

LS 2X03 - Lecture 17 – Human Activity and the Spread of Antibiotic Resistance

1. How are Antibiotics Introduced in the Environment?
2. Antibiotics in Sewage Treatment
3. Tracking Antibiotic Resistance Genes in the South Platte River, Colorado
4. Antibiotics Use in China

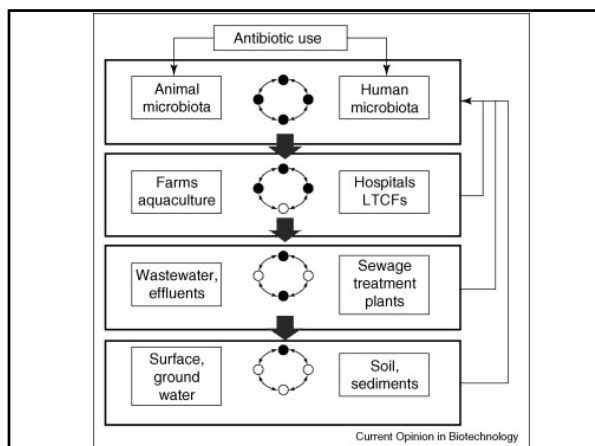
Key Concepts

- Antibiotic overuse
- Antibiotic usage in Agriculture
- Antibiotics in Sewage
- Antibiotic Resistance in Mixed Land Use
- Antibiotics Usage in China
- Antibiotic Resistance Genes in Wastewater Effluent

1. How are Antibiotics Introduced in the Environment?

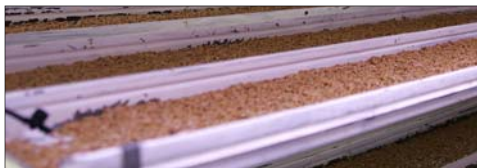
- Given problems tied to antibiotic resistance:





Antibiotics in Agriculture

- In the U.S., clinical use estimated at 10% of total antimicrobial use
- Farm-wide administration of antibiotics in feed and water:



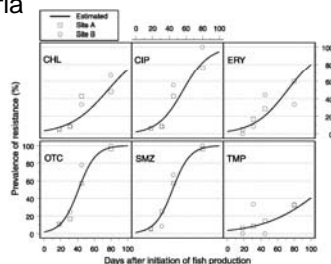
Antibiotics in Agriculture (2)

- Antibiotics have been used since the 1950s to control certain bacterial diseases of:



Antibiotics in Aquaculture

- Prophylactic use of antibiotics in fish farms has led to a rise in the number of resistant bacteria

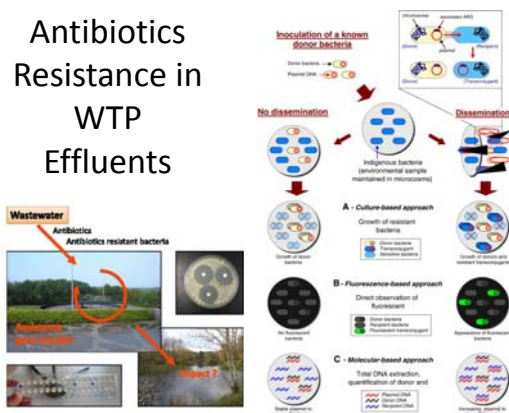


2. Antibiotics in Sewage Treatment

- After administration, antibiotics for human use or their metabolites are excreted and reach the treatment plant



Antibiotics Resistance in WTP Effluents

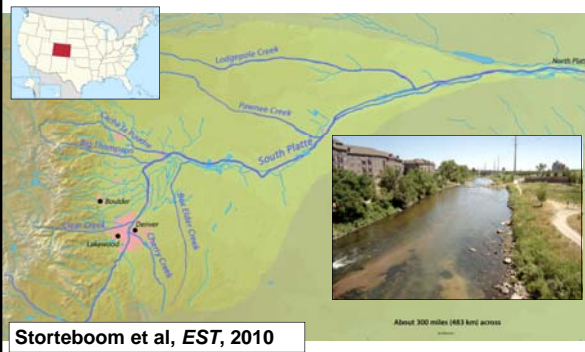


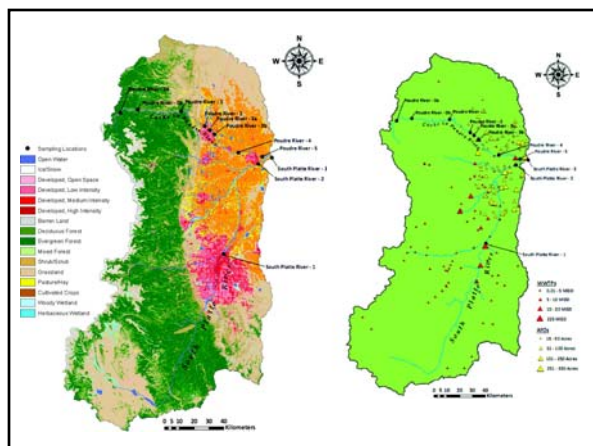
Releases By Pharmaceutical Manufacturers

- Recently found that in some Asian countries concentrations of up to:



3. Tracking Antibiotic Resistance Genes in the South Platte River, Colorado



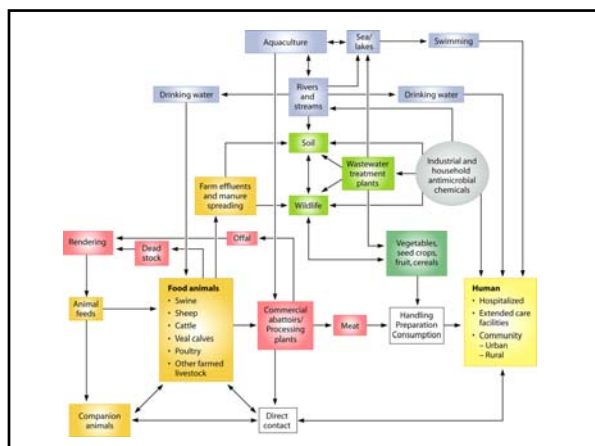






Frequency of Detection of Antibiotic Resistance Genes in the River Environments, Colorado

Antibiotic Resistance Gene(s)	Pristine River	Animal Feeding Operations lagoons	WWTPs	Impacted River
<i>tet(C)</i>	0.08	0.77	0.91	0.45
<i>tet(E)</i>	Not detected	0.28	0.45	0.06
<i>tet(O)</i>	0.08	0.85	0.91	0.23
All (total of 11 genes)				



Antibiotic Resistance and Wild Animals

- Provide a biological mechanism for the spread of antibiotic resistance genes

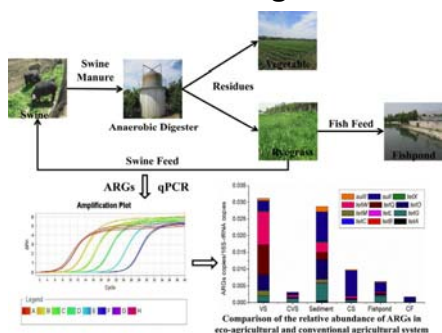


4. Antibiotics Use in China

- Antibiotics used in livestock:

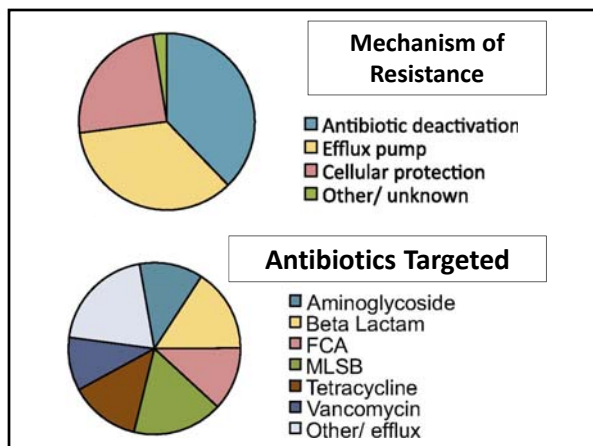
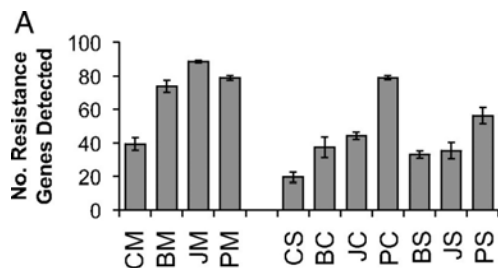


Antibiotic Resistance Genes Detected in Pig Farm



Resistance Genes Detected in Swine Farms

- 149 unique genes among all of the farm samples:



Conclusion

- Just as in hospital settings, the agricultural use of antibiotics selects for antibiotic resistance, arguably in a more widely disseminated fashion
- Residual amounts of antibiotics can reach surface waters, groundwater or sediments from wastewater effluents
- Antibiotics are also abundantly used in livestock industry

TO DO!

1. For next Lecture: read Article 19
2. Tutorials this week: : Group Presentations – only if scheduled by TA
 - (Bring enough copies of the Judging Forms)
