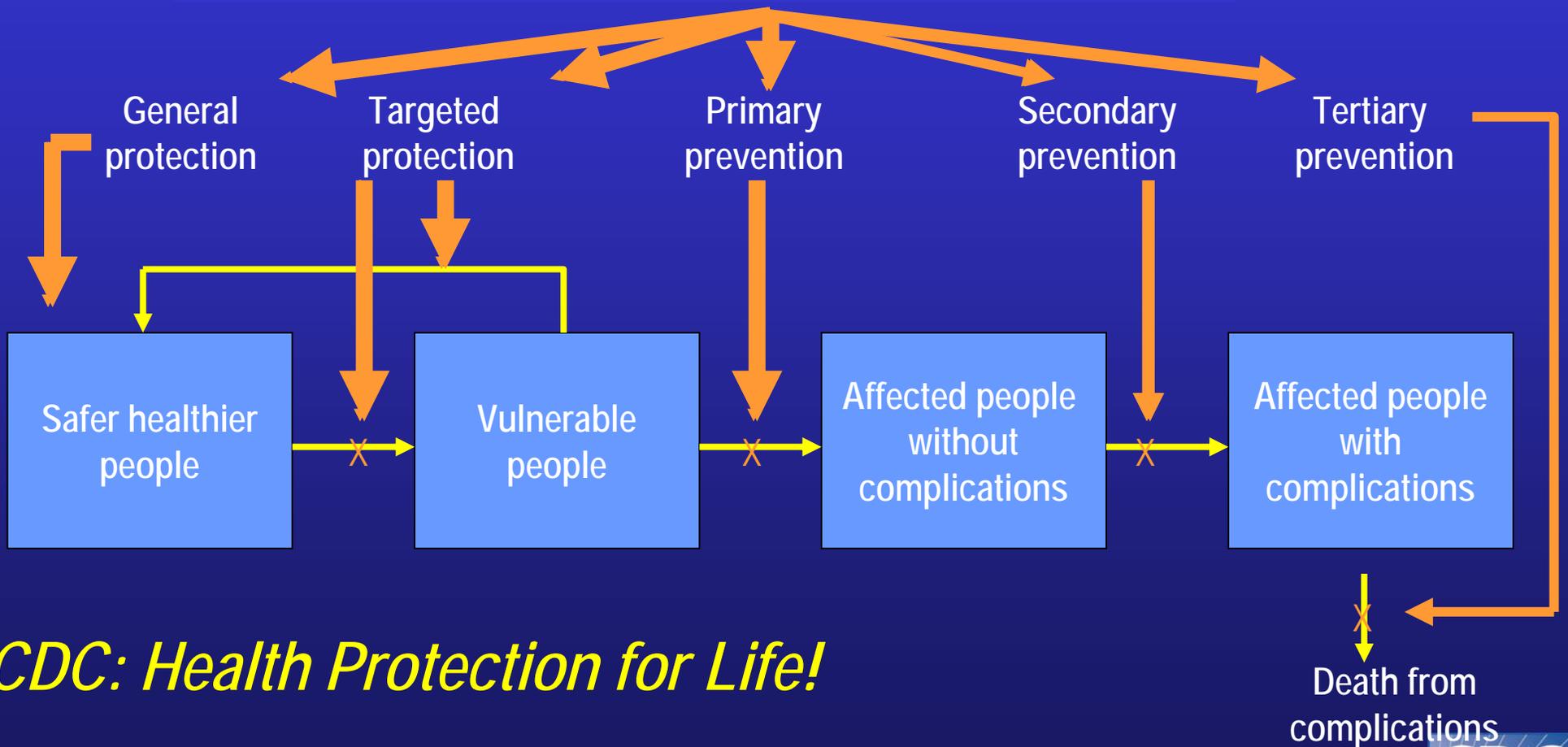


A photograph of a CDC sign in front of a building with a large tree in the background. The sign is white with the CDC logo in blue. The building is red brick with a large tree in front of it. The text is overlaid in yellow.

**Health Protection in the 21st Century:
Exploiting “Small World” Networks
www.cdc.gov**



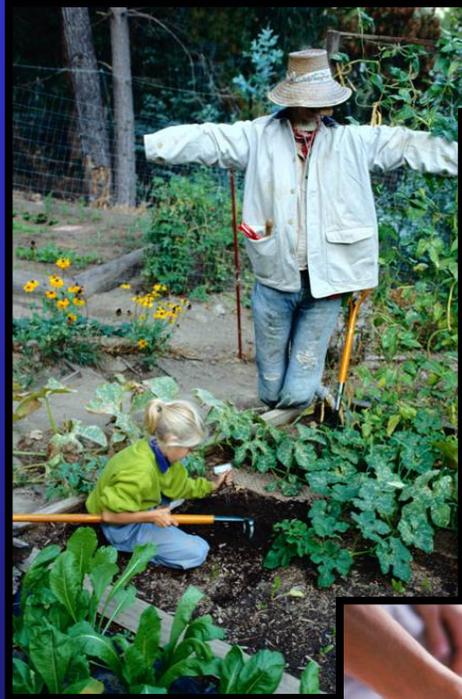
Future Health Priorities



CDC: Health Protection for Life!



Environmental Concerns



Pew Environmental Health Commission

Environmental Health Review

- **Environmental health system was inadequate and fragmented**
- **Responsibilities scattered among agencies**
 -
- **Unable to link environmental and health databases**

Recommended a “Nationwide Health Tracking Network for diseases and exposures”



Pew Environmental Health Commission

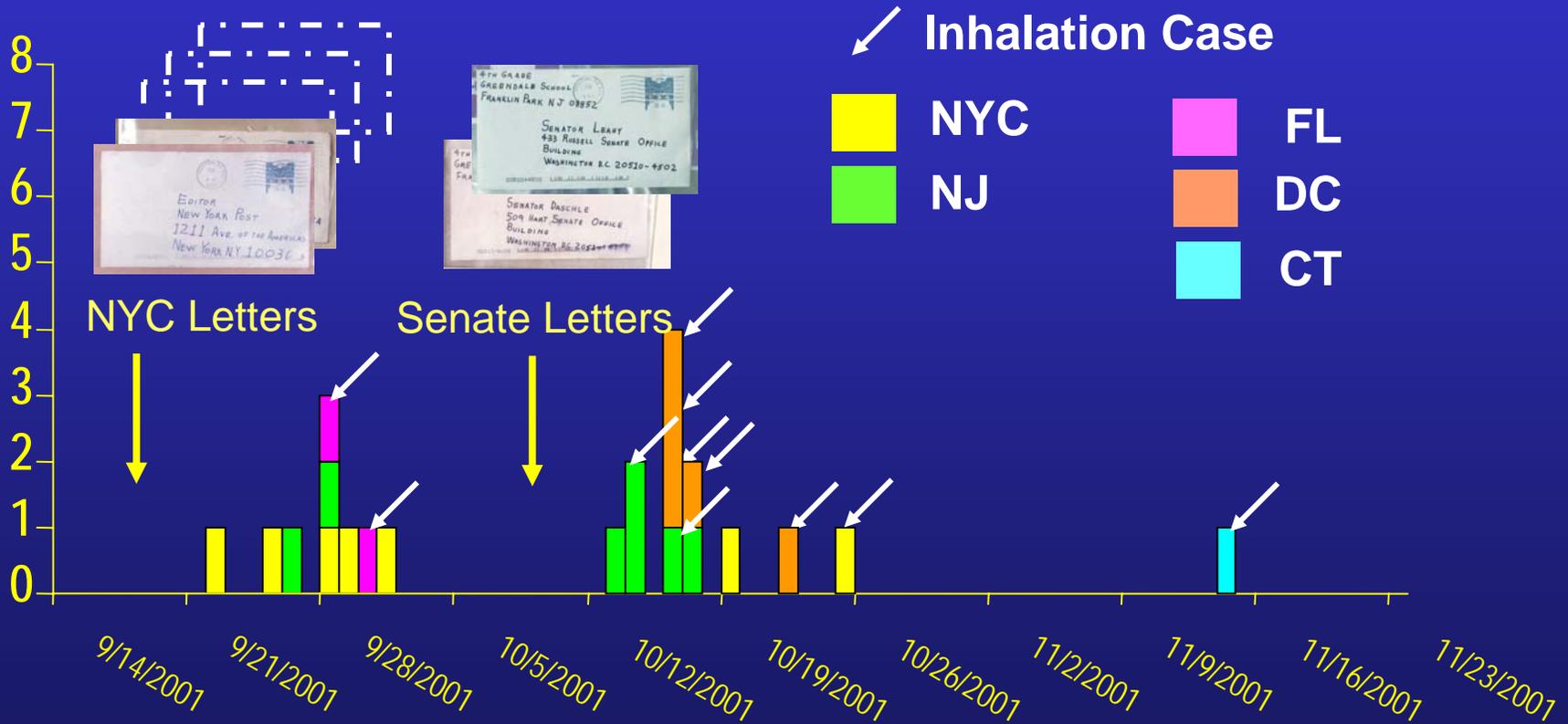
Environmental Health Review

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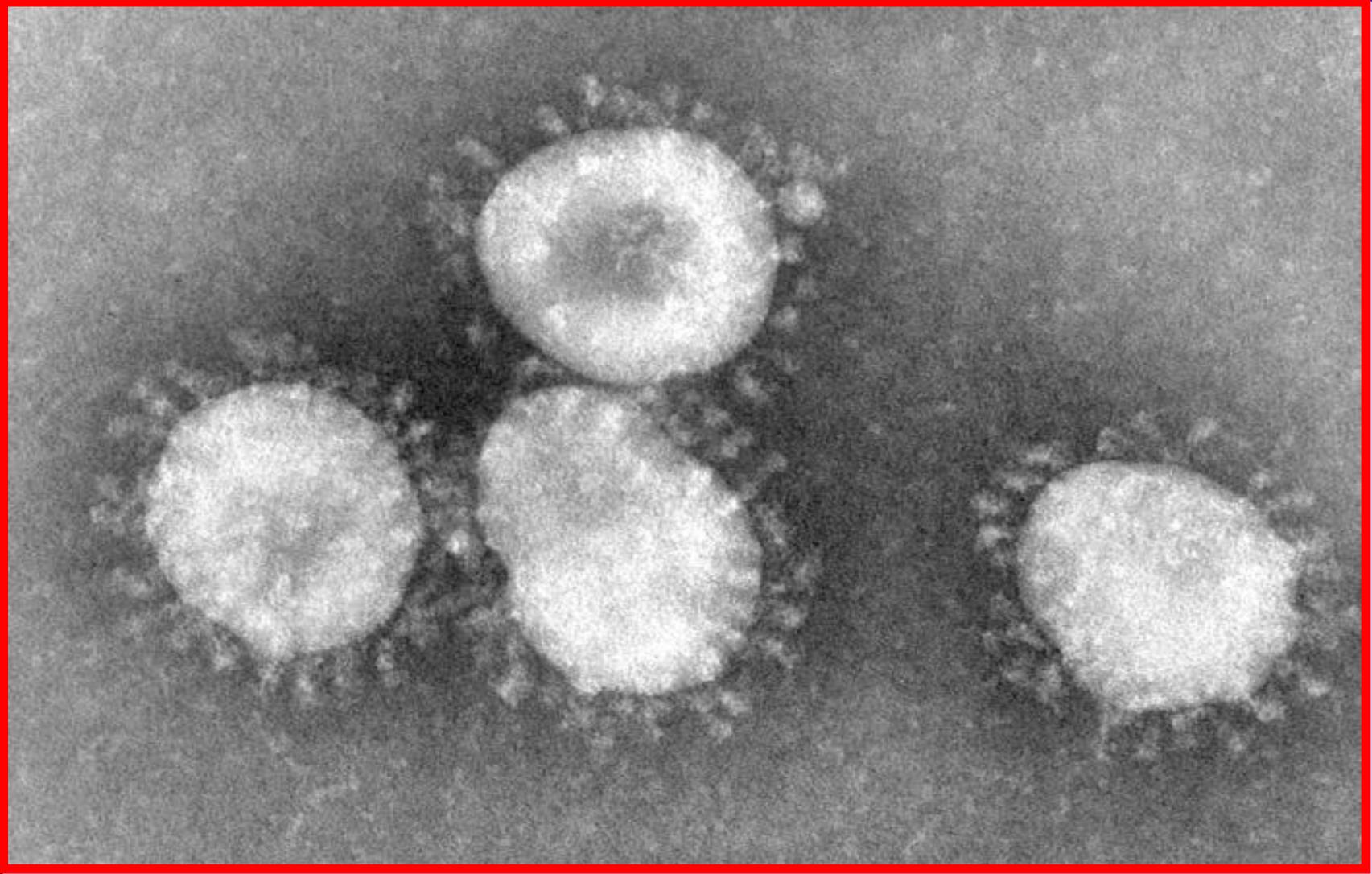
Recommended a “Nationwide Health Tracking Network for diseases and exposures”



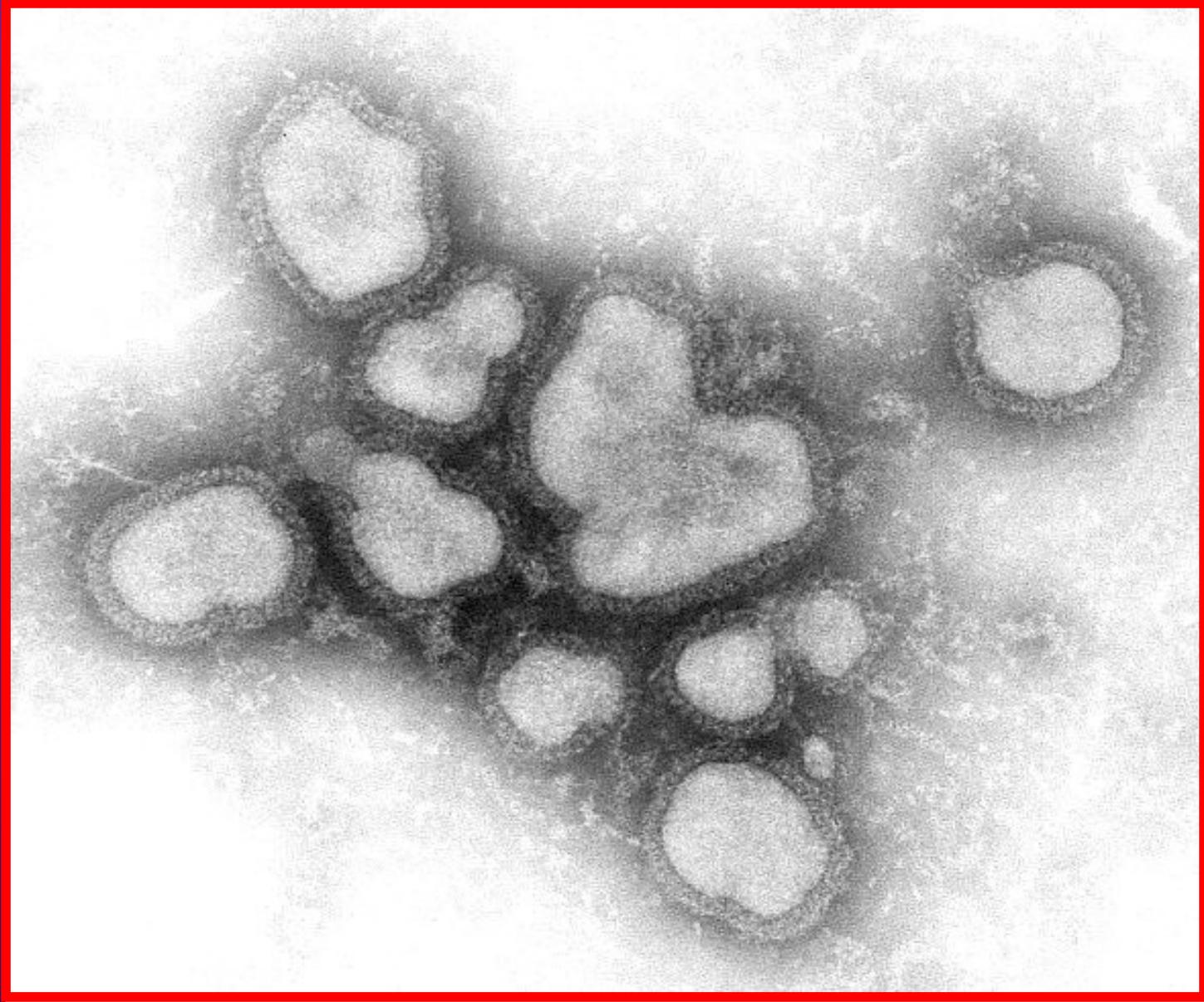
Bioterrorism-related Anthrax Cases





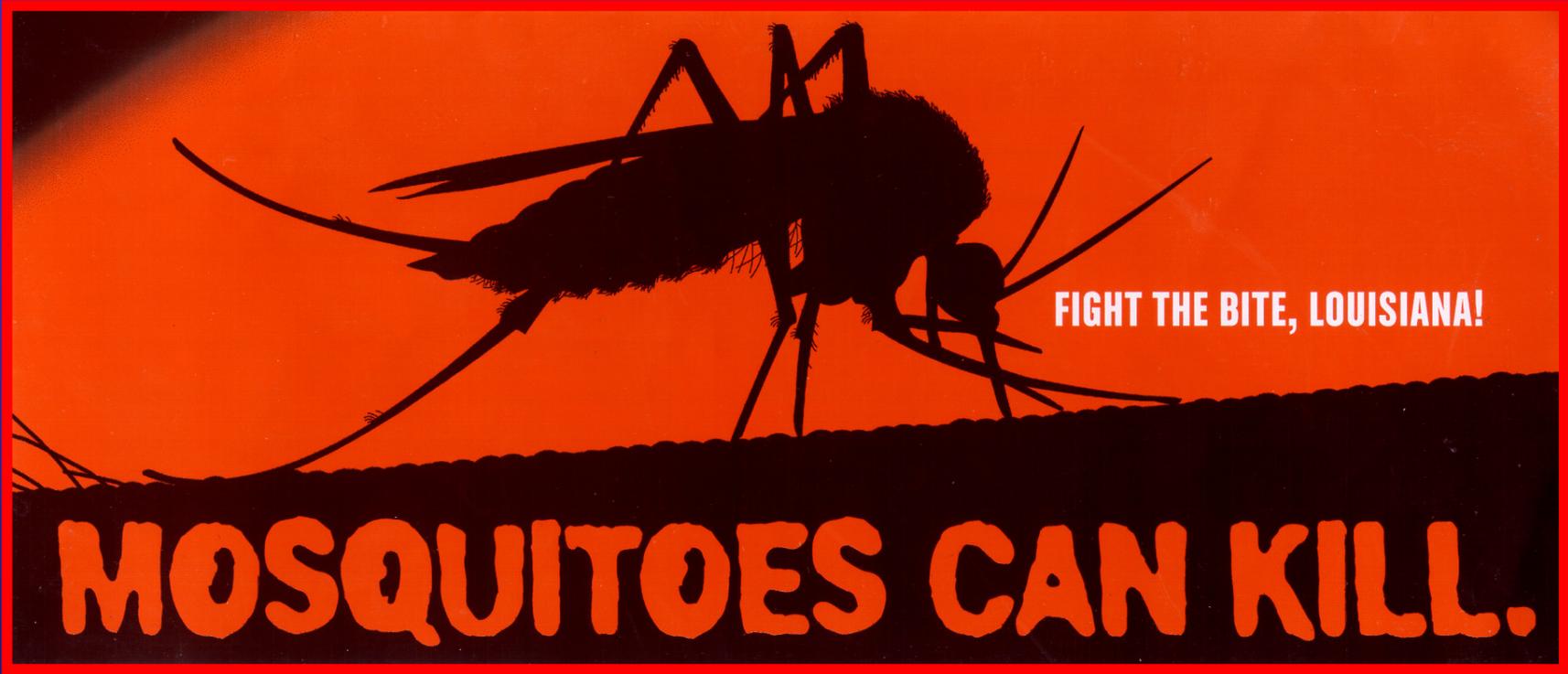








(IAP PHOTO)



FIGHT THE BITE, LOUISIANA!

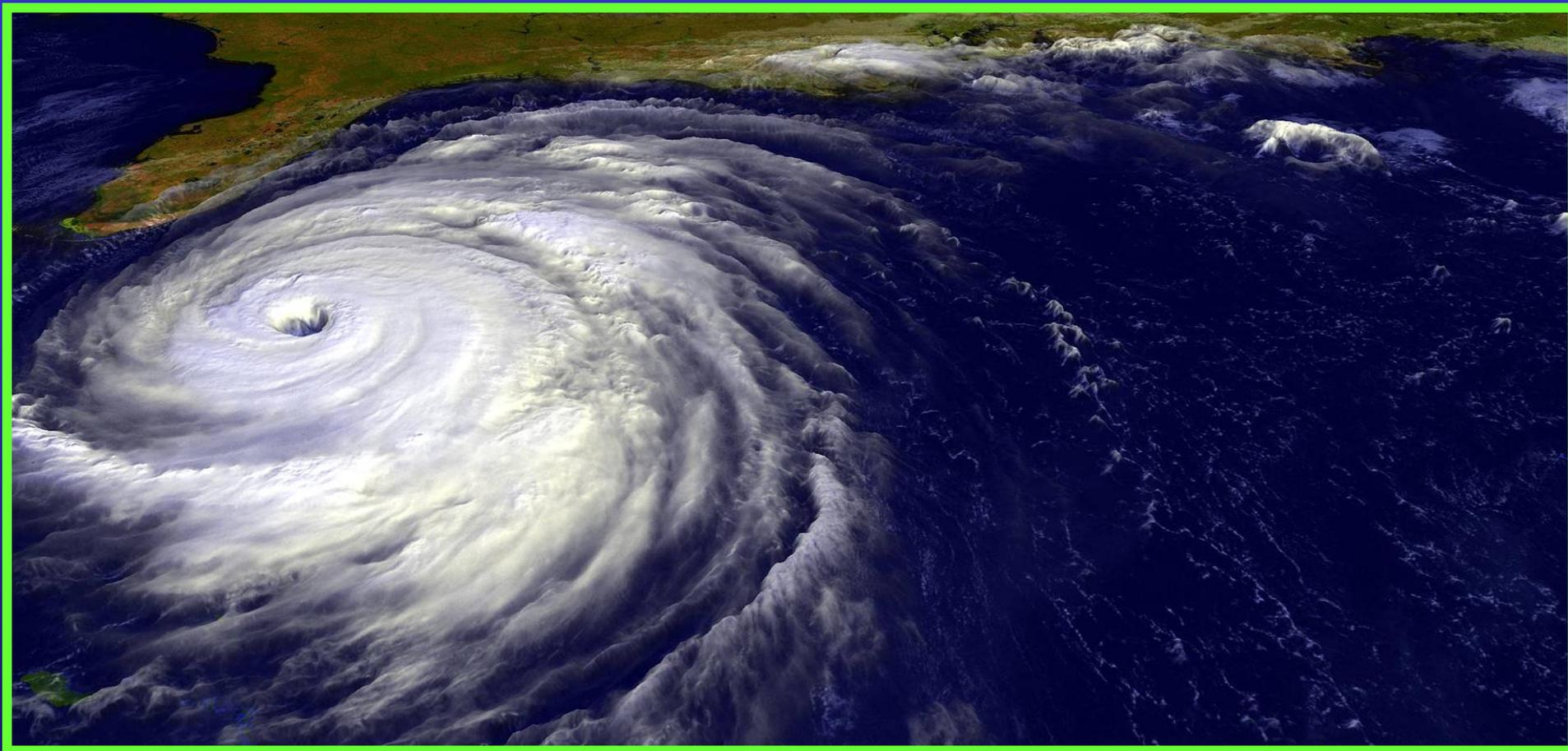
MOSQUITOES CAN KILL.



Flu Shots Over
All Vaccine Used

Call Santa Clara County Health Dept. for
other sites: 792-5200

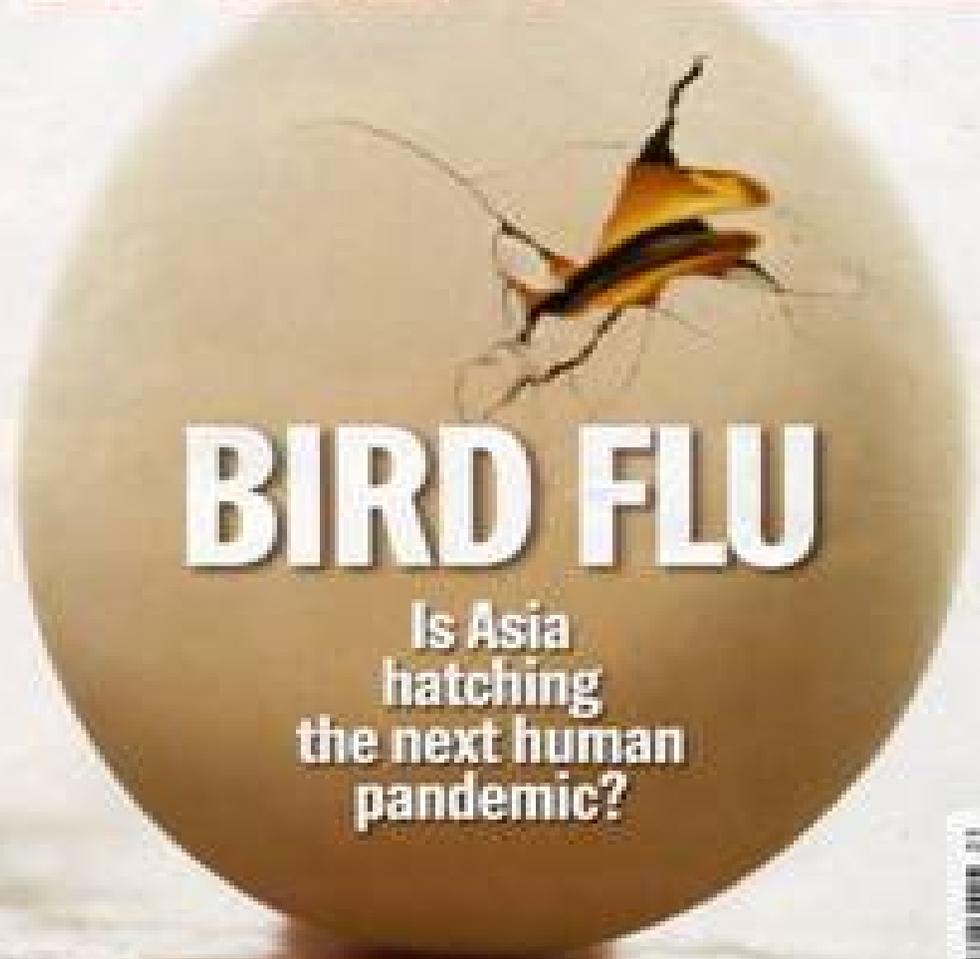




Tsunami Relief Efforts

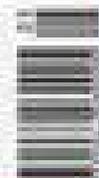


TIME

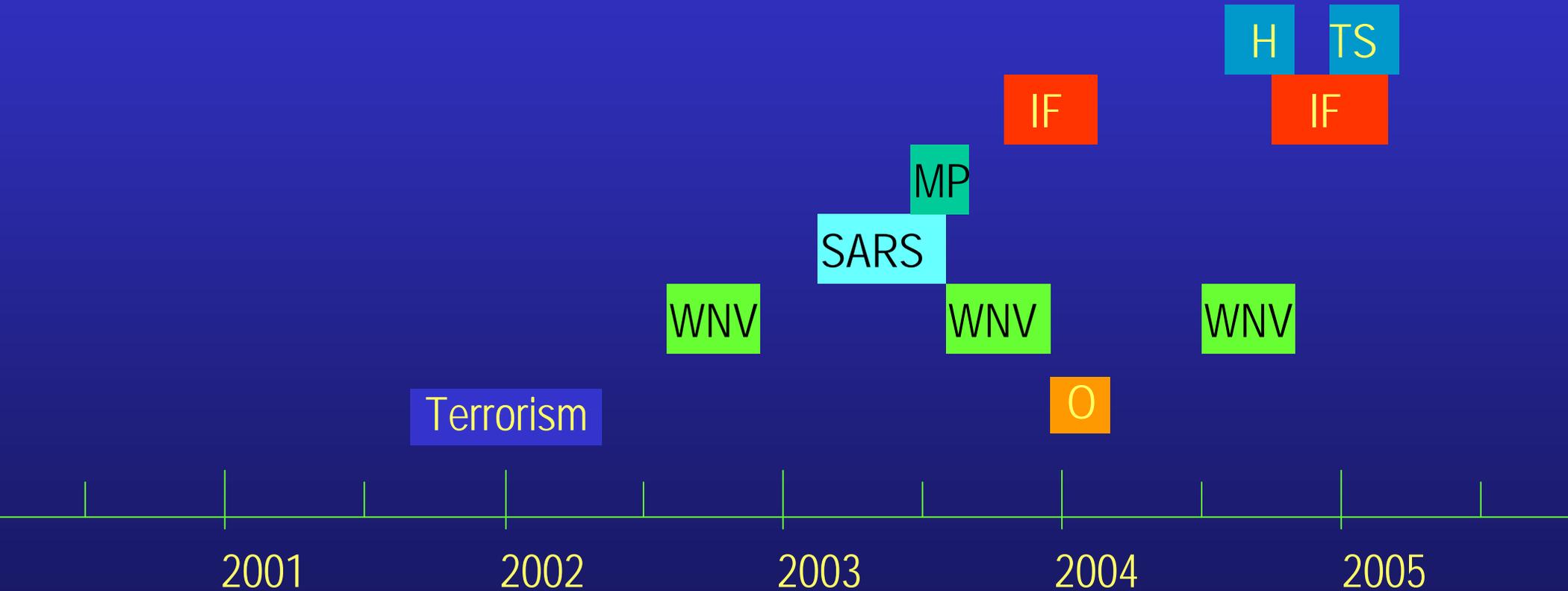


BIRD FLU

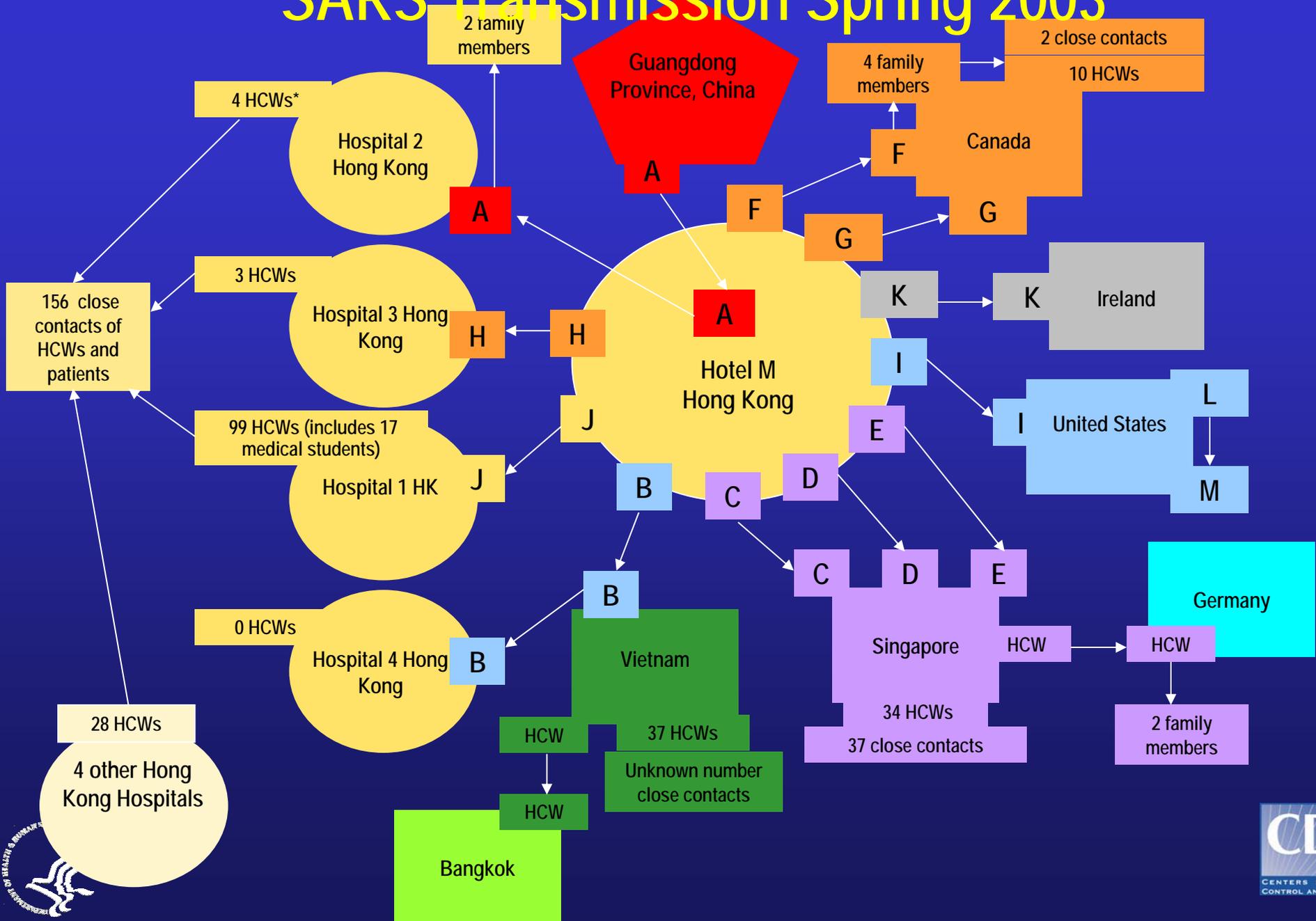
Is Asia
hatching
the next human
pandemic?



CDC Emergency Operations: 9/11/01- 1/18/05



SARS Transmission Spring 2003





It's a small world network!

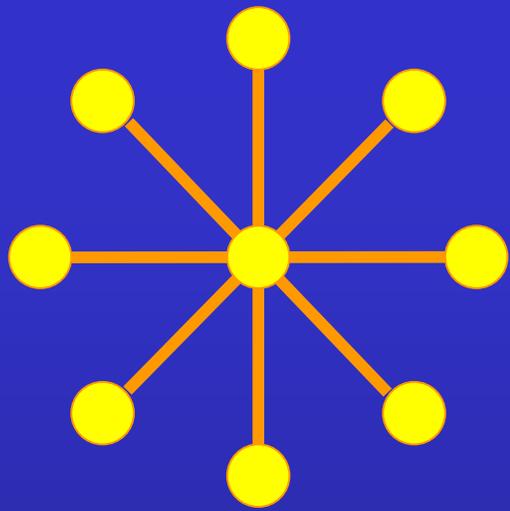


Small World Networks

“I read somewhere that everybody on this planet is separated by only 6 other people. Six degrees of separation. Between us and everybody else on this planet...It’s a profound thought!” *Quise in Six Degrees of Separation by John Guare*

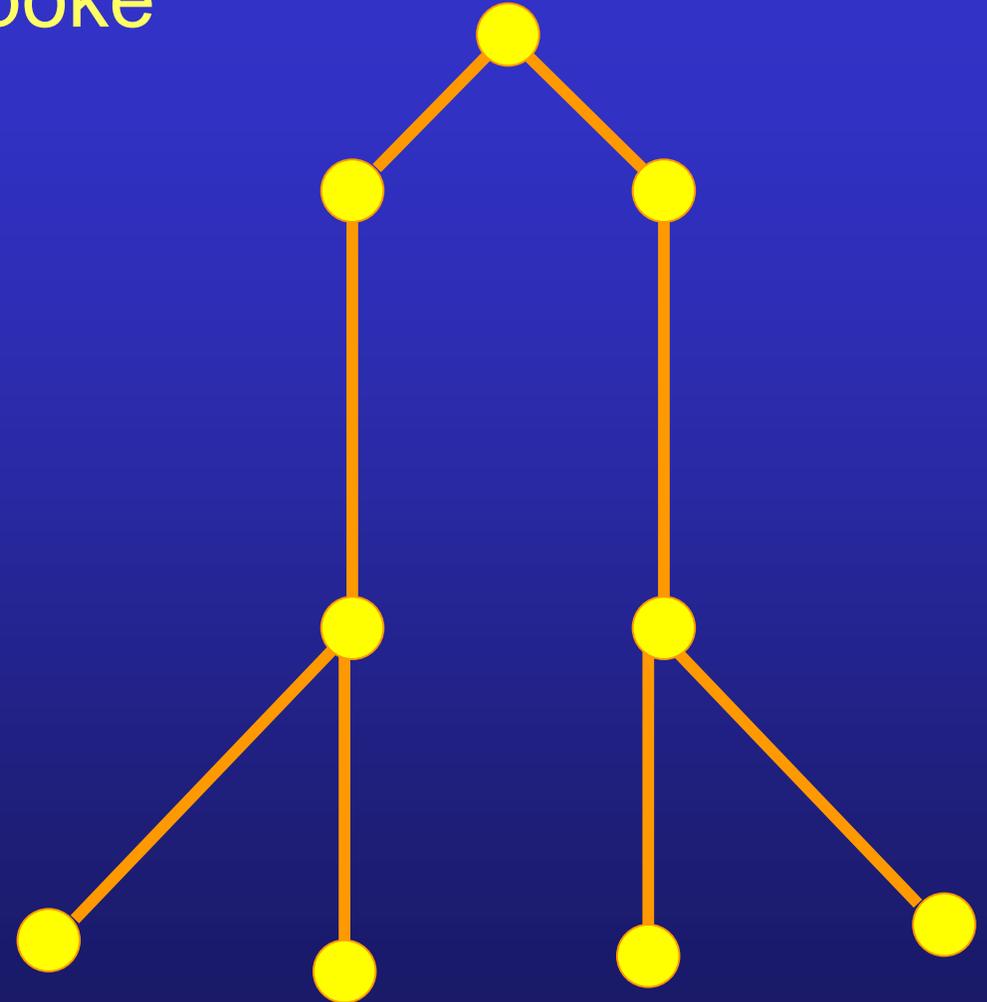
“The world is small...any one person can be reached through networks of friends in only a few steps.”
Stanley Milgram



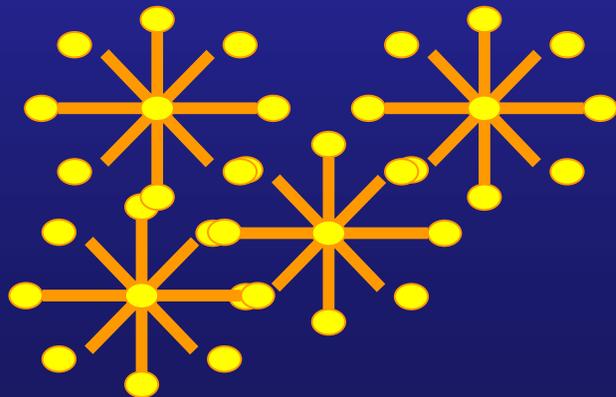


Hub and Spoke

Hierarchy



Multi-Hub and Spoke



Denning: Network Laws. Communications of the ACM 47:15-20, 2004



Cyberspace

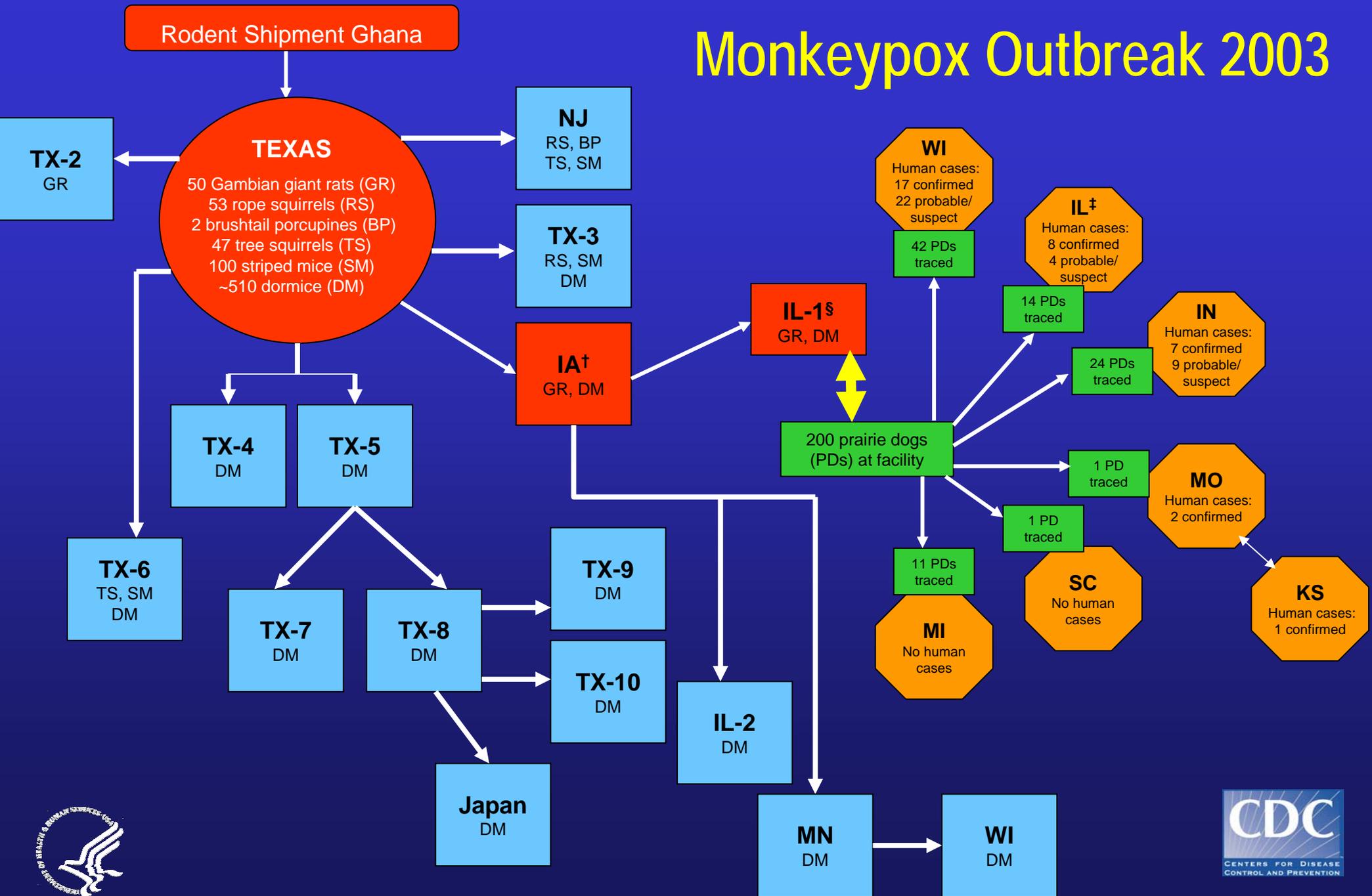


Internet

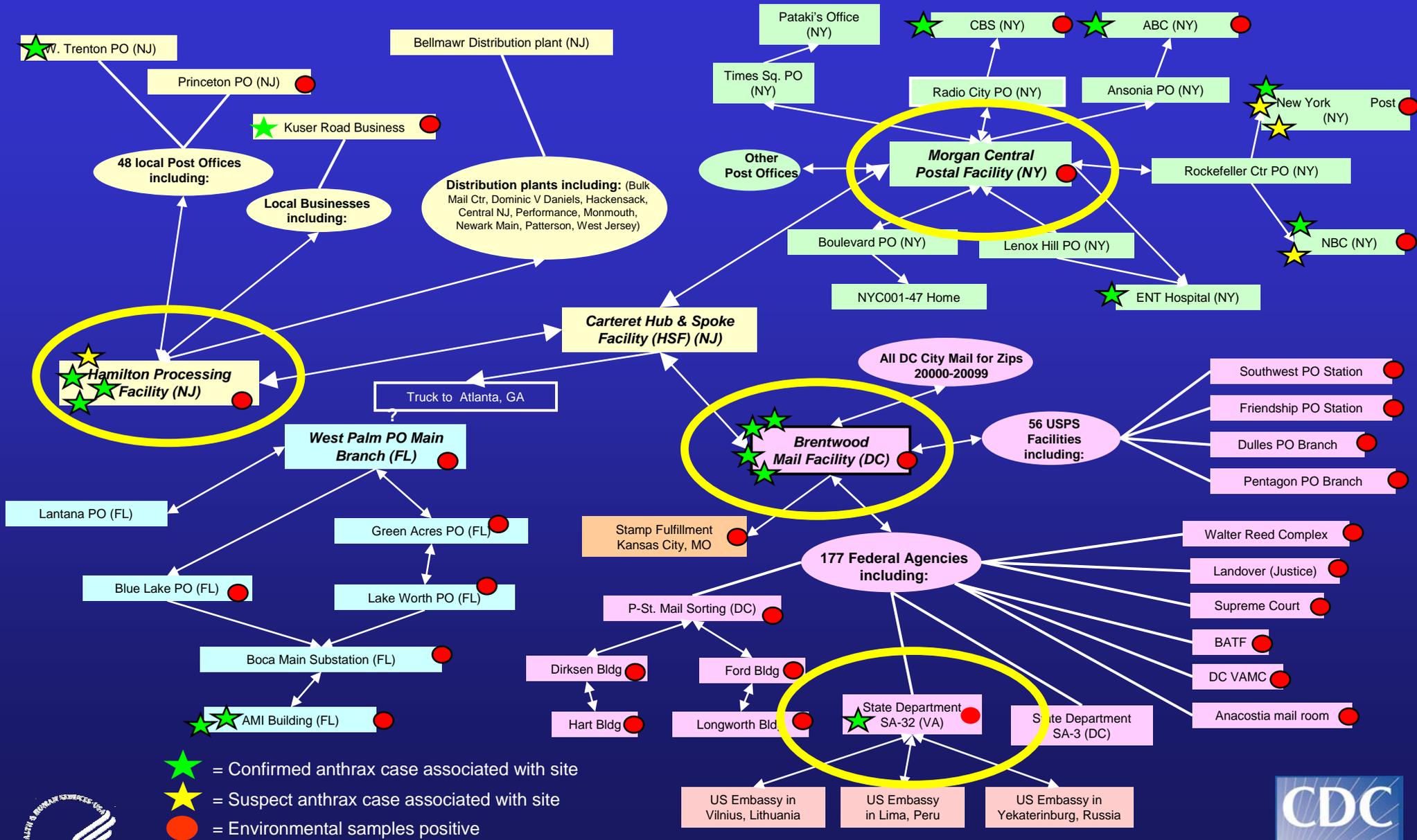
Weak tie... Strong Link!



Monkeypox Outbreak 2003



Anthrax Attack 2001: Mail Flow Network...



★ = Confirmed anthrax case associated with site
★ = Suspect anthrax case associated with site
● = Environmental samples positive

November 7, 2001





Protecting People in a Small World

Threat Characteristics

- Global threats with local impact; local threats with global impact
 - Health
 - Security
 - Economy
- Small world networks
 - Zoonoses / Vectors
 - Speedy transmission

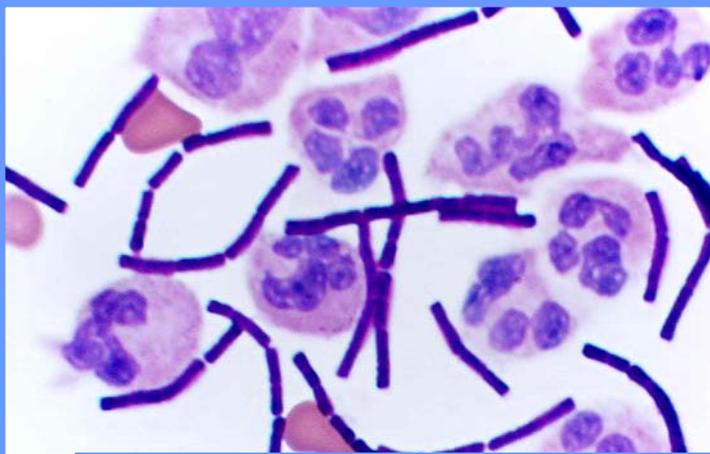
Preparedness Network Requirements

- Fast detection
- Fast science
- Fast & effective communication
- Fast & effective integration
- Fast & effective action!

Globalization, connectivity, and speed



Small World Networks: Fast Detection and Response - Clinicians



Public Health Dispatch

West Nile Virus Infection in Organ Donor and Transplant Recipients — Georgia and Florida, 2002

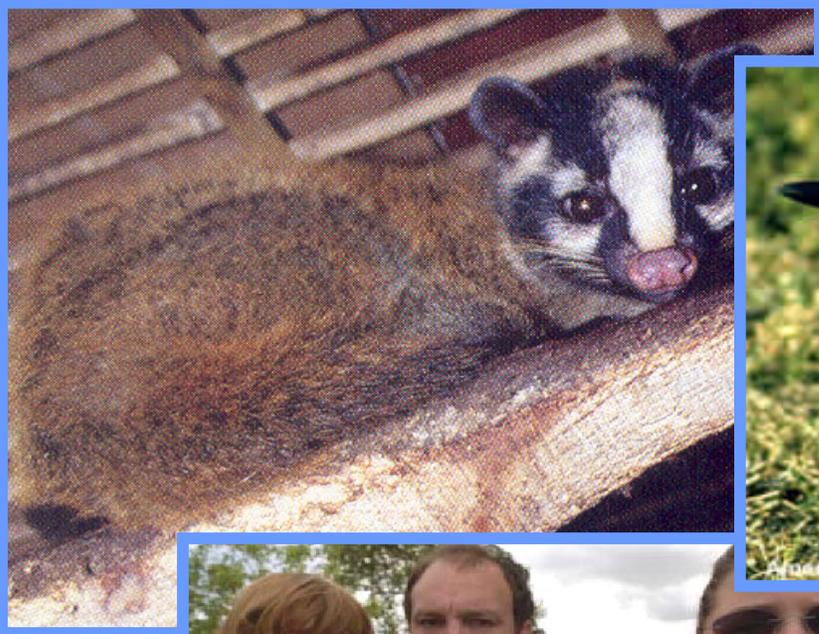
On August 23, 2002, the Georgia Division of Public Health

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from
ess in



Small World Networks: Fast Detection and Response...Veterinarians

Science 2003;301:1031.



USGS



BMJ 2003;326:1350.

TFAH. Aug 2003

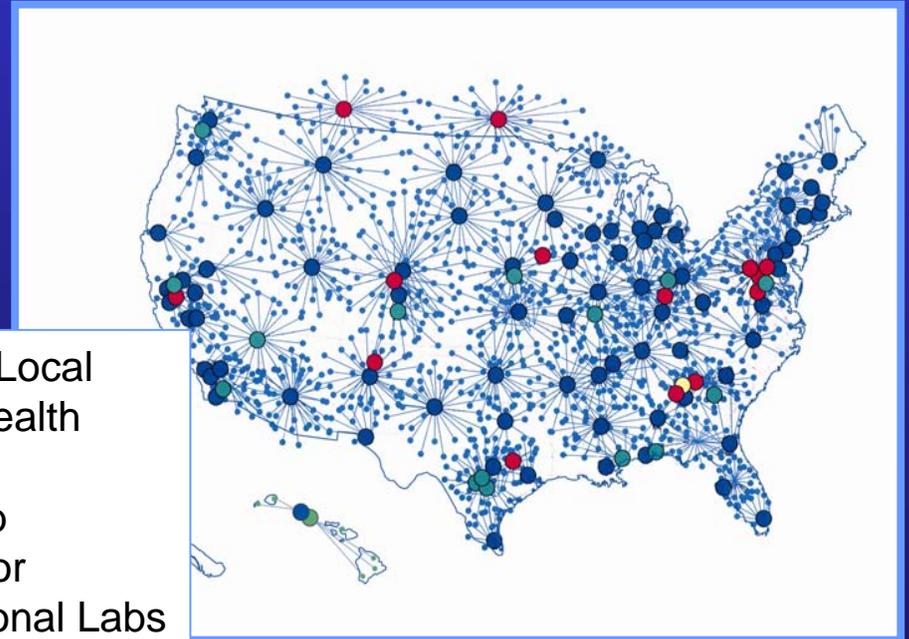


CDC's Laboratory Response Network

September 2001



September 2004



- State or Local Public Health Labs
- CDC Lab
- Federal or International Labs
- Military Labs
- Conceptualized Connections to Sentinel

Creating Strong Links!

Bioterrorism-Related Anthrax:
Collaboration Between Public Health
and Law Enforcement: New Paradigms
and Partnerships for Bioterrorism Planning and
Response

Jay C. Butler,* Mitchell L. Cohen,* Cindy R.
Friedman,* Robert M. Scripp,† and Craig G. Watz†

**Centers for Disease Control and Prevention,
Atlanta, Georgia, USA; and †Federal Bureau of
Investigation, Washington, D.C., USA*

POLICY FORUM

PUBLIC HEALTH

Building Microbial Forensics as a Response to Bioterrorism

Bruce Budowle,^{1*} Steven E. Schutzer,² Anja Einseln,¹ Lynda C. Kelley,³ Anne C. Walsh,⁴
Jenifer A. L. Smith,¹ Babetta L. Marrone,⁵ James Robertson,¹ Joseph Campos⁶



Small World Networks: Fast Science

WHO Collaborative Network for SARS



Small World Networks: Fast Science

Science magazine HELP SUBSCRIPTIONS FEEDBACK SIGN IN AAAS
 SEARCH BROWSE ORDER THIS ARTICLE

Originally published in Science Express as 10.1126/science.1085952 on May 1, 2003
 Science, Vol. 300, Issue 5624, 1394-1399, May 30, 2003

Characterization of a Novel Coronavirus

Paul A. Rota,^{1,2} M. Steven Oberste,¹ Silvia Peñaranda,¹ Bettina Bankamp,¹ Luis Lowe,¹ Michael Frace,¹ Joseph P. ...
 Cara Burns,¹ Thomas G. Ksiazek,¹ Peter ...
 Josef Limor,¹ Karen McCaustland,¹ ...
 Albert D. M. E. Osterhaus,³ Christian ...

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Articles

Coronavirus as a possible cause of severe acute respiratory syndrome

*J S M Peiris, S T Lai, L L M Poon, Y Guan, L Y C Yam, W Lim, J Nicholls, W K S Yee, W W Yan, M T Cheung, V C C Cheng, K H Chan, D N C Tsang, R W H Yung, T K Ng, K Y Yuen, and members of the SARS study group**

JOURNAL of MEDICINE

Science magazine HELP SUBSCRIPTIONS FEEDBACK SIGN IN AAAS
 SEARCH BROWSE ORDER THIS ARTICLE

Originally published in Science Express as 10.1126/science.1085953 on May 1, 2003
 Science, Vol. 300, Issue 5624, 1399-1404, May 30, 2003

The Genome Sequence of the SARS-Associated Coronavirus

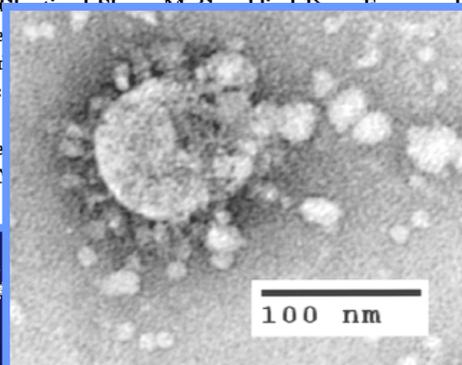
Marco A. Marra,^{1,2} Steven J. M. Jones,¹ Caroline R. Astell,¹ Robert A. Holt,¹ Angela Brooks-V...
 Yaron S. N. Butterfield,¹ Jaswinder Khattri,¹ Jennifer K. Asano,¹ Sarah A. Barber,¹ Susanna Y...
 Alison C...
 Michael...
 A. Gor...
 Francis...
 Donnie...
 Michael...
 Susan...
 Robert...

Identification of a Novel Coronavirus in Patients with Severe Acute Respiratory Syndrome

Christian Drosten, M.D., Stephan Günther, M.D., Wolfgang Preiser, M.D., Sylvie van der Werf, Ph.D., Hans-Reinhard Brodt, M.D., Stephan Becker, Ph.D., Holger Rabenau, Ph.D., Marcus Panning, M.D., Larissa Kolesnikova, Ph.D., Ron A.M. Fouchier, Ph.D., Annemarie Berger, Ph.D., Ana-Maria Burguière, Ph.D., Jindrich Cinatl, Ph.D., Markus Eickmann, Ph.D., Nicolas Escriou, Ph.D., Klaus Grywna, M.Sc., Stefanie Kramme, M.D., Jean-Claude Manuguerra, Ph.D., Stefanie Müller, M.Sc., Volker Rickerts, M.D., Martin Stürmer, Ph.D., Simon Vieth, Hans-Dieter Klenk, M.D., Albert D.M.E. Osterhaus, Ph.D., Herbert Schmitz, M.D., and Hans Wilhelm Doerr, M.D.

A Novel Coronavirus Associated with Severe Acute Respiratory Syndrome

Thomas G. Ksiazek, D.V.M., Ph.D., Dean Erdman, Dr.P.H., Cynthia S. Goldsmith, M.S., Sherif R. Zaki, M.D., Ph.D., Teresa Peret, Ph.D., Shannon Emery, B.S., Suxiang Tong, Ph.D., Carlo Urbani, M.D.,* James A. Comer, Ph.D., M.P.H., Wilina Lim, M.D., Pierre E. Rollin, M.D., Scott F. Dowell, M.D., M.P.H., Ai-Ee Ling, M.D., Charles D. Humphrey, Ph.D., Wun-Ju Shieh, M.D., Ph.D., Jeannette Guarner, M.D., Christopher D. Paddock, M.D., M.P.H.T.M., Paul Rota, Ph.D., Barry Fields, Ph.D., Joseph DeRisi, Ph.D., Jyh-Yuan Yang, Ph.D., Nancy Cox, Ph.D., James M. Hughes, M.D., James W. LeDuc, Ph.D., William J. Bellini, Ph.D., Larry J. Anderson, M.D., and the SARS Working Group†



Small World Networks: Prediction and Prevention

ASIA FIGHTS AN EPIDEMIC



SHAKIL ADIL / Associated Press

Alarm over the bird flu has risen at poultry farms such as this one near Karachi, Pakistan, as the country became the eighth to report a variant of the disease. A 6-year-old boy in Thailand marked the seventh recent fatality from bird flu.

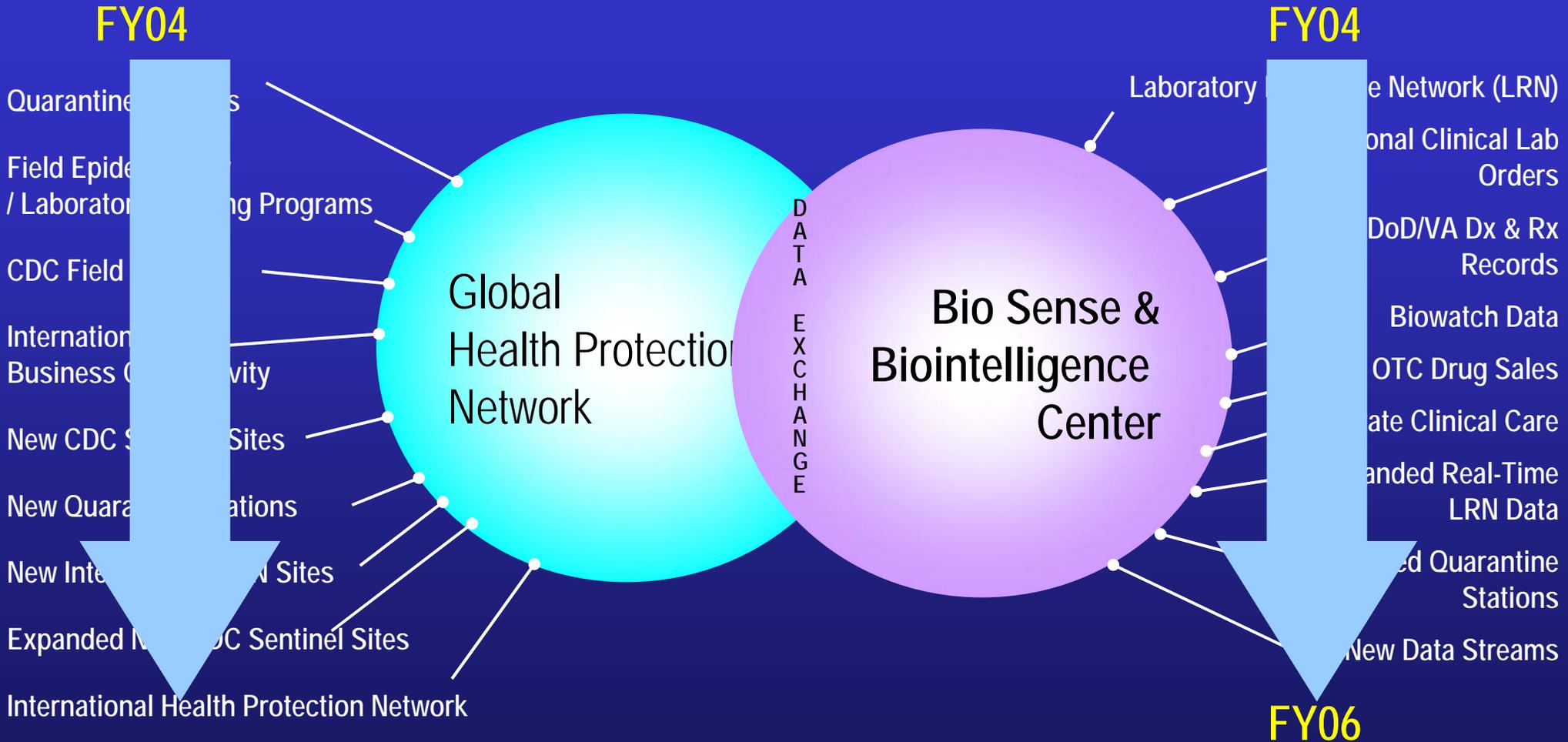
Killer bird flu rampant

Atlanta Journal Constitution



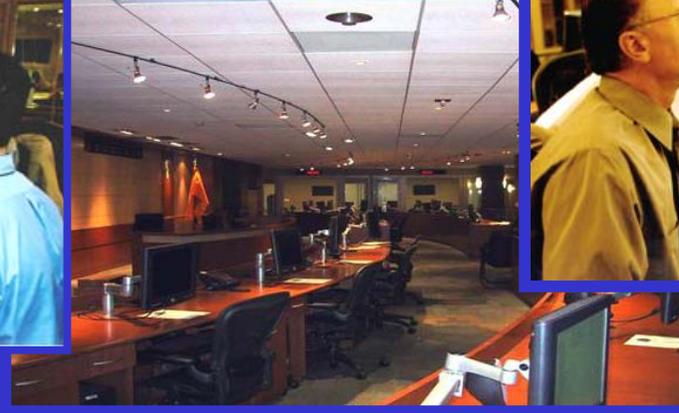
Small World Networks: Fast Detection and Response

CDC's International Health Protection Network

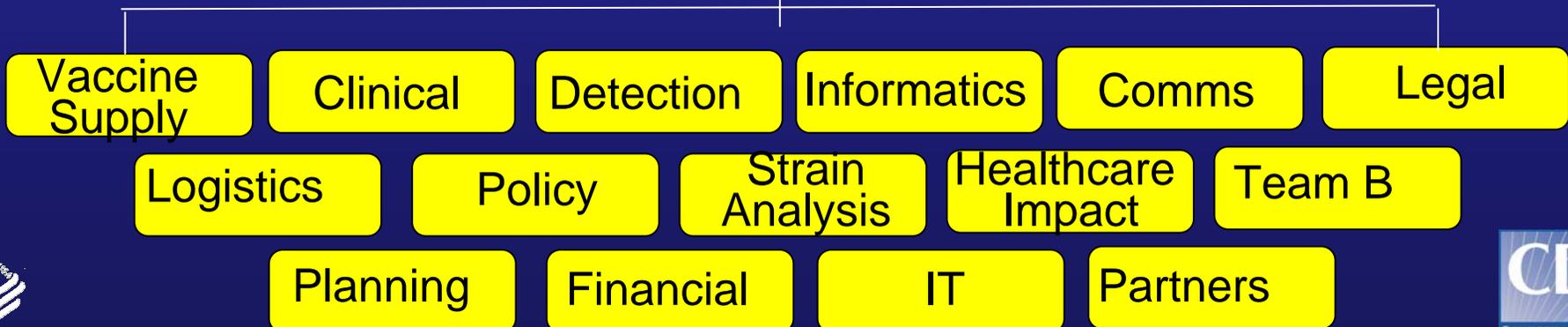


Small World Networks: Fast Action

Operation Influenza 2003-2004



**Coordinating Center
Infectious Diseases**

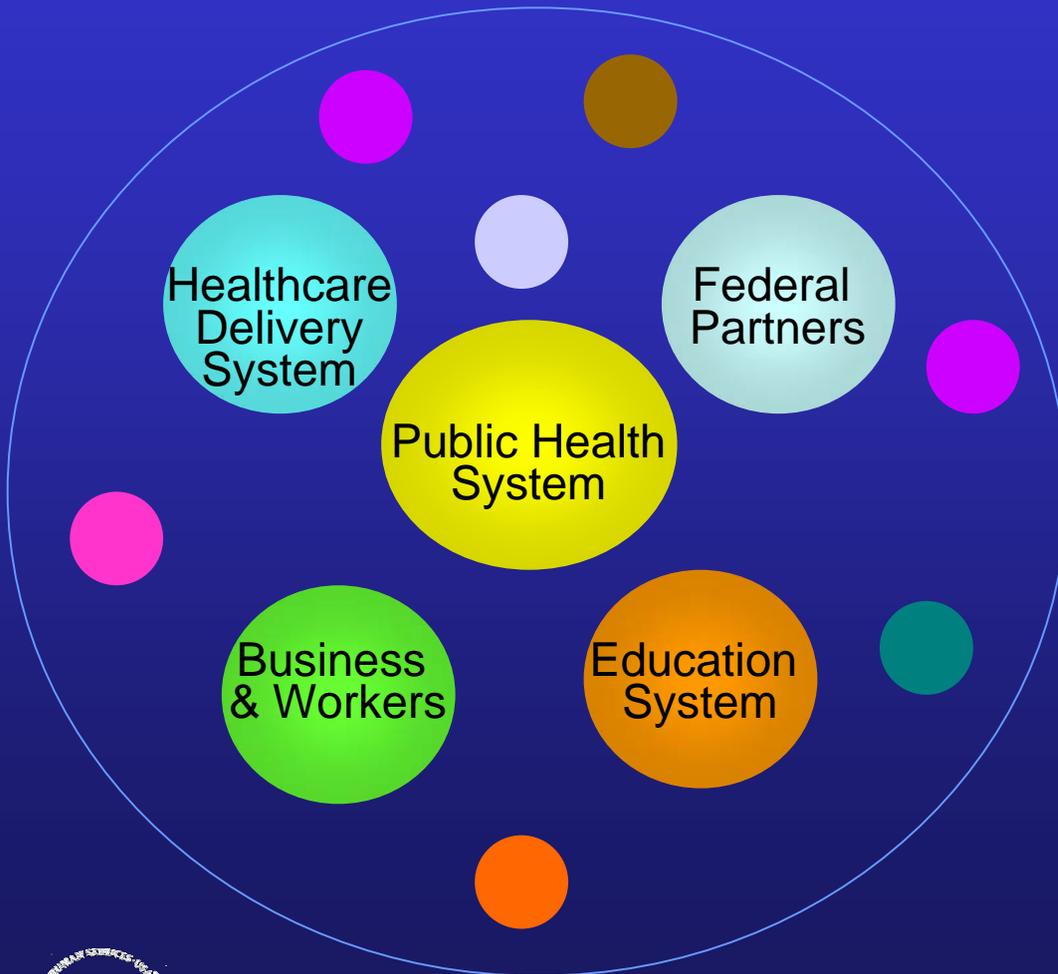


Network Wins Testing for Botulinum Toxins

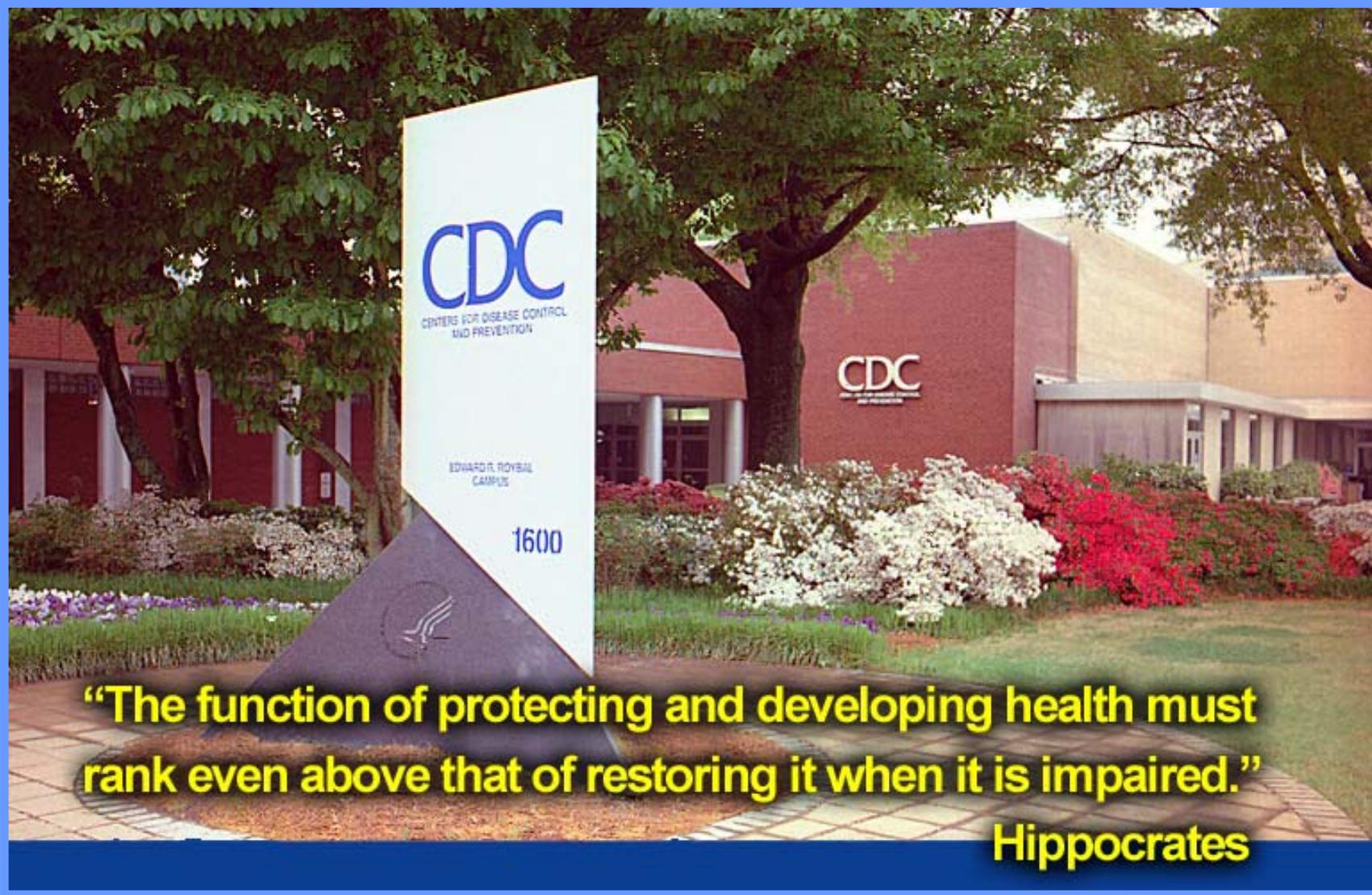
- Testing for botulinum toxins requires mice, is slow, and hard to identify all the toxins
- NCEH's mass spectrometry technology had potential for better measurement
- NCEH and NCID came together to develop improved test
- **New test is much faster, more specific, detects all botulinum toxins**
- Mass spec approach may work for other biological terrorism toxins



A Small World Health Network for Health Protection



- Multisector integration
- Public-private
- Non-partisan
- Local - state – national
- Domestic – international
- Animal – Human - Plant



www.cdc.gov

