



Obesity: A Big Problem?

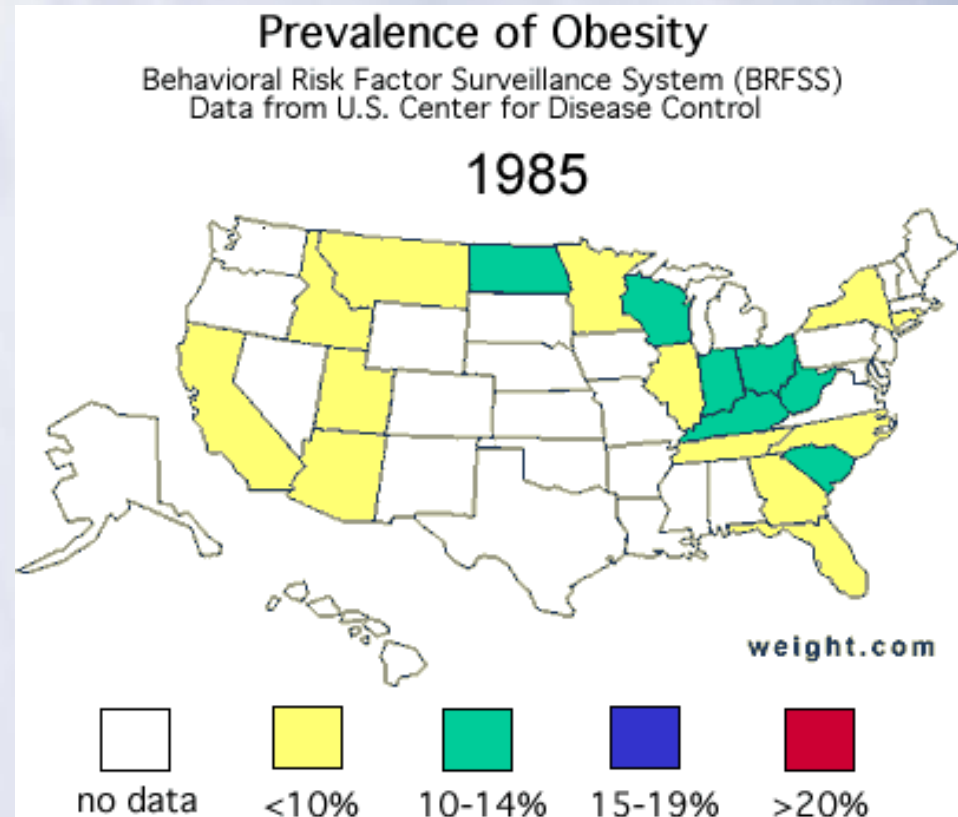


Got my chips
cashed in

Body Weight Stable until mid 1980s

- **Average body weight and the incidence of obesity was less than 15% and stable from earliest recorded history until about the 1980s.**
- **Body weight has risen precipitously since the 1980s.**
 - **BMI colors will change from white/yellow to green to blue/red**

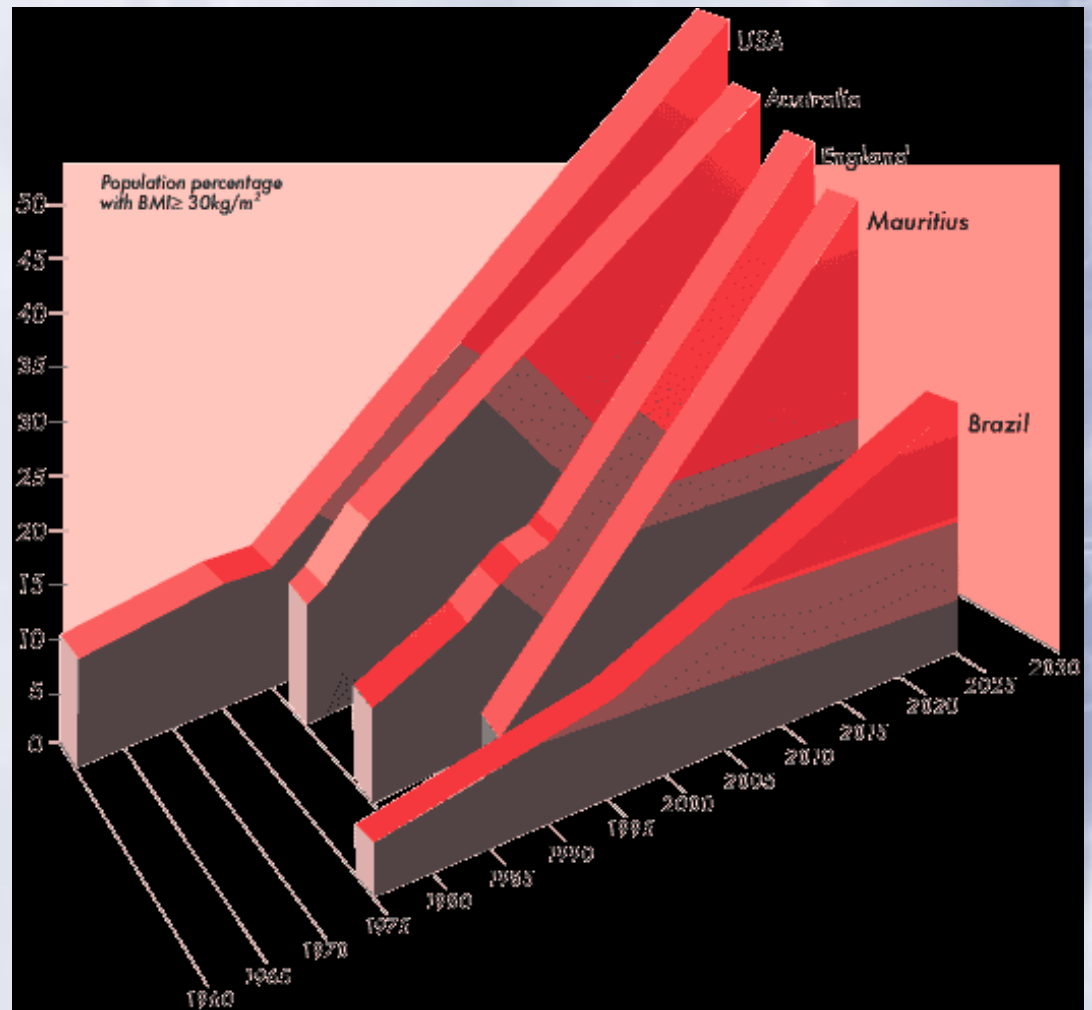
Watch the map! It's changing!

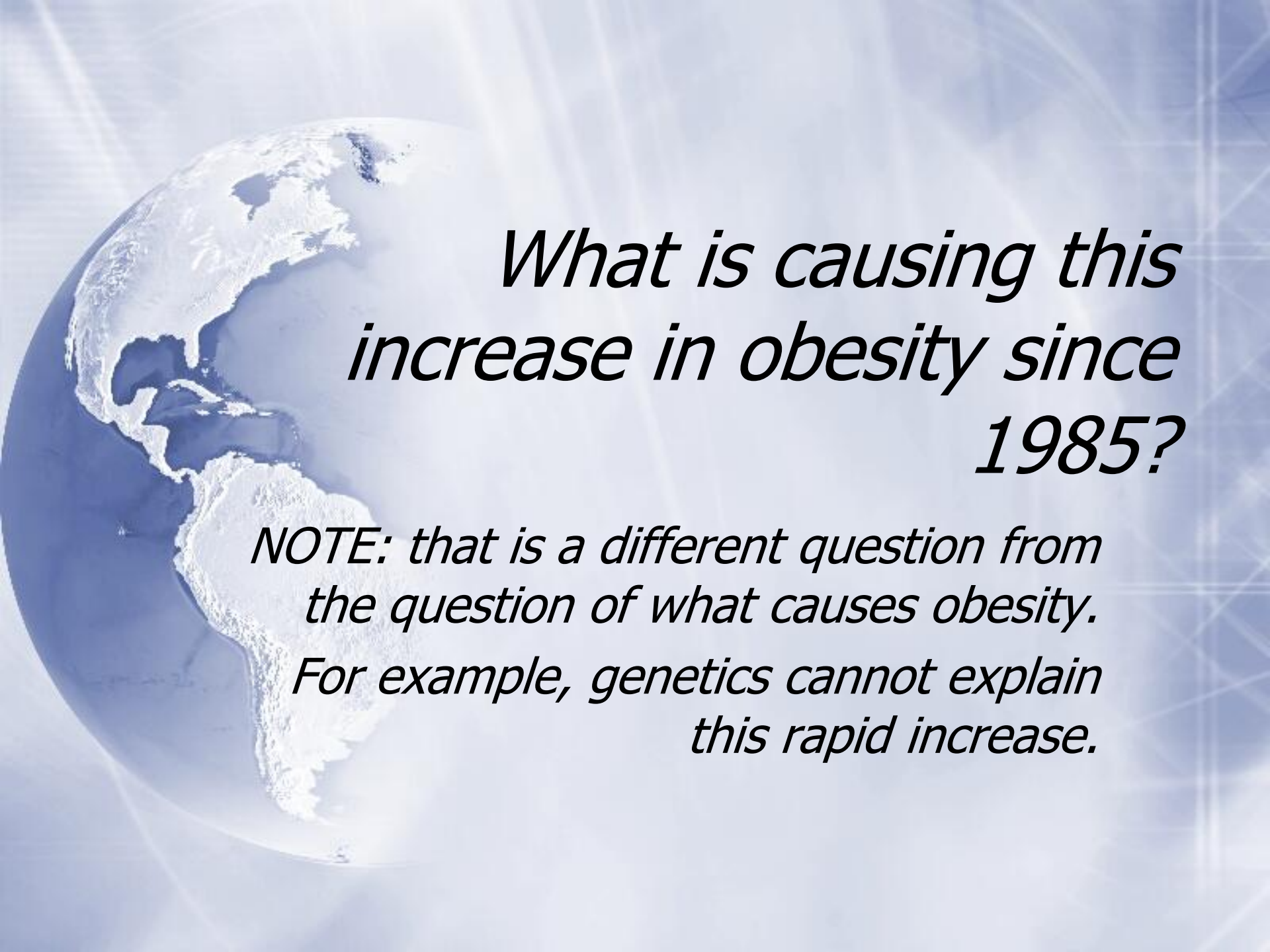


1985: <15%
obese

2000: >30%

Projected Obesity Worldwide





*What is causing this
increase in obesity since
1985?*

*NOTE: that is a different question from
the question of what causes obesity.
For example, genetics cannot explain
this rapid increase.*

Causes of Obesity

- Lack of willpower
- Marketing
- Lifestyle
 - High Stress
 - Sedentary
 - exercise might not make you thin
 - exercise might make you happier and healthier
- Genetics
- Food
 - Fat
 - Carbohydrates
 - complex, from vegetables
 - simple, processed
 - Dishonest food

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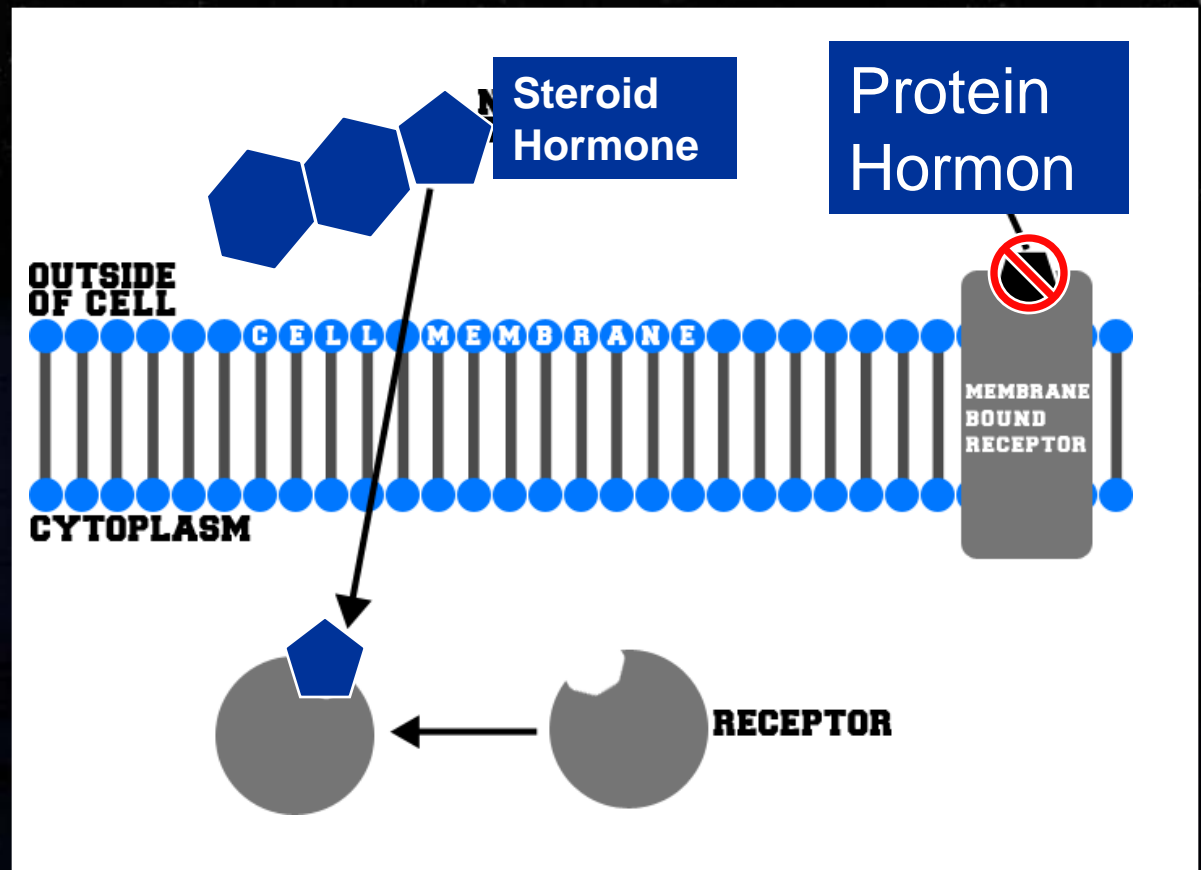
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Reminder

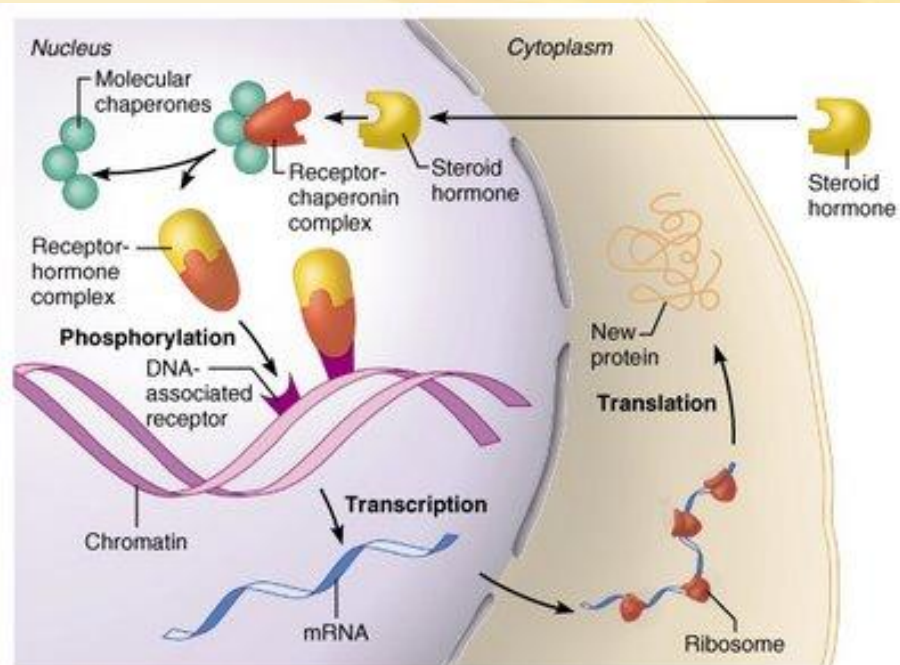
Mutations in the gene that codes for the protein leptin results in obesity and overeating

***Protein Hormones-** hydrophilic, cannot cross cell membranes
The adipocyte hormone, leptin, is an example*



Steroid Hormones (like testosterone, estradiol, progesterone)

- Lipophilic ♡
- Enter the cell
- Binds to cytoplasmic receptors
- Forms a receptor-hormone complex
- Sits on DNA associated receptor
- Promotes gene transcription



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Genetic Obesity

- **No single gene accounts for more than 1 % of obesity**
- **Several (probably over 100 major genes involved in obesity)**
- **The precipitous rise in obesity since 1985 is too rapid to be accounted for by inheritance alone**

Genotype-environment interaction

For example, people of different genotypes gain more weight on a high carbohydrate diet.

People with a different genotype respond to stress by overeating.

The Many Definitions of Obesity

- 1) **20% above desired body weight**
- 2) **> 30% above desired body fat content**
- 3) **>30 Body Mass Index (BMI: body weight/height kg/m²)**
- 4) **Current Definition**
 - **> 0.8 Waist-to-Hip Ratio (WHR) for women**
 - **> 0.95 for men**
 - **You can have a BMI over 30 and a WHR of .75 and have low probability of any co-morbidity**

Why is a high WTH a disease, but
high fat with low WTH not a
disease?

Why Do We Have **Fat**?

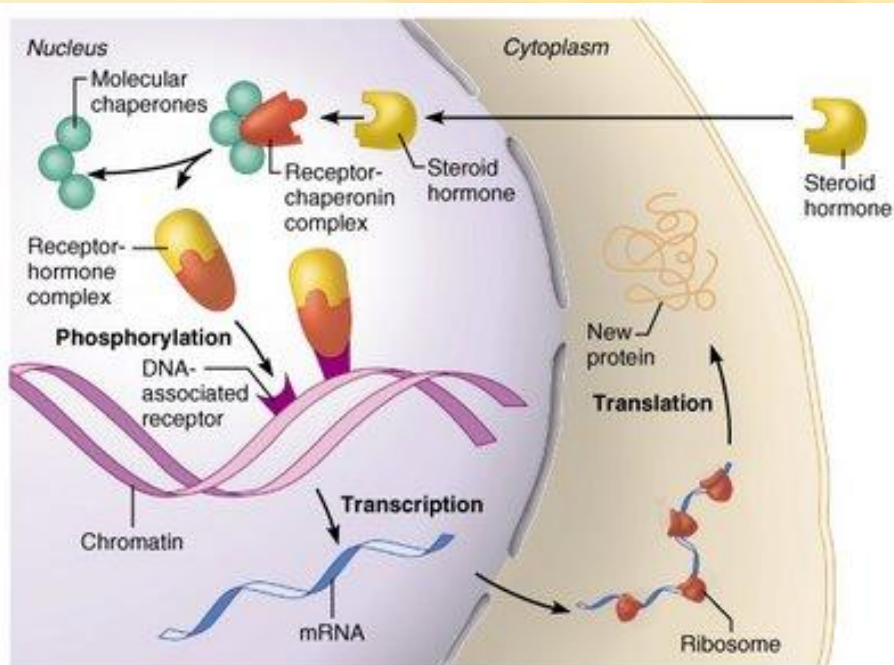
Reproductive Hormones

- **Are inhibited by low energy balance**
- **Increase energy intake and storage in anticipation of energetic demands of the offspring**
- **Make it easy to move fuels from storage in fat to be made into milk**

Steroid Hormones Make US Who We Are (like testosterone, estradiol, progesterone)

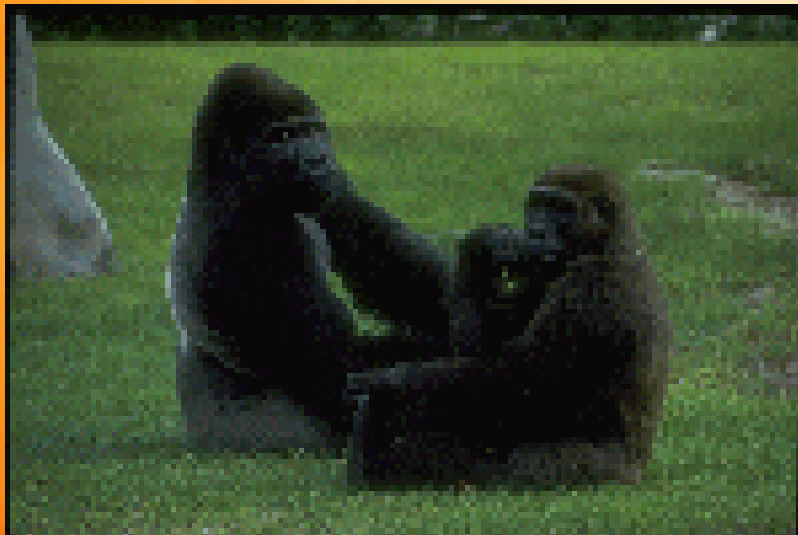


- Lipophilic (like our cell membrane)
- Enter the cell
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Steroid hormones cause differences between males and females



Humans are Sexually Dimorphic

Due to steroid action during gestation and after puberty



- Males
 - Taller, heavier
 - Broader shoulder
 - **Smaller hips, buttocks**
 - Smaller breasts
 - More facial hair
 - Deeper voice
 - Larger phallus
 - Less stamina due to lower subcutaneous fat
 - More heart disease due to tendency to gain abdominal body fat



Sexual Dimorphism in Body Fat Distribution in Humans

Abdominal vs. Subcutaneous Fat
Results in Apple vs. Pear Shape

Patterns of Body Fat Distribution

Abdominal
(Android)



Lower Body
(Gynoid)



Lipogenesis (Gaining **Fat**)

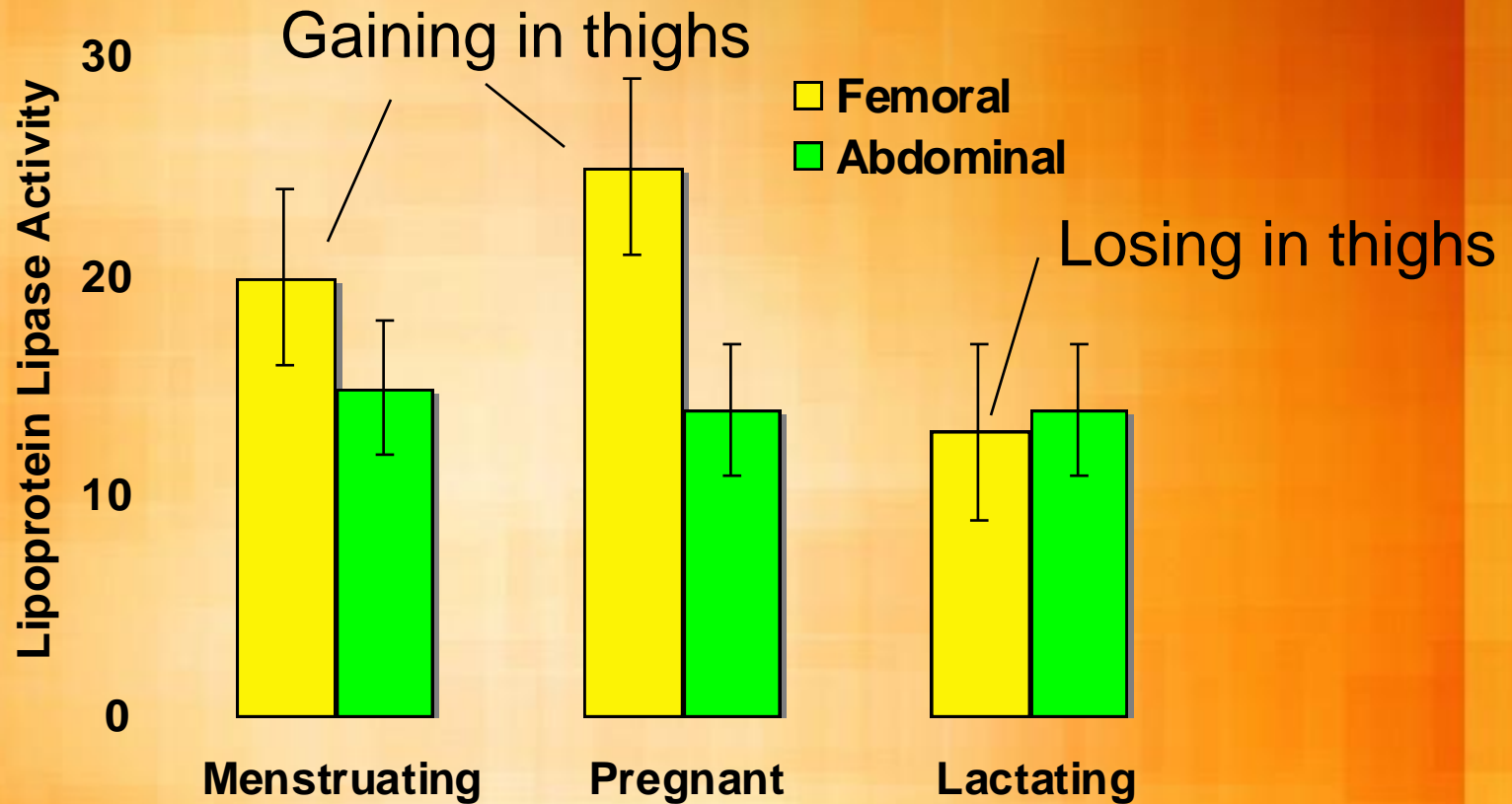
- **High LPL lipoprotein lipase**
 - An enzyme necessary making stored fat (lipids in adipose tissue)

- **Low levels of norepinephrine from sympathetic nervous system** _____

Lipolysis (Losing **fat**)

- Low LPL
- high HSL hormone sensitive lipase
 - Hormone necessary for breaking down triglycerides into FFAs and glycerol
- NE (norepinephrine) stimulates lipolysis, thus, NE stimulates glycerol release and inhibits LPL _____

High LPL = gaining
Low LPL = losing



Rebuffe'-Scrive et al., 1974

Lipoprotein Lipase Activity

- **Lactation:**
 - LPL lower than at other time
 - LPL in femoral = abdominal region
 -
- **Other times**
 - LPL in gluteofemoral > abdominal region
- **Thus, women gain fat in the buttocks and thighs prior to lactation, and lose it after lactation**

—

Gynoid Fat

(Pear-shape or Subcutaneous Fat)

- **Hips, buttocks, thighs, breast fat**
- **The hormones of pregnancy = progesterone = fat accumulation**
 - Increased insulin sensitivity
 - Decreased sensitivity to NE
- **The hormones of lactation = oxytocin, prolactin, fatty acids liberated (for making milk)**
 - Increased glucagon sensitivity
 - Increased sensitivity to NE
- **Gynoid fat is for feeding babies**



Nonabdominal **fat may be
critical for reproduction**

And it's not unhealthy!

**It might even be “protective”
against diabetes and heart disease**

Traits Associated with WTH in Women

<u>Trait</u>	<u>WTH High</u>	<u>WHT Low</u>	<u>Ref.</u>
Puberty onset	late	early	1
Testosterone	high	low	2
Triglycerides	high	low	1,3
Insulin resistance	high	low	1,4
Risk for Type II diabetes	high	mod-low	1,5
For gallbladder disease	high	mod-low	6
Risk for cancer (ovar.,breast, uterine)	high	mod-low	7,8
Hypertension, stroke heart disease, mortality	high	mod-low	3,5,9

Health Risks and Obesity

Abdominal (apple)

- ✓ Insulin resistance
- ✓ Hyperinsulinemia
- ✓ Hypercholesterolemia
- ✓ Low HDL cholesterol
- ✓ Diabetes mellitus
- ✓ Coronary artery disease
- ✓ Hypertension
- ✓ Stroke

Subcutaneous (pear)

No known health risks



Sir MixAlot

Why We Have Fat

Summary

- **Fat storage**
 - **Allows animals to survive food shortages**
 - **Thermal insulation**
 - **Cushioning**
- **Reproduction**
 - **Low fat (fuels) inhibits reproduction**
 - **The hormones of reproduction influence energy intake, storage, expenditure**
 - **Body fat distribution**
 - **Before lactation, gain fat in hips, thighs**
 - **During lactation, use fat in hips, thighs to make milk**

What explains the recent increase in obesity? A theory worthy of attention

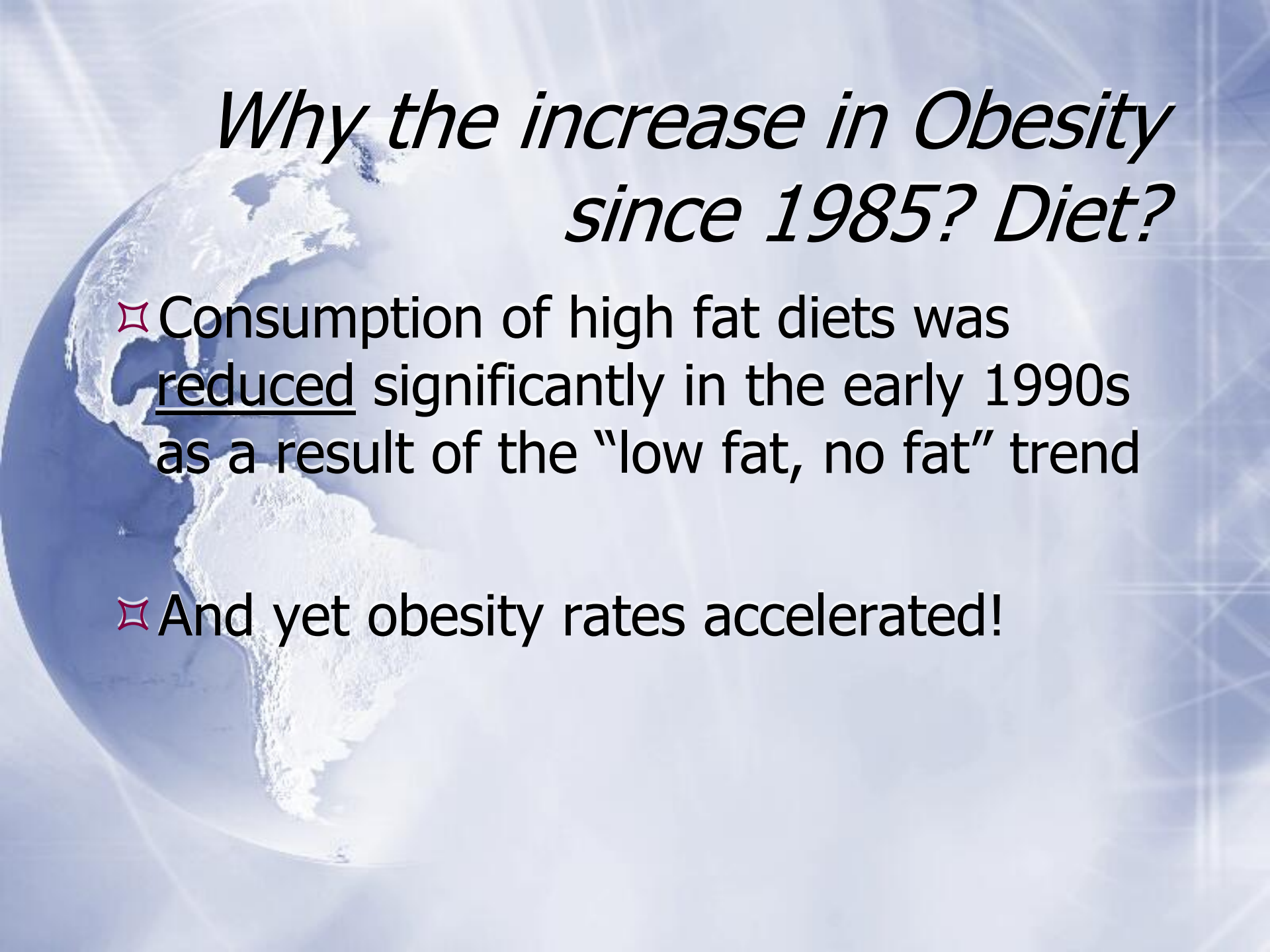
•Steroids during prenatal development promote android (unhealthy) obesity:

Promotes fat storage in the abdomen

•Where do these disruptive steroids come from?

•Increased steroids and steroid-like molecules in our environment:

- Pesticides, Herbicides, Plastics (water bottles)**
- Effluent from industry into rivers and ground water**
- Real steroids in the water supply**
- Steroid from pregnant cows that supply dairy products**

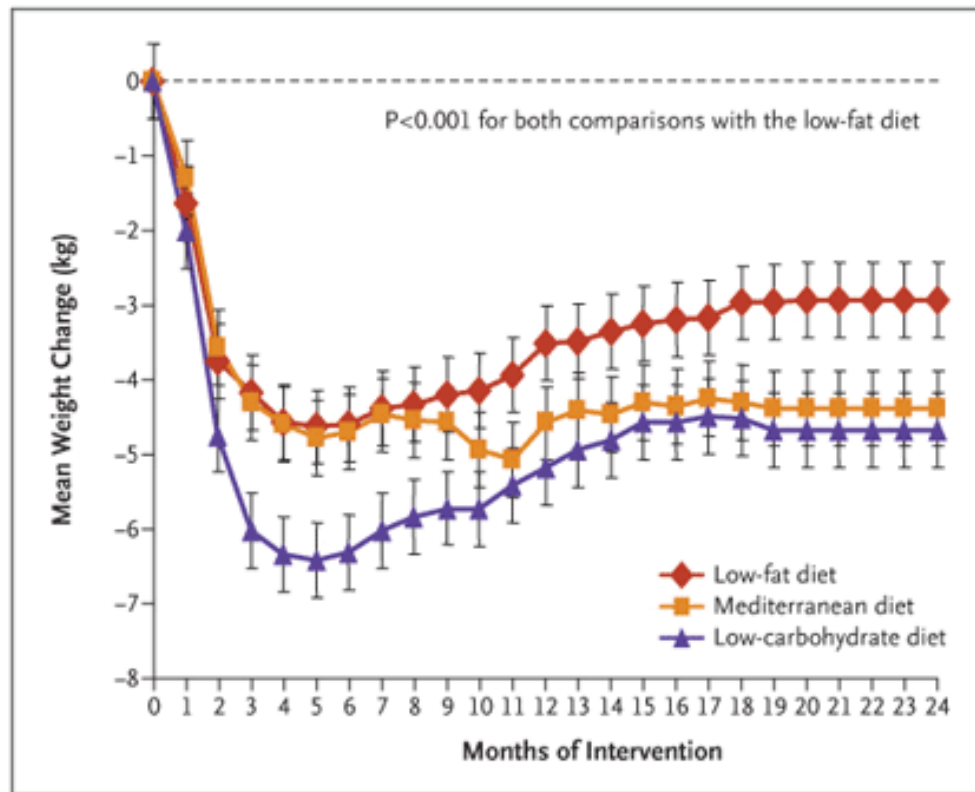


Why the increase in Obesity since 1985? Diet?

- ✧ Consumption of high fat diets was reduced significantly in the early 1990s as a result of the “low fat, no fat” trend
- ✧ And yet obesity rates accelerated!

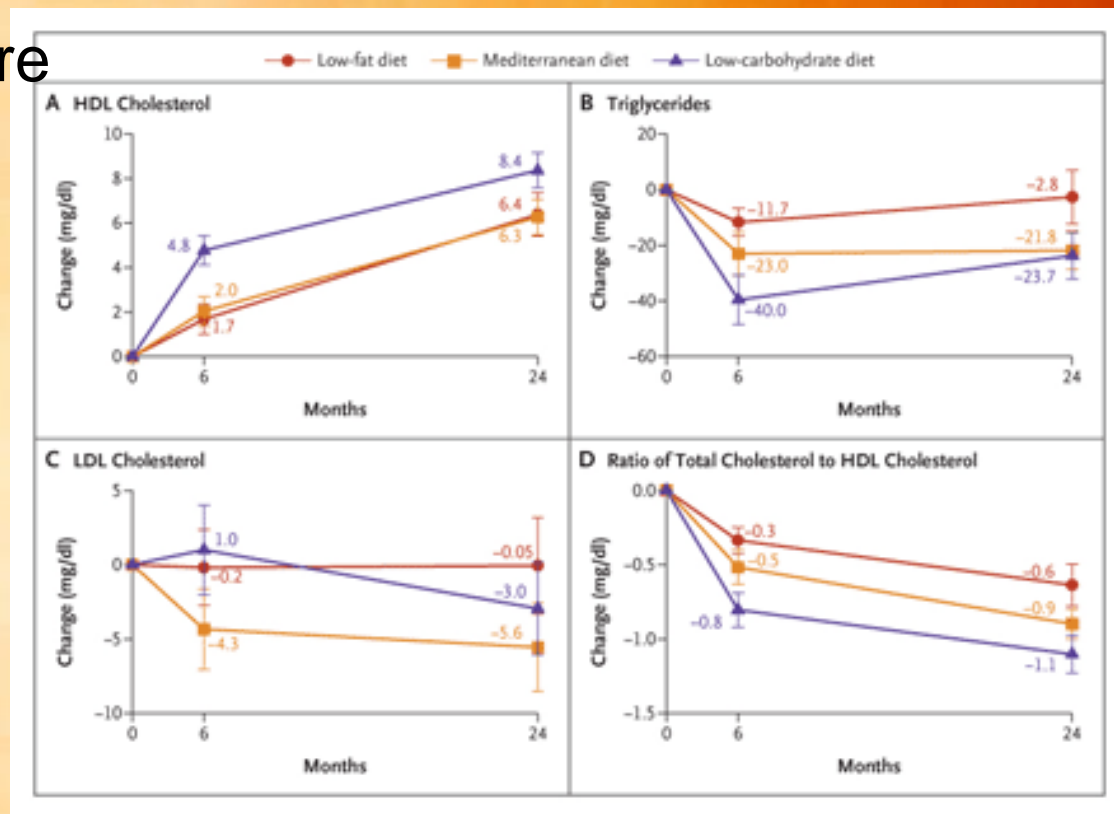
Weight Loss Greater on Low Carb Compared to Low Fat Diet (Shai et al., 2008)

People in Israel were
Fed three different
Diets for 2 years.



Low Carb Diet Results in a Healthier Cholesterol Profile (Shai et al., 2008)

People in Israel were Fed three different Diets for 2 years.



Low Carbohydrate Diets

- More effective for body weight loss
- Result in healthier cholesterol profile
 - Lower LDL and total cholesterol
 - Higher HDL cholesterol
 - Repeated in many studies

Eating Fat Does Not Make You Fat!

**So what makes us so fat?
Theories for which there is a
preponderance of evidence**

**Simple Carbs (sugar,
soda)**

Stress

How High Carb Diets Make Us Fat: A Theory Worthy of Attention

Chronically elevated insulin:

Promotes fat storage

Prevents the breakdown of fat for utilization by cells

High carbohydrate diets:

Increase insulin secretion

**During the evolution of our energy balancing
system (including the cells in charge of
glucose homeostasis**

**by insulin secretion), the diets our ancestors ate were
high in meat, fiberous vegetables, nuts, fruit (no processed
sugar or soft drinks)**

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- Lifestyle

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 - ~~Fat~~

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Energy Expenditure

QuickTime™ and a
TIFF (Uncompressed) decompressor
are needed to see this picture.

Sumo Wrestlers--Fat and Healthy

- **Excellent cardiovascular health**
- **Healthy insulin sensitivity**
- **High HDL and Low LDL cholesterol**
- **Low risk for atherosclerosis and type II diabetes**

QuickTime™ and a
TIFF (Uncompressed) decompresso
are needed to see this picture.

Exercise

- **Won't make everyone thin**
- **Will improve health if done in moderation, regardless of obesity**
- **Maintain muscle mass and bone density**
- **Might improve insulin resistance**
- **NEAT (nonexercise activity thermogenesis)**

**What else accounts for the
increase in obesity?**

Stress

Monkeys!



Stressed Primates Use Junk Food to Cope With Stress

- **Monkeys given their natural high fiber, low carb diet**
 - **Dominant monkeys eat more than subordinate monkeys**
 - **Subordinates have a decreased appetite and eat less, even though they have more than enough available to eat**
- **Monkeys with candy, potato chips, fries and cookies**
 - **Dominant monkeys nibble on these high calorie snacks during the day but do not gain weight**
 - **Subordinate monkeys increased caloric intake enormously by overeating the snack foods both day and night**

What does this say about the idea that we snack because we are victims of marketing?

- **The monkeys were not**
 - **subject to marketing or advertising**
 - **rebellling against “the fashion-nazis” or the thin, lithe ideal of beauty**
 - **were not without healthy alternative foods**
- **The subordinate monkeys**
 - **Ate more snack foods than dominants**
 - **Gained abdominal fat**
 - **Had an unhealthy lipid profile (high LDL)**
 - **Had higher circulating cortisol (stress hormone)**

Monkeys on Crack

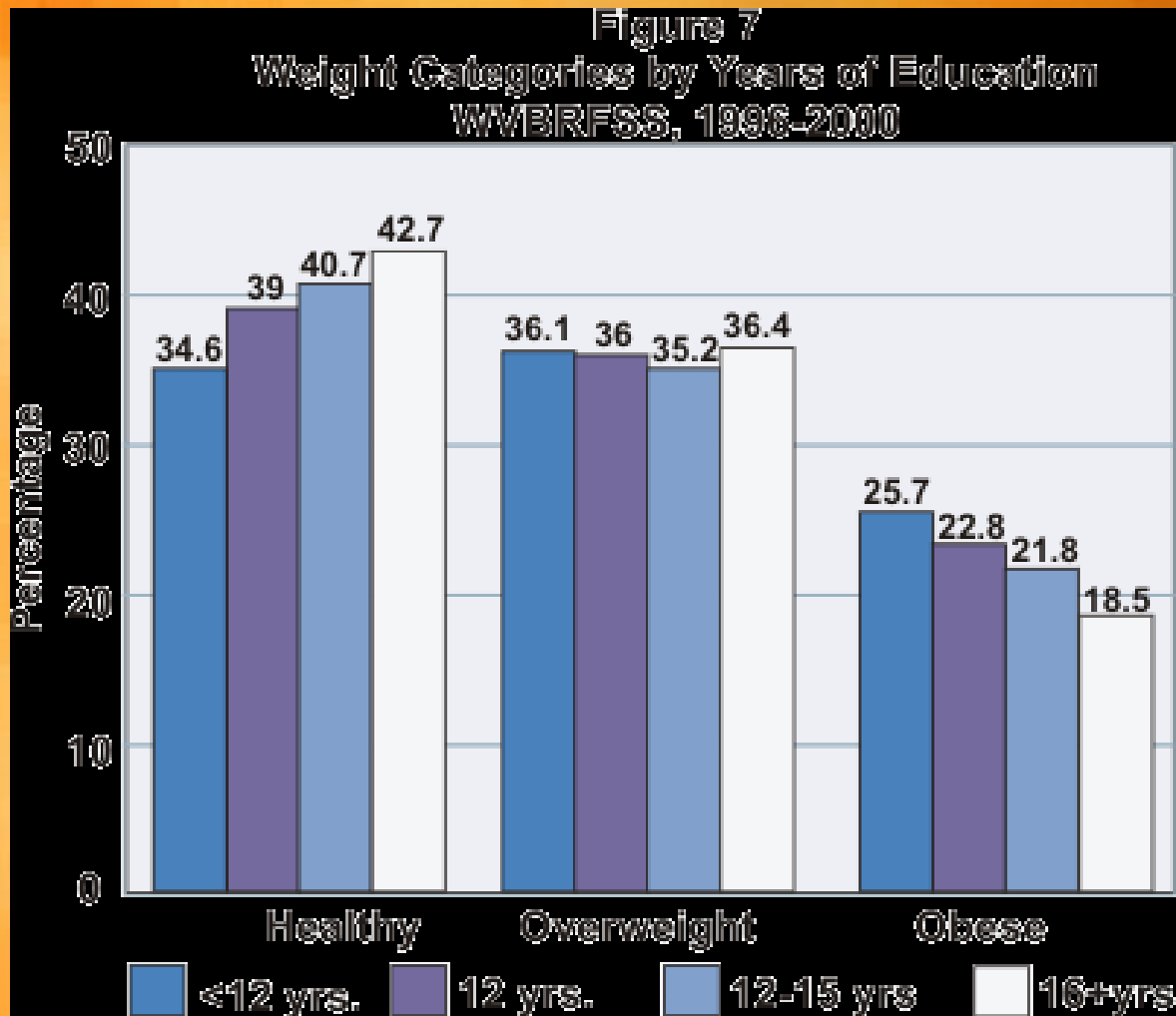
- **Subordinate monkeys had higher levels of cortisol (a steroid)**
- **Snacking is a way of lowering cortisol**
- **High cortisol leads to depletion of dopamine (a reward peptide)**
- **Subordinate monkeys also learned quickly to push a lever to obtain cocaine, dominant monkeys did not**
- **Snack eating may be related to the same reward pathways that mediate cocaine addiction (“food addiction”)**



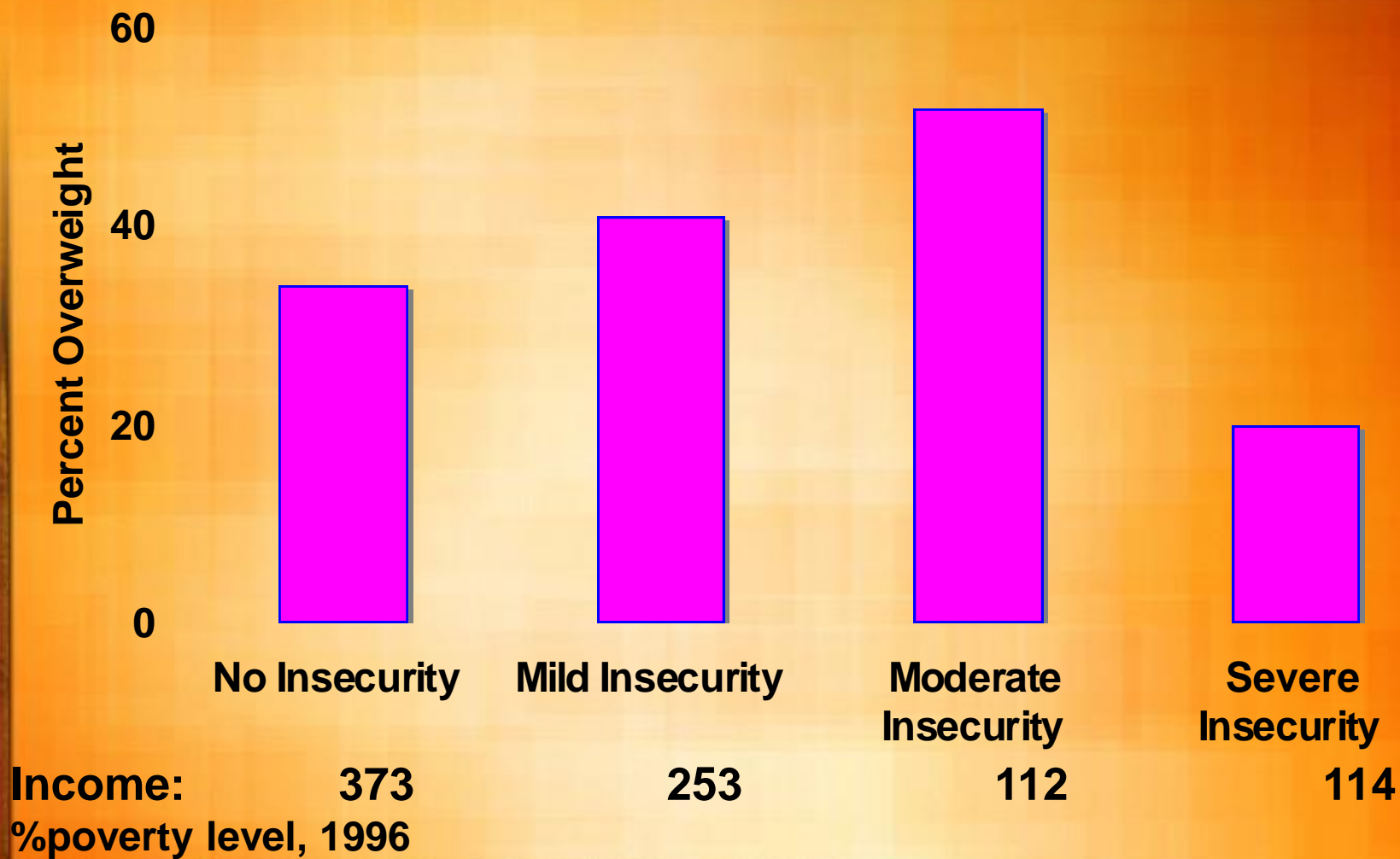
**Anything like this in human
primates?**

So glad you're a monkey man too

Obesity and Social Class



BMI in relation to Food Insecurity in Women



Possible explanations for the link between obesity, poverty and food insecurity

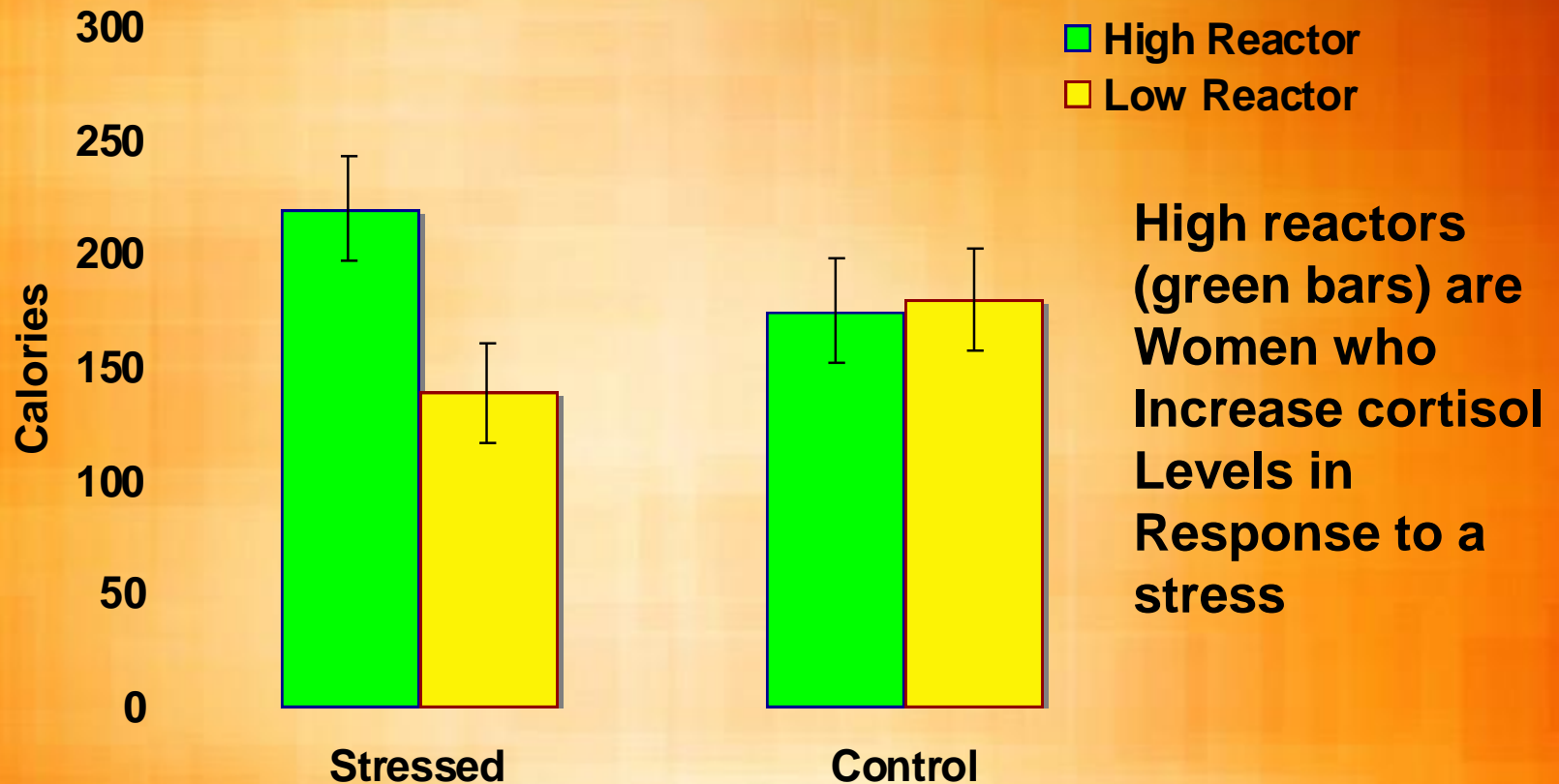
- 1) People with mild or moderate insecurity save money by buying cheap, energy rich foods that promote obesity (pasta).**
- 2) The conditions of poverty and food insecurity contribute to chronic stress, which is in turn linked to abdominal obesity.**
- 3) Intermittently going without food increases energy efficiency and thus, when food becomes available and the women gain extra weight**

Stress and Obesity

There are huge amounts of data to support
this idea

(mainly thanks to Bruce McEwan's
laboratory)

Calories consumed by women with congenital high or low stress reaction to a stressor



Epel et al., 2001

In Humans Stress Increases

- Strictly abdominal obesity
- Preference for calorically dense food
- Preference for “comfort food”
 - (Mary Dallman’s lab for example)
- Increases propensity to become addicted or to return to addictive behaviors

Causes of Obesity

~~Lack of willpower~~

~~Marketing~~

Lifestyle

✓ High Stress

Sedentary

exercise might not make you thin

exercise might make you happier and healthier

✓ Genetics

Food

~~Fat~~

Carbohydrates

complex, from vegetables

✓ simple, processed

✓ Dishonest food



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Lately it occurs
To meeeeeee