ANABOLIC-ANDROGENIC STEROIDS (p.1)

Are **Schedule II** drugs, along with narcotics
AAS are related to testosterone
can build muscle tissue, have masculinizing effects
are anabolic (stores energy) (vs. catabolic, uses energy)

AAS use is <u>wide spread among athletes (although will be disqualified if caught using):</u>
unfortunately, use is increasing in non-athletes as well (chasing the "hard body" look)
55% of 27 year old males (body builders) have used AAS
10% of 24 year old females (bb) have used AAS
20% of college athletes have injected AAS – estimated
7% of high school males & 3% females have used – estimated

Why use AASs?
increases muscle mass, physical strength, endurance, athletic performance,
alters physical appearance to be more attractive (to some!)…

Where does one buy AASs?
mail order, internet, health food stores, etc.
in form of **androstenedione** (precursor to testosterone)
found in "health foods", "body shaping" products

What do AASs do in the body?
shuts down body's normal testosterone production (creates a negative feedback loop through hypothalamus/pituitary)
hypothalamus --- GRF (gonadotropin releasing factor) --- ant. pituitary ---- LH & FSH released --- testes --- testosterone & sperm --- hypothal.

as AAS levels increase --- decrease in GRF, LH, FSH, testosterone

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but as above occurs, **muscle mass**, **aggression** and **masculinizing effects*** are still increasing due to the AASs themselves (have replaced the normal testosterone/androgen hormones from body)

*deeper voice, increased sweating, increased facial/axillary/pubic hair
some facial & other bone growth (lower jaw, forehead brow ridges)

Mechanisms of Action:

e.g. of **androstenedione** (precursor to testosterone)
e.g. of **dehydroepiandrosterone** (**DHEA**) (released by adrenal cortex)

the various AASs differ mainly in how easily/not easily they are **metabolized by the liver enzymes**
e.g. if taken **PO --- extensive 1st pass hepatic metabolism**

note: testosterone has an **active metabolite (androstanolone**) which is as active as an AAS substance
see Table 14.1, Julien 9th ed. for list of 8 synthetic AASs

note: **cortisone** (from adrenal cortex) secreted in times of stress --- increases in insulin & glucose --- more energy (also suppresses IS)
where does this glucose come from?
cortisone --- breakdown of stored energy from muscle tissue proteins --- if extensive, can lead to **muscle wasting**
e.g. **Cushing's Disease**
AASs block cortisone --- no breakdown of muscle tissue ("anti-catabolic" effects of AASs)

AASs <u>Used Clinically</u> for:

hormonal replacement in males	endometriosis in females
blood anemias	COPD
severe muscle loss	malnutrition

ANABOLIC-ANDROGENIC STEROIDS (p.3)

AASs (& testosterone) – pass **easily through BBB** (**& placenta**)
enters all body cells (neurons, muscle cells, etc.)
attaches to steroid RSs w/i cytoplasm of cell
then enters cell's nucleus & attaches to DNA
new mRNA is produced --- synthesis of new proteins --- **alters cell's functions**

Effects on **<u>Athletic Performance</u>**:
AASs --- increase in muscle mass and increase in muscle strength
even **w/o** any strength/weight training
anabolic effects (building of amino acids + energy --- proteins)
also involves AAS --- increased release of growth hormone (ant.pit.)
although the greatest increases are seen **w/** strength/wt. training

AASs --- no positive effects on aerobic performance
e.g. long-term sustained effort (e.g. long-distance runners, soccer or basketball)
are most "beneficial" for **short-term bursts of activity**

in **2000 were banned** by Olympics, Natl Football League, Natl Collegiate Athletic League,…but **not** by major baseball leagues

CNS Effects:
increased **aggression** ("roid rage"), **combativeness**
may be of "benefit" in athletics…may not
increased **psychotic episodes** (esp. + **symptoms**)
increased **depression** & increased risk of **suicide**
increased "**mania**"
all of the above even more so in predisposed Ss…

What would the above sxs of AAS use be mistaken for? What other diagnoses would have to be ruled out?

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Miscellaneous Effects/Information re. AASs:

in female users of AASs, AASs have masculinizing effects
- e.g. increased muscle bulk, lowered voice range, enlarged clitoris, decreased breast size
- e.g. the above-listed CNS effects
- not all of these masculinized effects disappear when AAS is D/C'd
  - for some tissues, the change cannot be reversed

in male users of AASs, breast size often ***increases*** ("gyncomastia")
- Why?...

in male users of AASs, often experience increased infertility, lowered sex drive, & increased prostate problems (including prostate cancer)

in all users of AASs, increased **cardiovascular risks**
- increased LDLs, decreased HDLs, increased BP, increased risk of MIs & CVAs (strokes), increased atherosclerosis

in all users of AASs, increased risk of **liver problems**
- liver enzyme induction
- increased risk of liver tumors (some beneign, some malignant)
- increased risk of hepatic hemorrhage
- increased risk of hepatitis (inflammation of liver tissue)

note: AAS "side effects" may have a **delayed onset** (days, weeks) after use
- thus, the neurological/hormonal/behavioral/physiological effects may not be recognized as having been caused by AAS use…
  - esp. psychological effects (aggression, mood, etc.)
  - increased risk for **misdiagnosis**
- contributes to family turmoil, spousal abuse, divorce, arrests, etc.

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Miscellaneous (cont.)

note: concommmitant use of other drugs can have **additive/synergistic** effects – cocaine, ethanol, stimulants, heroin, tobacco

note: AAS users who are/were "body builders"/weight lifters score significantly higher on **narcicism scales** vs. other non-AAS using BB/WLs
Which came first? The narcicism or the AAS use? don't know…

"androstenedione" is considered a "**dietary supplement**" by the FDA
i.e., the FDA cannot regulate it in any way (not oversee its manufacture, not regulate access to it, not oversee its sales, not monitor its harmful effects)… is this good?
"dehydroepiandrosterone" (DHEA) is also considered a "food supplemt"

How did this happen? Why are these AASs not "drugs"?

Physical Dependence & AASs:

after high dose repeated use of AASs, if D/C get strong **W/D effects -**

- esp. depression
- fatigue
- restlessness
- insomnia
- decreased appetite
- decreased sex drive
- drug cravings
- headaches
- suicidal thoughts (rare)
- dissatisfaction with body image (body dysmorphic disorder)