What Does One Health Have to Do with Agricultural Research?

Protecting Human, Animal, and Environmental Health

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Links Between Human and Animal Health

- Foodborne Disease
- Antibiotic Resistance
- Emergency Response
- Emerging Diseases
- Bio-Agro-Terrorism
- Disability
- Environmental Health
- Injuries
- Occupational Health
- Mental Health
E. coli O157 H7 Foodborne Outbreak
Bagged Spinach, California, September 2006

FIGURE 1. Number of confirmed cases (N = 183)* of Escherichia coli serotype O157:H7 infection, by state — United States, September 2006

*Confirmed cases reported as of 1:00 p.m. EDT on September 26, 2006.
Infectious Organisms Pathogenic to Humans and Percent Zoonotic

Intensity and Consolidation of Food Animal Production

- More animal protein needed with increasing human population
- Goal to increase supply of meat at affordable cost but not at cost of risk to health
What Are Relationships Between---

- Animal Production
- Animal Welfare
- Cost/price of food
- Food Safety
Animal Agriculture

- Animal protein to improve human nutrition
- Protect Animal Health
  - Endemic and foreign diseases, animal husbandry, agroterrorism, bioterrorism
- Promote Animal Well Being - Animal Welfare
- Improve food safety (pathogens, residues, antibiotics)
- Make food affordable
- Harmony between animal agriculture and the environment - ensure environmental quality
- Prevent and control emerging zoonotic infectious diseases - bioterrorism
- Occupational and childhood safety
Examples of Agricultural Research Leading to Advances in Public Health

- Role of cowpox in the development of the first human vaccine
- Effects of tuberculosis and brucellosis control in establishing food hygiene regulations
- Environmental management to prevent the scourge of vector-borne zoonoses
Dearth of evidence on relationship between animal production methods and food safety

- Induced moulting - salmonella enteriditis in eggs
- Salmonella spp., E. coli O157 adapted to cattle
- Pathogen control in feedlots (management of manure; disinfecting environmental surfaces)
- Salmonella antibiotic resistance factors
- Salmonella transmission - environmental factors that affect colonization in farm animals
- Commercial bird housing systems
  - Winter - campylobacter higher in non-caged birds, Summer — no difference
Animal Health Research

- Epidemiology of diseases impacting on production, human & animal health, points for prevention and control
- Predict conditions for outbreaks
- Diagnostics for early detection, prevention, control
- Vaccines, effectiveness of biosecurity, animal husbandry
- Development and testing of interventions for disease control – eliminate need for antibiotics
- Mechanism / outcome of antibiotic usage (therapeutic, prophylactic) on antibiotic resistance – molecular level
- Relationship among animal production, health, food safety
- Animal models
- Interventions to prevent occupational and childhood injuries
Who Conducts Agricultural Research?

- Colleges of Agriculture
- Colleges of Veterinary Medicine
- Industry
- Animal specialty groups
- Schools of public health
Poultry Carcass Disposal Options for Routine and Catastrophic Mortality

Avian Influenza Vaccines: Focusing on H5N1 High Pathogenicity Avian Influenza (HPAI) With a Comprehensive Bibliography

Swine Carcass Disposal Options for Routine and Catastrophic Mortality

Safety of Meat, Milk, and Eggs from Animals Fed Crops Derived from Modern Biotechnology (Issue Paper)

Using Risk Analysis to Inform Microbial Food Safety Decisions (Issue Paper)

Environmental Impacts of Livestock on U.S. Grazing Lands (Issue Paper)
Four Pillars of Zoonotic Disease Research

- Regular exchange of information among animal and human health researchers
- Methods for zoonotic disease detection in humans and surveillance in animals
- Examine how animal health determinants link to human health outcomes – guide interventions
- Incorporate new concepts of risk assessment, complexity theory and infectious disease ecology into public health research through facilitating training and research that crosses disciplines
Who Funds Research?

- Federal Government
- State Government
- Private Sector/Industry – livestock and poultry
Current Sources of Government Funding for Research

- Animal Health
  - Livestock/Poultry
  - USDA

- Human Health
  - HHS

- Environment
  - EPA

- Ecosystem
  - NSF

- Global Health
  - USAID

- Animal Health
  - Wildlife
  - DoInterior

- USGS
  - NWHC

- Fish and Wildlife

- CSREES
- ARS
- ERS
- APHIS

- NIH
- CDC
- FDA
Who Conducts One Health Research?

- Academic Health Centers
  - NIH- CTSA – Human Health
  - CDC Collaborative Research Centers
- Cross-disciplinary collaborations
  - Colleges of veterinary medicine, schools of public health, schools of medicine, colleges of agriculture, ecology departments, social sciences departments, federal agencies
- Agricultural research - ????????
One-Health

“One Health is the collaborative effort of multiple disciplines – working locally, nationally, and globally – to attain optimal health for people, animals, and our environment.”
Putting One Health Into Action

- Multidisciplinary practice, programs on the ground
  - Public health, occupational health, rural health
  - Disease surveillance– ArboNET for West Nile Virus

- Educating students, researchers, practitioners from multiple disciplines, policymakers (see policies below)

- Formulating “one health” policies
  - Workforce shortages, resource allocation, educational opportunities, guidance

- Multi-disciplinary integrated research
  - (e.g., NIH Clinical Translational Research Centers, CDC Cooperative Research Centers- HPAI at the Human-Animal Interface)
The Veterinary Oath

“... I solemnly swear to use my scientific knowledge and skills for the benefit of society through the protection of animal health, the relief of animal suffering, the conservation of livestock resources, the promotion of public health and the advancement of medical knowledge.”
Figure 1.2. The multiple links veterinary medicine provides between medical sciences and agricultural sciences not only promote man's health in a variety of specific ways, but establish a firm basis for more general cross-sectoral cooperation between health and food programs in government.
- **Target Audience:** medical, veterinary, agricultural and research communities. Bridging the gap between groups.
- Emerging foodborne pathogens; (FBP)
- Health problems/disease caused by FBPs
- Emergence of drug resistance in FBPs
- Methods and technology for rapid and accurate detection of FBPs
- Strategies to destroy or control FBPs in food production and processing environments
- Development of novel strategies for the prevention and control of plant and animal diseases that impact food safety
The Integrated Health Team
Protecting and Promoting Health

- Physicians
- Physician assistants
- Nurses
- Dentists
- Optometrists
- Veterinarians
- Veterinary technicians
- Other
Rural Communities

- Health care providers scarce to non-existent
- People in close contact with livestock, poultry, companion animals
- Intersection of environmental, human, animal health
Challenges to Achieving One Health

- Workforce Shortages and Different numbers (2-3 M nurses, 800 K physicians, 80 k veterinarians)
- Different cultures, vocabulary, missions
- Understanding of educational pathways
- Respect and appreciation, attitudes, trust
- Inequitable pay, benefits
- Protocols for communication, mechanisms
- Different resources
Challenges to Achieving One Health

- Trust, transparency, conflicts of interest
  - Animal health
  - Animal welfare
  - Public health
Training/Education

- Provide support for post DVM doctoral level training opportunities available (not only MDs!)

- Train health professionals together to aid in their understanding of
  - What each profession brings to the table
  - How to work together
The Pew Commission on Industrial Farm Animal Production, 2008

- Grant from The Pew Charitable Trusts to The Johns Hopkins Bloomberg School of Public Health
- Recommend solutions to problems created by concentrated animal feeding operations in four primary areas:
  - public health
  - the environment
  - animal welfare
  - rural communities.
Intensified Food Animal Production-- Contributes to:

• Increase in antibiotic-resistant bacteria with overuse of antibiotics

• Air quality problems

• Contamination of rivers, streams, and coastal waters with concentrated animal waste

• Animal welfare problems, with extremely close quarters in which animals are housed

• Significant shifts in the social structure and economy of many farming regions throughout the country.
Improve Research in Animal Agriculture

Three Main Areas of Concern:

• The lack of public funding for research into industrial farm animal production issues.

• The increase in research funding by members of the animal agriculture industry.

• The lack of transparency in funding sources in much agricultural research.
Different, Imbalanced Resources

- **Bioterrorism Research Funds 2002**
  - NIH: 1.75 Billion
  - USDA: 150 Million

- **Avian Influenza 2005**
  - “USDA Sec. ...today announced a request for $91 million in additional resources to safeguard the United States against highly transmissible forms of avian influenza. *The request is part of the $7.1 billion National Strategy to Safeguard Against the Danger of Pandemic Influenza outlined by President Bush today*. AgWeb.com 11/1/05
FY-09 Budget for Research Federal Agencies

Millions of Dollars

- CSREES
- ERS
- ARS
- EPA
- NCRR
- NIAID

Series 1
Decline in Funding Animal Research

- State funding decreased
- FARAD – monitoring program to detect residues in food products under attack
- CSREES- 1433 “formula funds” reduced to under $3 million per year
New Approach to Funding for One Health Research?
Summary

- One Health research is essential for promoting and protecting human, animal, and environmental health including food safety and national preparedness and defense.
- A One Health approach including prevention is key for health reform and should be assigned high priority.
- Veterinary medicine is an important member of the one-health research and practice team. A critical workforce shortage exists; other agricultural, social science researchers are critical as well.
- More strategic funding mechanisms, education, research, policies, and guidance all needed to achieve one health goals.
A Strong Future for One Health

- Changing climates and ecosystems, with increasing vector populations
- Encroachment on animal habitat
- Changing human behaviors and lifestyles with animals
- Globalization of the food supply; threat of agro-terrorism
- More and faster global travel
- Civil unrest/war - displaced people and animals
- Microbial adaptation and change (Influenza!)
- >80% of bio-threat agents of concern are zoonotic
- Growing awareness of value and benefit to One Health by different health professions and policy makers