

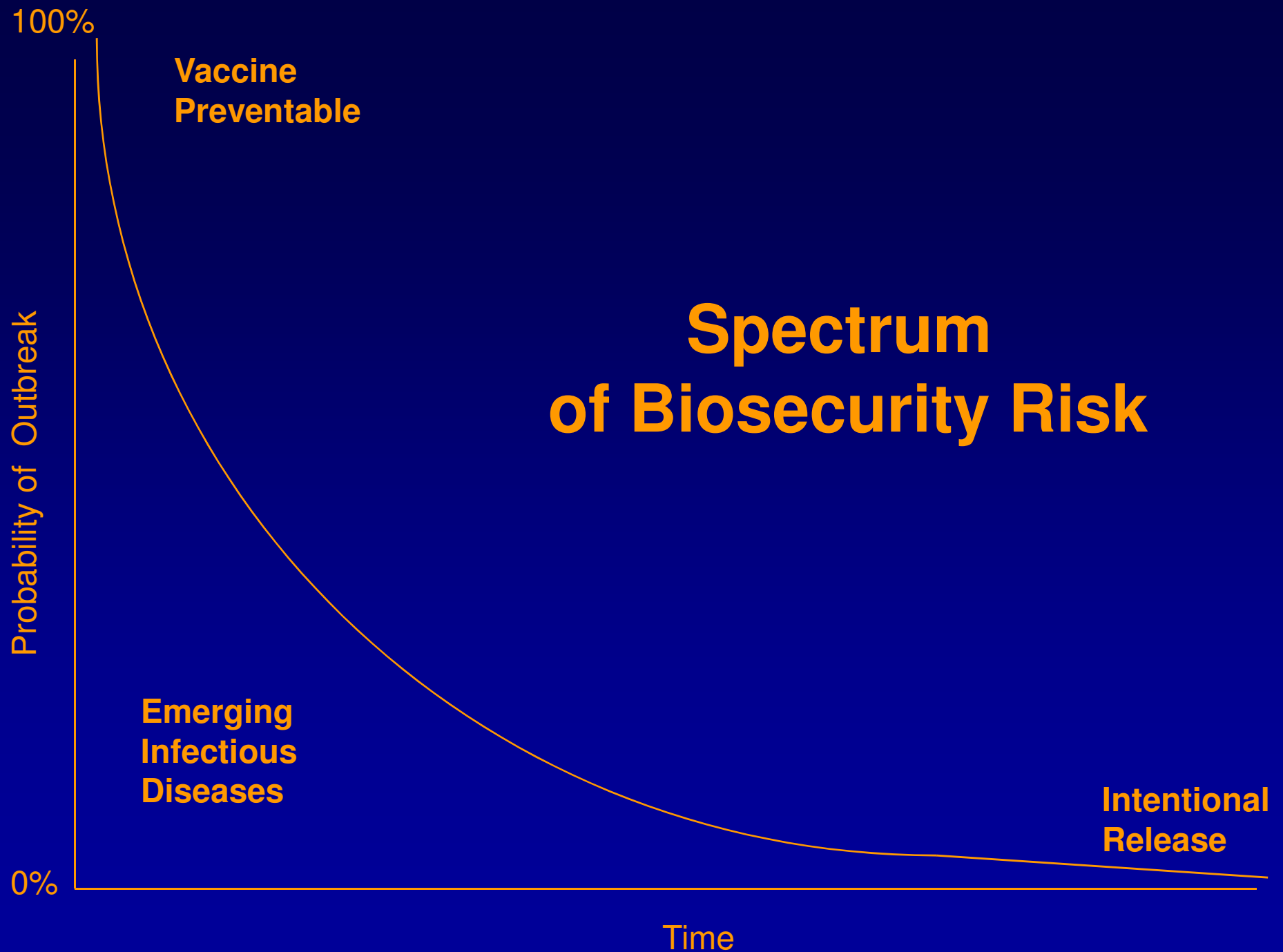
A One Health Discipline:
the case for integrating science,
medicine & public health

Gary L. Simpson, M.D., Ph.D., M.P.H.

Challenges

- Pressing need for enhanced, global, integrated, species-neutral, infectious disease surveillance for outbreak detection, diagnosis and response.
- Notable lack of pathogen genomics infrastructure, including forensic molecular epidemiology resources.
- Slow response to the reality that the vast majority of emerging infectious diseases are of zoonotic origins.
- Investments in preparedness, frequently, have been without routine intrinsic, medical and public health value.
- Major traditional and structural barriers that limit the potential for integrating science, medicine and public health.

Spectrum of Biosecurity Risk



Major Factors Contributing to Emerging Infections: 1992

1. Human demographics and behavior
2. Technology and Industry
3. Economic development and land use
4. International travel and commerce
5. Microbial adaptation and change
6. Breakdown of public health measures

Institute of Medicine Report, 1992

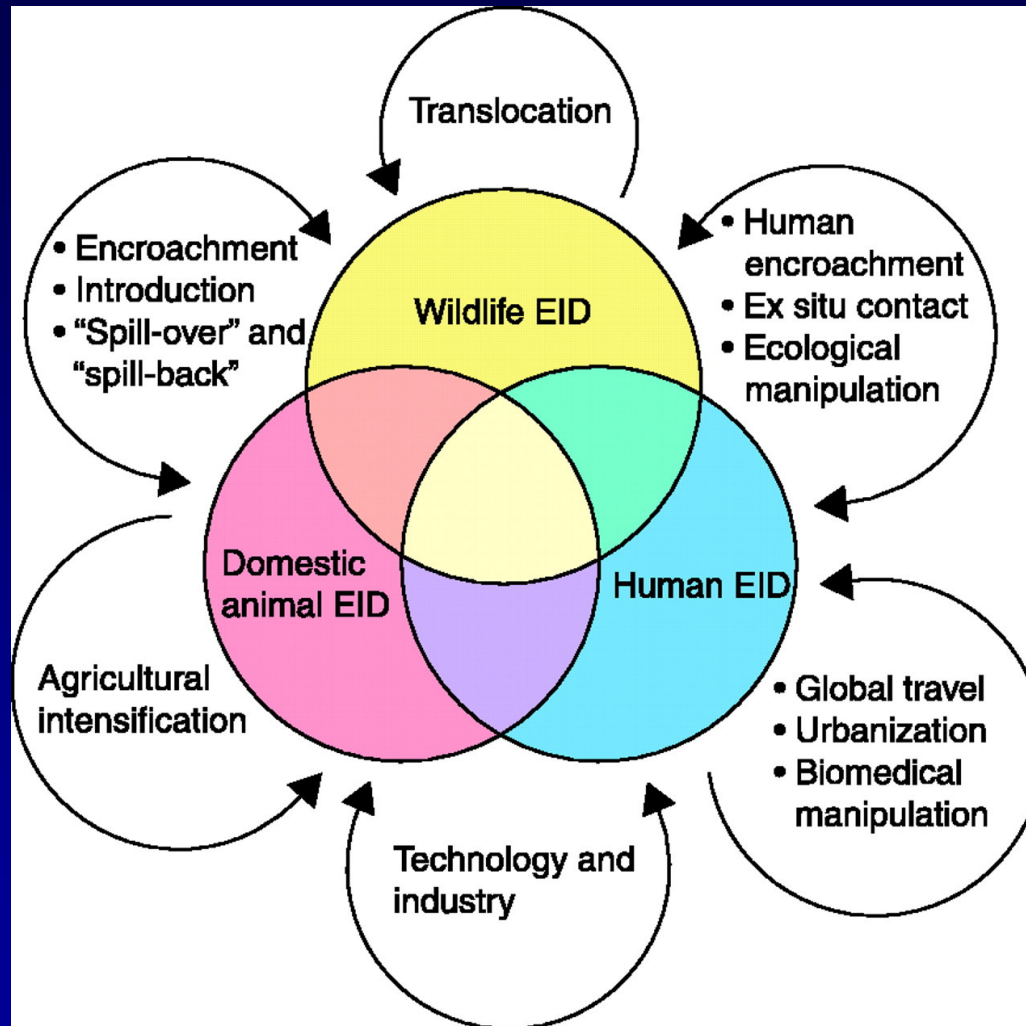
More Factors Contributing to Emerging Infections: 2003

7. Human vulnerability
8. Climate and weather
9. Changing ecosystems
10. Poverty and social inequality
11. War and famine
12. Lack of political will
13. Intent to harm

Institute of Medicine Report, 2003

Zoonotic Infectious Diseases

- Zoonosis-“Disease or infections which are naturally transmitted between vertebrate animals and humans.” (W.H.O.)
- 60% of the est. 1,451 known infectious diseases of humans can infect both humans and animals.
- 75% of all emerging infectious diseases of the past two decades are zoonotic.



P. Daszak et al., *Science* 287, 443 -449 (2000)

Hantavirus Pulmonary Syndrome

GREETINGS FROM

NEW MEXICO

ZIA SUN

SYMBOL



THE SUNSHINE STATE

LAND OF ENCHANTMENT

NEW MEXICO



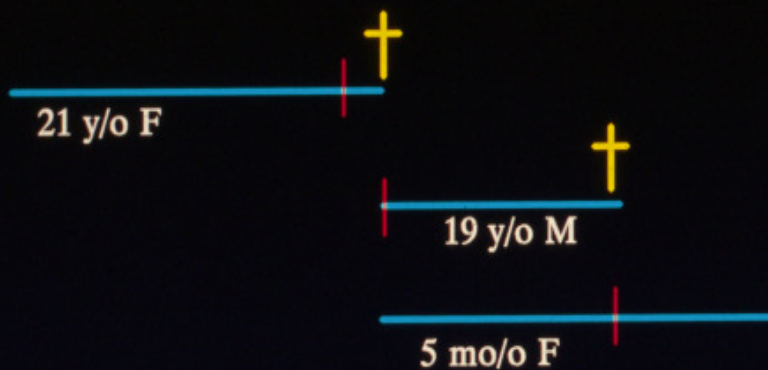
Land of the Flea

Home of the Plague

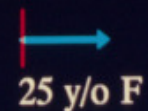
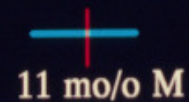
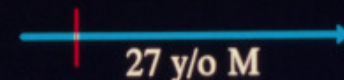
Index Cluster

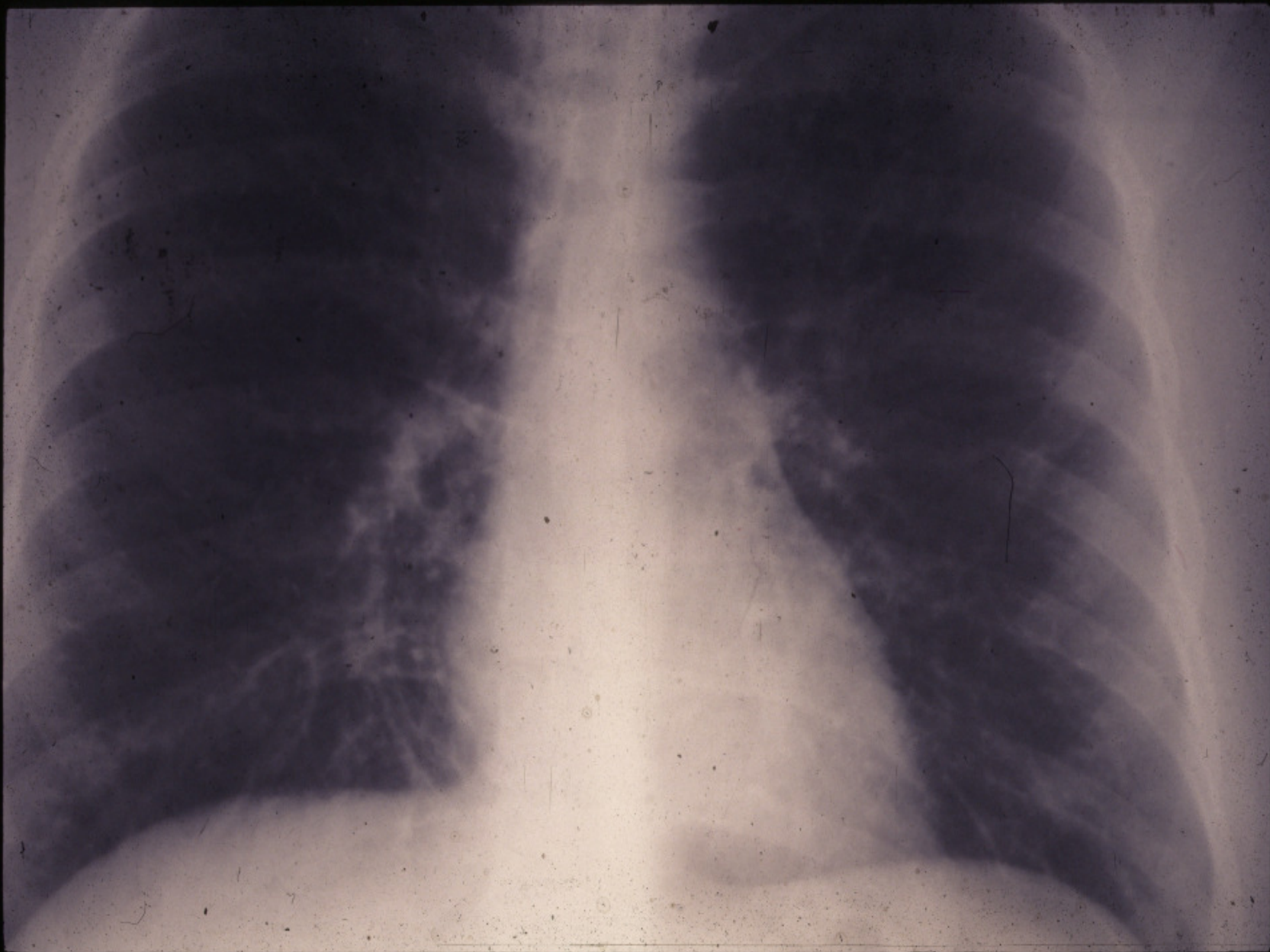
May

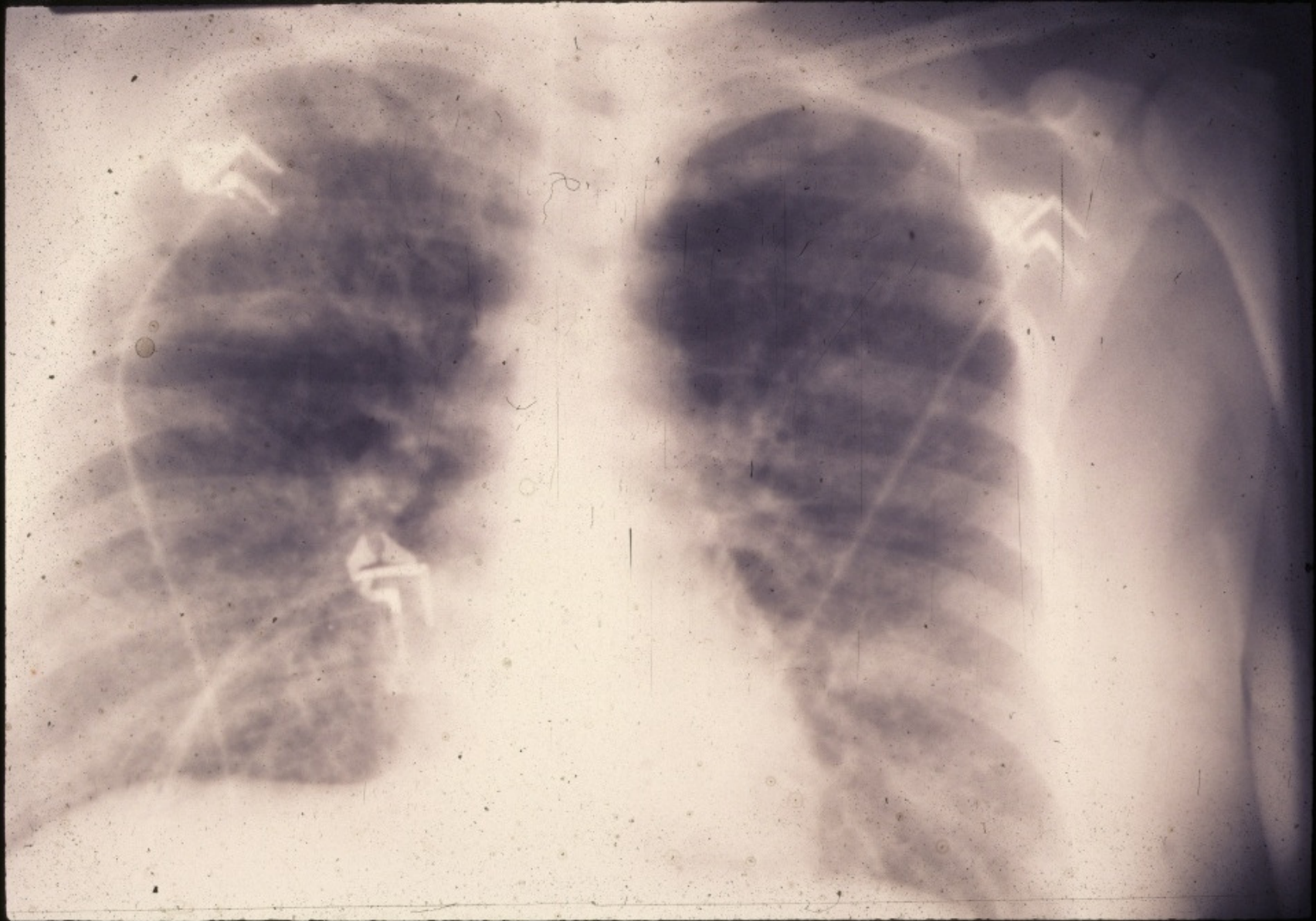
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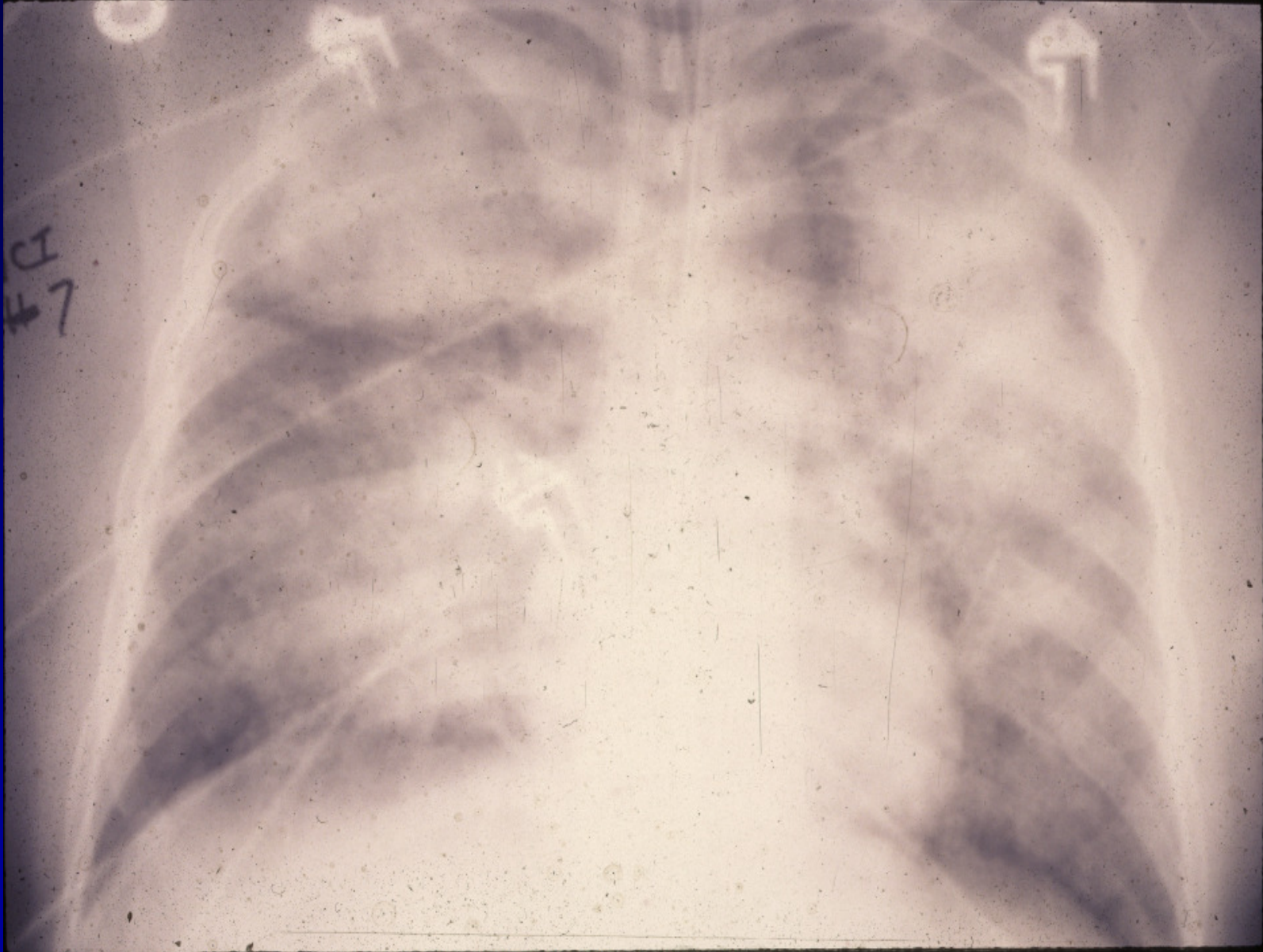


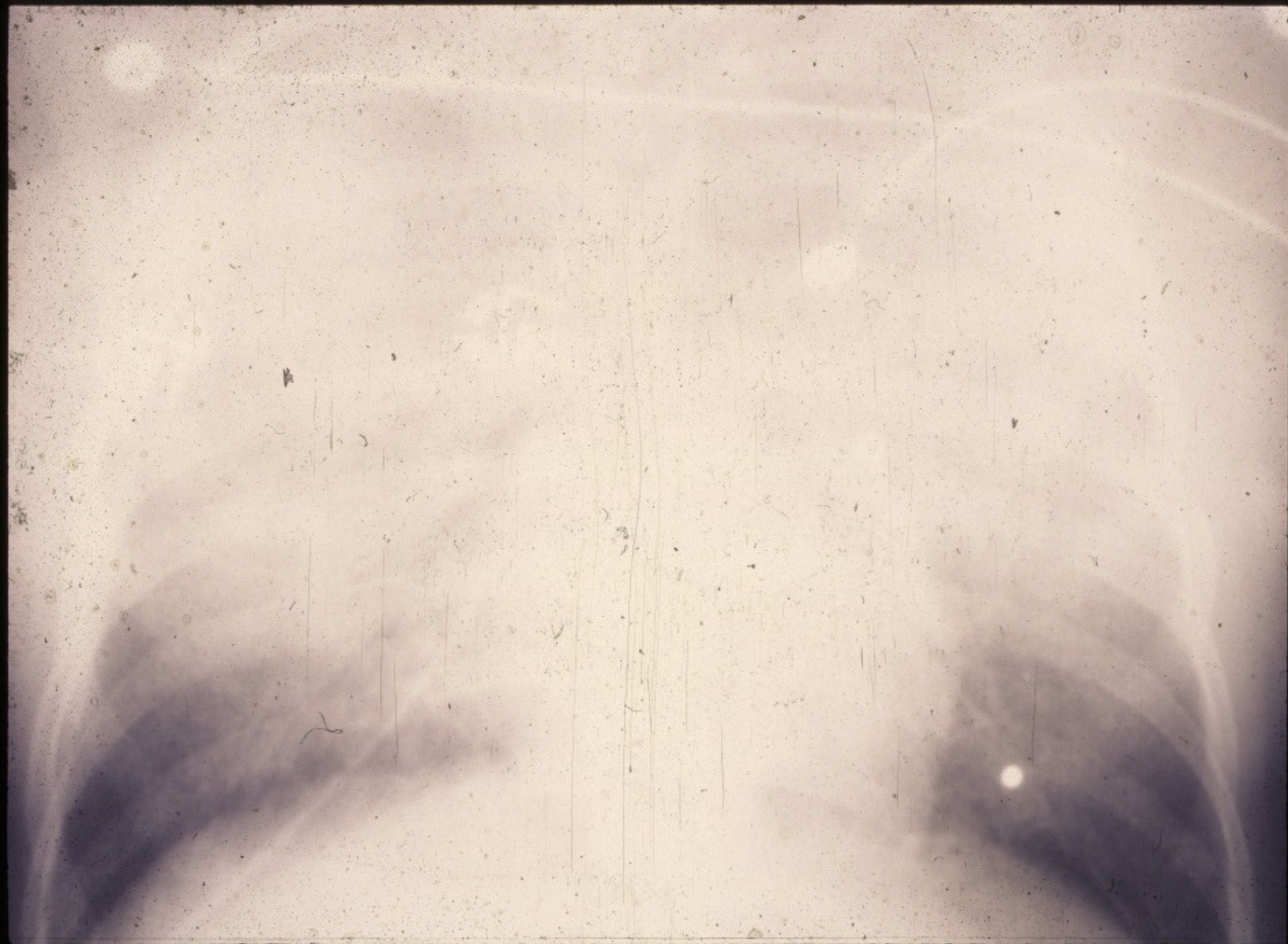
| = Admission
+ = Death



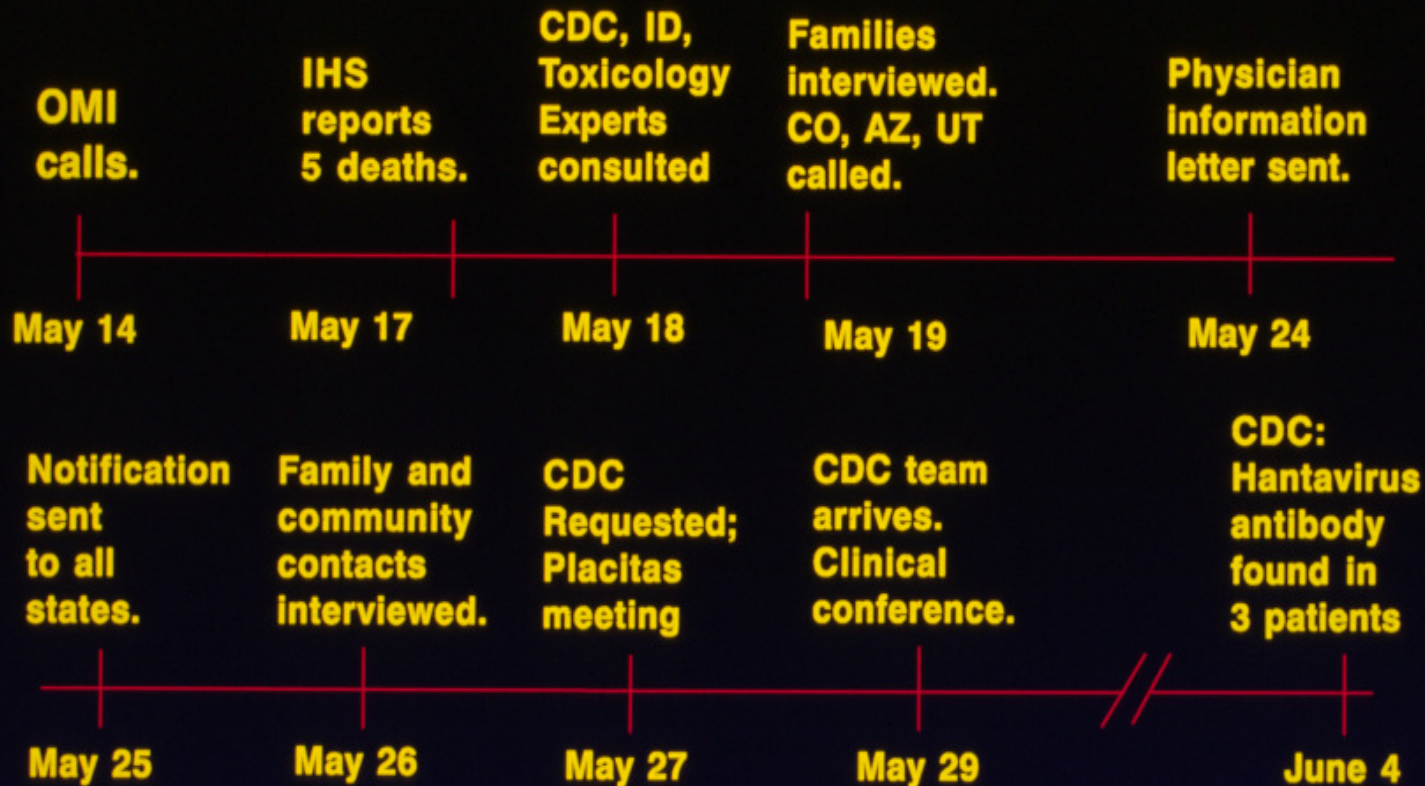








Timeline - Unexplained deaths, 1993



Disease Conditions in the Differential Diagnosis

Bacterial	Viral	Environmental
Plague	Influenza	Paraquat
Tularemia	Adenovirus	Phosphene
Anthrax	Parvovirus	Phosgene
Legionella	Coxsackie	DNP
Leptospirosis	RSV	Metal fume fever
Chlamydia	Hemmorhagic Fevers	Toxic Oil Synd.
Mycoplasma		Polymer fume fever
Brucella		
Ehrlichiosis	Fungal	New Agent
Q fever		
Rickettsia		



Molecular Epidemiologic Linkages PCR analysis demonstrated:

- **Infecting agent was a hantavirus.**
- **Infecting agent was newly recognized.**
- **RNA sequences from tissues from different patients were homologous.**
- **RNA sequences from deer mouse tissues were homologous to those found in patients.**

Case Rodent Location

1 A		Snowflake	AZ*
2	1(A)	Hesperus	CO
3	2	Grand Junction	CO
4 B		Cortez	CO
5 C		Grand Junction	CO
6	3	Grand Junction	CO
7 D		Sedan	NM
8 E		Farmington	NM
9	4(H)	Pinehill	NM
10	5	Springerville	AZ
11	6	Springerville	AZ
12 F		Alpine Ranchero	AZ
13	7	Black Mesa	AZ
14 G		Pinehill	NM
15	8(G)	Pinehill	NM
16	9(G)	Pinehill	NM
17	10(G)	Pinehill	NM
18 H		Pinehill	NM
19	11(H)	Pinehill	NM
20	12(H)	Pinehill	NM
21	13(G)	Pinehill	NM
22 I		Black Mesa	AZ
23 J		Casamero Lake	NM
24	14	Black Mesa	AZ

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           g           c   c   a
           g           c   c
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3 1 2 3 3 4 5 6 6 7 9 9 1 1 1 1 1
9 7 0 3 9 5 7 0 6 2 0 6 0 0 1 2 3 3
                    5 8 1 9 2 8

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**“I hope we never lose sight of one fact,
that this was all started by a mouse.”**

Walt Disney









New World Hantaviruses





NEW MEXICO

Albuquerque Journal

Page 1, Section D

New Mexico State Reschedules Navajo Programs

By E...

DESERT MYSTERY

Concert postponed

GALLUP — A mysterious illness in the Southwest has caused another Navajo country concert postponement. Sawyer Brown and (the) were slated to...

...postponing the programs for high school-bound Navajo students. Health officials... merit" in the decision New Mexico Athletic UNM Lobo Club to promotional Lobo G Farmington next week. The universities ca last week in the m state-federal invest...

tion of the illness, which has been silent for 10 days

Doctors Almost Cancel Convention

'Damage Control' Quashes Illness Rumors

The Shock '93 convention, which concerns the effects of trauma-caused shock, began Monday. It brought in about 600 medical doctors and Ph.D.s from around the world and their families. The Shock '93 convention, which concerns the effects of trauma-caused shock, began Monday. It brought in about 600 medical doctors and Ph.D.s from around the world and their families.

around the Four Corners area. The federal Centers for Disease Control and Prevention in Atlanta said that as of Tuesday, it was investigating 30 possible mystery illness cases, including the 16 deaths.

Reichard said his medical organization has been holding conventions around the Four Corners area. The federal Centers for Disease Control and Prevention in Atlanta said that as of Tuesday, it was investigating 30 possible mystery illness cases, including the 16 deaths.

izers have flow said. us," said manager en able to

CDC: 'Not Navajo disease'

By Peggy Williams

6-17-93

The mystery illness that has infected approximately 30 persons in New Mexico, Arizona, Utah and Colorado and claimed the lives of 16, is not a Navajo disease, Bob Howard told the Independent yesterday afternoon. Howard is the nation's...

"It's clear that this is a hantavirus, but we're probably dealing with a new variant," Howard explained. (See related story this page.) Hantaviruses are found in certain rodents and their droppings.

care. Right now, we're treating this with medication...

Page 12—The Independent—Gallup NM—Thursday, June 3, 1993

School visit canceled over fears of mystery illness

Mary Ann Hunter, superintendent of the Chinle Unified School District, said the decision to cancel the visit was made after a meeting...

Navajo children visited another Southern California landmark — the La Brea Tar Pits. The Heschel school paid for both the students' fee and their lunch.

recommendation to avoid people from Arizona and New Mexico," Mascola said. Mascola said that considering how little information Levine and Hunter had about the disease, she understands why they probably made a...

Navajos call for investigation of discrimination

By Merley Shebala

WINDOW ROCK, Ariz. — The Navajo Nation has officially called for an investigation of reports of discrimination against Navajos.

The tribal council voted 61-7 on Wednesday for the investigation, which they are asking to be conducted by the attorney general for the tribe and states of New Mexico, Colorado, Utah and Arizona.

national media reporting that can be identified as inaccurate or where the Navajo people have been inappropriately disparaged or slandered, the entity responsible for said inaccurate reporting be asked to make appropriate corrections or apologies.

The council asked that if the inaccurate reporting was done "with malicious intent, that the attorney general assess the appropriateness of seeking some type of redress."

Jackson, led the push for a special council session on the UARDS and sponsored all the legislation for the session.

Navajo Nation Justice Department attorney Tom Christy informed the council that to prove damages against the media, in a case dealing with public figures and public information, "maliciousness" must be shown to be involved.

Christy said, "That may be very difficult to prove, however it may be...

clarifications from the media would make it clear to the rest of the United States the UARDS is not a Navajo disease, "so people won't discriminate against us."

But not all the tribal lawmakers felt discrimination had occurred.

Chinle Council Delegate Leo R. Begay said the Chinle Unified School Board, which he also sits on, felt there was no discrimination against Navajo children who were not allowed to visit with children in California...

member of, heard there was discrimination against Navajo students, but that only involved the postponement of some summer programs by some state educational institutions.

He predicted the attorney generals wouldn't find "too much evidence of racism."

Begay said the reports of discrimination, like the inaccurate dubbing of the UARDS, was the fault of the media.

The news media, like the Independent's "Truth Well Told" banner...

after the council session, said the Chinle school board had not met with the children involved in the California incident or their parents.

"If it was a big issue, they (parents) would have come to the school board," he said.

He said the California school, Heschel Day School, a Jewish school, is raising funds so "the kids can take the trip again."

Another piece of legislation sponsored by the council 67-0 was a...

7-10-93

**Secret
CIA files
reveal ...**

GERM WARFARE TEST ACCIDENT KILLED NAVAJO INDIANS

■ THE MYSTERY disease ravaging Indians in the Southwest was triggered by a vicious germ warfare virus captured from Iraq during the Gulf War — and unleashed by the CIA!

An EXAMINER probe has exposed shocking evidence that the Central Intelligence Agency secretly spread the virus through Indian reservations to test its potency and set the stage for the development of a vaccine against it.

In a world-exclusive interview, a CIA source reveals: "The never-divulged



EDITORIAL

By Charles L. Ortleb

**Dr. Gary Simpson: Successful
Medical Sleuth, or
Incompetent Pompous Ass?**

Enhanced Surveillance

Surveillance

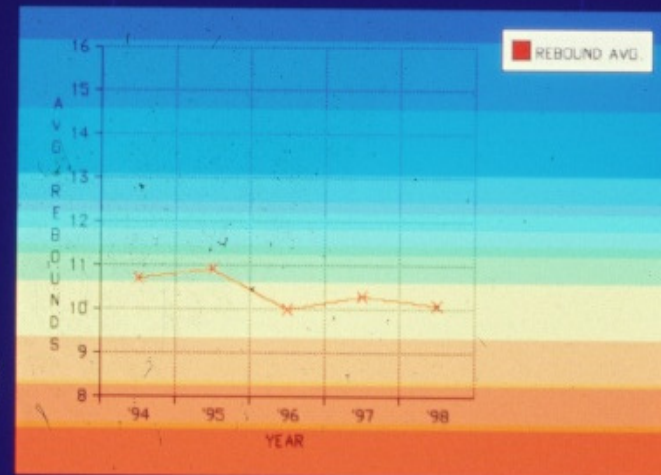
...the ongoing, systematic collection, analysis, interpretation, and dissemination of data regarding a health-related event for use in public health action to reduce morbidity and mortality and to improve health.

MMWR 50(RR-13), July 27, 2001



Surveillance

- Passive suspect case report system
- Enhanced passive reporting
- Active case finding
- Laboratory reports
- Data mining
- Syndromic surveillance



Sentinel Surveillance

Monitoring of key health events through sentinel:

- Sites
- Events
- Providers
- Vectors & animals



New Mexico

Office of the Medical Investigator

- Comprehensive autopsy report & computerized database
- Retrospective analyses/prospective coding for epidemiology & research
- Organization: statewide population-based surveillance
- UNM tie: consultation/collaboration, enhanced diagnostic accuracy, research



New Mexico

Office of the Medical Investigator

- Investigates 4800 of 12400 deaths/year
- 1850 autopsies/year (>95% of NM autopsies)
- Sentinel groups*:
 - Children less than 2 years (7%)
 - Alcoholics (>7%)
 - IVDA'S (>5%)
 - AIDS patients (1.3%)



*Nolte KB, et al. Arch Pathol Lab Med 120:125-128, 1996.

Medical Examiner

Infectious Disease Deaths

- Infections 25% of natural disease autopsies*
- Pneumonia, meningitis, upper airway, encephalitis, myocarditis, necrotizing fasciitis, endocarditis, pyelonephritis, AIDS, sepsis

*Nolte KB, et. al., Arch Pathol Lab Med 1996;1120:125-128



Infectious Disease Death Review Team

- Monthly examine autopsies w/ demonstrated or suspected infections
- Members: ID, forensic & clinical pathology, microbiology, epidemiology, public health
- Identify notable pathogens, unusual clinical or pathologic syndromes, epidemiologic settings
- Monitor sentinel populations



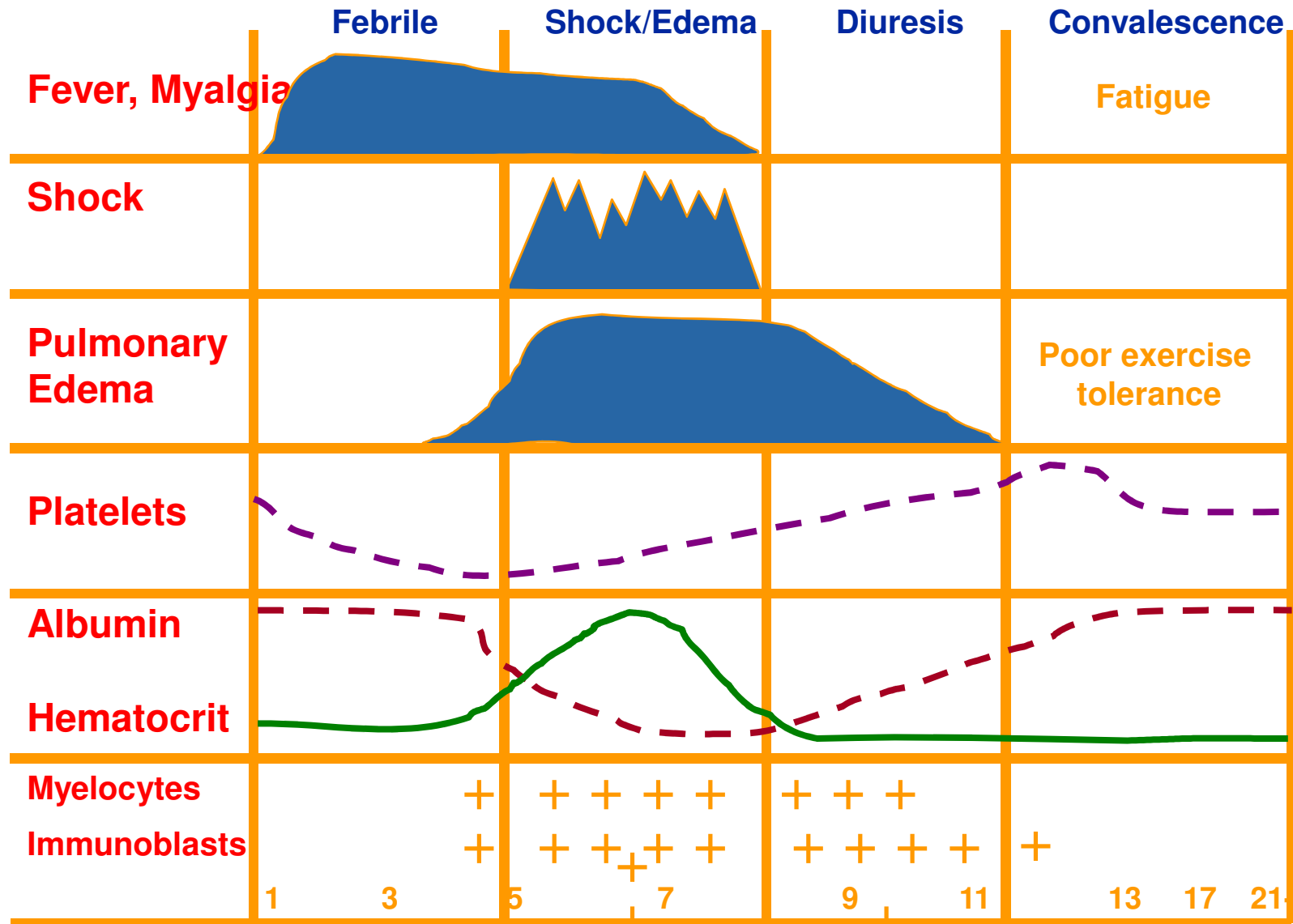
“Severe Fever and Thrombocytopenia Syndrome”



The most valuable surveillance tool will always be the astute clinician.



Hantavirus Cardio-Pulmonary Syndrome (Sin Nombre Virus)



Acute Undifferentiated Febrile Illness

(“Flu-like” illness or nonspecific viral syndrome)

- **Characterized by sudden onset of fever and headache,
and**
- **Associated with generalized constitutional symptoms of:**
 - **myalgia**
 - **malaise**
 - **weakness**
 - **lethargy**
 - **anorexia**

I TOLD YOU I WAS SICK

B. P. ROBERTS

MAY 17, 1929

JUNE 18, 1979

Differential diagnosis of fever and thrombocytopenia in the Southwest

- Hantavirus pulmonary syndrome
- Bacterial sepsis
- Borreliosis (relapsing fever)
- Strep./Staph. toxic shock syndromes
- Plague
- Tularemia
- Spotted fever-like illness
- Parvovirus B19
- Primary HIV infection
- Acute bacterial endocarditis
- Colorado tick fever
- Acute/chronic alcoholism
- Drug reaction
- ITP
- TTP/HUS
- DIC
- Pancreatitis
- Rheumatic fever
- Lupus
- Hematologic malignancy

**Diagnoses of 180 cases of Undifferentiated Febrile Illness
& thrombocytopenia over a 6 year period:
Diagnosis made 1 day to 3 weeks after referral.**

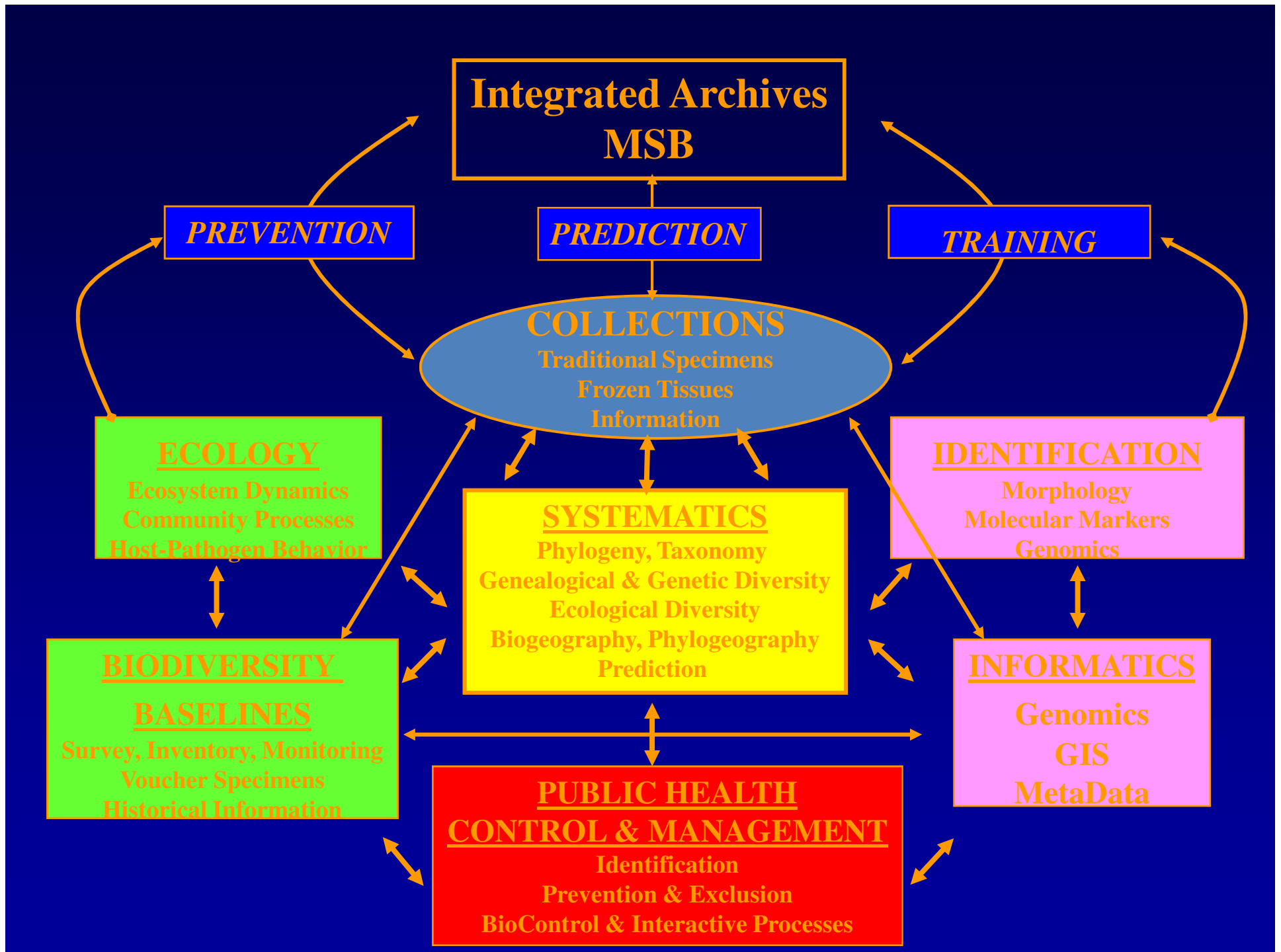
- Hantavirus pulmonary syndrome (17)
- Bacterial sepsis (10)
- Plague (3)
- Tularemia (2)
- Borreliosis (5)
- Parvovirus B19 (5)
- Typhus-like fever (RMSF serol.) (5)
- Acute HIV-1 infection (3)
- Q fever (2)
- Acute rheumatic fever (2)
- Colorado tick fever (1)
- Bartonella species (5)
- Novel arenavirus(5)
- Undiagnosed = cryptic UFI (115)

Public Health Applications of Genomics

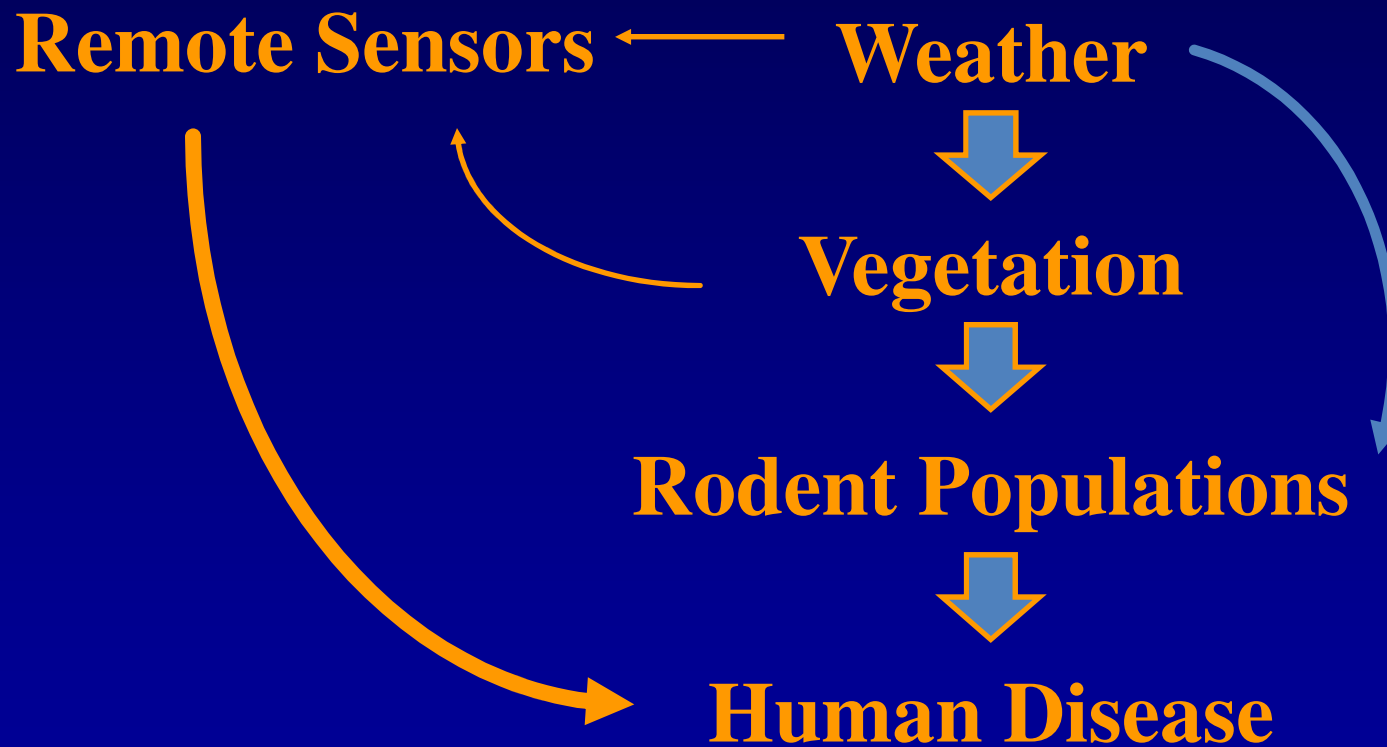
Microbial genomics will become routine

- Pathogen toolkit and pathogenesis
- Origin
- Fingerprinting and tracking spread
- Molecular diagnosis
- Rationally designed vaccines and drugs
- Targeted public health interventions

Specimen Archiving
and
Infectious Disease Modeling

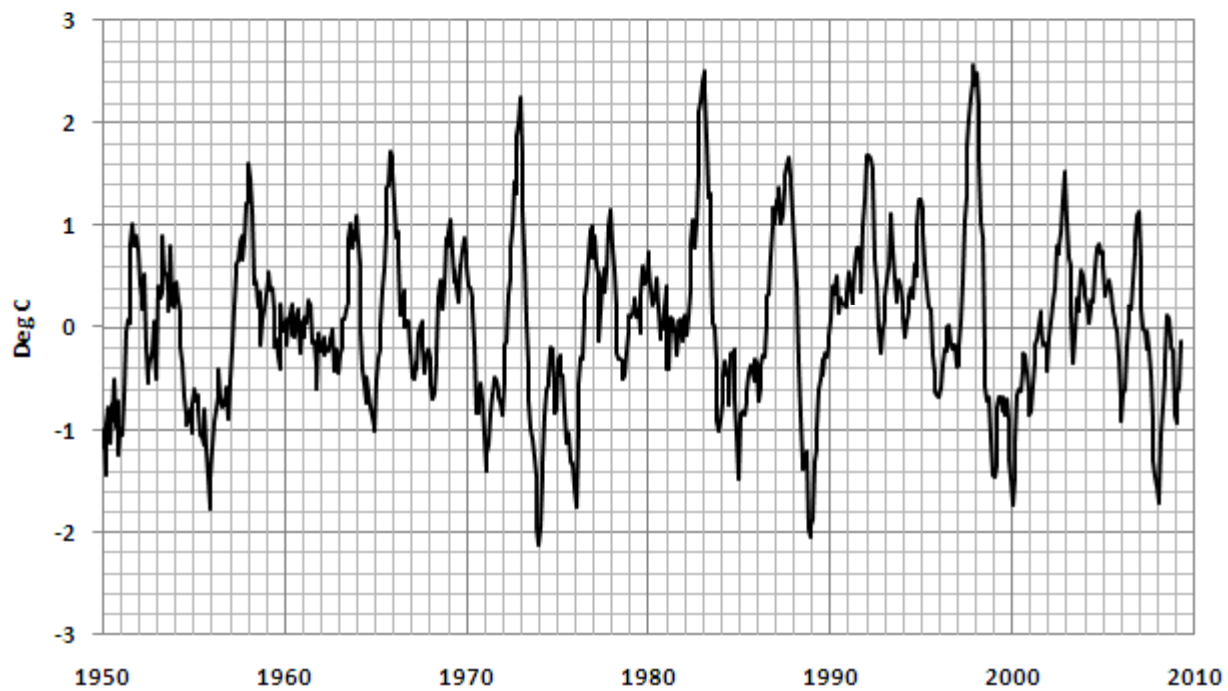


Reservoir studies → **Predictive model**

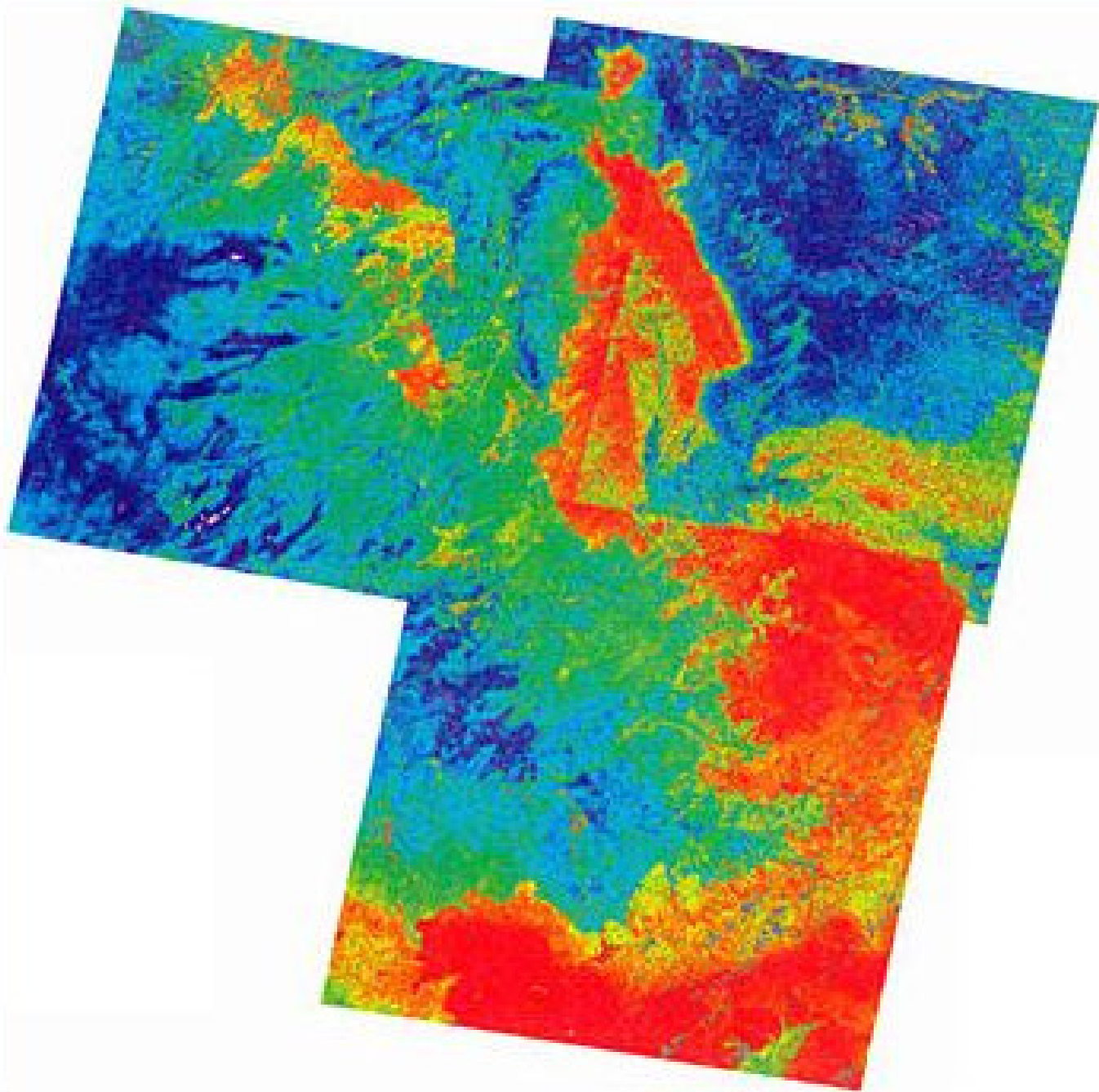


Surveillance and Prediction of Microparasites

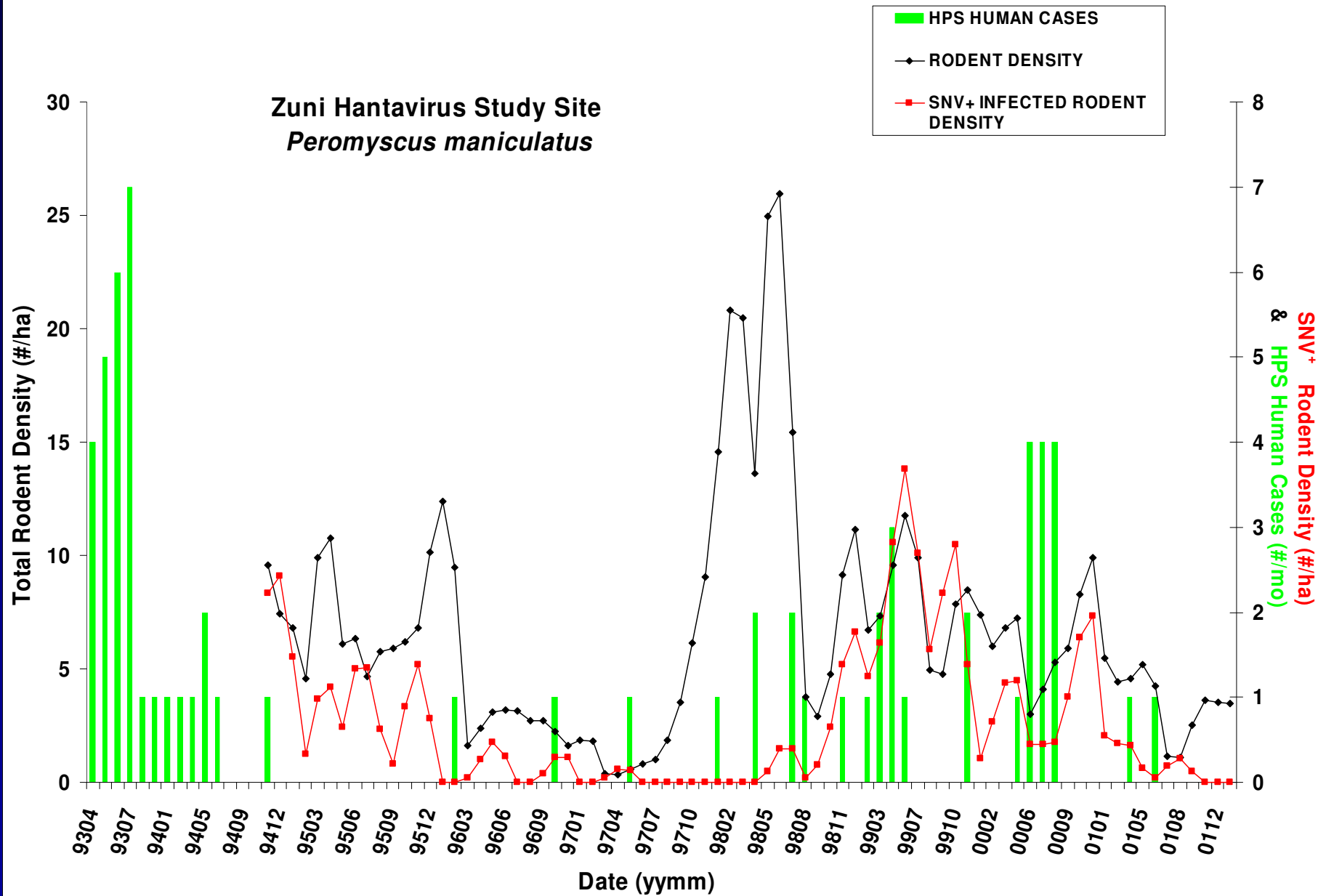
NINO3.4 SST Anomalies
Jan 1950 to Apr 2009







Zuni Hantavirus Study Site
Peromyscus maniculatus



One World, One Health, One Medicine

“To win the diseases battles of the 21st Century while ensuring the biological integrity of the Earth for future generations require interdisciplinary and cross-sectional approaches to disease prevention, surveillance, monitoring, control and mitigation, as well as to environmental conservation more broadly”

Key Points

- **The current global milieu (population size, density, mobility, location, vulnerability) favors the emergence of infectious disease.**
- **Wildlife, domestic animals and humans are dynamic, and their environments are complex and global.**
- **The implications of emerging infectious diseases are unprecedented and unpredictable.**
- **Our (the world's) response must be coordinated, integrated, interdisciplinary, multiorganizational, which in turn, requires pre-existing collaborative, productive, trusting relationships.**
- **If you live, work or play on the planet, you have a stake in this issue.**

Curricular Implications

- Worldview

- Skill sets

 - leadership

 - team dynamics & facilitation

 - systems thinking

 - change/advocacy

 - creativity and innovation

Curricular Implications (cont'd)

- Self-awareness

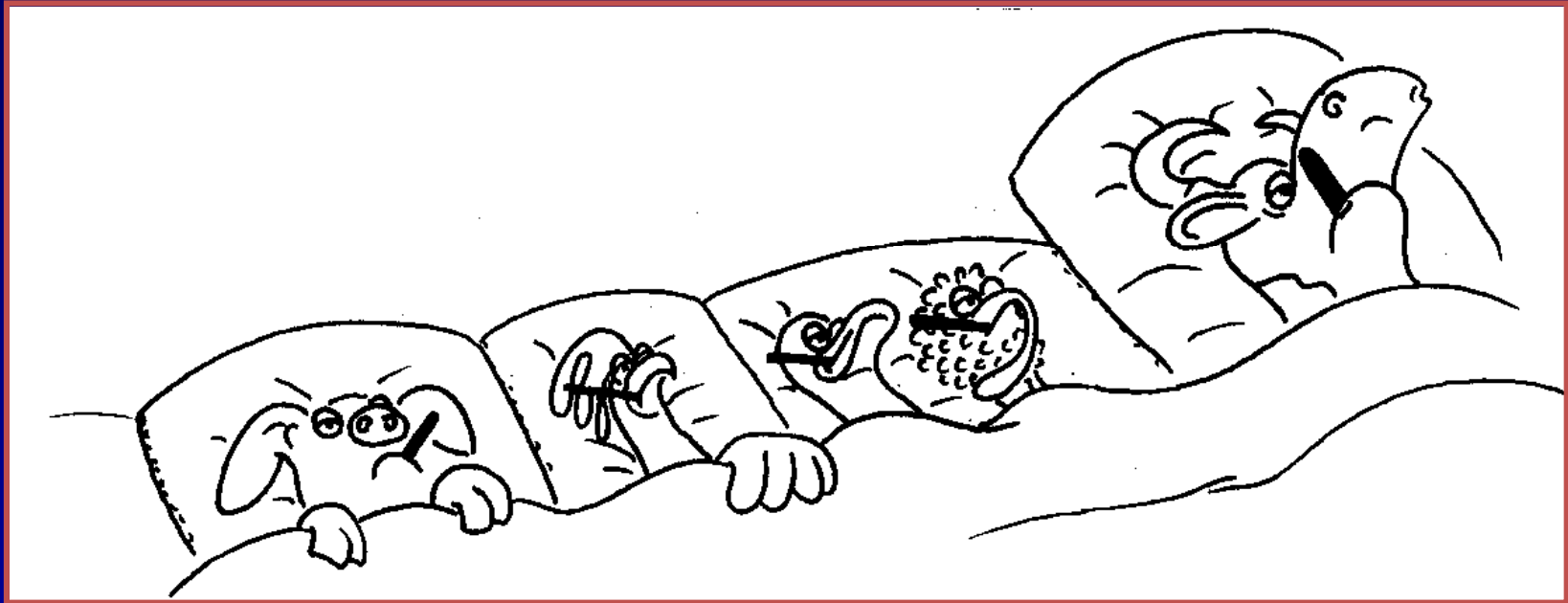
VUCAD

complexity science

non-linear systems

leadership in emergent, self-organization

Final Thoughts



“I wake up every morning determined to both change the world and have one hell of a good time. Sometimes this makes planning the day a little difficult.”

E.B. White

One World – One Health – One Medicine



One World – One Health – One Medicine

One Love



Acknowledgments:

- Mary Wilson, M.D., Harvard Medical School
- Lonnie King D.V.M., Centers for Disease Control
- Sandra Cointreau, The World Bank
- Duc Vulgia, M.D., California Dept. of Health Services
- Robert Burnham, M.D., BCCDC
- Laura Kahn, M.D., Princeton

Links:

www.cdc.gov

www.oneworldonehealth.org

www.who.int

www.wcs.org

www.onehealthinitiative.com