The transmission of animal and human pathogens through global trade

"Turning the microscope upside down"

Ann Marie Kimball, MD, MPH, FACPM

February 11,2009, Washington DC

Dimensions of Globalization: Would Darwin Recognize this World?

- Political
- Cultural
- National Security
- Financial
- Development
- Homogenization
- Environmentalism

- The nation state?
- Universal values?
- Peace or War?
- Where is the money?
- What is progress?
- “One size fits all”
- Which shade of Green?

Thomas Freidman, The Lexus and the Olive Tree, 1999

Based on “The Lexus and the Olive Tree”

Risky Trade

Infectious Disease in the Era of Global Trade

Ann Marie Kimball, University of Washington, USA

The current value of global trade has reached a staggering $6 trillion pa in merchandise crossing borders at the same time raising fears for global health. Yet, investment in public health infrastructure and disease control was never envisaged to cope with international trade of this volume and diversity. Indeed, most health systems lag far behind, especially in poor countries. This has created new vulnerabilities for global populations to the introduction and amplification of infection through trade. Public fears have been further heightened by frightening news reports of deadly diseases such as Mad Cow disease and E.Coli.
Risky Trade: Infectious Disease in the Era of Global Trade provides a thorough examination of the actual risks posed by epidemic disease in the modern age of globalization. The author draws on the economics of international trade and epidemiology to explore the health issues arising from the enormous increase in global trade and travel. Issues covered include:

- The scale of the problem with particular reference to the Salad outbreak of E.Coli; global SARS; avian influenza; HIV/AIDS; and other important international epidemics of disease;
- Risks from particular microbes – enteric and viral infections; highly infectious agents; antimicrobial resistance; and, stealth agents;
- Global dissemination of outbreaks as a result of human travel and trade;
- Prevention, surveillance and control;
- The future health of global trading and future hopes for population safety worldwide.

In addition to highlighting the problems, the book also addresses some of the potential benefits the same globalization can bring to epidemic control through surveillance, diagnostics, treatment and investigation. The empirical approach ties together existing descriptions and case studies of epidemics building a comprehensive framework for examining new events and considering historical experience with infectious outbreaks. The volume will be a valuable guide to students, academics, practitioners, and policy makers in the areas of international trade, health economics, epidemiology, international/public health and disease control.

This book is a must-read for policy makers in health and trade, and for captains of industry who want to keep their ships sailing smoothly in a world where infectious diseases are easily transported across international borders by humans, insects, agricultural products and livestock.
David L. Heymann, MD, Executive Director, Communicable Diseases, World Health Organization

At a time when world leaders are increasingly aware of public health's importance to security, economics, development and human dignity, Professor Kimball's Risky Trade: Infectious Disease in the Era of Global Trade illuminates with a master's touch the complexities of what is a defining 21st-century challenge – managing globalization's acceleration of the age-old struggle between people and pathogens.

Professor David P. Fidler, Henry T. Ice Faculty Fellow, Indiana University School of Law, Bloomington, USA

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Risky Trade Kimball

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Risky Trade

Infectious Disease in the Era of Global Trade

Ann Marie Kimball

What was Darwin's Greatest Tool?

Scope of the Science

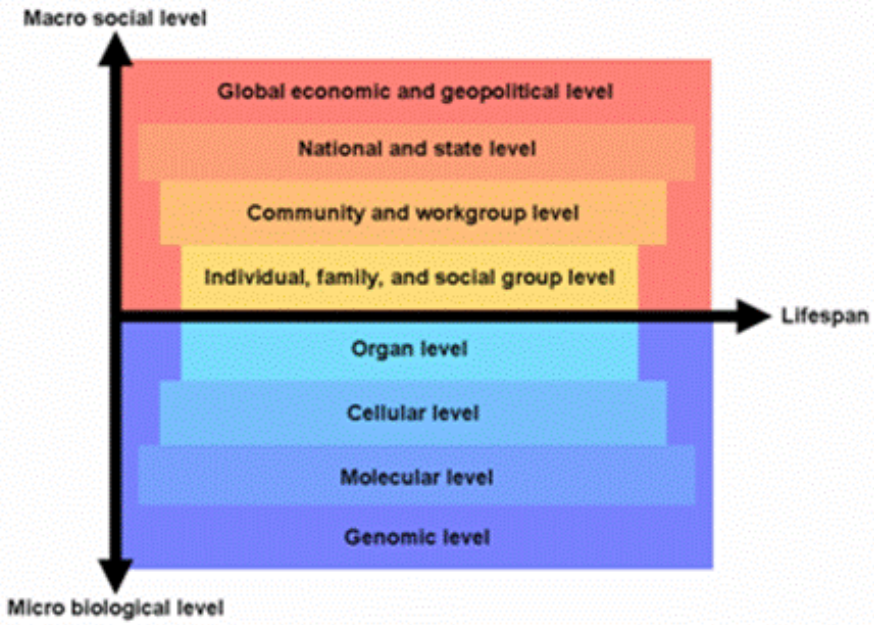


Figure 1. Health as a continuum between biological and social factors across the lifespan. (Adapted from Glass & McAtee, 2006).

Factors of Emergence-Related to Human activity

- Demographic, population
- Behavior
- PH Infrastructure breakdown
- Travel
- Technology, Trade
- Microbial Change
- Climate Change
- War
- Intentional Release
- Land Use

Emerging Infections, 1992,
Microbial Threats to Health ,2003
Institute of Medicine

“Trade Related Infection”

- An infection which emerges as a result of consolidation, changes in manufacture due to global market pressures OR
- An infection which is amplified geographically through product (or animal) trade OR
- An infection which results in economic damage from trade embargoes of affected products (or animals)

Kimball, Arima, Hodges, 2005

A sampling of costs of epidemics

Kimball, Davis 2001

Event	Sources of Costs	Estimated Amounts
Avian Influenza Hong Kong 1997	Trade restrict. Loss of poultry Preferred breeds	$13 million US
Plague, Surat, India 1994	Trade. Tourism, diamonds	$1.3 billion US
E. Coli 9157H:7 Sakai, Japan 1996	Inspection, import market, compensation	$1.5 million market only
Cholera, Lima, Peru 1993	Trade, Tourism	$700m-$1.5b

KOREA unveils $130 billion estimate for Avian Influenza in Asia, 2004

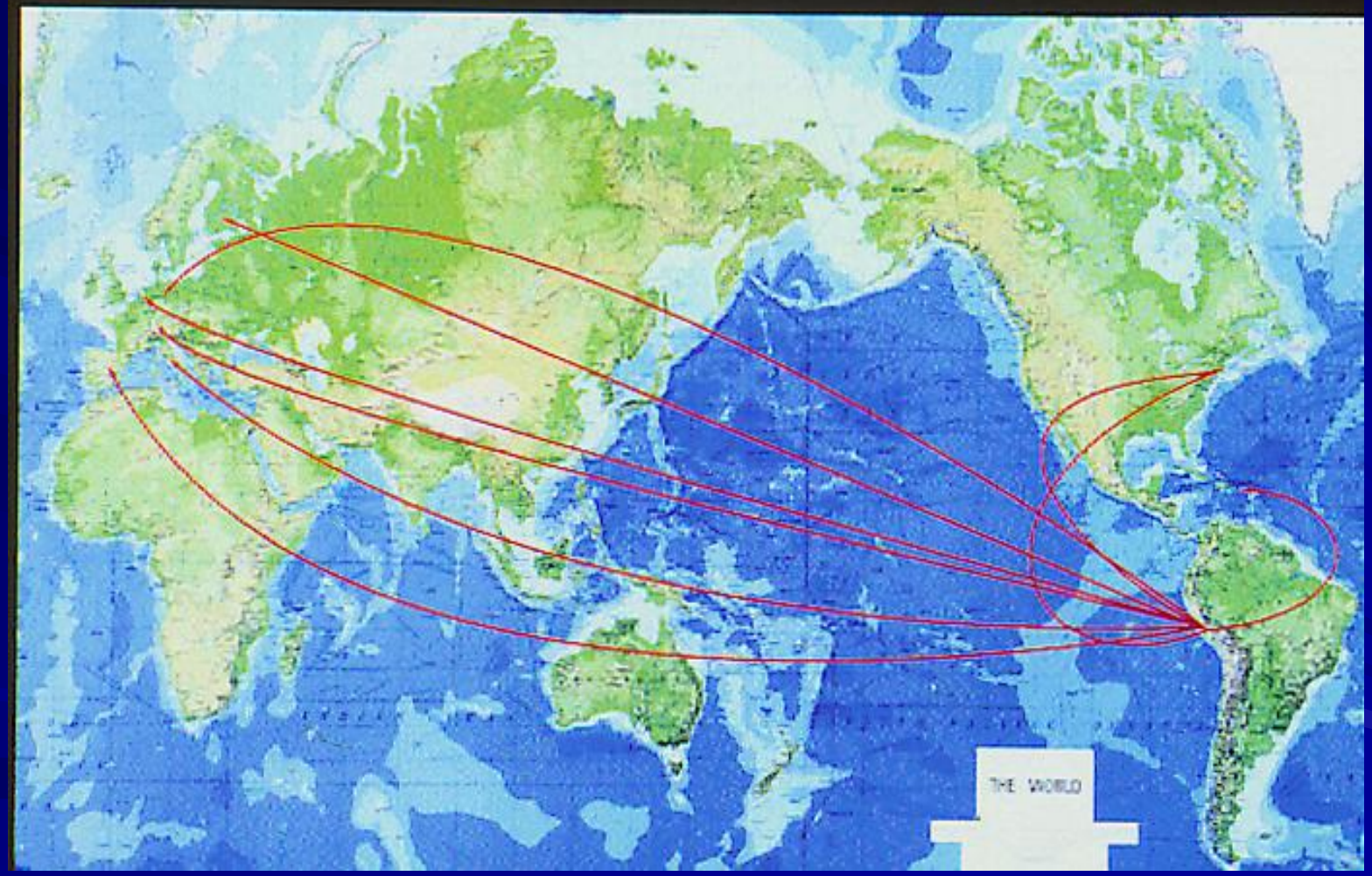
왼쪽부터 앤 킴벌, 폴 알귄, 메리 미란다, 허영주씨. 주완중기자(블로그)wijoo.chosun.com

Estimate from Oxford Forecasting Group, 2004

Microbial Transportation: The Global Express

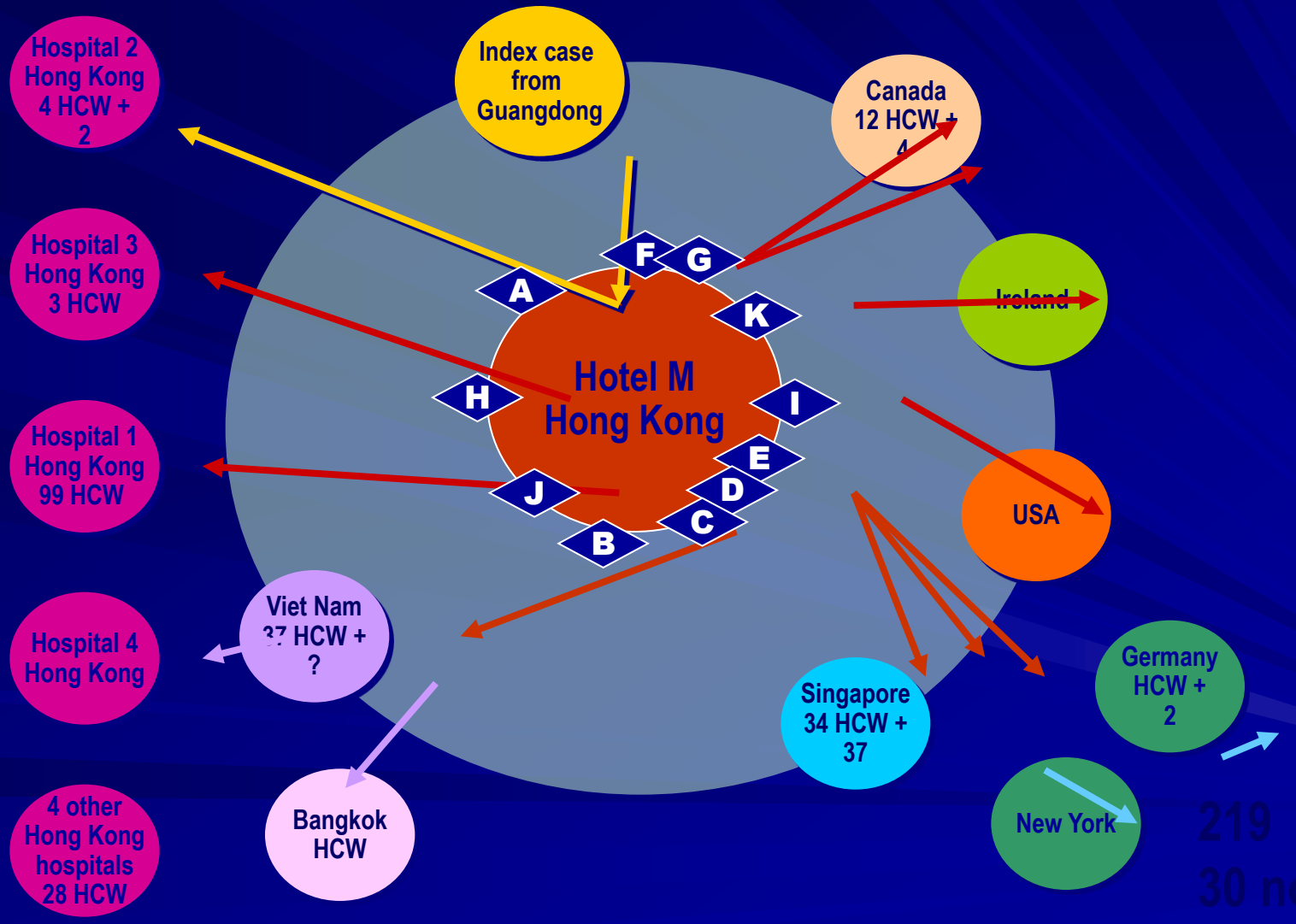
- Travel in or on humans or human derived products
- Travel in or on animals or animal derived products
- Contamination of seeds or fruits or vegetables
- “Hitchiking” by arthropods bearing vector borne disease

Known transnational cases of drug-resistant TB diagnosed among individuals recently living in Peru



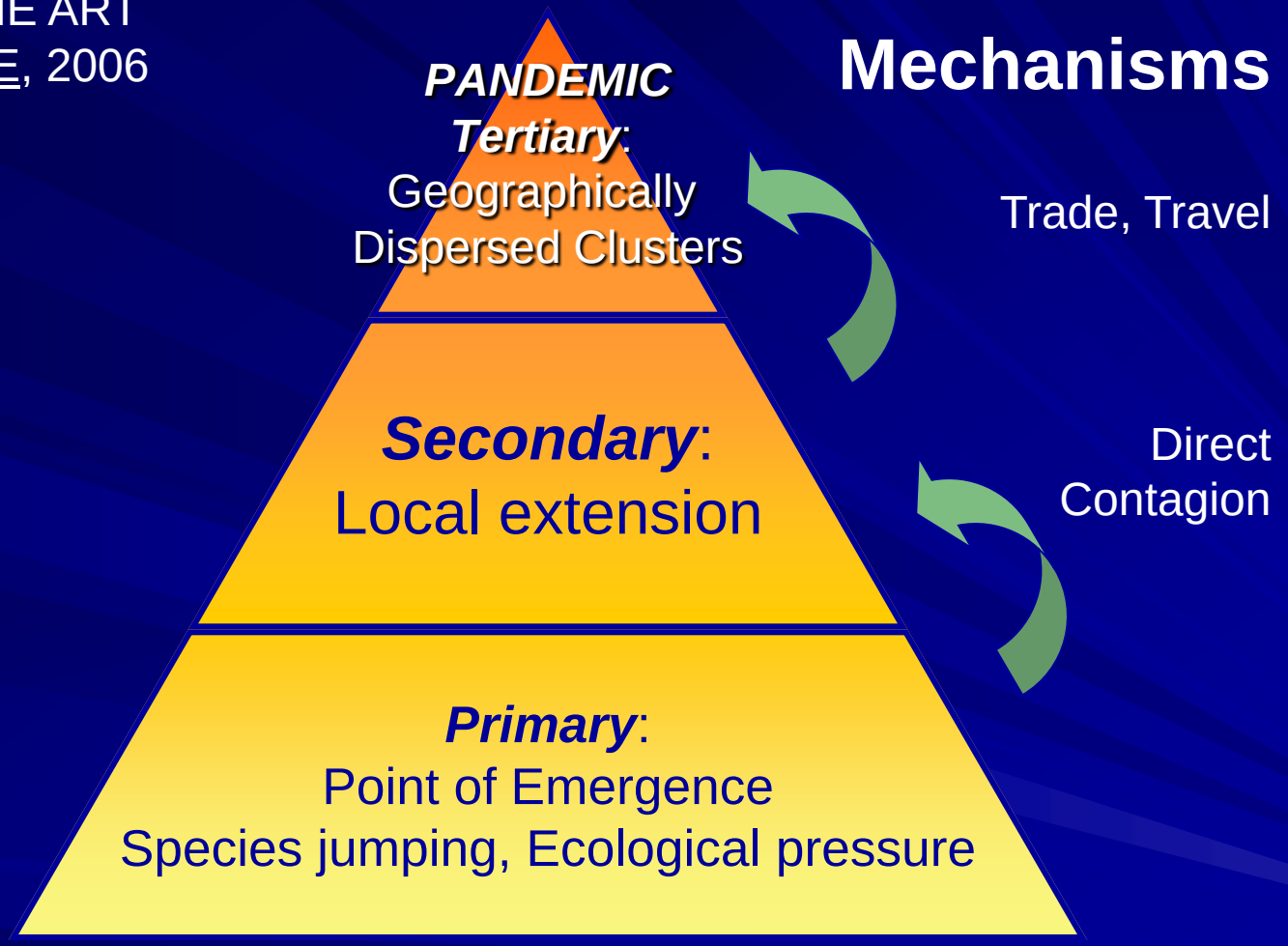
HOW FAST WILL IT CROSS THE PACIFIC???

SARS: international amplification and transmission by guests at Hotel M, Hong Kong, 21 February–26 March



Source: WHO/CDC

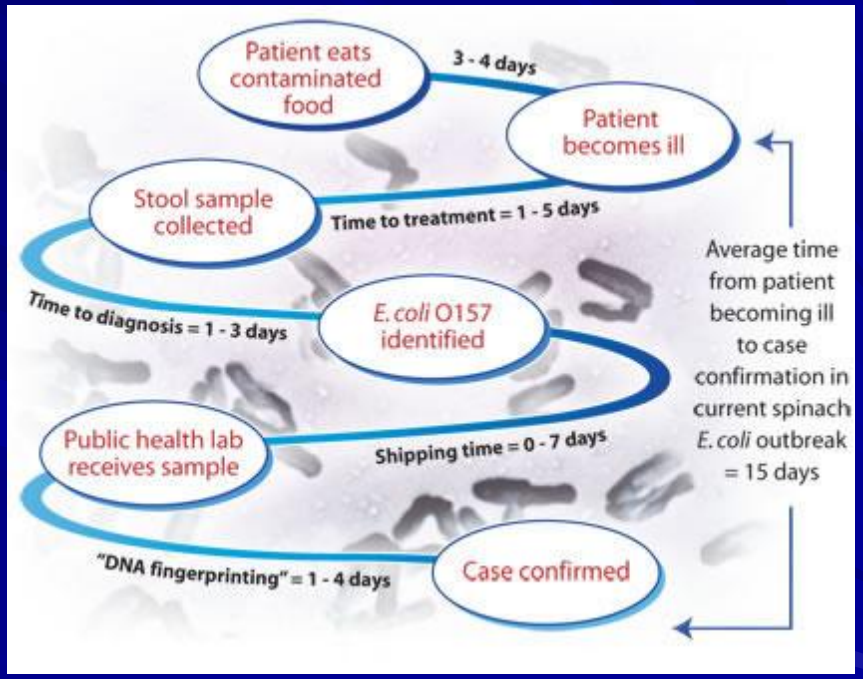
STATE OF THE ART
RISKY TRADE, 2006



Levels of Prevention: Levels of Microbial Traffic

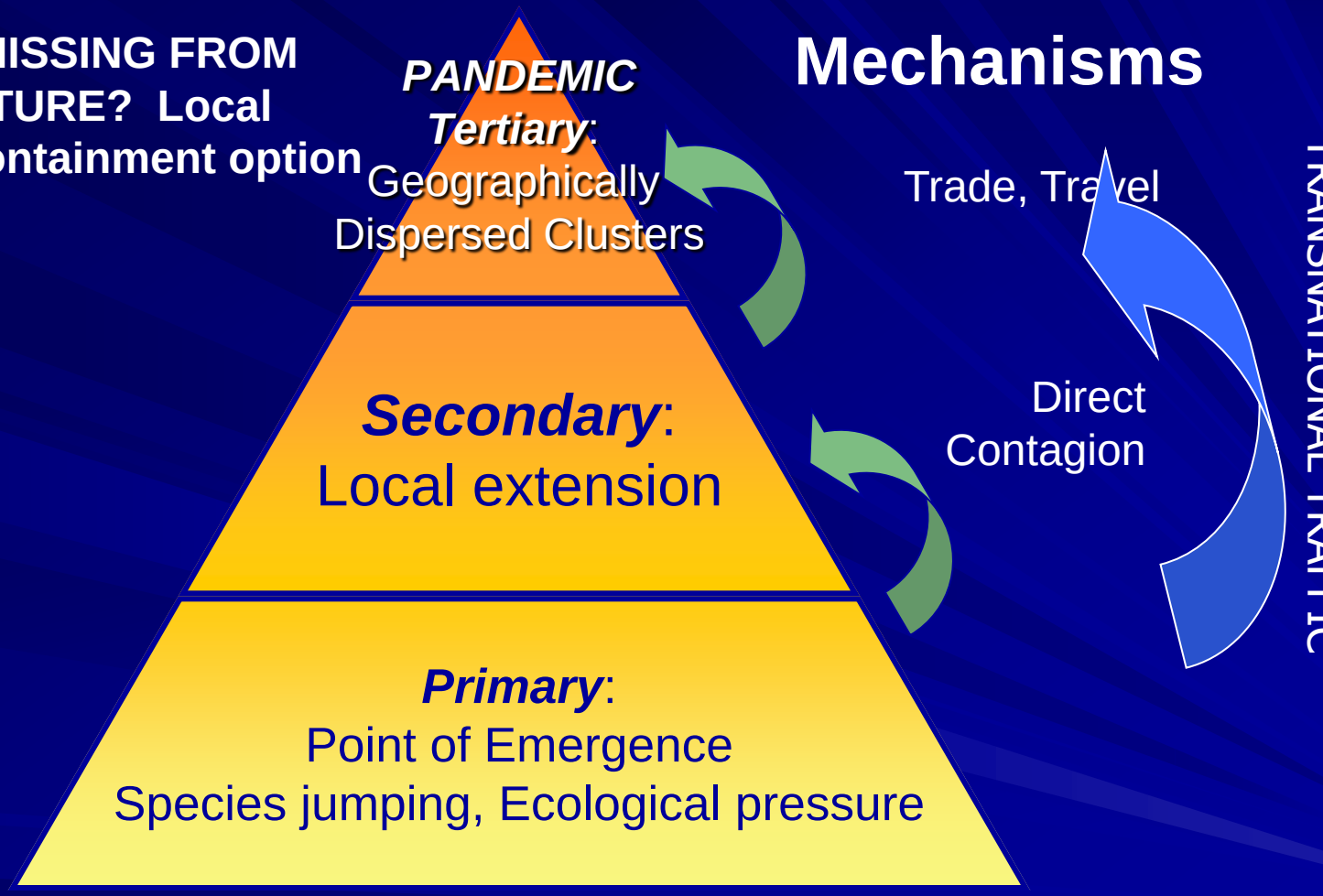
Transborder transmission-Fresh Spinach USA

- “The first reported illness associated with the outbreak began on August 5, the most recently reported case had onset of illness on September 5.
- The states that have reported cases are WI (29), UT (11), NY (7), OH (7), MI (6), NM (5), OR (5), IN (4), ID (3), KY (3), PA (3), CT (2), ME (2), ***CA (1),*** MN (1), NV (1), TN (1), VA (1), WA (1), and WY (1).
- **Spinach is the source,”**



CDC update, September 15,2006

WHATS MISSING FROM THIS PICTURE? Local Health Containment option

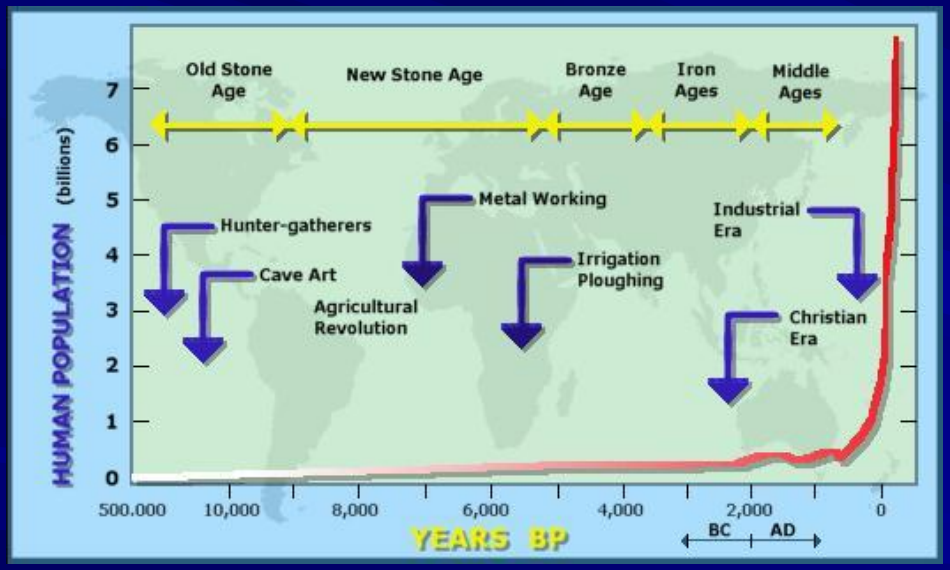


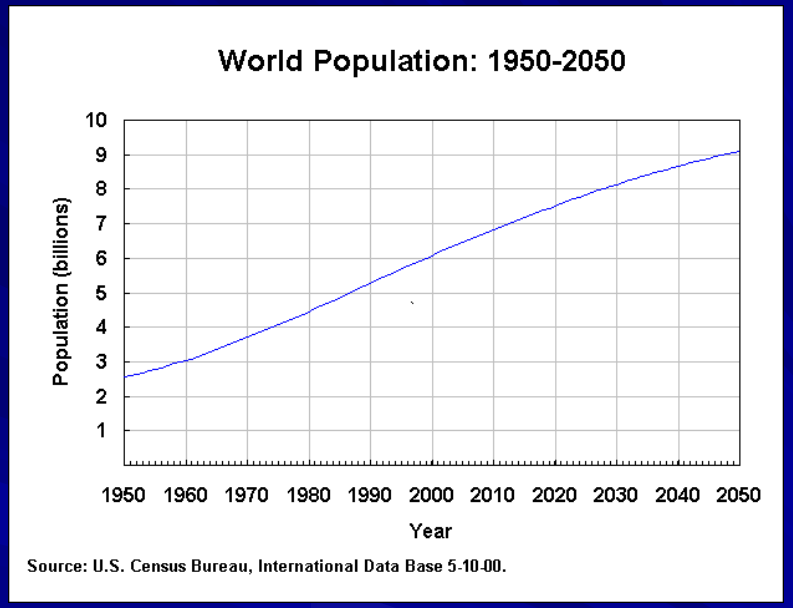
Levels of Prevention: Levels of Microbial Traffic

Risky “unconscious” pressures on microbial pathogen populations

- Human, animal population number and density
- Lack of even access to water, sanitation
- “ramping up” production to meet global appetites
- Use of antimicrobials as growth promoters

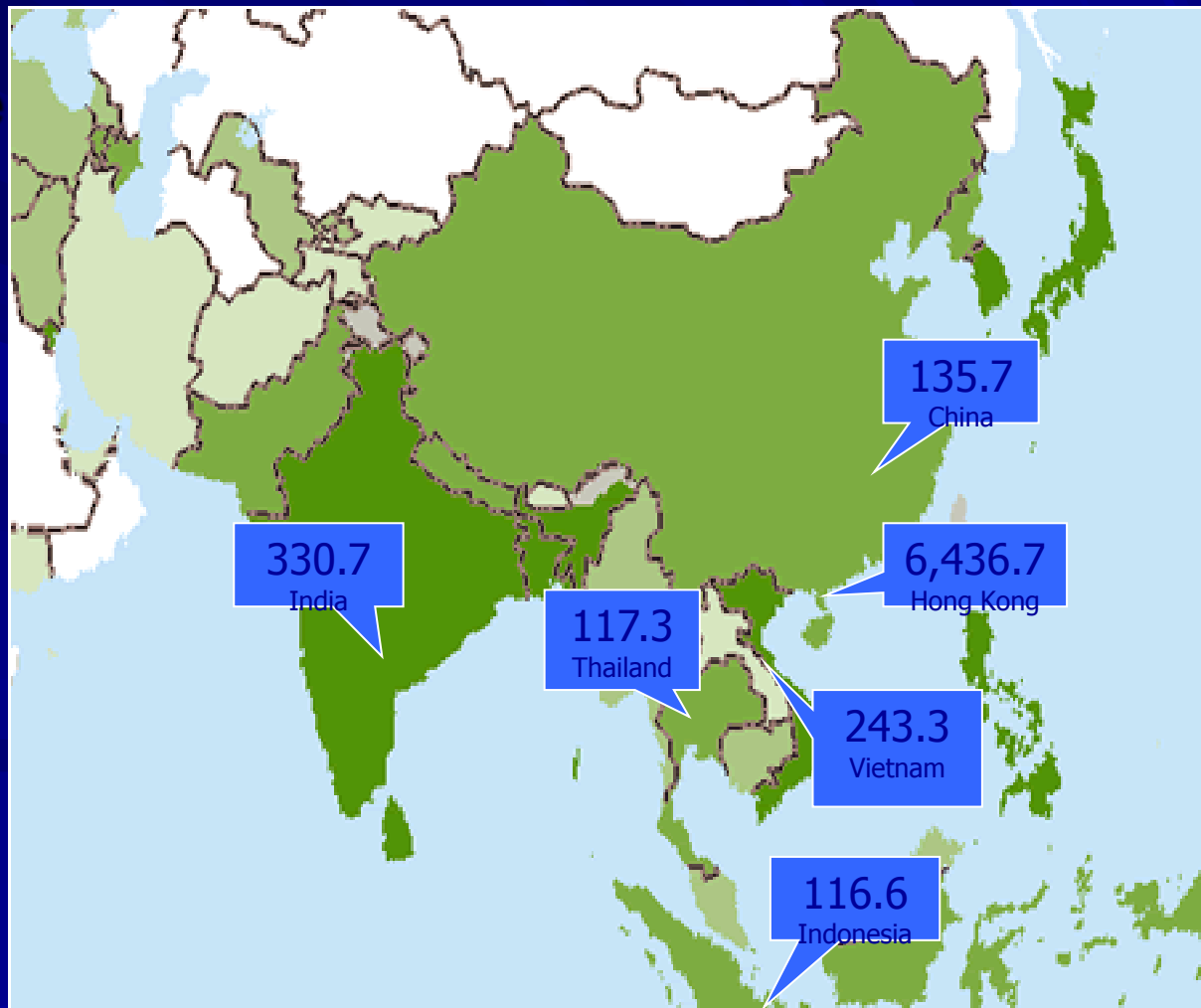
WORLD POPULATION





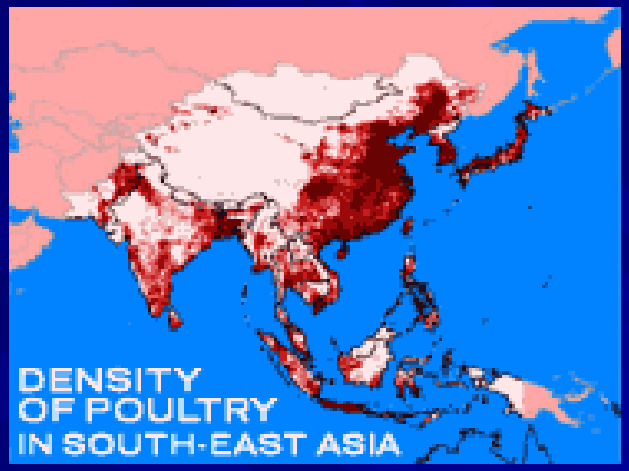
Population Density

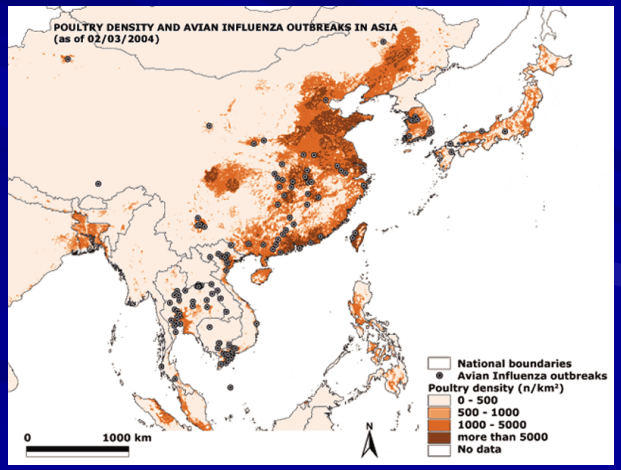
- Human population density in Asia is five fold greater (on average) than density in North America
- In many population centers poultry and livestock are co-located with humans



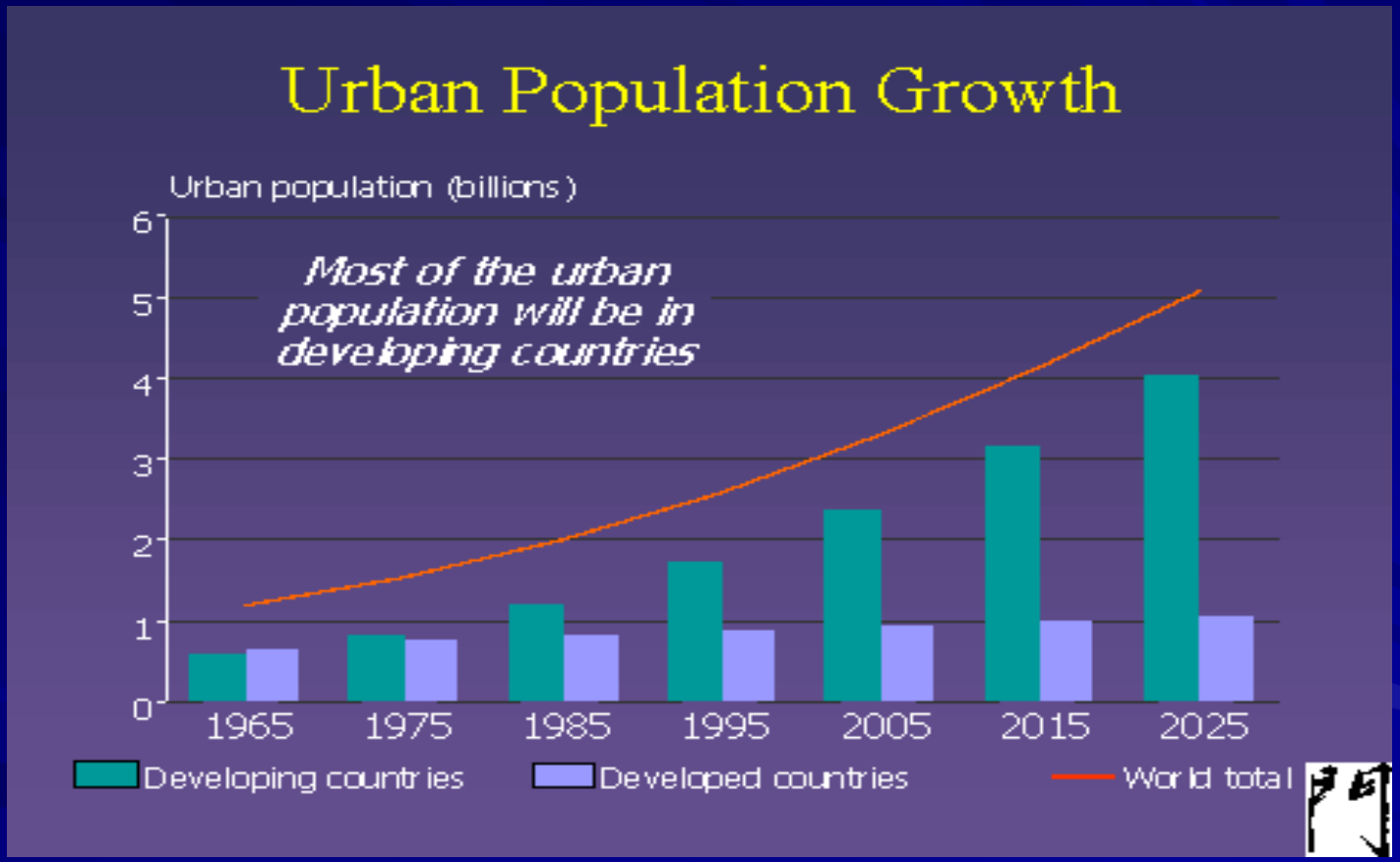
Hosts and crowding and "ramping up"

- Poultry outbreaks have occurred throughout Asia
- Human "bird flu" has occurred in China, Hong Kong, Thailand, Vietnam, Cambodia, Indonesia





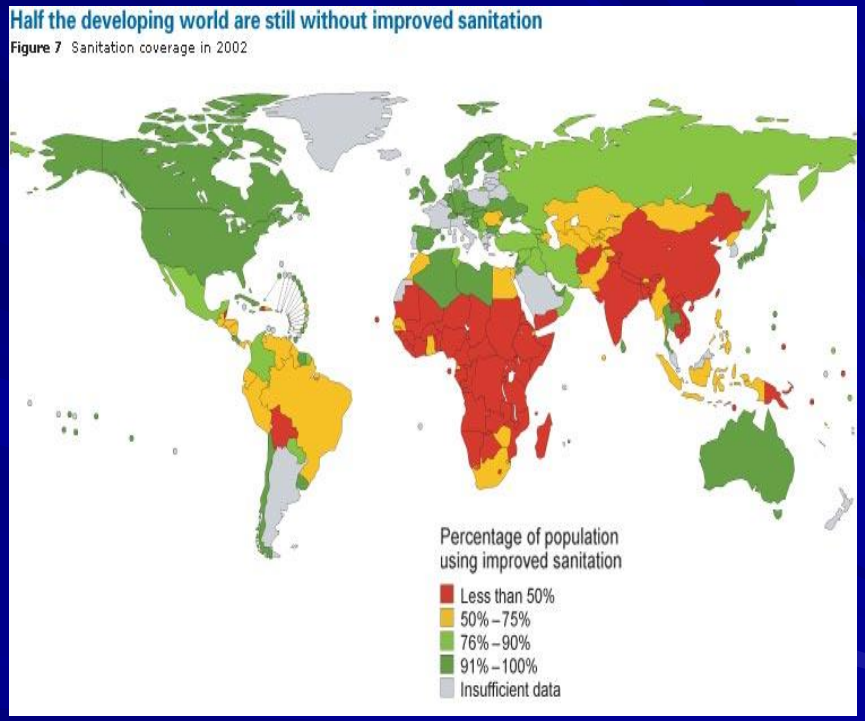
World urban population



Uncontrolled Urbanization

RISK: population density, poor water and sanitation infrastructure="Planetary Overload"

- High co-located populations of humans, swine and poultry
- Poor sanitary infrastructure



Sanitation, water and biosecurity?

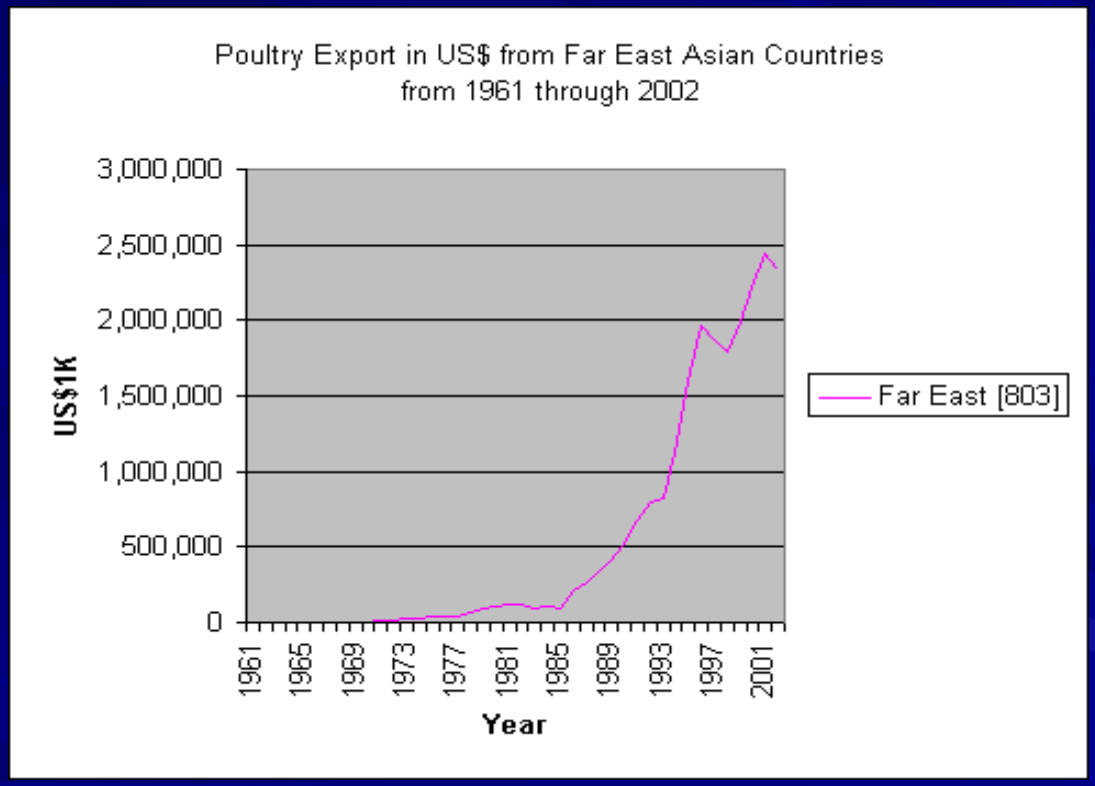
- As new arrivals come into the city, they bring their food animals with them.
- Contact intensifies, largely local consumption, creates biosecurity risk for industrial agricultural
- Superimposition of industrial farming in crowded areas enhances risk of new pathogen emergence

The Pressures of the Global Marketplace and Global Trade work in “unconscious selection” of pathogens

- “ramping up” and shifting production temporally correlates with emergence of new pathogens
- Extended production chains, transportation disseminates pathogens and stymies local control
- Limited population safety net in place

Charles Darwin -“I Love Fools Experiments; I am always making them”

A Five Fold Increase in Poultry Exports in Fifteen Years



What is intensive agriculture?

- **Vertically integrated system**
- **“Integrator” owns stock from birth or hatching through slaughter,**
- **“Integrator” controls all aspects of animal husbandry**
- **Environmental concerns “externalized” by limited market power of grower**

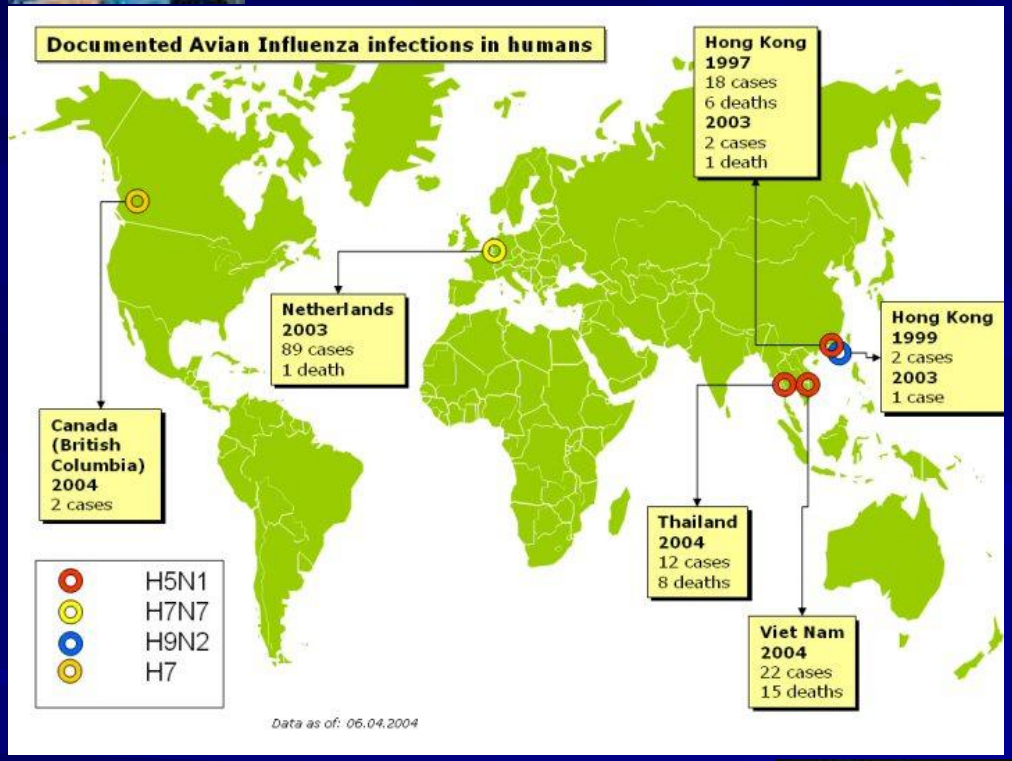
“*Putting Food on the Table: Industrial Farm Animal Production In America, April 2008*

And we are intensifying our food animal practices

- **Introduction of intensive vertically integrated poultry agriculture into Thailand mid 1960s, (Charoen Pokphanol, Thailand and Arbor Acres Food US)**
- **Introduction into China 1978 by CP corp**
- **Poor biosecurity in backyard farms despite biosecurity of facilities**
- **With Avian Influenza risk compounded by free ranging ducks (asymptomatic reservoir for virus)**

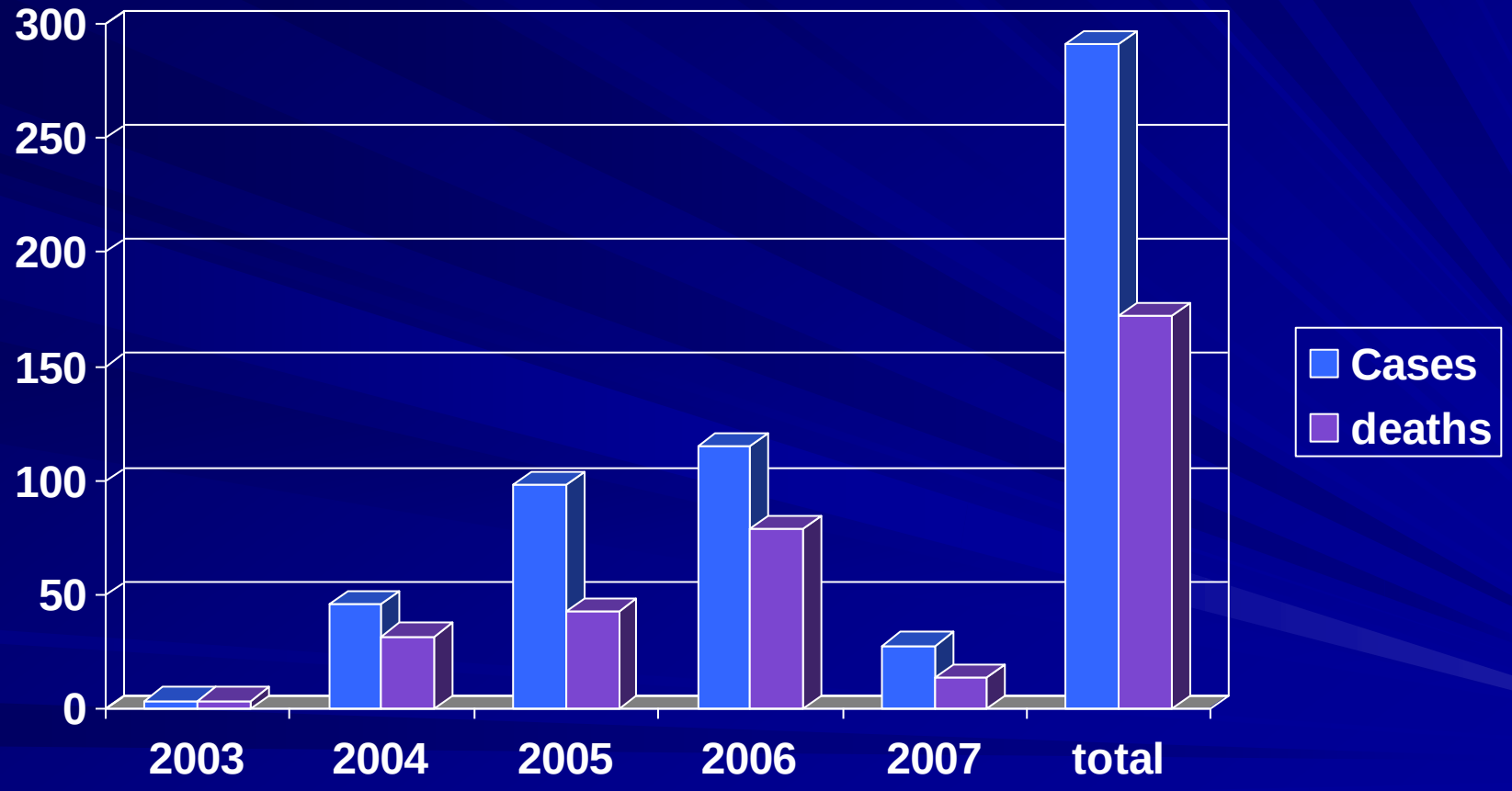
Model Poultry Farm, Ho Chi Mihn city

What is next with Avian Influenza?



- Active Surveillance in place ,sub-regional exercises in pandemic preparedness
- High human mortality, poor transmission
- 166 deaths in 272 cases worldwide (63 deaths in 81 cases in Indonesia)
- “Threshold” for pandemic is not known.

Human cases and deaths, Avian Influenza 2003-2007 *(WHO data, April 11, 2007)*



So What is the Global Regime for Pandemic control?

- IHR: passed 2005, “into force” 2007 implementation by 2009
- Positive obligation of countries to control disease within their borders, assist others to do the same
- New regulations at air and seaports
- US concurred December 2006 in line with federal system
- New definition of “Public Health Emergency of International Concern” (all hazards approach.


Is the event serious?
Yes
No
Is the event unexpected?
Is the event unexpected?
Yes
No
Yes
No
Could it (or has it) spread internationally?
Yes
No
Risk for international sanctions?
Yes
No
Reassess when more informatio n available
Notify the event under the International Health Regulations

Tools of the Trade

Agreement	Nexus with Emergence Paradigm	Manner of action
GATT	May encourage enterprises to “gear up” to enter global marketplace, or to consolidate	Commitment to tariff reduction may necessitate enhanced efficiency
TBT	Potential detection/ tracking of “stealth” infections in biologicals: STANDARDS	Notification of trade change due to human health concerns
SPS	Potential detection/tracking of zoonotic, food-related infections: STANDARDS	Notification of trade change due to human health concerns

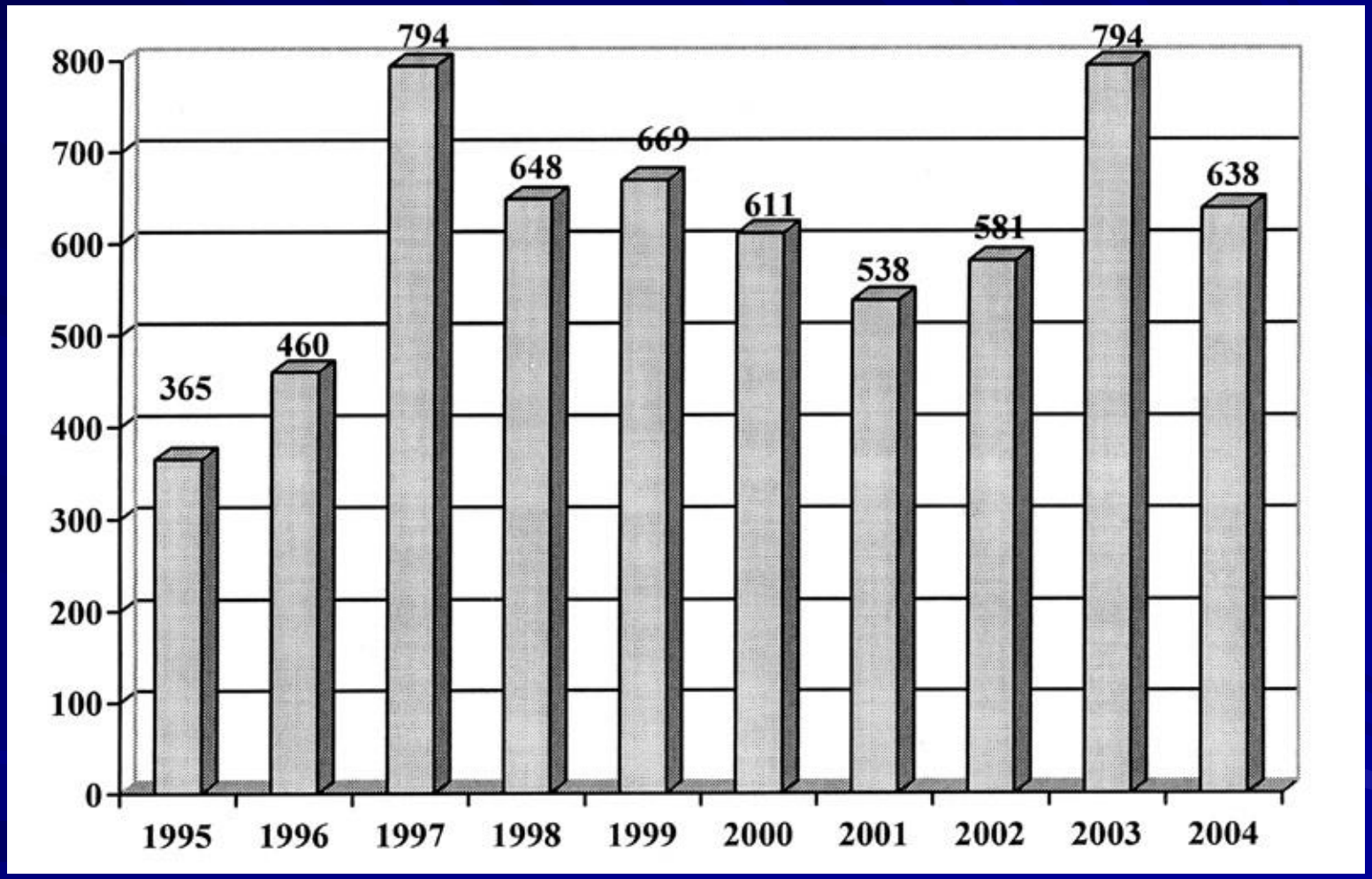
Tools of the Trade

Agreement	Nexus with Emergence Paradigm	Manner of action
TRIPS	Innovation, development of pharmaceutical treatments for new infections; access issues.	Protects intellectual property of new products; allows compulsory licensing in Public Health emergencies.
GATS	Consumption Abroad and Medical Tourism	Unknown risk of microbe and resistance traffic.

URGENT NOTIFICATIONS

- SPS mandates notification of urgent trade restrictions.
- TBT mandates notification of urgent trade restrictions.
- In both instances, human health concerns are the leading rationale for notification

TBT urgent measure notifications by Year, 1995-2005



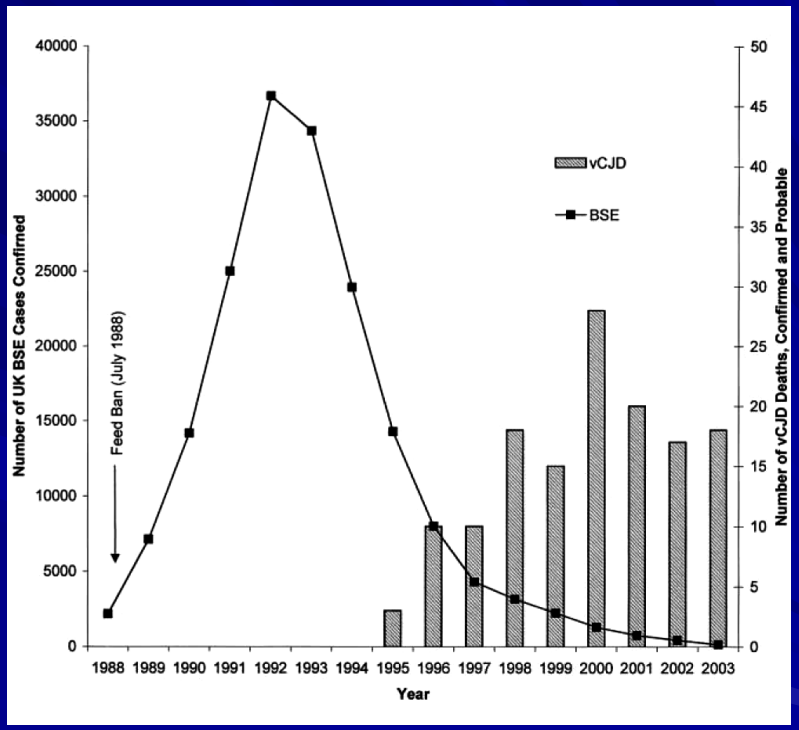
The majority of urgent measures are filed for reasons of "human health"

The Pressure of entering the “Global Market”: Case study: BSE/nvCJD Disease

- Major contributor to disruption of beef trade
- Correlation with UK entry into WTO, reduction of tariffs required increased efficiency of “cottage” beef market
- Change in husbandry practice implicated
- Novel agent, long latency

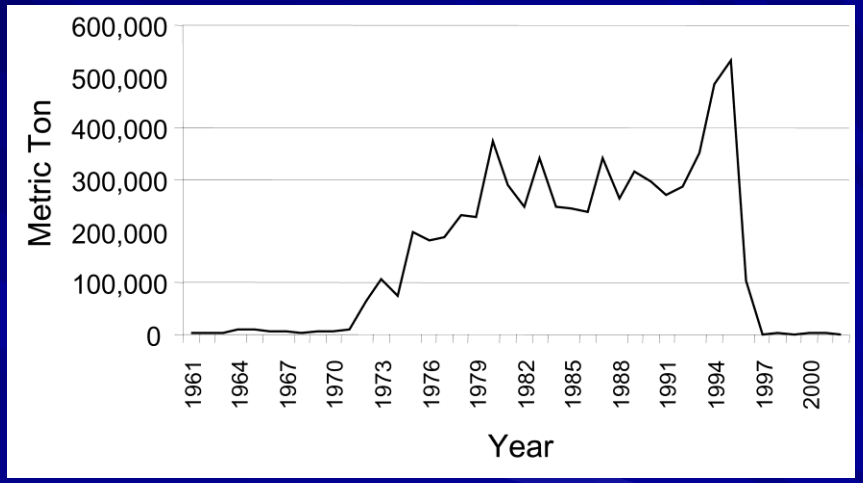
Superimposed Epidemics

- Long incubation period of up to 10 years allowed extensive circulation of MBM infected product in the global market prior to identification of risk.



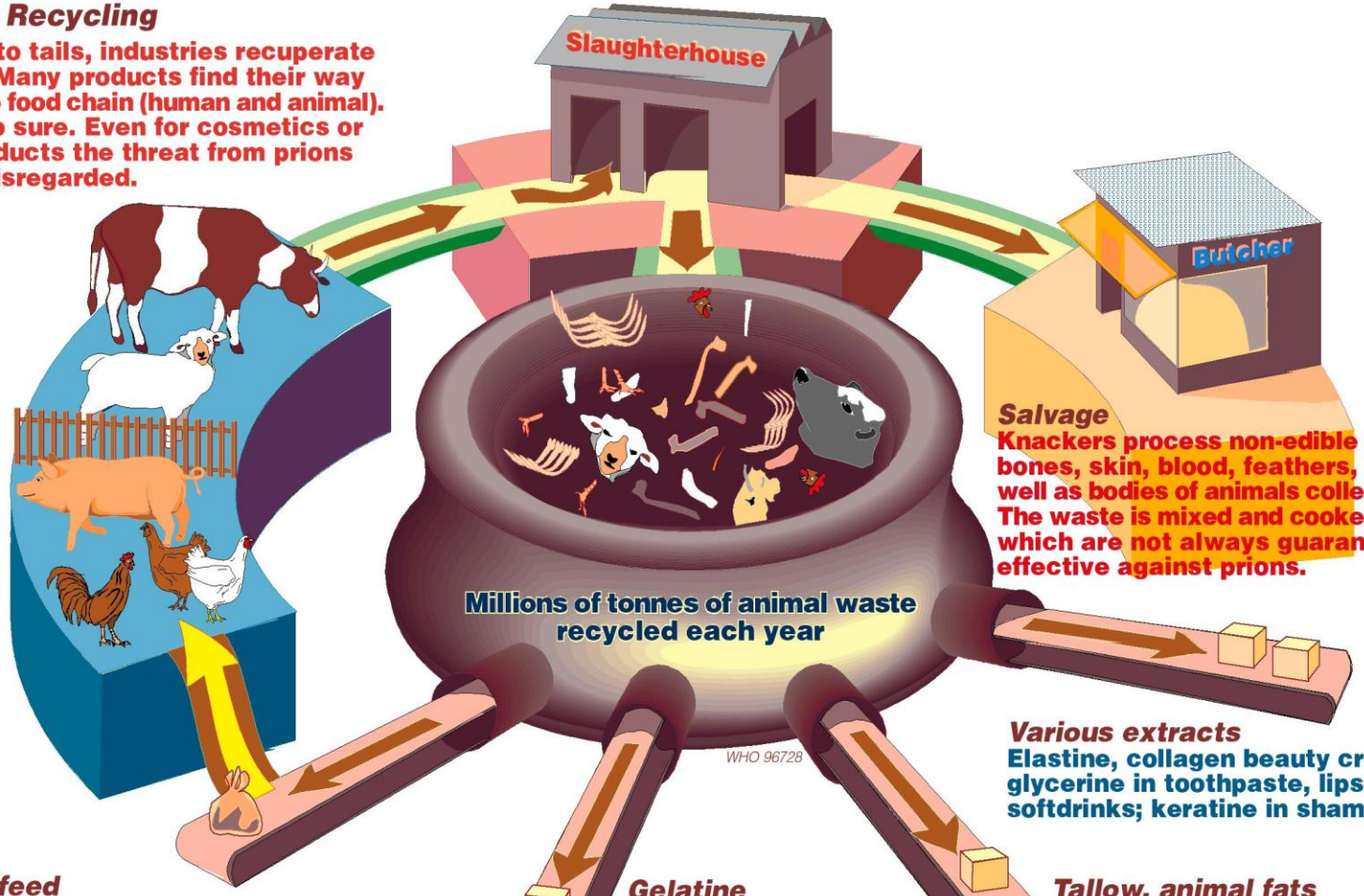
UK beef exports

- Identification of nvCJD with BSE in cows devastated the UK beef export market
- Hypothesis of causal link in 1996, still under scientific dispute. Not under “commercial” dispute



The Great Recycling

From horns to tails, industries recuperate everything. Many products find their way back into the food chain (human and animal). Safe? Not so sure. Even for cosmetics or medical products the threat from prions cannot be disregarded.



Stock farming

Salvage

Knackers process non-edible animal remains: bones, skin, blood, feathers, rind, offal, as well as bodies of animals collected from farms. The waste is mixed and cooked using methods which are not always guaranteed to be effective against prions.

Various extracts

Elastine, collagen beauty creams; glycerine in toothpaste, lipstick, some softdrinks; keratine in shampoos

Animal feed

Millions of tonnes are produced each year. Prohibited for cattle and sheep, reserved for pigs and poultry (and also fish), for which it is presumed that there is no risk.

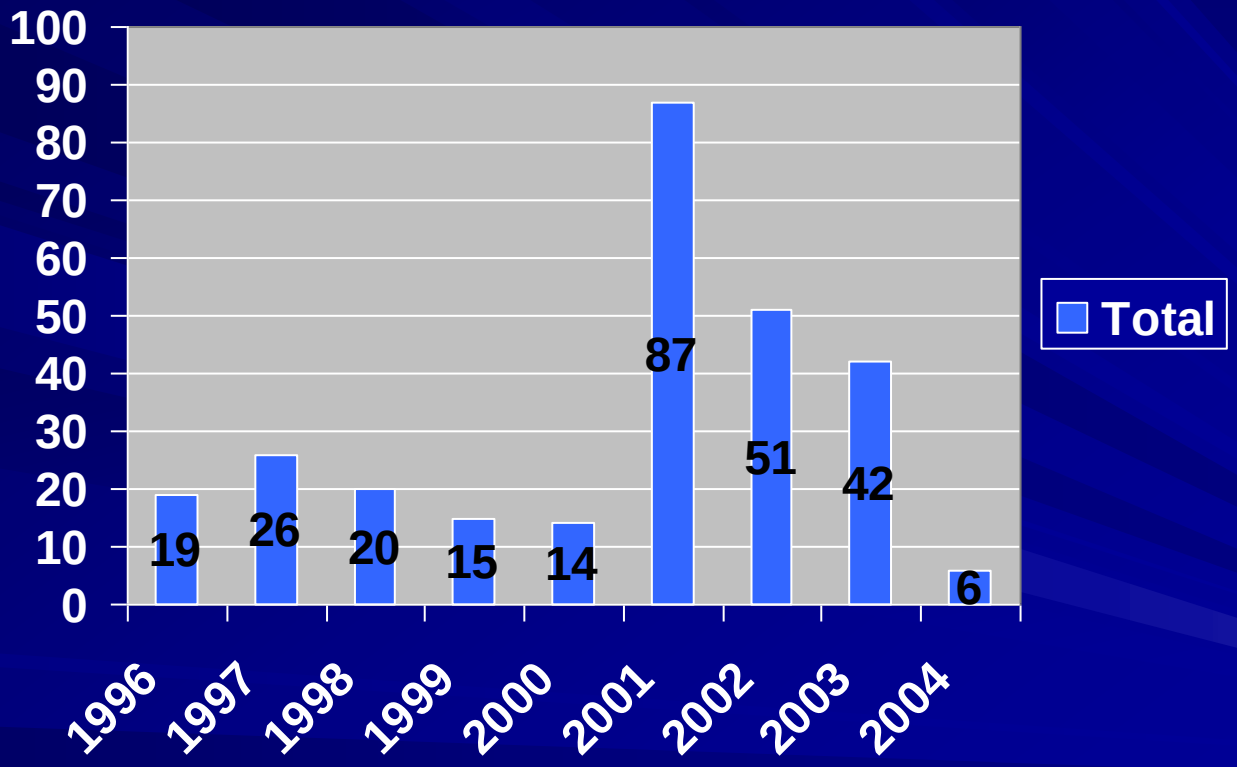
Gelatine

From sweets to patés, desserts to medicines, even for the preparation of table wines

Tallow, animal fats

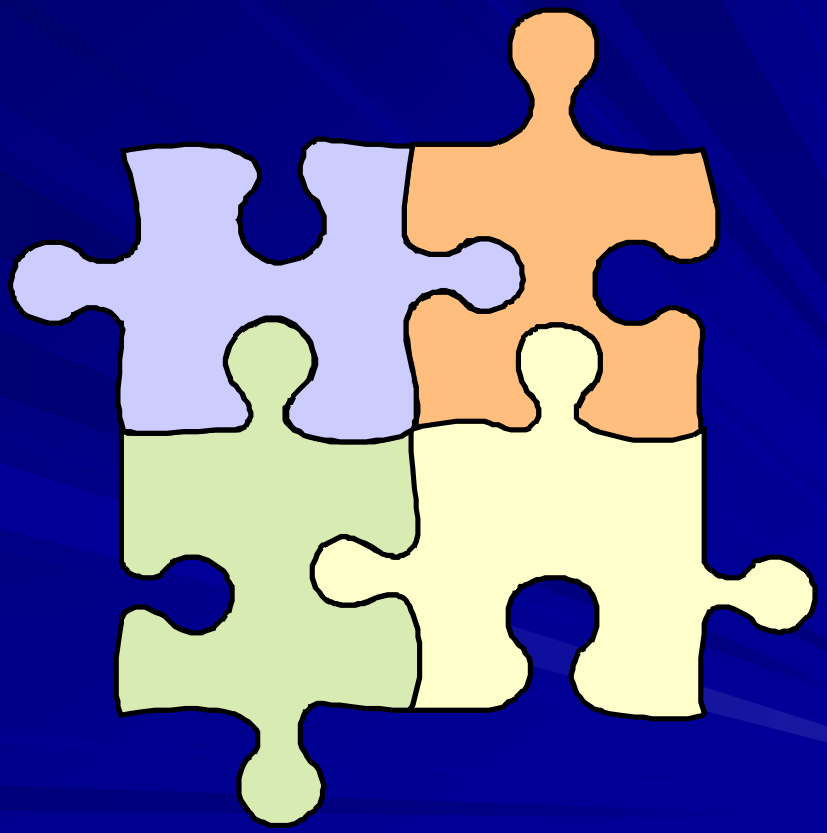
Omnipresent in foodstuffs (biscuits, ice-creams, stock, cooking oil). Also used for making soaps.

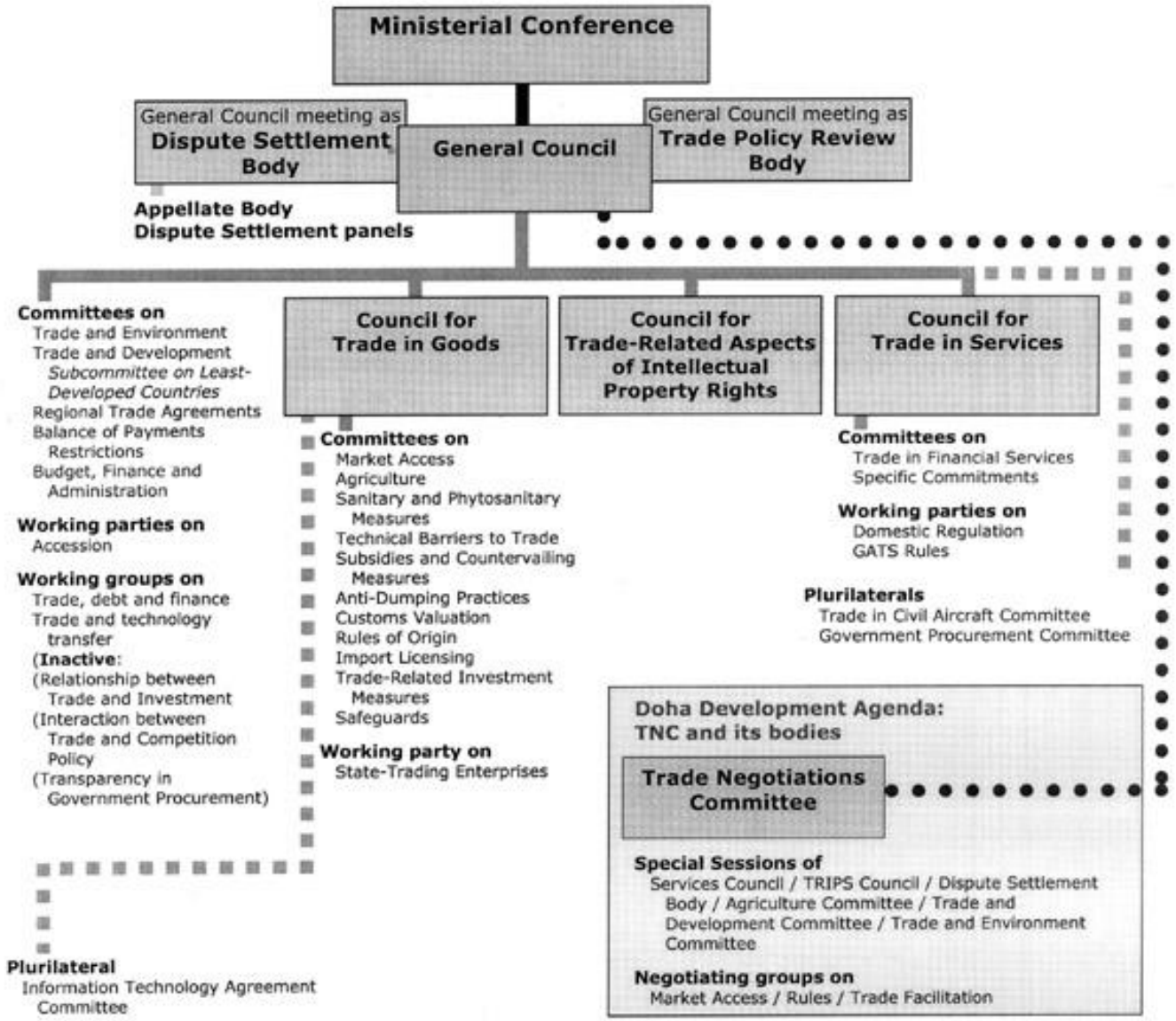
The number of BSE-related SPS urgent notifications as of December 2003



The 3 trillion dollar question…

- Why is there no working group on Health at WTO?





Key

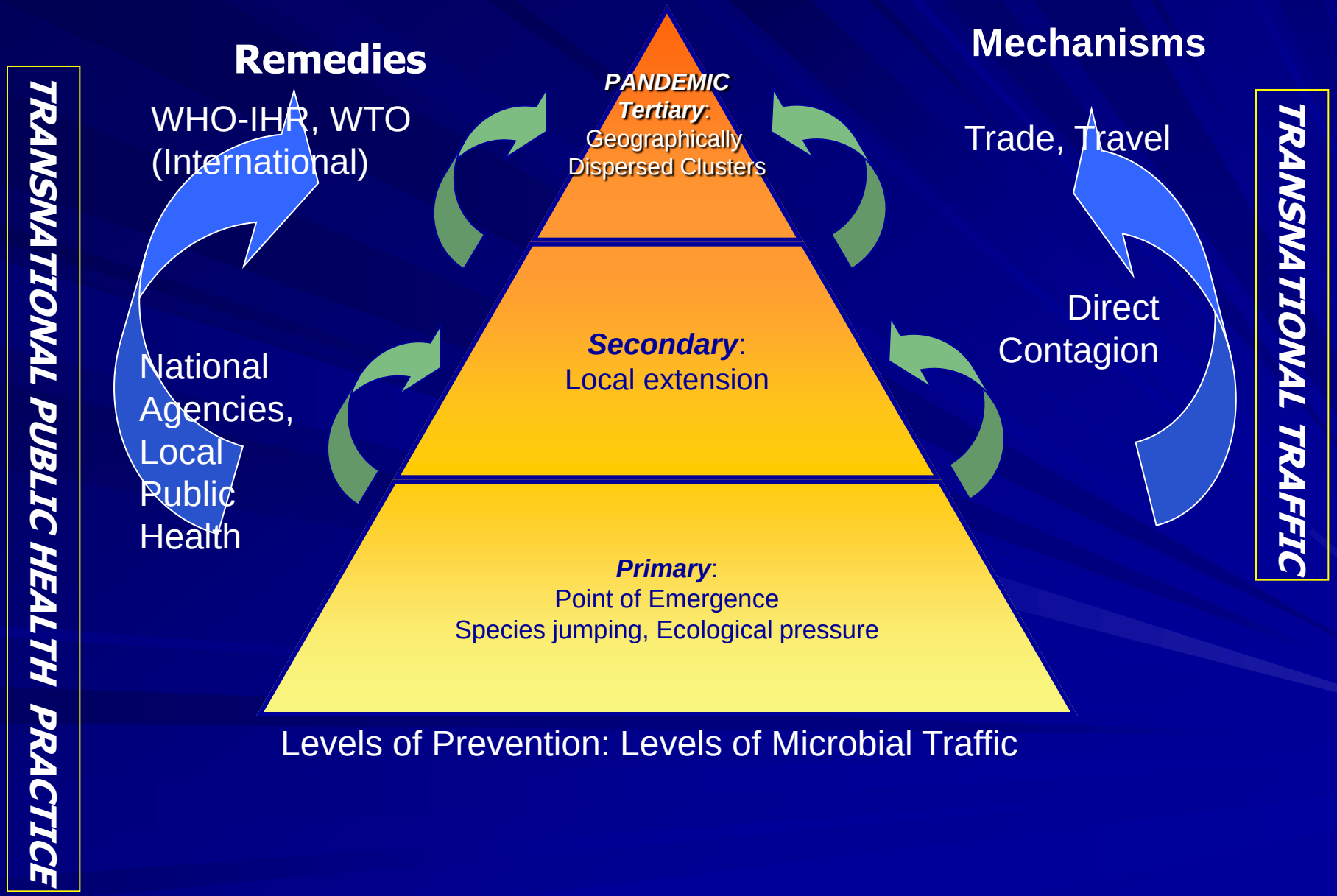
- Reporting to General Council (or a subsidiary)
- Reporting to Dispute Settlement Body
- Plurilateral committees inform the General Council or Goods Council of their activities, although these agreements are not signed by all WTO members
- Trade Negotiations Committee reports to General Council

The General Council also meets as the Trade Policy Review Body and Dispute Settlement Body

Antimicrobial Resistance: The Sleeping Giant ?

- Global animal husbandry has included use of antibiotics as “growth promoters”
- Use in US estimated at 12 million kg to 70 million kg annually (Jameson et al 1993, Asrestrup 2001)
- May be common in developing countries
- “Integrated Fish Farming” using farm animal waste as fodder potentially source of enhanced resistance particularly in the tropics (Peterson A et al, 2002)

THE NEW IMPERATIVE FOR GLOBAL POPULATION SAFETY



Problem Statement

- The Globalization of Health and the protection of the worlds populations has lagged behind the globalization of economies and societies in other domains
- The globalization of commercial production and Globalization is market driven, Public Health is not
- The medical market concept has proven dysfunctional for population coverage: It relies on population purchasing power

Conclusion

- “Variability is not actually caused by man; he only *unintentionally* exposes organic beings to new conditions of life and then nature acts on the organization and causes it to vary”—Darwin
- We have an imperative to understand the population risks posed by global commerce and to systematically assure population safety.

Acknowledgments

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Thank you!