 6, 11)
 - And ~~cancers of anus, vagina, vulva, cervix~~
- Recommended for ~~boys and girls at age 11 or 12.~~

Dr Drew



Herpes

- Genital herpes
- Caused by herpes simplex virus type 2 (HSV-2) (enveloped DNA virus)
- 25% of people over 30 infected in US
- Transmission occurs most often when lesions present
- Virus replicates in skin/mucous membrane at site of infection
 - Vesicle



Herpes

- Lifelong latency in nerve cells
- Possible recurrences
- Decrease over time
- Treatment
 - No cure
 - Antiviral drugs (Valtrex) suppress outbreaks.

