Antimicrobials Used In Animal Husbandry

Rachel Roisman, M.D., M.P.H.
California Environmental Contaminant Biomonitoring Program
Office of Environmental Health Hazard Assessment

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Criteria for recommending additional designated chemicals

- Exposure or potential exposure
- Known or suspected health effects
- Need to assess the efficacy of public health actions
- Availability of a biomonitoring analytical method
- Availability of adequate biospecimen samples
- Incremental analytical cost

Selected antimicrobials used in animals

Group/Class	Antimicrobial	Usage	Sold (weight)
Ionophores	Monensin	Cattle	11 million pounds
	Lasalocid		
Arsenicals	Arsenilic acid	Poultry	
	Roxarsone, cabarsone		
Glycolipids	Bambermycin	Pigs, poultry	
Pleuromutilins	Tiamulin	Pigs	
Quinoxalines	Carbadox	Pigs	
Tetracyclines	Tetracycline	Pigs	< 9.3 million pounds
	Chlortetracycline	Cattle, pigs, poultry	
	Oxytetracycline	Cattle, pigs	
Cephalosporins	Ceftiofur sodium	Cattle, swine	< 4.5 million pounds
	Cephapirin	Cattle	
Macrolides	Erythromycin	Cattle	
	Oleandomycin	Chickens, turkeys	
	Tylosin	Cattle, pigs, chickens	
Lincosamides	Lincomycin	Pigs	
Polypeptides	Bacitracin	Cattle, pigs, poultry	
Streptogramins	Virginiamycin	Swine	
Sulfonamides	Sulfamethazine	Cattle, pigs	< 1.2 million pounds
	Sulfathiazole	Pigs	
Penicillins	Penicillin	Poultry	
Aminoglycosides	Gentamycin sulfate	Chickens, turkeys, swine	< 0.3 million pounds
	Neomycin	Cattle, swine, sheep, goats	
Elfamycin	Efrotomycin	Pigs	Data not available

Orange: used to treat human diseases with few or no alternatives.
Olive: not used in humans, but belong to class of antimicrobials used in humans
Tan: used to treat human diseases; alternatives exist
Blue: not currently used to treat human diseases.

Exposure or potential exposure

- No required reporting of use in food animals
- Amounts of antimicrobials applied to feed: 2.5 to 125 mg/kg bodyweight, depending on the animal and on the antimicrobial
- Between 40% and 70% of total antimicrobial use in U.S. is for non-therapeutic purposes in livestock
- Exposure in humans occurs via:
  - consumption of commercial meat products
  - environmental exposure from animal waste

Exposure in humans

- Consumption of commercial meat products
  - USDA tests few samples, rarely detects violations
- Environmental exposure to antimicrobials in animal waste likely significant
  - Poor gut absorption of antimicrobials in animals
  - As much as 90% of the parent compound may be excreted
  - Resistant organisms tend to persist in animal waste

Known or suspected health effects

- Major health concern is development of drug-resistant bacteria and transmission to humans
- Multiple studies confirm that transmission of resistant organisms occurs from animals to humans via a variety of mechanisms:
  - Consumption of contaminated meat
  - Animal-to-human transfer
  - Environmental transfer

Need to assess efficacy of public health actions

- Antibiotic resistance is large and growing public health problem
- Loss of effective treatments and increasing prevalence of multi-drug resistant bacteria can lead to increased morbidity and mortality
- Monitoring of antibiotic resistance in humans could serve as tool to assess efficacy of efforts to reduce non-essential antibiotic use

Laboratory considerations

- No data found on levels of antimicrobial residues in humans
- Detection of antimicrobial residues in humans from animal husbandry activities unlikely due to low doses and water solubility of compounds
- Any antimicrobial biomonitoring program would have to account for direct human use of antibiotics of interest
- Biomonitoring for antimicrobial residues unlikely to be fruitful

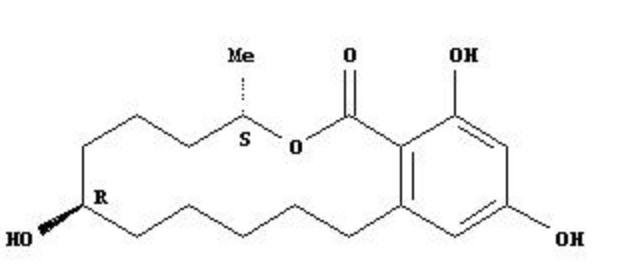
Alternative biomonitoring

- Biomonitor for microorganisms and do further testing for resistance patterns
  - Gastrointestinal flora in stool cultures
  - Upper respiratory tract flora in nasal swab cultures
- Biomonitoring for resistant organisms could not be completed with current laboratory capabilities
  - Collaboration with outside researchers necessary

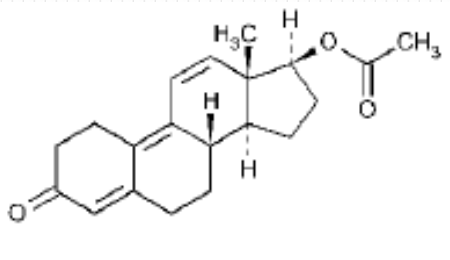
Synthetic Hormones Used In Animal Husbandry

Synthetic hormones used in animal husbandry

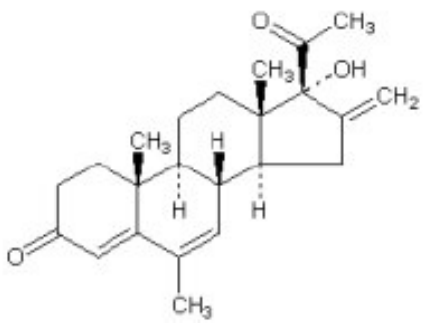
- Zeranol:
  - Non-steroidal, synthetic estrogen
  - Administered by implantation of continuously releasing hormone pellet
  - Metabolite, zearalenone, also produced by fungi that are common contaminants of corn



- Trenbolone acetate (TBA):
  - Synthetic androgen
  - Administered by implantation of continuously releasing hormone pellet



- Melengestrol acetate (MGA):
  - Synthetic progestin
  - Administered in cattle feed
  - Also used for estrus synchronization and suppression



Exposure or potential exposure

- Volume of use reporting not required
- Over 85% of all steers and heifers were implanted at least once in their lifetime with synthetic or natural hormones
  - Many cattle receive more than one implant
- Exposure in humans occurs via:
  - Consumption of commercial meat products
  - Environmental exposure to synthetic hormones in animal waste

Exposure in humans

- Consumption of commercial meat products
  - USDA tests few samples, rarely detects violations
- Environmental exposure to synthetic hormones in animal waste
  - Cattle excrete administered hormones into environment
    - Approximately 0.2% and 20% over natural elimination rates for estrogens and androgens/progesterones, respectively
  - Livestock farming thought to be major source of steroid hormones found in regional groundwater and external surface water

Persistence in the environment

- Zeranol has been found in low concentrations (ng/liter) in sewage discharges
- TBA metabolites stable in animal waste with a half-life of 267 days in liquid manure
- MGA present in soil 195 days after fertilization with solid dung and after cultivation of a maize crop

Known or suspected health effects

- Concern for cancer, reproductive effects, and endocrine disruption
- Zeranol:
  - Natural estrogen known cause of human breast and uterine cancer
- TBA:
  - Anabolic steroids are reproductive toxicants and listed under Proposition 65
- MGA:
  - Progesterone is listed as known to cause cancer under Proposition 65

Need to assess efficacy of public health actions

- Concerns regarding persistence and toxicity
- Biomonitoring could aid efforts to keep synthetic hormones out of food supply and environment
- It may be difficult to determine if source of exposure is use in animal husbandry

Laboratory considerations

- Limited experience with measuring synthetic hormones in humans
- Sensitive methods exist for detecting use in animals
- Laboratory has necessary equipment for analysis
- Development work would be needed to establish and validate the methods