

Drugs – Exam 2

Lesson 1

Feb 7th

Ben Johnson – changed the attitude for enhancement drugs

- fastest man on the planet
- 3 days after he was all over the news for using enhancement drugs
- Suspended 1 year from competition
- Tested positive again for roids, therefore banned for life (stanozolol)
- Recent phenomenon that we are concerned with drugs in sports. Began with Ben Johnson in 1988. Suspended from competition in 1988, second offense in 1993 he was banned for life.
- Drug he used was invented by John Manson.

John Manson

- scientist that invented stanozolol
- Canadian drug
- Canadian scientist.

Mark McGwire

- hit 70 home runs in 1 season
- used creatine and drosinome (was a OTC drug that was legal back then)

Barry Bonds

- hits 762 home runs
- a year later, his contract expired
- never proven that he used roids
- His ties with specific companies caused suspicion, but never proven.

Marion Jones

- surrenders gold medals for using roids
- 3 gold medals and 2 bronze
- Went to jail for lying about the roids
- Her husband was tied with same company as Bonds.

Olympics in ancient Greece

- athletes used roids so that the show was better
- athletes were encouraged to take drugs (herbs, potions)
- Socially acceptable to take PED, wanted best show possible.
- Athletes kept quiet about ways, no giving away any edges.

Zulu warriors

- consumed a beverage called DOP
- Dop is a beverage that makes them stronger, aggressive and more courageous (alcohol + mild hallucinogenic)
- Afrikaans: doop
- English: Dope (origination of the name)

Doping race horses

- people doped horses to make them slower so they can bet on the other horse
- therefore, fix races so...
- racetracks started doing dop test on horses, looking for cocaine and alcohol.

Cycling was notorious for doping (any endurance events)

- good thing!! People wanted to see the best race possible
- enhance endurance
 - o caffeine

- cocaine
- alcohol
- nitro glycerine
- **strychnine** → only one that actually helps (poison)

Olympic marathon – 1904 in St Louis

- temperature above 40
- 100% humidity
- Dirt roads
- Not every athlete had shoes
- Idea that if you drank too much water, you would get cramps
- Thomas Hicks
 - Collapse so his trainer got him up to get him running again
 - Gave him **brandy, egg whites, strychnine (rat poison)** → helped him to start running
 - Won the race but collapse, took an hour to revive
 - trainer believed the drugs saved him.

Adrenaline

- **used as drug in 1901**
- used for short periods of time (boxing)
- required **injection**

Gordon Alles - 1929

- **discoverers amphetamine**
- longer lasting adrenaline
- used on himself
 - decongested his nose
 - used for **cold symptoms**
- side effects: **kept you awake**
- germans used this side effect to their advantage

Methamphetamine in war

- Blitzkrieg – **Pervitin** - as endurance drug
- germans used it so that they could always be on the move
- use discovered by allies, when they kidnapped pilots, they found tablets of pervitin.

R.H. Winfield

- experiments with Stirling aircrews
- compared amphetamine and methamphetamine to caffeine.
- amphetamine was used by Americans but they wanted to use it as methamphetamine
- has some pilots take amph, methamph and caffeine
- caffeine was used for soldiers but they had bad side effects: hands shaken
- **amphetamine and methamphetamine made soldiers fearless**
- **Amphetamine marketed as cold medication, was given as hyperstimulant to soldiers.**

Amphetamines in the Tarawa invasion

- made soldiers more aggressive and fearless
- was still marketed as cold medication in the US

Soldiers as athletes

- similar drills (running etc)

First sports amphetamine

- in **1952 Olympics**
- used in sports with long distance
- **beneficial for long distance sports**

- athletes didn't want to talk about it because they didn't want people to figure out what they were using

Jensen

- Rome Olympics
- Collapsed so his 2 teammates were holding him up
- He passed out, crashed his bike, cracked his skull and died
- Passed out because of heatstroke, pushed beyond body's capacity
- Amphetamines caused him to be able to continue pushing, even his body couldn't take it anymore (horse phenomenon)

Tom Simpson (July 13th 1967, 45 degrees outside)

- Tour de France
- Thought it was bad to drink water, so limited the water you were allowed to take
- Collapse and died on the spot
- Cause of death was heat stroke
- Had amphetamines tablets in his pocket so he pushed his body beyond his limits

Nervous system has several sub systems

- voluntary nerves (want to move your arm)
- involuntary nerves (digestive system, respiratory)
- look online for image
- amphetamine increases your fight or flight
 - o amphetamine looks like the sympathetic system chemical (fight or flight) therefore increasing your endurance
 - o amphetamine continuously stimulates your body therefore, unable to stop (because your body doesn't know it)
 - o amphetamines takes away your ability to know when to stop
- Brain. ->spinal cord -> voluntary nerves -> muscles
- Brain-> spinal cord -> involuntary nerves -> Organs (sympathetic, fight or flight: increase heart rate, go faster, ect) Uses noradrenaline
- Brain-> spinal cord -> involuntary nerves -> Organs (parasympathetic, maintenance: digestion, kidney function. Ect)
- Amphetamine stimulates the Sympathetic system (fight or flight) therefore increase endurance
- regular activity, we get tired/soar, which is a safety device, avoid overloading.
 - o Amphetamine makes you "unable to stop" even when body can't take it anymore. It removes this safety mechanism to avoid overexhaustion.

Olympics restrict drug use in 1967

- first testing in Grenoble in 1968
 - o Sympathomimetic amines
 - amphetamines
 - o Central nervous system stimulants
 - strychnine
 - o Narcotics
 - Heroin
 - cocaine
 - o Antidepressants
 - o Tranquilizers
 - Calms you down (archery)

Drugs were not banned because of unfair advantages (unfair advantages equal to better coaching, facilities, ect)

- **banned because they're harmful for your health**

Hans-Gunnar Liljenwall wins and loses bronze

- tested positive for alcohol
- did nothing wrong but because of press, they took away his bronze (looked bad)

Fritz Pregl and Oskar Zoth

- injected themselves with bull testicle extract
- measured muscles strength using middle fingers – didn't work

Charles Brown-Sequard

- injected himself with macerated dog testicles (as Viagra) – didn't work
- internal secretions as physiological regulators
- treating an organ with itself
 - o heart for courage
 - o brain for idiocy

Victor Lespinasse

- transplanted testicles from one donor to an other

First isolation of male sex hormone

- 40kg of bull testicles gives 20mg of male sex hormone
- Therefore, hard and difficult to get
- injected into Capon (Neutered rooster), after injection it became more aggressive

Semi Synthesis of testosterone – 1935

- from cow gall bladder – you get cholesterol
- convert cholesterol into testosterone
- testosterone for inmate rehabilitation

First athletes using testosterone

- race horses
- very expensive so billionaires would buy some for their horses

Soviets used steroids

- discover fundamentals of steroid use
 - o training methods
 - o side effects

John Ziegler – US

- york barbell club
- had dinner with soviet trainer and found out about steroids in training
- **effects of extra testosterone**
 - o Anabolic
 - Muscles mass
 - Strength
 - Bone growth
 - o androgenic effects
 - body hair
 - acne
 - sex drive
 - testicle shrinkage
 - clitoral enlargement
- therefore, **invented Dianabol**

Dianabol – **1958** and **Stanozolol** – 1961

- anabolic steroids
- Ziegler came up with the idea while working for a pharmaceutical company
- Much better drugs for athletes because there was no side effects
- Produced for wasting conditions (rehab for broken bones, cancer, coma etc)
- therapeutic benefit

Dr Manfred Hoppner

- director of sports medicine, East German swim team to prove superiority of communism
- thought use of steroids would help to get better athletes
- East Germany - 11 of 13 gold medals won at 1976 Olympics
- Women were built, chest hair, large clits
- East German swimmers forced to take roids (10 years old)
- Therefore...

Olympics banned roids in 1977

East Germany established doping lab in Kreischa

- gained access to testing protocols
- developed masking techniques in doping labs

Steroid testing uses GC/MS

- finding a drug in urine or blood
- downside: urine contains thousands of chemicals
- GC (gas chromatograph) sorts molecules
 - o Mixture is passed through the tube
 - o Some molecules will stick, some will be slippery and go through
 - o Longer you go through the tube, more they will separate
 - o GC sorts molecules using speed (time)
 - o Peaks (time) correspond to a certain molecule and the amount (big peak)
 - o Ex: M&M's
- MS (mass spectrometer)
 - o Throws molecule (small wrong will go a long distance and a big rock will go a short distance)
 - o Rocks drop because of gravity, molecules drop because of a magnetic field
 - o Molecule is identified like a figure print (different form for every molecule) → used to identify compounds

Lesson 2

Feb 9th

Steroid testing – T to E ratio

- normally a ratio of testosterone and epitestosterone (in your body) is 1:1
- ratio can be high as 4:1 → flagged for steroid use
- mask presence of extra T by injecting E = ratio of 4:4
- Floyd Landis claimed 11:1 was normal

Diuretics

- makes you pee
- makes you drink a lot of water
- excess steroids from your pee will come out therefore your masking your roid use
- presence of Diuretics shows that athlete is trying to hide roid use

Add materials to urine

- add alcohol or soap to pee

Original synthesis of steroids

- converted cholesterol from cows
- very expensive

Modern semi synthesis of steroids

- Diosgenin → Progesterone → Testosterone
- Diosgenin from Mexican yams
- GC/MS identifies if roids were made from animal of plant

Carbon has 2 isotopes

- 99% of carbon atoms have mass of 12C
- 1% of carbon atoms have mass of 13C
- Plants and animals have different amounts of 13C
- With the GC/MS, they found that Floyd Landis's roids were from a plant

T helps you build muscle

- when you exercise, you create a microscopic damage to your muscle
- therefore your muscle needs to rest and recover
- roids help you recover from this damage quicker
- therefore you can exercise more frequently and effectively

Health risk of steroids

- liver damage
- heart damage
- reproductive damage
- safe drug if taken in a safe way
- used for speed recovery (broken leg)
- long term health risk are unknown and difficult to measure
 - o athletes vary doses
 - o athletes mix steroids
 - o athletes take large doses
 - o athletes are very secretive about the use

BALCO made designer steroids

- designed to avoid detection
- no testing done
- the 'clear' – Tetrahydrogestrinone
- undetectable before 2002
- fingerprint was unknown

Temptation to abuse

- Dianabol → tested roid
- Anadarine → anabolic but not a steroid (next generation of anabolic drugs) → didn't make it through FDA but can be purchased on the net

Desire to win makes drugs dangerous

- used properly, they are safe
 - o medical supervision
 - o limited dosing
- but.. players abuse it!

Red blood cells

- body makes 3 million RBC every second
- RBC controlled by erythropoietin (EPO)
- Benefit from increased O2 capacity

- Training at high altitudes increases RBC production

Blood doping – instant altitude training

- take blood from your body, concentrate RBC's and then restore it (wait 3 months)
- athlete now has improved O2 capacity

Ed Burke proposes blood doping to USCF in 1984 Olympics

- didn't want to at first
- Danny Haute used blood doping and made the Olympic team
- USCF changed their idea because they saw that it worked
- But, there wasn't enough time to do it because it was only a few weeks before Olympics so, they used blood from other people → safety issue
- Therefore, USCF banned blood doping in 1985
- IOC outlawed blood doping in 1986

Anemia is a serious condition

- treat with iron supplements of transfusions
- EPO could be a perfect anemia drug
- When you have lots of EPO, you have a lot of RBC
- EPO is a protein (many AA)

Amino acids work like building blocks

- chemical synthesis of protein is impractical because you can only make small quantities
- some proteins are available from animals
 - o supply is limited
 - o extraction is difficult
 - o small risk of contamination
 - o not human proteins
 - doesn't work as well
 - immune reactions

Human cadavers make a poor drug source

- possibility of infection
- very expensive to produce
- difficult to extract
- limited supply

Recombinant protein – engineered source

- make human protein in a bacteria or yeast
- human protein is a good drug
- insert the human gene into a bacteria
- bacteria will use gene to make human protein
- protein is encapsulated
 - o bacteria place extra protein in pockets
 - o easy to isolate and purify
- protein is easy to make in large amounts

DNA is an information storage device

- cells use DNA as a template to make protein
- DNA is a list of amino acids
- Remove human gene from chromosome
- Insert the gene into a plasmid (DNA in a circle)
- Insert the plasmid into a bacteria → bacteria will now make the protein

Genetic engineering to make human protein

- copy the gene describing a human protein

- bacteria and yeast are easy to grow
- recombinant protein is easier to purify

Recombinant human proteins are better drugs than animal proteins

- Protein is human
- Source is safe
- Source is cheap
 - o Bacteria or yeast easy to grow

Recombinant EPO is one of the best drugs in the last 30 years

- any disease requiring blood transfusion
- may use EPO instead
- EPO abused from day 1
- 18 pro cyclists die from heart attacks

Clinical trials

- can only be done using humans
- use by athletes before proper dosing was known in result of overdosing
- overdose of EPO thickens blood causing heart attacks
- IOC banned EPO before it was on the market
- Testing EPO was impossible → Hematocrit (testing RBC)

EPO and rhEPO have AA sequences

- no test can tell the difference
- 2 tests
 - o On test = if injected 1 week before, can be tested positive
 - o Off test = if injected 3 weeks before, can be test positive

Lecon 3

Feb 14th

ANTIBIOTICS

Changed the world

- 1900 – lived 44 years
 - o Main causes of death
 - Pneumonia
 - Tuberculosis
 - Influenza
- 2004 – live until 82 years
 - o Main causes of death
 - Heart disease
 - Cancer
 - Stroke
 - Accidents

Plague – 50% of population died

- was very common
- treatment unknown
- doctors run away from infected area

Post natal infections – 30% death rate

- during child birth
- changed with penicillin
- with penicillin, number of deaths during child birth is near 0

Surgery – 3% death rate

WW1 and WW2

- soldiers died from
 - o STD
 - o Malaria
 - o Influenza
 - o Cholera

John Snow

- disapproved miasma theory in 1854 (idea of disease was caused by bad smells)
- scientific investigation of cholera in London
- made a map of those infected
- cluster of people with the disease from a water pump
- therefore, bacteria in the water
- was able to convince the city gods to deactivate the pump

Agostino Bassi showed microbes cause disease

- established a link with microbes you could only see with a microscope and disease
- Atharva-Veda identifies living animals causing disease

Louis Pasteur 1864

- develops pasteurization
- found that if you heat milk at a low temperature, you will keep its flavour and destroy bacteria

Lister develops antiseptis

- Listerine

Gram 1884

- stains bacteria with colour
- selective chemical identified certain bacteria

Erlich

- Trypan red
 - o selectively colors typanosome
 - o identifies bacteria and leaves the red blood cells alone
- Salvarsan 606 (poison)
 - o Safe form of arsenic
 - o First successful antibiotic
 - o successful for treatment of syphilis – the great pox
 - o 600 mL was injected in your blood stream
 - o if injected in muscles, would kill the tissue

Gerhard Domagk 1932

- red dye called Prontosil
 - o gave some to his daughter who recovered and survived
 - o then marketed
 - o only works in vivo because it was metabolised into sulphanilamide
 - o therefore, they started selling sulphanilamide
 - no color
 - cheaper to make
 - first ever REAL successful antibiotic

Sulfa drugs

- sulfa drugs saved many lives in WW2 – similar drug to sulphanilamide
- Sulfa drugs inhibit bacterial growth with dihydropteroate synthase (enzyme)
 - o Drug get jammed in the enzyme

Alexander Fleming - 1928

- the real successor of antibiotics
- contaminates culture
- mold prevented bacterial growth
- published his results – paper that changed the world
- used penicillin to purify bacteria in a lab
- gave some to mice which didn't become sick but didn't do the key experiment (give some to infected mice to see if his extract would cure them)

Florey and Chain – 1941

- isolate penicillin
- home built machines to isolate penicillin
- produced in milk
- tested with mice and placebo.. it worked
- did first test on human who was infected by shaving
- Britain not the best place for research → no funding
- Were scared of being jacked by the Nazis
- So they transported it to the Americans

Penicillin in US

- production moves to corn steep liquor (waste product of corn starch)
- British were not making the penicillin on a large enough scale
- Peoria, USA became the capital of penicillin
- Penicillin production became war priority → WW2
- Stockpiled for military then available to the public

Penicillin

- very safe – you can chug a bottle and nothing will happen
- bacteria cells are different than human cells
- difference is.. surrounding the bacterial membrane is a cell wall
 - o rigid outer layer
 - o imparts structure
 - o resists internal pressure
- if bacteria doesn't have this cell wall, the bacteria explodes
- Lactam ring
 - o secret to activity
 - o in all antibiotics
- Natural penicillin not drug-like – Penicillin G
 - o Is unstable
 - o Must be injected
 - o Only works against some bacteria
- Artificial penicillin drugs are drug-like – Amoxycillin
 - o can be stored for long times
 - o can be taken orally
 - o works against most bacteria
- Major side effect
 - o Allergy – less than 1%
 - Random chemical reaction with a protein in your body
 - Therefore, body thinks this protein is dangerous
 - Develops only 2nd or 3rd time of penicillin intake

Cephalosporin

- mold found in Italian sewer

- similar to penicillin
- has less chemical activity than penicillin

Streptomycin

- inhibits protein synthesis
- very different from penicillin

Tetracycline

- semi synthetic
- may make you photosensitive (sensitive to sunlight)
- interferes with calcium metabolism (bad for teeth)

Antibiotic resistance is a growing problem

- over prescription
- prophylactic use may promote resistance → good for cows to create more meat)
- overused to avoid STD
- biggest problem: patient compliance → not following directives
 - o if docs say to take it for 10 days, do so.. even tho you feel better after 3 days
 - o drug is effective above a certain line → dosage is the key

Most dangerous forms of bacteria

- found in hospitals
- strong enough to survive antibiotics
- nosocomial infection
 - o Necrotizing fasciitis
 - Eats your flesh
 - o Staphylococcus aureus
 - Open you up, scoop away the mucus/bacteria
 - If it doesn't work.. cut cut cut
 - o Clostridium
 - In quebec hospitals
 - o Methicillin
 - Resistant to Staphylococcus aureus

Antibiotics are commodity chemicals

- no one is making them anymore
- developing new antibiotics is way to expensive therefore no pharmaceutical company doesn't want to work on it
- doctors are reluctant to use new antibiotics, therefore no one wants to make them

Lecon 4

February 16th

TOBACCO

Kills

- most dangerous substance in the world
- kills more than
 - o DDT
 - o Industrial chemicals
 - o Pesticides
 - o Cocaine
 - o Alcohol
 - o Homicide
 - o Suicide
 - o Etc

- 1/3 of cancer deaths is caused by tobacco
- 1/3 of heart disease is caused by tobacco
- Kills 420 000 people in North America per year → 6 billion per year

Discovery

- discovered by Columbus in 1492
- first taken by natives
- natives 'drank' smoke from Tobago
- first shipment of tobacco from Tobago

Jean Nicot

- introduced tobacco to France
- healing herb → l'herbe nicotaine
- treated asthma

Revive drowning victims

- forced smoke into drowned victim
- all BS

Smoking clubs

- use to be an expensive exercise
- very unpleasant/harsh
- hurt the throat because of the acids
- was done very rarely
- used long stem pipes to let the tobacco smoke cool down

Snuff

- powder inhibited as cocaine
- inhibited nicotine
- popular with aristocracy

Cigarettes were expensive

- were all hand rolled
- took a lot of time and cost a lot of money
- therefore, smoking was not popular

Bonsack machine

- machine designed to roll a cigarette
- changes the nature of cigarette smoking
- reduced production cost

Flue-curing

- had to create bigger bulks of tobacco so they heated up the tobacco artificially
- reduced harshness of smoke by heating up the leaves quickly

Bonesack machine and the flue-curing increased exposure to toxic substances

- could afford to smoke a lot
- smoke brought deep into lungs
- Cigarettes now addictive
- Risk = toxicity X exposure
- Smoking is now very dangerous
 - o Average smoker consumes 10 000 cigarettes per year
 - o Inhales deeply
 - o Hold smoke in lungs
 - o Added chemicals → plutonium

Nicotine

- addictive substance
- 2mg per cigarette required to addict smoker
- 1 piece of gum has 2 mg
- Acts on acetylcholine receptors → neurotransmitter
- Messenger-receptor interaction
 - o Changes the shape of the receptor
 - o Produces a biological response
- is an agonist at low doses
- is an antagonist at high doses
 - o blocks chemical messages
 - o contributes to the addictive nature
- smoker regulates the dose
 - o if you don't inhale (agonist) → stimulates the smoker
 - o if you inhale (antagonist) → represses signals to the brain therefore helps you relax
 - o regulates their mood → feeling peppy or relaxed
- stimulates dopamine release (reward system)
 - o very powerful way of getting someone addictive
- smoking cues adds to the addiction
 - o out on a porch, take a smoke because it's a habit
- uses as a pesticide
 - o lethal dose is 60 mg (cigars contain 120mg)
 - o if children eat cigarettes, they could die
 - o dose makes the poison
- nicotine to kill elephants (with darts)
- stimulates the heart muscle
 - o heart attack
 - o increases heart rate

Toxic substances in tobacco smoke

- Carbon monoxide is the most dangerous substance
- CO reduces O₂ carrying capacity in blood
 - o CO sticks to haemoglobin (holds iron together) therefore the O₂ can't attach itself
- This leads to heart attack → #1 killer from tobacco
- Toxic substances alter and damage your DNA

Alton Ochsner

- linked cancer to smoking – 1919
- 1919 – 400 cases in North America of lung cancer → chimney sweeps
- 2004 – 190 000 cases in North America of lung cancer → smokers

Reconstituted tobacco

- Recon
 - o Paper made from tobacco
 - o Cut into small strips
- Can use the whole tobacco plant
 - o Cheaper
- can blend tobacco
 - o cut costs by mixing small amount of high quality tobacco with cheap quality tobacco
- easy to introduce additives
 - o flavour, burn rate
- control nicotine content
 - o deliver the 2 mg of nicotine no matter what

Paper is specially designed

- many chemical additives to control burning
 - o even burning rate

- TiO₂ keeps the paper lit
- burn rings combustion
 - thin areas burn quickly when smoker draws
 - thick area burn slowly between puffs

The filter

- is a decoration
- makes people believe you don't inhale the nasty stuff

Eclipse

- less dangerous cigarette
- produces less combustion products

Accord

- less dangerous cigarette
- battery powered heater

→ never marketed

- proves that smoking isn't good if you invent another cigarette
- why invest billions of dollars in this new cigarette when your already making billions

February 28th

Missed class

March 1st

VACCINES

Anti Vaccine propaganda

- vaccines are very safe
 - experiments prove it
- people thought it caused autism
 - autism symptoms appear at age 2 → vaccinations are given at age 2
 - wakefield study (paper) – link with autism and vaccinations but it was a bad study (only 12 children) – study was a fraud
 - loss of confidence led to lower vaccination rates

Thiomersal preservative is safe

- contains mercury
- used for decades in all kinds of vaccine
- vaccine has less mercury than one piece of fish

H1N1 panic

- people weren't sure if they should get flu shot
- lots of panic because of the wakefield study
- vaccine said dangerous because of mercury
- adjuvant worries (some had adjuvant, some didn't)
 - adjuvants reduce the need for booster shots (extra shots a few months later)
 - produces a strong immune reaction
 - alum used in most early vaccines as adjuvant
 - lipids also used in adjuvants

Gulf war syndrome

- soldiers blamed this on squalene
- there wasn't any squalene
- your body makes squalene
 - o normal human metabolite
 - o used to make steroids
 - o can buy as nutritional supplement
- squalene is safe

Vaccines cause side effects

- adverse effects
 - o swelling, redness, soreness
 - o fever (short time)
- allergic reactions
 - o rare
- disease (extremely rare)
 - o only with live or attenuated organisms
 - o 69 cases of polio between 1978 and 1983 (US)
 - 51 associated with vaccine
 - BUT, benefits outweighs risk
- board of impacts online

Cervical cancer kills 250 000 woman each year (world)

- viral disease
- Rigoni-Stern 1842
 - o Cervical cancer only in married woman
 - o Rare in nuns and single woman
- cervical cancer only in sexually active woman
 - o caused by warts
 - o some are sexually transmitted
 - o human papillomaviruses

Human Papillomaviruses (HPV)

- more than 200 types
 - o each specific to certain tissues
- only a few types cause cancer
- found in cervical cancer

Guardasil made from virus protein

- manufactured in recombinant yeast
- effective against types 6, 11, 16, 18 of HPV
- very safe
 - o does not use a complete virus

Vaccine only works if previously uninfected

- best to administer before sexually active
 - o ages 9 to 13
- can be administered up to age 26
 - o consult doctor
- available for both sexes

Politics now a major barrier

- they say that if they get guardasil, they'll be more tempted to become sexually active
- BS because they are too young to think about that (9 to 13)
- Evolution of vaccines.. board online

HIV

New disease in 1981

- homosexual men had very weird diseases (rare skin cancer – viral disease) - HIV
- HIV discovered in 1984
- Virus spread rapidly
- Iv drug use
- Unsafe sexual practice
 - o Anal sex
 - Responsible for early appearance in homo
 - Primary route of sexual transmission in North America
 - o Bareback sex
 - Virus transmission is easily blocked with condoms
 - o dry sex
 - primary route of transmission in Africa
- Politics and bullshit
 - o Homophobia during the early years
 - Leaders refused to acknowledge that AIDS existed in their country
 - Homosexuality is normal, if you refuse to believe this, you deny reality
- hetero sexual disease only 1 year after – 1985

Religious fundamentalism in the US

- blocked education programs
- resisted condom distribution in Africa
 - o if you sold condoms, you didn't get any money
- promoted unrealistic solutions

AIDS now the worlds most deadly disease

- Malaria was #1 until late 1990s
- 4th leading cause of death word-wide

Treatment is unpleasant

- 16 or more pills
- Complex regimens
- Side effects are harsh
 - o Rash (fatal 7%), nausea, nightmares, diarrhea, headache, anemia, hepatitis, lipodistrophy (takes fat from your face)
- high cost – 10 000\$/year
- only one person has been cured so far
 - o used radiation to kill all his blood cells
 - o transplanted blood from resistant donor

Is an HIV vaccine possible?

- testing early vaccines was difficult because everyone was afraid to get near it
- couldn't get insurance to test it
- only people who wanted to help were catholic priest

Aids virus targets helper T cells

- lives in helper T cell
- virus looks for that cell
- cell looks for the virus
- phases
 - o Acute – T cells increase
 - Flu like symptoms
 - High viral load

- Chronic – T cells decrease but you still have some unlike an other virus in witch you would have none left – because HIV live in T cells
 - Can last up to 20 years
 - Zero symptoms but very infectious
 - Immune system destroys 99.9999% of viral particles
 - A few virus particles escape and continue the infection
 - Phase ends when immune system runs out of CD4 cells
- AIDS – T cells increase again
 - Last 2 to 4 years
 - Viral replication is very high
 - Immune system is destroyed

Attempts to make a vaccine

- replicates rapidly in large numbers
 - 10 billion new viral particles very day
- immune system is highly efficient in removing virus
 - small leakage prevents body to eliminate it completely