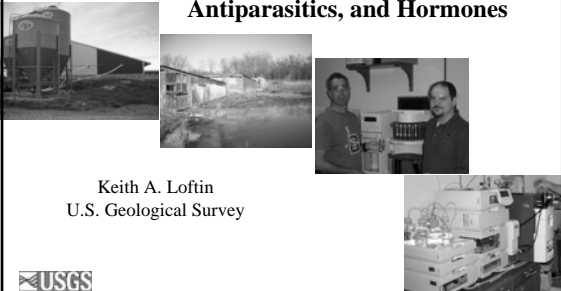



Agricultural Occurrence of Antibiotics, Antiparasitics, and Hormones



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Acknowledgements

Dana Kolpin, Iowa City IA	James Gray, Boulder CO
Ed Furlong, Denver CO	Sheridan Haack, Lansing MI
Larry Barber, Boulder CO	Kymm Barnes, Iowa City IA
Mike Meyer, Lawrence KS	Mark Burkhardt, Denver CO
Steve Zaugg, Denver CO	Mike Focazio, Reston VA
Keith Loftin, Lawrence KS	Melissa Schultz, Denver CO
	Vicki Blazer, Leetown WV
	Pat Anderson, Fort Collins CO

Center expertise (e.g. Bret Bruce, Gail Cordy, Betsy Frick, Kathy Lee, Pat Phillips, Doug Schnoebelen, Paul Stackelberg)



Emerging Contaminant Project
toxics.usgs.gov/regional/emc/index.html



Plus many more...

Outline

- A. Introduction to Antibiotics, Antiparasitics, and Hormones used in Agriculture in the United States
- B. Environmental Transport of Pharmaceuticals
- C. Occurrence of Pharmaceuticals
- D. Summary
- E. Take Home Message

Veterinary Usage of Antibiotics, Antiparasitics, and Hormones in the United States

Refer to the U.S. FDA website for a comprehensive data base of permitted veterinary pharmaceuticals in the United States. (http://www.fda.gov/cvm/Green_Book/greenbook)

The LPE website will have summary tables of commonly used veterinary antibiotics, antiparasitics, and hormones featuring chemical names, examples of common trade names, and livestock usage

In many cases the same compounds or compounds from the same chemical classes are used in both human and agriculture. Example: Ciprofloxacin used in cattle and also use to counteract Anthrax exposure in humans after 9/11/01.



Concerns Regarding Usage of Antibiotics, Antiparasitics, and Hormones in the United States

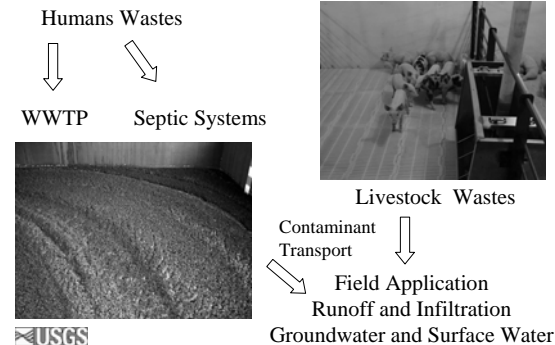
U.S. Fluoroquinolone usage for poultry was banned in 2005 (www.fda.gov/bbs/topics/news/2005/new01212.html) (www.fda.gov/oc/antimicrobial/baytril.pdf)

Ivermectin, an antiparasitic, was shown to have detrimental effects on dung. (Iwasa et. al., 2007, Bull. of Entomol. Res., 97:619-625.)

A hormone in many birth control pills was applied to a Canadian Lake resulting in a crash in the minnow population. (Kidd et. al., 2007, PNAS, 104: 8897-8901)





Environmental Transport of Pharmaceuticals "The Quick Version"




USGS Occurrence Studies for Antibiotics, Antiparasitics, and Hormone Studies

- Initial occurrence study focused on 139 streams across the United States (30 states) subject to influence by urban inputs, agriculture inputs, and a mixture of both inputs in 1999 and 2000. Both hormones and antibiotics were included in this assessment.
- The results of the stream occurrence study prompted us to investigate occurrence in a more expanded manner further up the "pipeline".
 - Swine Lagoons at animal feeding operations (42 AFOs) in 1998-2002
 - River Bed Sediments in 2002 (16 states)
 - Biosolids and Manures in 2004 (11 states) – cattle, dairy, poultry, and swine




Occurrence of Antibiotics in Surface Water


- Pharmaceuticals
 - Antibiotics (individual compounds generally less than 5 µg/L)
 - Hormones (individual compounds generally less than 0.16 µg/L)
- Many antibiotics and hormones have been frequently detected in water and wastewater both nationally and internationally (ppb or lower).
- Many pharmaceuticals are present as mixtures (up to 38 compounds in 1 sample)
- Usage data indicates more compounds should be found in these systems and perhaps in higher concentrations....




Where are they?
Degraded or Sorbed?

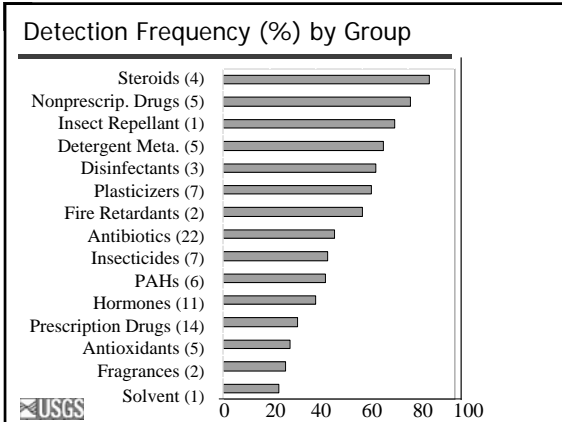


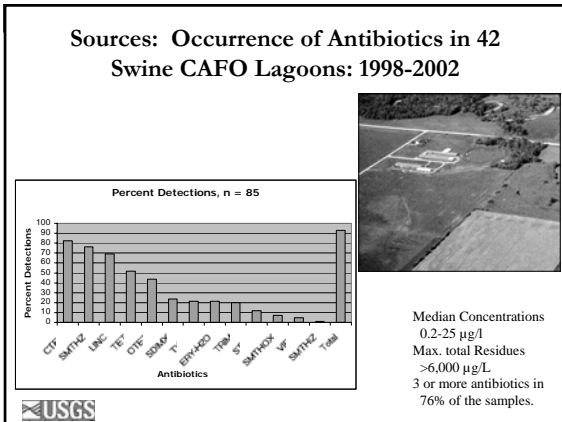
Stream Monitoring Network (1999-2000)

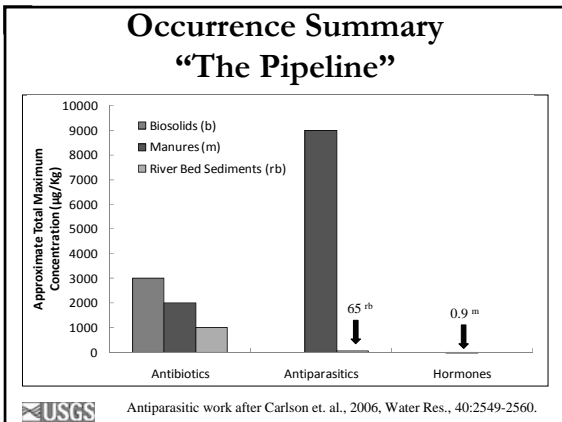


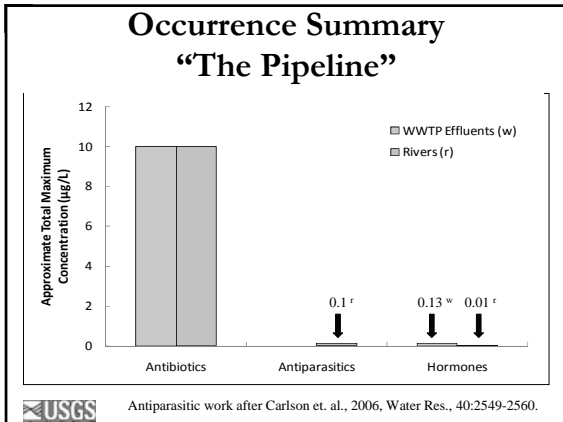
- animal
- urban
- mixed
- control













Take Home Message...

- Antibiotics, antiparasitics, and hormones are:
 - reaching the environment,
 - traceable from source to receiving water,
 - and frequently occur as mixtures.
- Both agriculture and human usage of these compounds are contributing to the presence of pharmaceuticals in the environment. Estimates have placed usage at approximately 50% for each category in the United States.
- Environmental pharmaceutical concentrations tend to decrease at each stage in the "pipeline".
- The story is incomplete. More information is needed directly linking biological effects with environmental concentrations of pharmaceuticals. But enough scientific evidence exists to warrant further investigation.

USGS
