

# Behavioral Biology and Obesity

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- This lecture will instead consider obesity in *naturalistic perspective*, building on the biologist's notion that fattening in humans and other animals originated as a response to **starvation risk**.



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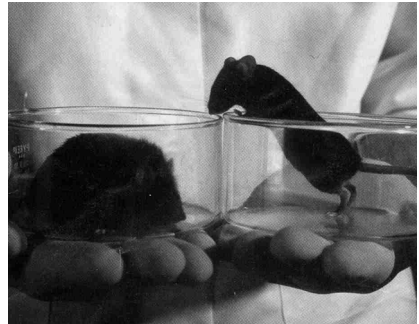
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# Endocrinology of Obesity: Leptin

Clinical symptoms of **starvation**:

- hyperphagia
- decreased body temperature
- decreased physical activity
- diminished immune function
- infertility

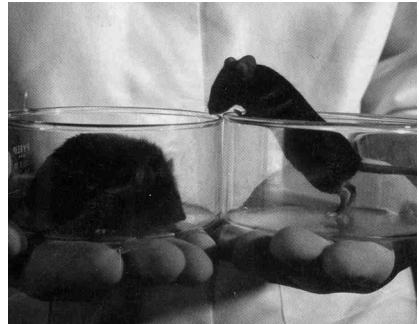


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References: Zhang *et al.* 1994, Montague *et al.* 1997, Farooqi *et al.* 1999





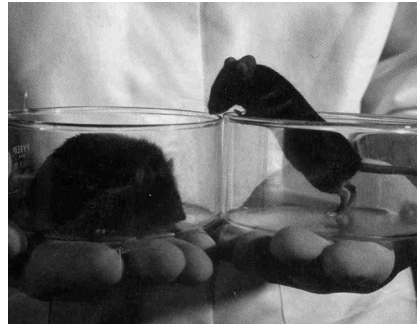
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The effect of leptin is the same, of course, in **humans**.



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# Seasonal Fattening: Siberian Hamsters

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- The key environmental trigger appears to be **photoperiod**.



References: Whybrow 1988, Allen *et al.* 1993, Mercer *et al.* 2000



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- The key environmental trigger appears to be **photoperiod**.
- In **humans**, *seasonal affective disorder* characterized by depression, hypersomnia, hyperphagia, and weight gain. Most commonly prescribed treatment: exposure to artificial light.
- Conversely, *summer depression* causes insomnia, decreased appetite, and weight loss.



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## Social Rank and Obesity: Willow Tits

In natural settings, willow tits fall into stable binary **dominance hierarchies** that determine **access to food** supply.



References: Ekman & Lilliendahl 1993, Clark & Ekman 1995, Brodin & Lundborg 2003



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- In spite of restricted access to food supply, **subordinate tits** typically **fatter** than their dominant counterparts.



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Similar patterns observed in **humans** and other primates.

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*Might variation in **material risk** drive incidence of obesity in the modern world?*
- Risk is difficult to measure, and it is not clear *a priori* which environmental indicators of impending scarcity will be most important empirically (but: anthropology provides clues).
- Nevertheless, many studies have reported a positive relationship between obesity (or related health problems) and various forms of “economic insecurity.”



# Economic Insecurity

## Risk driving fattening...?

- poverty & obesity  
(Drewnowski 2004)
- inequality & health  
(Wilkinson & Pickett 2006,  
Gottschalk & Moffitt 2009)
- social status & health  
(Marmot 2004)
- social networks & obesity  
(Christakis & Fowler 2007)
- affluence & self-control  
(Offer 2006)
- “stress”-related eating (Greeno & Wing 1994, Laitinen *et al.* 2002)
- food insecurity & obesity  
(Townsend *et al.* 2001)
- financial insecurity & weight gain  
(Gerace & George 1996)
- job insecurity & nicotine  
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(Morris *et al.* 1992, Hannerz *et al.* 2004,  
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  - interviewed annually or bi-annually 1988-2000.
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  - interviewed annually or bi-annually 1988-2000.
  - variables: height/weight, weekly employment histories, annual household income, county of residence, other demographics.
- Measures of economic insecurity:
  - probability of job loss
  - number of 50% income drops
  - dispersion of income path
  - probability of poverty
  - (received inheritance)
  - (health insurance)





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Local labor market conditions provide a natural experiment;  
result can be interpreted as "causal"  
(subject to identification assumption).



# Why the Poor Get Fat: Results

Effect of Economic Insecurity on Body Weight (lbs.) in Men, 1988-2000

Probability of Job Loss	61.75** (31.2)	—	—	—	111.8*** (23.6)	68.76*** (22.2)
50% Income Drops, 1988-2000	—	5.445* (3.15)	—	—	—	—
R <sup>2</sup> on Income Trend, 1988-2000	—	—	-24.27*** (7.17)	—	—	—
Probability of Poverty	—	—	—	2.997 (34.70)	—	—
Inheritance (in \$1000)	—	—	—	—	-0.0443*** (0.008)	-0.0448*** (0.007)
Health Insurance	—	—	—	—	—	-3.518 (6.41)
N	2561	2561	2281	2281	2561	2548
R <sup>2</sup>	0.67	0.672	0.64	0.672	0.67	0.671

Robust standard errors (adjusted for within-state clustering) in parentheses.

\* significant at 10%, \*\* significant at 5%, \*\*\* significant at 1%

See Smith *et al.* (2009) for details.



# Obesity Rates in the OECD

- Smith & McCluskey (WIP) estimate fixed-effects model of obesity rates in 17 OECD countries between 1990 and 2007.
- Obesity data from *OECD Health*, adjusted for demographics and self-reporting
- Preliminary results: labor market variables have more explanatory power than GDP, food prices, or dietary quality
- Overall explanatory power is weak



Table 5: Fixed Effects

	Obesity Rate (U.S.= 0.0%)		
	1990	2007	Fixed Effects
United States	0.0	0.0	0.0
New Zealand	-6.5	-6.1	-1.6
England	-6.2	-8.9	-3.1
Australia	-9.1	-12.6	-3.7
Finland	-9.7	-14.3	-6.1
Spain	-10.3	-13.3	-6.1
Czech Republic	-5.9	-18.0	-6.4
Netherlands	-12.9	-19.3	-7.1
Canada	-3.2	-13.4	-7.3
Denmark	-12.0	-17.4	-7.4
Iceland	-10.6	-8.7	-7.4
Austria	-10.1	-16.5	-7.9
Sweden	-12.8	-20.0	-8.6
France	-12.8	-18.8	-9.3
Italy	-13.1	-20.7	-11.2
Switzerland	-14.0	-22.5	-16.0
Japan	-17.8	-29.8	-21.4



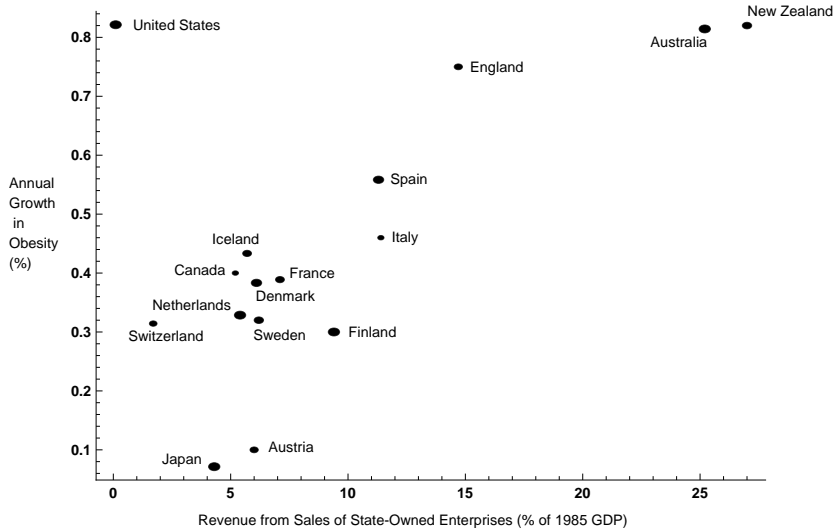
Table 3: Obesity Rankings, 1990-2007

	Obesity Rate (%)			Rank		
	1990	2007	Difference	1990	2007	Difference
Iceland	9.4	23.9	14.5	10	3	1
New Zealand	13.5	26.5	13.0	5	2	2
United States	20.0	32.6	12.6	1	1	3
England	13.8	23.7	9.9	4	4	4
Spain	9.7	19.3	9.6	9	6	5
Australia	10.9	20.0	9.1	6	5	6
Finland	10.3	18.3	8.0	7	8	7
Denmark	8.0	15.2	7.2	11	10	8
France	7.2	13.8	6.6	12	12	9
Austria	9.9	16.1	6.2	8	9	10
Netherlands	7.1	13.3	6.2	14	13	10
Sweden	7.2	12.6	5.4	12	14	12
Italy	6.9	11.9	5.0	15	15	13
Switzerland	6.0	10.1	4.1	16	16	14
Canada	16.8	19.2	2.4	2	7	15
Japan	2.2	2.8	0.6	17	17	16
Czech Republic	14.1	14.6	0.5	3	11	17





### Privatization and Obesity in the OECD, 1985–1999



# America's "Great Risk Shift"

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  - 1981-present **Pensions**: from pooled to individual risk
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- Though some point to a dramatic rise in **fast food** restaurants over this time period...



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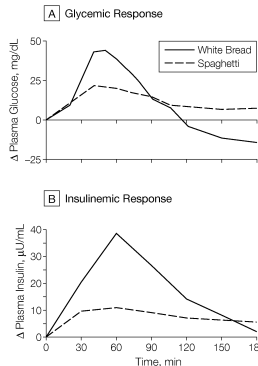
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  - cellular “starvation response”
  - appetite stimulation, **lipogenesis**



Refs: Irvine 1952, Ludwig 2002, Taubes 2007,  
Wurtman & Wurtman 1998



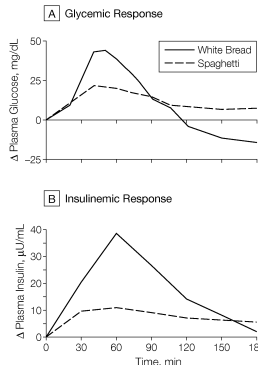
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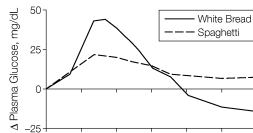
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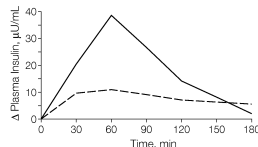
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...which together suggest economic insecurity might cause weight gain in part by inducing **changes in dietary composition**.

**A** Glycemic Response



**B** Insulinemic Response



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- Rising obesity could be due—in part—to changes in the economic environment that have increased idiosyncratic material risks faced by households.
- It might even be possible that shrinking public expenditures have something to do with our expanding waistlines...



Worries go down better with soup than without.  
—Jewish proverb

