


Ecology of Disease

Weekly theme: **CONTACT**
 Lecture: **STD's**



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Let's talk about sex, baby!

VD = Venereal Diseases
 named from Latin Venus - goddess of love

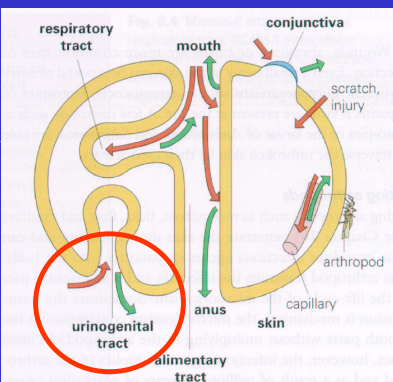
STD = Sexually Transmitted Diseases
 STI = Sexually Transmitted Infections

- concentrate on mode of transmission
- avoid 'love' connotation

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Transmission routes

- faecal-oral
- aerosol
- predator-prey
- vector-borne
- sexual



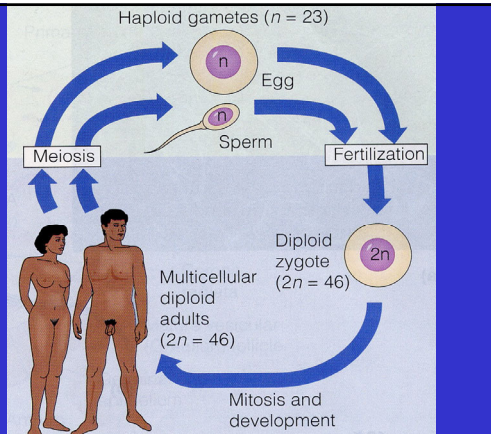
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What is sex?

Extremely variable (animal/plant/protistan/..) but basically involves:

- gender differentiation
 - female (produce ova)
 - male (produce sperm)
- meiotic division
 - recombination (heritability)
 - mutability (novel genotypes)

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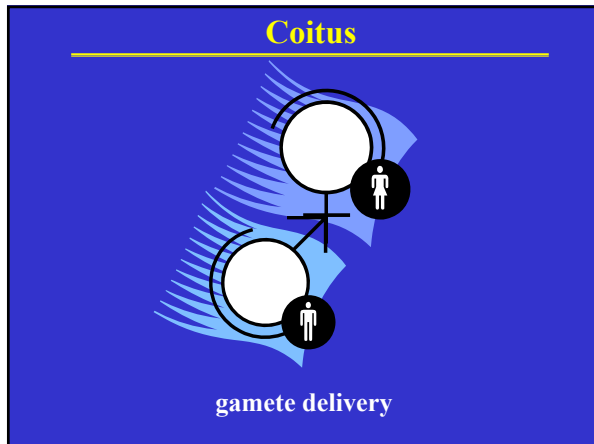
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Sex - the 'act'

Behaviour designed to bring gametes together

- gamete transfer
 - synchronized spawning (broadcast)
 - copulation (deposition in reproductive tract)
- fertilization
 - external (spawning events, egg masses)
 - internal (uterine implantation, gestation)

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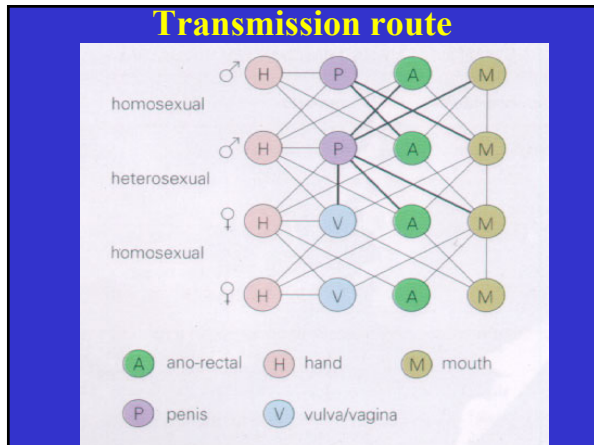
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Transmission success

Related to frequency of sexual contact

- sporadic (sex for reproduction)
 - seasonal breeders, oestrous cycles
- often (sex for pleasure and reproduction)
 - physiological/psychological (libido, sex/love)
 - social/moral/ethical (pair bonding, family groups, sexual hospitality, prostitution)
 - contraceptive practices (safe-sex, condom use)

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Transmission frequency

Related to number of sexual partners (gender ratios, sexual behaviour, promiscuity)

- multiple female partners
 - common in animal kingdom
 - gregarious species - males maintain harems
 - domestication/animal husbandry
 - artificial insemination (AI)
- multiple male partners
 - uncommon in animal kingdom
 - females select strongest
 - emancipation

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Incidence of STD

Global increase (>300 million pa)

- population density
- urbanization
- greater mobility
- change in sexual behaviour (TV)
- lack of proper health care
- lack of sex education
- taboo subject
- emerging diseases
- lack of vaccines

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TOP TEN

Causative agent	disease	new cases/yr
<i>Chlamydia trachomatis</i>	urethritis	97 million
<i>Trichomonas vaginalis</i>	vaginitis	94 million
<i>Neisseria gonorrhoeae</i>	gonorrhoea	78 million
papillomaviruses (6 types)	genital warts	32 million
herpes simplex 1 & 2	genital herpes	21 million
<i>Treponema pallidum</i>	syphilis	19 million
<i>Haemophilus ducreyi</i>	chancroid	9 million
HIV	AIDS	2 million
hepatitis B	hepatitis	1 million
<i>Candida albicans</i>	thrush	very common

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A pox on you!

macules → papules → vesicles → pustules → pocks
(spots) (pimples) (fluid) (pus) (scars)



- Chicken pox (varicella) dsDNA herpes-virus
- Small pox (variola) DNA poxvirus (cowpox)
- Great Pox (syphilis) spirochaete

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Syphilis

- caused by *Treponema pallidum* (pale-spirochaete)
- penetrates mucous membranes
- incubation period around 3 weeks
- disease progresses through three phases
 - primary (1-3 months)
 - secondary (2-6 weeks)
 - latent (3-30 years) then tertiary [immuno-evasion due to inert lipid coat]
- high morbidity/mortality
- *in utero* transmission
 - abortion/congenital abnormalities
 - silent infection

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Syphilis lesions

primary syphilis

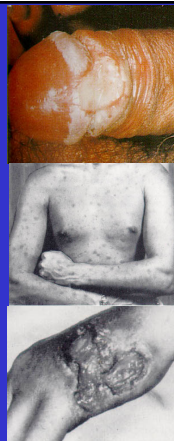
- chancre (ulcer)
- persists 2-6 weeks
- disappears spontaneously

secondary syphilis

- skin rash, fever
- persists weeks
- some mortality

tertiary syphilis

- gumma (soft lesion)
- CNS signs (paralysis/insanity)
- high mortality



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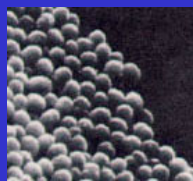
Problems with syphilis

- cannot be cultured *in vitro*
- diagnosis by microscopy and/or serology
- combination serology
 - nonspecific (non-treponemal) tests (early transient resp.)
VDRL test (tests for anti-lipid IgM/IgG)
RPR test (rapid plasma reagin)
 - specific (treponemal) tests (late persistent responses)
FTA-ABS (fluorescent treponemal antibody absorption)
TPHA (haemagglutination)
- confusion with yaws and pinta (non-STD)
- treat with penicillin (tetracycline/doxycycline/erythromycin)
- notifiable - social medicine involves tracing contacts

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The Clap!

- from French *clapoir* (brothel)
- gonorrhoea
- Gram-negative diplococcus
Neisseria gonorrhoeae
- very fragile organism
- survives only brief period outside body
- not transmitted by toilet seats
(unless that's where you have sex)



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Gonorrhoea

- incubation period 2-6 days
- in males
 - infections in urethra, acute presentation
 - dysuria (pain on urination - razorblades)
 - urethral discharge (watery - viscous)
- in females
 - infections in cervix and urethra
 - many asymptomatic (carriers)
 - abdominal pain, burning on urination, discharge
 - pelvic inflammatory disease (PID)
 - Fallopian tube involvement, blockage/salpingitis
 - infertility

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Gonorrhoea lesions

- urethritis with discharge
- local complications (papules)
- systemic complications (septic arthritis)



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Virulence

Bacteria infect non-ciliated epithelial cells
 Multiply in intracellular vacuoles
 Damage due to host inflammatory responses

Virulence factors include:

- pili - aid attachment to epithelia
- protein I - membrane antigens, virulent serotypes
- protein II - membrane antigens, avirulent colonies
- LPS - lipopolysaccharide endotoxin activity
- IgA protease - enzyme released to destroy IgA
- capsule - resists phagocytosis

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Problems with gonorrhoea

- infection transmitted to child via childbirth (gonococcal ophthalmia - eye infection)
- diagnosis by microscopy, culture, biochemistry
 - culture in Thayer-Martin medium
 - Gonozyne tests
- treatment with penicillin but resistant strain emerged (PPNG = penicillinase-producing *N. g.*)
 - shift to spectinomycin but resistance emerged
 - shift to tetracycline
- notifiable - social medicine involves tracing contacts

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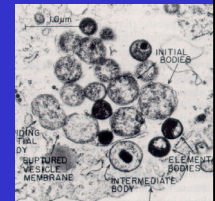
Not the clap!

NGU = non-gonococcal urethritis

- gonorrhoea-like infection
- inflammation/discharge
- but gonococci absent

most diagnosed as
 • *Chlamydial* urethritis

similar to cause of koala infertility (wet bottom syndrome)



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Chlamydia spp.

Small bacteria, obligate intracellular parasites

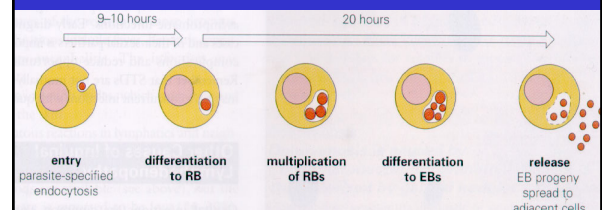
species (serotype)	hosts	disease
<i>C. trachomatis</i> (A-C)	humans	trachoma
(D-K)	humans	urethritis
(L1-3)	humans	lymphogranuloma venereum
<i>C. psittaci</i> (?)	birds, mammals	pneumonia
<i>C. pneumoniae</i> (?)	humans	acute respiratory disease

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Chlamydia life cycle

Biphasic life cycle

- reticulate body (RB) - intracellular multiplication
 - elementary body (EB) - extracellular survival
- Infect host cells by 'parasite-induced' endocytosis
 Exit by host cell rupture or exocytosis



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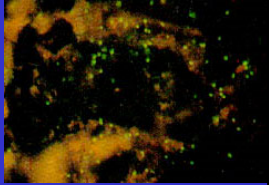

Clinical syndromes

infection	syndrome	complications
in men	urethritis epididymitis proctitis	Reiter's syndrome polyarthritis mucocutaneous lesions
in women	urethritis cervicitis salpingitis	ectopic pregnancy infertility arthritis
neonates	conjunctivitis	pneumonitis

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Chlamydia

- fluorescent cells
- glycogen inclusion
- lymphogranuloma venereum (LGV)

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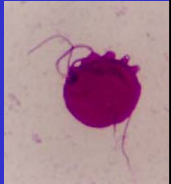
Problems with Chlamydia

- infection transmitted to child via childbirth (chlamydial ophthalmia or pneumonia)
- diagnosis by microscopy, culture, biochemistry
- tissue culture (McCoy cells)
- MicroTrak test (IFAT)
- ELISA for antigens
- Chlamydiazyme assay
- treatment with tetracycline or doxycycline (erythromycin in pregnant women)
- not notifiable

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Trichomoniasis

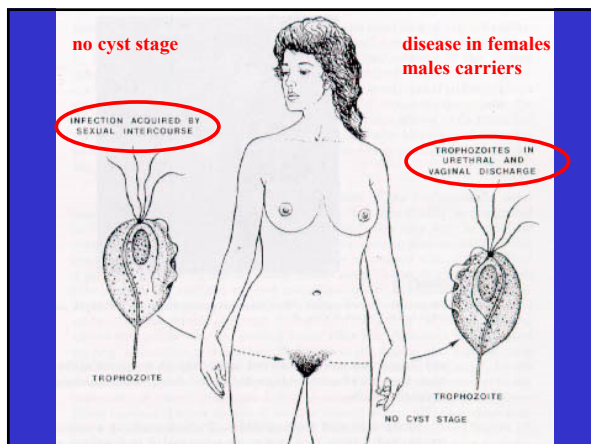
- protozoan parasite
- zooflagellate
- surface browser
- parasitic/commensal in wide range of vertebrates (mammals, birds, reptiles, amphibia, fish)



Three species in humans

- Trichomonas vaginalis* vagina/urethra
- Trichomonas intestinalis* intestines
- Trichomonas buccalis* mouth


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Disease in humans

- infections in males
 - in urethra (sometimes prostate)
 - often asymptomatic
- infections in females
 - in vagina (likes acidic environment)
 - causes vaginitis (mucopurulent discharge)
 - endometritis (inflammation)
 - linked to cervical cancer?
- treatment with metronidazole, tinidazole



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Disease in cattle

- asymptomatic carrier bulls
 - screen AI donors
 - contaminated cryopreserved sperm
- cause of abortion in pregnant cows
 - irritates endometrium
 - intra-uterine death
 - abortion/resorption/mummification
- subsequent infertility
 - uterus unsuitable for implantation
 - stock culled from herd

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Summary

STD's thrust into prominence by HIV-AIDS epidemic
minority groups already contravened sexual taboos
people more willing to talk about STD's and safe sex

but classical STD's still prevalent and becoming worse

- syphilis, gonorrhoea, NGU/NSU, trichomoniasis

emerging drug resistance, diagnostic problems, denial!

animal STD's favoured by intensive animal husbandry
including artificial insemination, cryopreservation

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