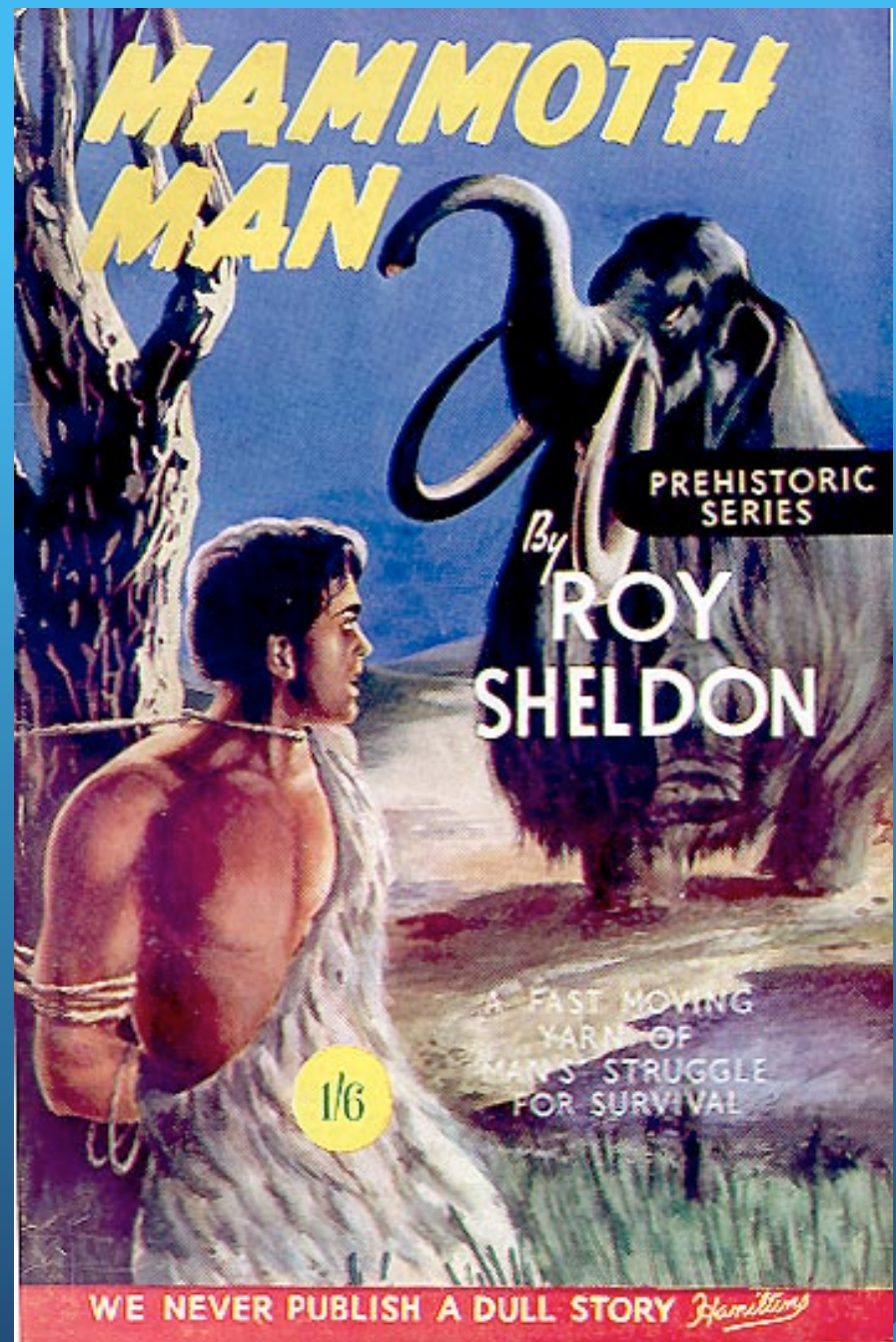


Pleistocene



Is this your
evolutionary
past?



Who Scuba Dives?

- None of our ancestors breathed compressed gas
- Extreme environments can cause illness
- Goal of this talk: understand how gene environment mismatch causes disease



How about this?



Iatrogenic illness

This?

- High altitude mountaineering
- Does anybody belong at 26,000 feet?



gene-environment modernity mismatch and disease

Joe Alcock MD MS



Modern Medicine...

- We usually think about modern life as being a good thing for health
- Hygiene
- Improved life spans
- Life-saving surgery
- Powerful pharmaceuticals

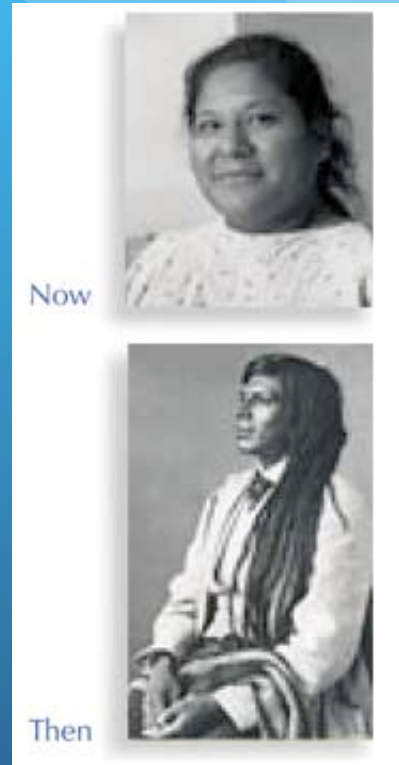
Environmental Mismatch

- Diseases of modernity
- Diseases of western civilization
- Novel environment




Downside?

- Novel environment can sometimes cause illness.
- Diabetes in Pima Indians
- 8% in Mexico: eating traditional diet of beans, corn, squash
- 50% in Arizona: eating high fat, high sugar, typical American diet



Cardiac Risk Factors

- Smoking
 - High Cholesterol
 - High Blood Pressure
 - Diabetes
 - Obesity
- 
- Did our ancestors have as many heart attacks as we do?

Novel Environment - Mismatch

- Are you a caveman in a modern environment?



Supersized Americans

- Come up with an evolutionary hypothesis for why modern diet is bad for you
- Why do trans fats, salt, saturated fat, and refined sugar taste so good?



Chinese diving project



Platform diving injures eyes

- 24 of 180 Chinese divers have retina injuries
- Begin diving at age 6
- Thousands of repetitive head decelerations
- Medal winner in Athens games unable to compete this year because of blindness
- Extreme environment
- What other sports cause gene-environment mismatch injury?

Night Shift



- Night workers have more heart attacks
- Artificial light promotes cancer
- Why?

Vegas, baby

- Gambling affects the same pathways as cocaine!
- Why?
- What is the ancestral condition that gambling is mimicking?



Pima Indians have highest rate of diabetes in the world

- Why?
- Nature or nurture?
- Does the concept of race apply in medicine?



Drugs

- Cocaine
- Heroin
- Nicotine
- Valium
- What do they have in common?



Drugs

- Cocaine and Methamphetamine have clinical effects that mimic dopamine and adrenalin (prevents reuptake)
- Heroin is mimic of endogenous opiates
- Nicotine is a mimic of nicotinic neurotransmitter
- Valium is a mimic of GABA neurotransmitter



Environmental Mismatching

- Evolutionary concept of disease
- New technology allows people to experience extremes
- Often occurs because the novel condition mimics a different ancestral condition
- Disordered Signaling



New technology allows people to go to high places



- Supplemental oxygen, high tech fabrics and materials allow mountaineers to achieve altitudes incompatible with life

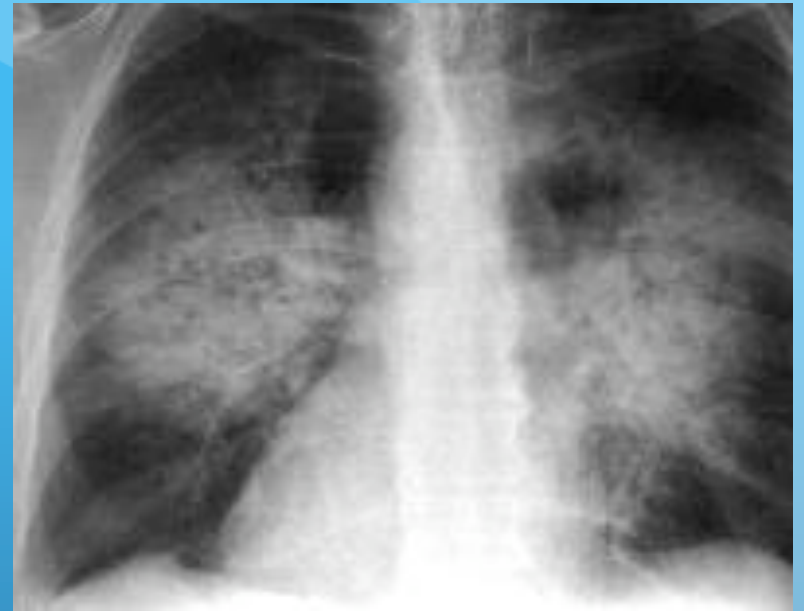
We can change - a little bit

- Over time, we breathe faster at altitude
- We change our body chemistry
- We make more blood cells
- And if you go to Wheeler Peak your oxygen levels will be LOW!



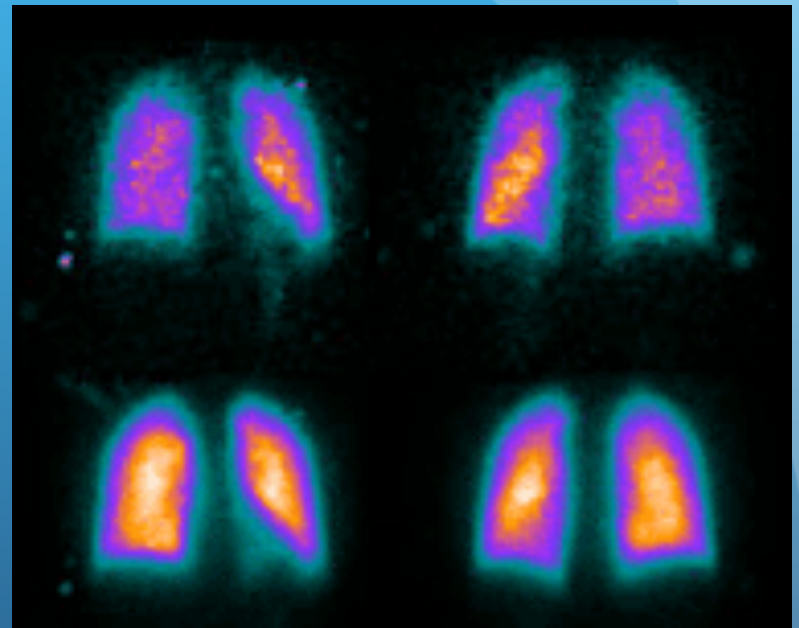
High Altitude Pulmonary Edema

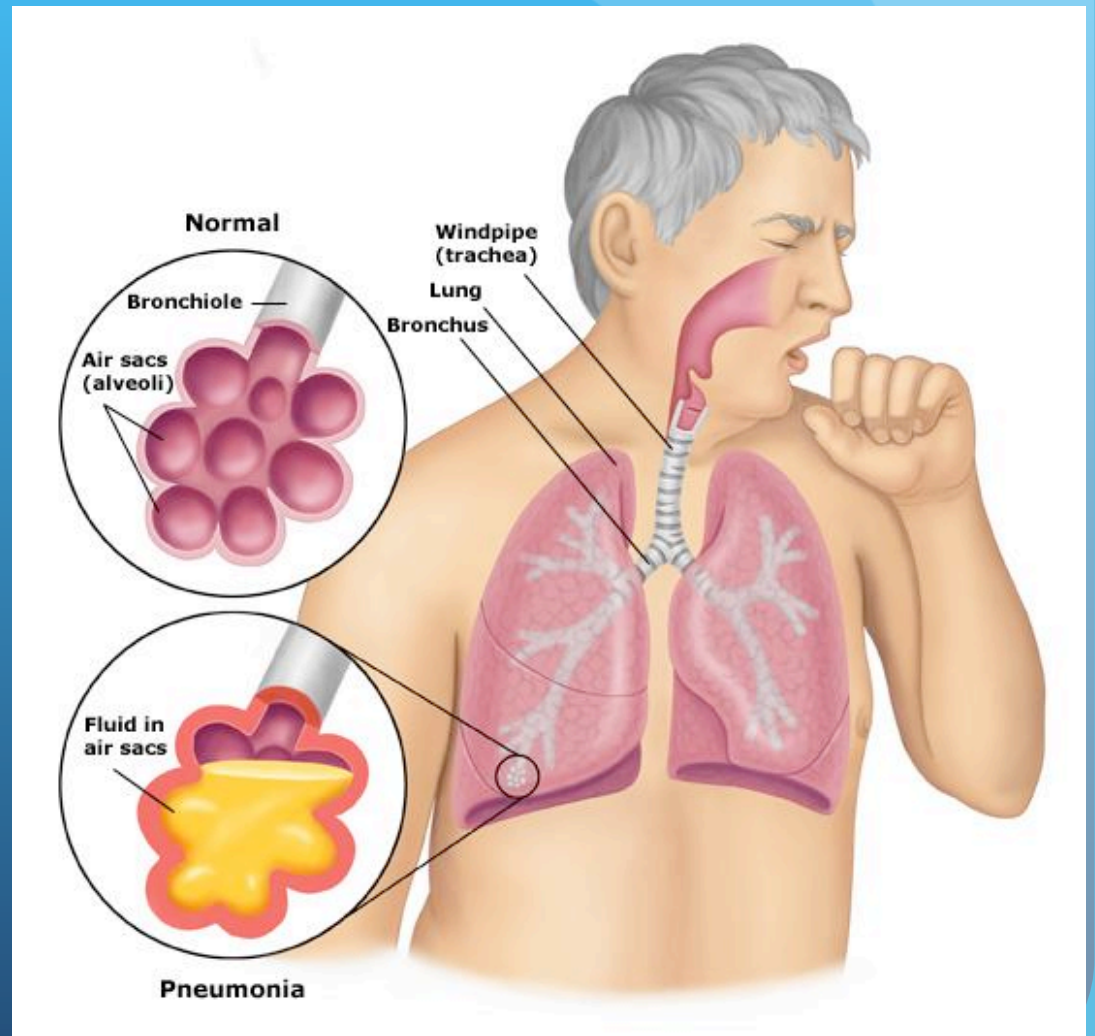
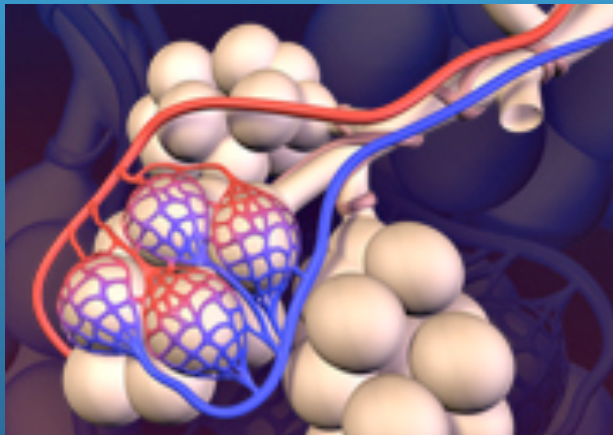
- This happens all the time at Taos ski valley!
- Lung vessels shrink, pressure goes up, fluid leaks
- Blood is 90% water: seeps out



Low Oxygen and Blood flow

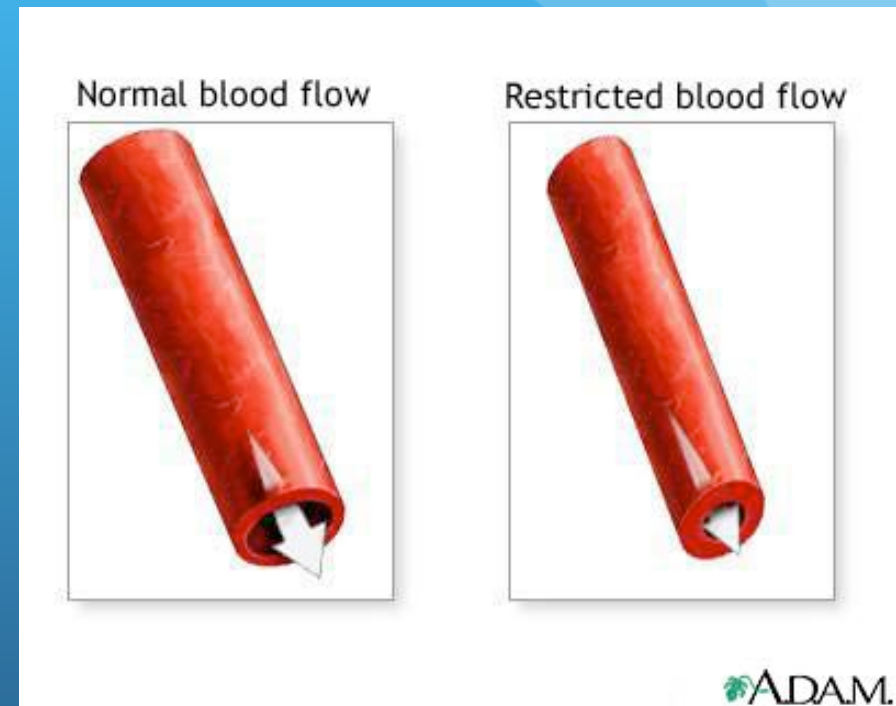
- Air flow and blood flow
- Moves blood towards normal part of lung to maintain normal oxygen levels in arteries.





Hypoxic pulmonary vasoconstriction

- Bad at extreme altitude (Maladaptive)
- Fluid leaks out from high pressure in lung arteries
- Mismatch: In the lung, altitude hypoxia is a mimic of lung infection!



Acute Mountain Sickness

- Mountain Sickness caused by low oxygen
- HAPE = vasoconstriction. Adaptive in lung diseases and maladaptive at extreme altitude (environmental mismatching)

Summary

- Mismatch between genes and environment cause diseases of modernity and extreme environments
- Novel environments contribute to diseases of western civilization
- Mismatch - mimicry