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*Thoughts on BRD
Research Needs in the
Next 10-20 Years*

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Research has led to many important discoveries, such as:

- how a calf becomes a BVDV PI, and how such calves can be identified with IHC;
- vaccines that decrease respiratory disease and abortion due to IBRV and BVDV;
- value of weaning / pre-conditioning;
- how colostrum handling and feeding is related to calf mortality.

Realized Improvements

1. 100 pounds more beef per unit
2. Morbidity/Mortality
1970 – 27%/5%
1990 – 14%/2%
3. Better vaccines
4. Better diagnostics
5. Better handling
6. Better nutrition

Questions!

1. Have we reached the point of diminishing returns?
2. Should our research efforts be re-focused towards other objectives and needs?
3. Are the cattle industries we work with satisfied with the current practices with regard to BRDC?

How much does research cost?

For a small lab:

Technician: \$32,000/year + benefits @ 36% = \$43,520

1 PhD student: \$25,000/year (more if a DVM)

2 MS students: 2 x \$20,000 = \$40,000

Animals, supplies, materials, travel:

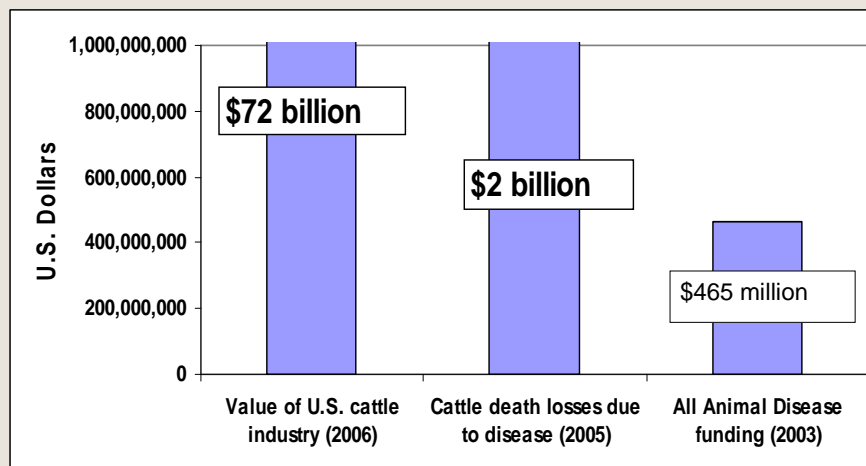
e.g.: Field study of *M. bovis* impact on production (R. Rosenbusch et al):
\$8500/year

e.g.: Laboratory study of immune response to BRSV + *M. bovis*
coinfection (A. Woolums et al): \$25,000/year

If lab is undertaking 2 similar field studies and 2 similar
lab studies: \$67,000/year

Overhead: 20%-100%, depending on institution and source of funds
(average 60%, or \$105,312)

Total: \$280,832 per year



Value of U.S. cattle: U.S. cash receipts for milk, cattle, and calves (NASS, 2006).

Cattle death losses: all nonpredator losses, less losses due to theft, weather, and unknown causes (NASS, 2005).

ALL Animal Disease Funding: From Table 4-2 of NRC Report "Critical Needs For Research in Veterinary Science", 2005.

How much does not doing research cost?

- Causes of new diseases will not be determined
 - New diseases always develop
- Improved ways to treat and prevent existing diseases will not be developed
- Producers will continue to lose money due to cattle sickness and death
- Beef quality and supply will decrease, cost will increase
- **DECREASED CONSUMER CONFIDENCE**
- **LOOSE NEXT GENERATION OF RESEARCH SCIENTISTS AND CLINICIANS**

Research areas funded by USDA's competitive grants program (NRI)

In 2007:
\$164 million awarded

Animal Protection and Biosecurity:
\$15 million awarded in 2007

Plant Biosecurity
Managed Ecosystems
Soil Processes
Water and Watersheds
Global and Climate Change
Air Quality
Bioactive Food Components for Optimal Health
Human Nutrition and Obesity
Food Safety and Epidemiology
Animal Reproduction
Animal Growth and Nutrient Utilization
Animal Genome
Animal Protection and Biosecurity
Microbial Genomics
Arthropod and Nematode Biology and Management
Microbial Biology
Biology of Weedy and Invasive Species in Agroecosystems
Plant Genome
Plant Biology
Agribusiness Markets and Trade
Rural Development
Agricultural Prosperity for Small and Medium-Sized Farms
Improving Food Quality and Value
Biobased Products and Bioenergy Production Research
Nanoscale Science and Engineering for Agriculture and Food Systems

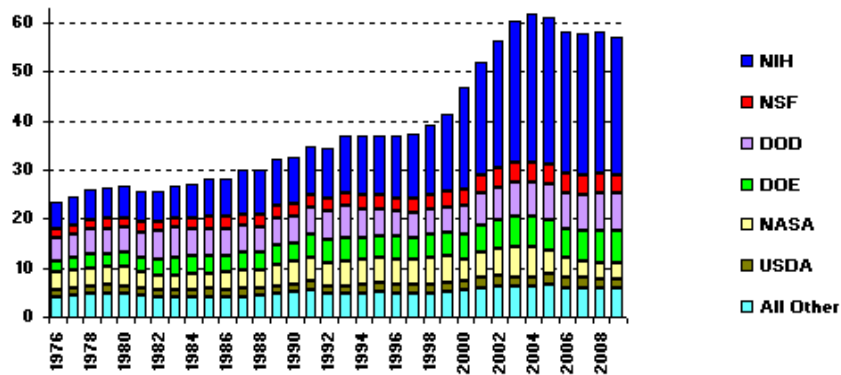
Breakdown of all 2005 CSREES funding by category for Animal Protection (animal disease specifically)

Provided by Peter Johnson, CSREES NRI

Total available for animal disease research in 2005: about \$40 million

Funding Source	Fiscal Year (\$ in thousands)
	2005
HATCH (Formula- Ag. Expt. Stations)	8,626
Mc-Stennis (Formula - Schools of Forestry)	136
Evans Allen (Formula- 1890 institutions)	690
1433 Animal Health (Formula)	3,679
Special Grants (Congressional line item appropriations)	4,252
NRI Grants (Competitive)	15,299
SBIR Grants (Competitive)	2,217
Other CSREES (Cooperative agreements, etc.)	4,755
Total CSREES	39,654

Trends in Research by Agency, FY 1976-2009 (as of 9/08) *
in billions of constant FY 2008 dollars



Source: AAAS analyses of R&D in annual AAAS R&D reports.

* FY 2009 figures are AAAS estimates of R&D in the FY 2009 omnibus / continuing resolution. Research includes basic research and applied research. 1976-1994 figures are NSF data on obligations in the Federal Funds survey. SEPT. '08 REVISED © 2008 AAAS

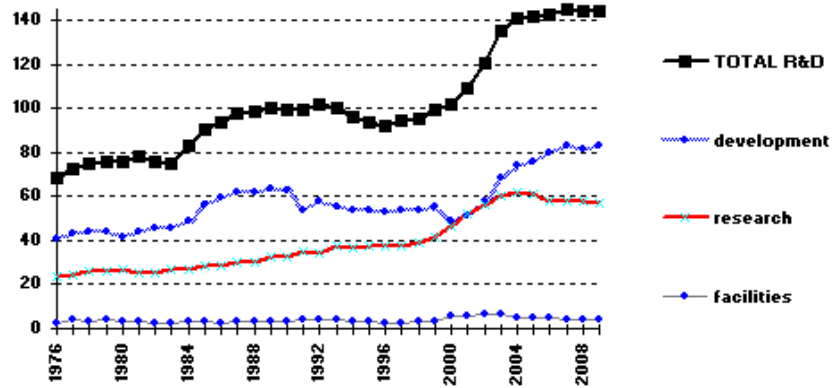


- In order to use limited sources most effectively, USDA NRI only funds research on a few diseases:

Ruminants: Bovine viral diarrhea, Bovine and ovine respiratory disease complex, infectious causes of dairy cattle mastitis, and Johne's Disease

- Research is also funded by the animal health industry
 - Supports USDA or FDA approval of products to be marketed
 - Data for marketing
 - Basic R&D
 - Very small to nonexistent for some companies
- Very important component of animal health funding, but
 - By nature, is not independent
 - Only certain topics relevant
 - Vaccines, antimicrobials, antiparasitics, etc.

Trends in Federal R&D, FY 1976-2009 (as of 9/08) *
in billions of constant FY 2008 dollars



Source: AAAS analyses of R&D in annual AAAS R&D reports. * FY 2009 figures are AAAS estimates of R&D in the FY 2009 omnibus / continuing resolution. R&D includes conduct of R&D and R&D facilities. Data to 1984 are obligations from the NSF Federal Funds survey. GDP figures are from OMB, Budget of the U.S. Government FY 2009. SEPT. '08 REVISED © 2008 AAAS



What is needed for BRD Research?

- Coordination of integrative teams through an overarching agency (USDA) to provide peer review and priority review of public research funds. This would include use of development grants (as seed funding) available to public/private partnerships.
- Strengthen testing and validation of new procedures in production settings (providing more than cost analyses).
- Re-establish old links between clinicians, diagnosticians and basic research.
- Strengthen programs to support both basic and applied research through graduate fellowships, residencies and start-up funding.

What can be done ?

- Encourage animal health industry to provide some support for independent research?
 - Annual contributions by animal health companies to an independently administered foundation?
 - Could fund grant proposals on a competitive basis
 - Program like this for PCV and PRRSV research
 - Funded largely by Boehringer Ingelheim
 - Summer Scholars – Merial Ltd.

Possible Funding Structures

MATCHING \$\$ - Integrated Teams

- USDA – CREES/ARS
- State – Universities and Departments of Agriculture
- Pharma/Bio Industry
- Producer Groups
- Consumer Groups
- Foundations / Private Donors

Integrated Research Objectives

- Trait selection for enhanced resistance to BRD and perhaps other acute inflammatory diseases
- Innovative immunization strategies that provide rapid and effective onset of immunity
- Handling practices to minimize stress of cattle
- Early and rapid diagnostic methodologies to anticipate clinical “breaks” and enhance early and more effective use of therapeutics and management strategies
- Antimicrobial therapy that aims for a reduction in microbial resistance in addition to a reduction in clinical disease
- Therapeutic management that includes reduction of microbes and inflammation and also enhances healing (reducing pain and stress and improving well-being)
- Continued recognition that health and welfare are components of quality systems

Table 1. Continued investigations to understand the pathogenesis of BRD

- Pathogenesis of major infectious agents associated with BRD
- Improved vaccines – marginal efficacy, incremental gain?
- The genetic basis of disease resistance
- Role of inflammation in pathogenesis – relationship to severity of disease
- Vaccine formulation and presentation strategies
- Recognized link to historical research, basis of productivity
- Basis for training the next generation

Knowledge Gaps
Biological Functions

Biological function of host genes

Mechanisms of defense, proteins involved, interplay between processes

Biological function of pathogen virulence genes

Mechanisms of virulence, proteins involved

Lewis Thomas

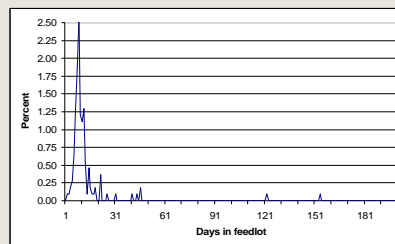
“the microorganisms that seem to have it in for us . . . turn out . . . to be rather more like bystanders. . . . It is our response to their presence that makes the disease. Our arsenals for fighting off bacteria are so powerful . . . that we are more in danger from them than the invaders.”

Germes NEJM 1972;287:553-5

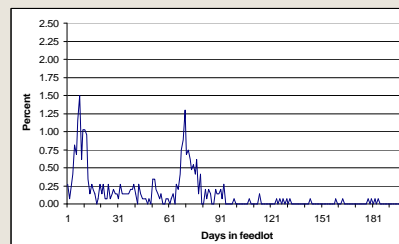
Table 2. Enhanced Clinical Management of BRD

- Use of epidemiological concepts to manage BRD – relationship to pathogenesis, therapeutics and disease management
- Stress management – handling, feeding, environmental pressure, transport
- Antimicrobial therapy – realizing clinical cures as well as minimizing selection of resistant organisms
- Metaphylactic use of antibiotics (vaccines?)
- Vaccination strategies and approach (timing of immunizations)
- Early diagnostic tools and strategies
- Pre-arrival management
- Improving laboratory to production system technical transfer

Epidemiology Patterns and Causes are not clearly defined



1990 13%



1987 27%

Table 3. Innate BRD Resistance

- SNIPS that relate to enhanced resistance to BRD pathogens – or perhaps enhanced clearance or healing?
- Interplay of nutrition and disease management

Take this to the bank:

“... if you do not meet the societal demands regarding animal treatment and ethics – they will be legislated and forced upon us!”

Dr. Bernie Rollin, BRD Symposium, 05
AUG 2009

Critical Actions

- Continue to build strong partnerships with advocacy groups to:
 1. Generate a sustained, positive campaign regarding the values of the food animal industry.
 2. Capture the value (\$\$\$) of doing it well
 3. Assure the public that milk and beef can be produced humanely and safely.

[It costs a little more but we are worth the investment!]

What can we do?

- Talk to your state and federal governmental representatives
 - Ask for meaningful, sustained support for animal disease research
 - Including diseases without zoonotic or bioterror implications
 - Work with other veterinary associations
 - AVC
 - AVMA
 - American Association of Veterinary Medical Colleges (AAVMC)

Conclusions:

- **Consumer confidence requires safe and affordable beef**
- **Safe and affordable beef supply requires healthy cattle**
- **Maintaining cattle health requires advancements in science**
- **Visionary efforts will ensure science advances to preserve cattle health**
- **Attention to the societal ethic will allow us to capture a greater portion of the value of wholesome and safe products**

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