# 2.12 EXPLORE AN ISSUE: BACTERIAL RESISTANCE TO ANTIBIOTICS

## Understanding the Issue

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1. An antibiotic is a chemical produced synthetically or by microorganisms that inhibits the growth of or destroys certain other microorganisms. Examples are penicillin, streptomycin, tetracycline, and ciprofloxacin.
2. Variation within a bacterial population appears to cause bacterial resistance. First exposure to an antibiotic kills weaker strains of bacteria. Other members of the population have slight variations in their genetic material that allow them to survive the antibiotic. This resistance is passed on to offspring.
3. Antibiotic treatment:

| Effectively treated with antibiotics | Unaffected by antibiotic treatment |
|---|---|
| strep throat | common cold |
| anthrax | rabies |
| tuberculosis | smallpox |
| syphilis | mumps |
| botulism | HIV/AIDS |
| | measles |
| | influenza |

4. The resistance of bacteria to antibiotics is related to the greater exposure of microorganisms to antibiotics. Mutations occur with each exposure, and before long, a large population of resistant bacteria exists.
5. Seventy percent of all antibiotics produced are used in livestock production. This increases the exposure of microorganisms to antibiotics and resistant species survive to pass resistance on to offspring. Eating meat from animals exposed to antibiotics may affect the human immune system. Farmers can help reverse the trend in antibiotic resistance by reducing their total use of antibiotics and restricting use to disease treatment, not prevention.
6. Any accurate depiction of the relationship between antibiotic use and resistance is acceptable.
7. Antibiotic doses are carefully calculated, according to the species of bacteria and the nature of the infection. Often, symptoms of infection will disappear before the infectious agent is removed from the body. Stopping a treatment midway runs the risk of the infection recurring—this time with bacteria that have developed resistance to the antibiotic used. The son's cold is not affected by antibiotic treatment, so administering old pills to him stresses his system unnecessarily, removing the beneficial bacteria from his body.

### Take a Stand: Should non-therapeutic use of antibiotics in farm animals be banned?

| Statement | |
|---|---|
| Non-therapeutic use of antibiotics in farm animals should be banned. | |
| **Arguments for** | **Arguments against** |
| Drugs given to farm animals for therapeutic, production, or disease prevention reasons can cause microorganisms to become resistant to drugs used to treat human illness.<br><br>Bacteria pass from animals to humans through direct handling of farm animals or manure, through the consumption of undercooked meat, eggs, or unpasteurized milk, from handling pets, or from ingestion of unwashed fruits or vegetables. Antibiotic-resistant strains (e.g., *Salmonella typhimurium* DT 104, *E. coli* O157:H7 and *Campylobacter jejuni*) are increasingly common in animals. The diseases they cause are difficult and expensive to treat in humans.<br><br>*Campylobacter* is the most common bacterial cause of diarrhea in North America, estimated to affect about 1% of the population. Eating undercooked chicken or turkey, or other food that has been contaminated from contact with raw poultry, is a frequent source of *Campylobacter* infection. Fluoroquinolone will not work if a fluoroquinolone-resistant strain is involved. The U.S. Center for Veterinary Medicine has already taken measures: the fluoroquinolone Baytril has been withdrawn from use with chickens and turkeys.<br><br>Fluoroquinolone is one of the most valuable drug classes available to treat human infections. Cross-resistance occurs throughout this class of drugs: resistance to one fluoroquinolone can compromise the effectiveness of all fluoroquinolone drugs. We cannot afford to lose this treatment through abuse in the agricultural sector.<br><br>Experimental and potentially toxic drugs are now used to treat organisms that are resistant to all improved antibiotics. Unless antibiotic resistance problems are quickly detected and contained, the world could be faced with previously treatable diseases that have again become untreatable. This is a backwards step. | Barnyards are dirty places. Animals live in the presence of pathogens (e.g. *E. coli*). Preventative measures are needed to keep disease at bay.<br><br>Recent studies indicate that if there were a ban on non-therapeutic drug use, the annual cost to consumers would be between $4.84 and $9.72 per capita.<br><br>USDA reports that U.S. hog producers saved about $63 million in feed costs in 1999 due to their use of low levels of non-therapeutic drugs.<br><br>Widespread antibiotic use is essential in farming as protection against diseases that could decimate livestock and remove family income. It is unfair to remove this competitive advantage from an industry that is already struggling.<br><br>Mandatory vet visits, legislation, and closer monitoring can reduce this problem to a reasonable and manageable level. For example, the U.S. government has established the National Antimicrobial Resistance Monitoring System for Enteric Bacteria. This plan has four areas of focus to address bacterial resistance to antibiotics: surveillance; prevention and control; research; product development.<br><br>Evidence of a transfer of bacterial resistance from animals to humans is weak or lacking; more research needs to be done before a ban is considered.<br><br>Agricultural practices are not the only culprit in this situation. It is estimated that doctors write 50 million unnecessary prescriptions for antibiotics for human ailments each year. |
| **Decision** | |
| An informed response will be given. | |
| **Justification** | |
| Research should support the decision. | |

# 2.13 PROTISTS

## SECTION 2.13 QUESTIONS

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### Understanding Concepts

1. *Euglena* is classified as a plantlike protist because it contains chloroplasts. Other identifying features: one or two flagella; eyespot; pellicle; central nucleus; contractile and food vacuoles; mitochondria.
2. *Euglena* is a single-celled organism; algae are multicellular organisms. Algae have no tissue structure, unlike plants, which are highly specialized into tissues.