394 Fifty years of pharmaceutical technology and its impact on the livestock we produce. R. L. Preston*, *Professor Emeritus*, *Bellingham, WA*.

Technology, including pharmaceutical technology, has contributed to improved animal efficiency and health over the past 50 years and will continue to do so in the future. Technology is utilized by the livestock industry because it improves efficiency and health thereby reducing the cost of production that in turn, reduces the cost of food for the consumer and helps to sustain the economic production of animals. However, there are well-funded anti-technology forces at work to limit the application of technology in beef, food animal and agricultural production in general. The mainstream media smothers consumers with confusing information that often transforms their ignorance into fear. This impacts their willingness to believe what they read and hear, and can result in misguided choices. All land-based industries are affected by these misguided choices, by legislation and by regulations that threaten their economic sustainability. This presentation details the impact of past and current technology on the efficiency of livestock production and demonstrates the potential impact that anti-technology forces could have not only on livestock production but also on this country's food production in the future. Technology must play a continuing role in agriculture. Although scientific research will continue, the eventual acceptance of technology will depend on getting consumers to better understand and value the role of scientific research in assuring them of a sufficient and affordable supply of safe, high-quality, nutritious food.

395 How are we making bacteria more resistant to antibiotics? Darwinian impacts. T. R. Callaway*[1], J. L. Rychlik[2], T. S. Edrington[1], R. C. Anderson[1], and D. J. Nisbet[1], [1]*ARS, Food and Feed Safety Research Unit*, *College Station, TX*, [2]*Rychlik and Associates*, *Hillsboro, OR*.

This presentation will address the Darwinian selection of genes of antibiotic resistance in food animals. Darwin's concept of survival of the fittest is as critical when applied to bacteria as it is to animals. Bacteria live in a highly competitive environment that is similar to the macrobiological world with its selective pressures. Neo-Darwinism views genes as selfish and as the ultimate unit of natural selection rather than the host organism. Bacteria carrying antibiotic resistance genes are merely vehicles for ensuring the reproduction and dissemination of these genes. Antibiotic resistance genes can be shared horizontally amongst bacteria of the same or different species through conjugation, transduction and transformation. Mobile genetic elements (DNA fragments, transposons, phage and plasmids) are wild cards in the evolution of bacteria and can introduce or combine new genes or groups of genes to bacteria, especially antibiotic resistance genes. The horizontal and vertical movement of these genes is critical to the further dissemination of the genes by ensuring the survival of the bacterial hosts. Addition of selective pressure via feeding antibiotics helps to select for new antibiotic resistance and provides an environmental niche opening for resistant strains to fill and proliferate. Strategies for using new or medically-important antibiotics must be developed and implemented that do not enhance Darwinian and neo-Darwinian selection for antibiotic resistance genes and their host organisms. The antibiotic resistance gene is as critical as the bacteria itself as related to the dissemination of antibiotic resistance throughout the food animal population.

Key Words: Darwinian Selection, Antibiotic Resistance, Genetic Transfer

396 Antibiotic resistance gene transfer in the intestinal tract – possible implications for agriculture? A. Slayers*, *University of Illinois*, *Urbana*.

Every day, many bacteria pass through the human intestinal tract. Many of these bacteria come from the food supply and may thus have become resistant to antibiotics if the farm where they originated uses antibiotics routinely. Since most of these bacteria do not cause disease, it may seem irrelevant to be concerned about whether or not they are resistant to antibiotics. They could become a human health problem, however, if they are able to pass their resistance genes to bacteria that normally reside in the colon, because members of the resident colonic microflora are common causes of post-surgical infections. To assess the likelihood of horizontal resistance gene transfer in the colon, we have determined whether the same resistance gene is found in bacteria from different species or genera. Our findings and those of others suggest that transfer of resistance genes across species and genus lines occurs fairly readily in the human colon.

Key Words: Antibiotic Resistance

397 Does ionophore resistance risk human health? J. B. Russell*, *ARS/USDA*, *Ithaca, NY*.

Since World War II livestock in the United States have been fed subtherapeutic doses of antibiotics as "growth promotants." The mechanism of this action is still not entirely clear, but it appears that antibiotics by altering the natural gut flora inhibit bacteria that are detrimental to the host. This routine use of antibiotic in animal feed has lead to concern and debate. With the general increase in antibiotic resistance, their effectiveness use to combat disease has diminished, and many common pathogenic bacteria to carry multiple antibiotic resistances. In January 2006, the European Union banned the use of all antibiotics as animal growth promotants, and this ban includes a special class of antibiotics called ionophores. Ionophores are fed to beef cattle and more recently dairy cattle, but their mode of a action that is distinctly different from other commonly used antibiotics. Ionophores dissipate ion gradients across the cell membranes of sensitive bacteria. Ruminal bacteria that produce hydrogen, a precursor of methane or deaminate amino acids are inhibited, and these effects increase energy and amino acid availability to the animal. However, many ruminal bacteria are resistant to ionophores even if ionophores are not fed, and this resistance is due to the outside surface of their cells (glycocalyx). Adaptation experiments indicated that ionophore resistance did not confer an increased resistance to other classes of antibiotics, and there is no evidence suggesting that ionophore resistance can be spread from one bacterium to another. Because only some animals can be safely fed ionophores, and ionophores have never been used for human therapy, ionophore resistance is not apt to pose a significant threat to human health.

Key Words: Antibiotics, Ionophores, Resistance