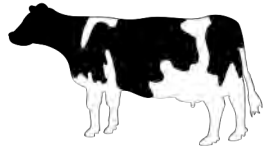


Zoonotic Diseases and Worker Health



PAHO/WHO



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Disease or Inapparent infection (or infestation)

contact
 (direct or indirect)
 with animals or
 their products and
 contaminated environment



**Professional
 Zoonoses**

(also recreational or
 accidental)

**ingestion of food
 products from infected
 animals**



**Food-Borne
 Zoonoses**



Source: Pr. J. P. Ganiere,
 School of Vet. Med.,
 Nantes, France

Professional ZONNOSES



Rabies

Tuberculosis

Brucellosis



Q Fever

Chlamydiosis



Leptospirosis

Anthrax



Erysipeloid

Streptococcosis (*S. suis*)



Poxviruses (orf...)

Influenza (?)

& salmonellose, campylobactériose ...



Food-Borne ZONNOSES (FBZ)



Bovine Spongiform Encephalopathy
nvCJD (about 150 human cases)

Salmonellosis

Listeriosis

Campylobacteriosis

E. coli O157:H7 Infection

High level
of infection
carriage
in animals



FBZ

tuberculosis, brucellosis, Q fever, ...

Source: Pr. J. P. Ganiere, School of Vet. Med., Nantes, France



Risk factors for sporadic *Campylobacter jejuni* infections in rural Michigan.

Source: Potter and Kaneene Am J Public Health. 2003;93:2118-23.

- **OBJECTIVES:** Risk factors for campylobacteriosis in a rural population. Exposure to live farm animals was hypothesized to increase the risk for *Campylobacter jejuni* enteritis.
- **RESULTS:** Persons engaged in poultry husbandry had increased odds of campylobacteriosis (OR = 6.88; 95% CI = 1.44, 32.95). Dose-response relationship between the number of types of poultry contact and campylobacteriosis.
- **CONCLUSIONS:** 18% (95% CI = 6%, 30%) of *Campylobacter* cases occurring in rural populations were attributable to poultry husbandry. Cases occurred in individuals who were not poultry farmers by occupation.

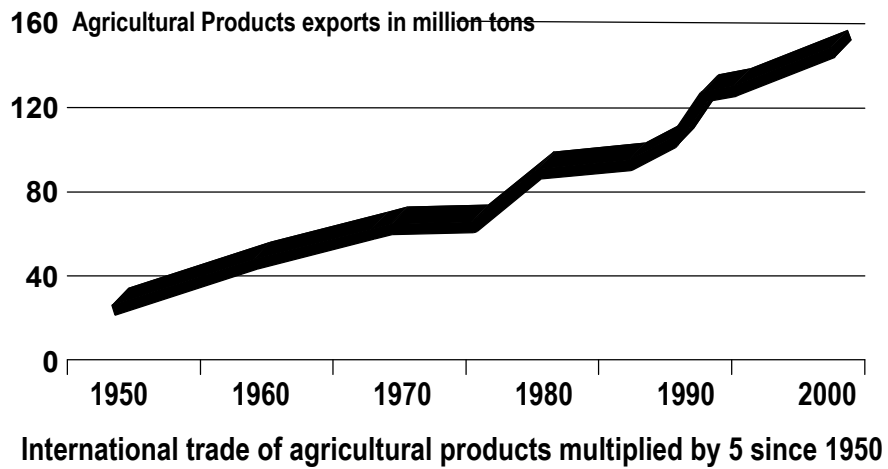
ZOONOSES and the RISK of DISEASE EMERGENCE

Taylor et al., Phil. Trans. R. Soc. Lond. B. 2001, 356:983-989.

- **61% of human pathogens are zoonotic and 12% are emerging pathogens.**
- **75% (132/175) of the emerging pathogens are zoonotic.**
- **Overall, zoonotic pathogens are twice as likely to be associated with emerging diseases than non-zoonotic ones .**

Increased International Trade of Agricultural Products.

Source: WTO, 2000



H5N1- Influenza outbreak Hong Kong 1997-1998

One million chickens were destroyed
Imports from mainland China were stopped
Shortage of poultry occurred in HK



Transmission of H7N7 avian influenza A virus to human beings during a large outbreak in commercial poultry farms in the Netherlands.

Source: Koopmans et al., Lancet. 2004;363:587-593.

- Outbreak of highly pathogenic avian influenza A virus H7N7 (February 2003), in commercial poultry farms in the Netherlands.
- 453 people had health complaints: 349 reported conjunctivitis, 90 had influenza-like illness, and 67 had other complaints.
- A/H7 virus detected in conjunctival samples from 78 (26.4%) people with conjunctivitis only, in five (9.4%) with influenza-like illness and conjunctivitis, in two (5.4%) with influenza-like illness only, and in four (6%) who reported other symptoms.
- Unexpectedly high number of transmissions of avian flu A virus subtype H7N7 to people directly involved in handling infected poultry, and evidence for person-to-person transmission.

Serologic evidence of H1 swine Influenza virus infection in swine farm residents and employees.

Source: Olsen et al., Emerg. Infect. Dis. 2002;8:814-9.

- Seropositivity to swine and human H1 influenza viruses evaluated in 74 swine farm owners, employees, family members and veterinarians in rural south-central Wisconsin, compared with 114 urban Milwaukee (WI) residents.
- The number of swine farm participants with positive HI antibody (titers ≥ 40) to swine influenza viruses (17/74) and their geometric mean titers were significantly higher ($p < 0.001$) than in urban control samples (1/114).
- Swine virus seropositivity was significantly associated ($p < 0.05$) with being a farm owner or a farm family member, living on a farm, or entering the swine barn ≥ 4 days/week.
- Swine farmers may represent an important sentinel population to evaluate the emergence of new pandemic influenza viruses.

Nipah virus, Malaysia, 1998

- Most patients were pig farmers.
- Clinically undetected Nipah infection was noted in **10 (6%) of 166 community-farm controls** (persons from farms without reported encephalitis patients) and **20 (11%) of 178 case-farm controls** (persons from farms with encephalitis patients).

Source:Parashar et al.
J. Infect Dis. 2000;181:1755-1759



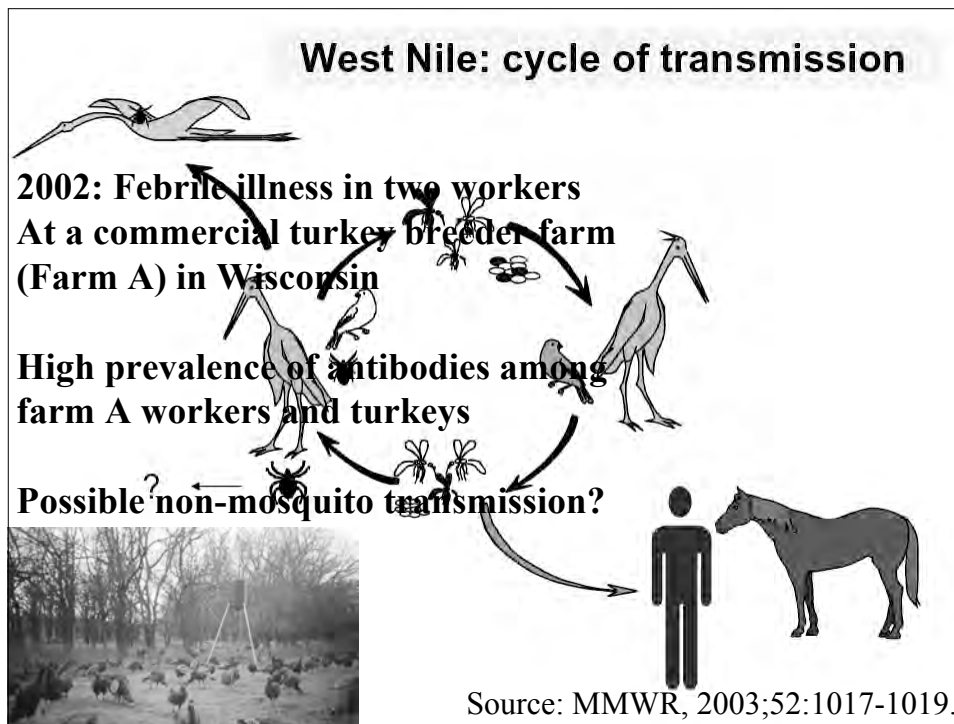
Source:Parashar et al. J. Infect Dis. 2000;181:1755-1759



Nipah virus, Malaysia, 1998

Cases were more likely than community-farm controls to report increased numbers of sick/dying pigs on the farm (59% vs. 24%, $P=.001$) and were more likely than case-farm controls to perform activities requiring direct contact with pigs (86% vs. 50%, $P=.005$). Only 8% of case patients reported no contact with pigs.





West Nile Virus infection among Turkey Breeder Farm workers, Wisconsin, 2002

Source MMWR, 2003;52(42):1017-1019.

| Exposure Group | No. tested | No. WNV IgM + | (%) |
|--|------------|------------------|------|
| Farm A workers | 19 | 8 | (42) |
| <i>Farm A workers exclusively</i> | 11 | 6 | (55) |
| <i>Farm A workers and other breeder-farm workers</i> | 8 | 2 | (25) |
| Other breeder-farm workers | 38 | 2 | (5) |
| Non-breeder farm workers | 13 | 0 | (0) |
| Turkey meat processing | | | |
| Plant workers | 22 | 0 | (0) |
| Farm A residents* | 14 | 0 | (0) |

(* Do not work with turkeys)

ZOONOTIC DISEASES IN FARMERS:

United Kingdom, 1992-1999

Source: Coleman, Acta Tropica, 2000;76:71-75.

600 farmers enrolled from 3 areas: Herefordshire, Lancashire and Norfolk (200 for each region).

Serosurvey for

Bornavirus, Hantavirus, Orthopoxvirus and parapoxvirus;

Bartonella spp., *Borrelia burgdorferi*, *Brucella* spp.,

Chlamydia spp., *Coxiella burnetii*, *Helicobacter pylori*,

Leptospira interrogans

Echinococcus granulosus, *Neospora caninum*,

Toxoplasma gondii

Fecal samples for *Salmonella* spp., *Shigella* spp.,

Campylobacter spp., and *E. coli* O157:H7

ZOONOTIC DISEASES IN FARMERS:

United Kingdom, 1992-1999 (Cont'd)

Source: Coleman, Acta Tropica, 2000;76:71-75.

Results

Ringworm and Orf (4%) rather common and associated with exposure to cattle and sheep (24% said to have had orf).

Chlamydia psittaci: 80% prevalence (most significant risk: attendance at lambing).

Coxiella burnetii (Q fever): 27%; 4 times more common than in controls (ambulance men). Exposure to cattle especially at calving was greatest risk factor amongst positive farmers.



Ecthyma



Pseudo-cowpox



Bovine Papular Stomatitis

POX-VIRUSES

Orf & Milkers' Nodule (Pseudocowpox)



Source: Pr. J. P. Ganiere, School of Vet. Med., Nantes, France

ZOONOTIC DISEASES IN FARMERS:

United Kingdom, 1992-1999 (Cont'd)

Source: Coleman, Acta Tropica, 2000;76:71-75.

Results (Cont'd)

No seropositive for *Brucella* and very low prevalence <0.5% for *Borrelia burgdorferi* and surprisingly for *Leptospira interrogans* (<0.2%).

Hantavirus: 4.7% (1991) and 4.8% seroconverted during the first year, Orthopoxvirus and parapoxvirus;

Bartonella henselae: 3% spp.,
Helicobacter pylori: 30%.

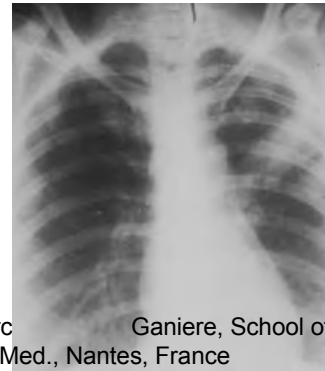
AVIAN CHLAMYDIOSIS

(*Chlamydophila psittaci*)



Enzootic in many duck (France), turkey (USA, France, U.K.), poultry farms...

Often subclinical infection revealed →
By human disease
farmers, veterinarians, Slaughterhouse workers (respiratory route)



Source: Ganiere, School of Vet. Med., Nantes, France

CHLAMYDIOSIS IN FARMERS/PLANT WORKERS: UNITED STATES

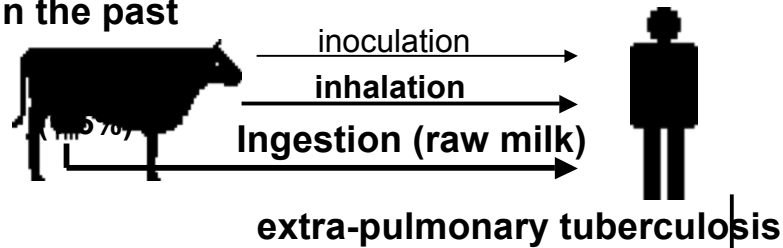
Source: Eidson, JAVMA, 2002;221:1710-1712.

Turkey farmers:

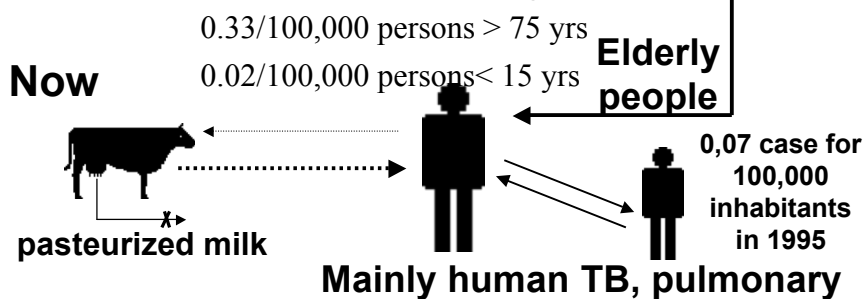
- Outbreak in Minnesota: many cases in processing plants, rendering plants, farm and further process plant. 186 suspect cases, 122 confirmed cases, serologically.
- North Carolina: 60 suspected cases, 40 confirmed. High rate of air sacculitis in birds (25% versus normal of 1-3%).

France: Human Tuberculosis caused by *M. bovis*

In the past



Now



Source: Pr. J. P. Ganiere, School of Vet. Med., Nantes, France

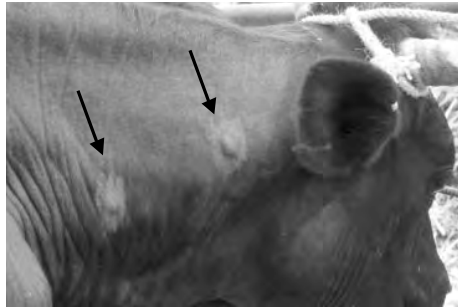
Epidemiology of *Mycobacterium bovis* Disease In San Diego County, 1994-2000.

Source: LoBue et al., Int. J. Tuberc. Lung Dis, 2003;7:180-185.

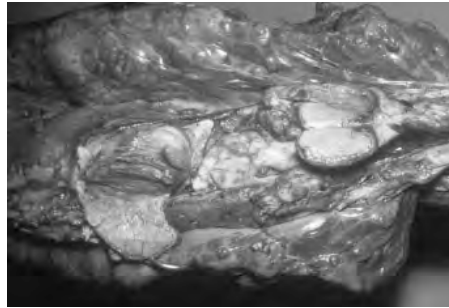
- Between 1994 and 2000, 1,931 evaluable cases of culture-positive TB were identified; 129 (6.7%) were infected with *M. bovis* and 1,802 were infected with *M. tuberculosis*.
- More than 90% of *M. bovis* cases occurred in Hispanic persons. About 25% of patients were children, and the main site of disease was extra-pulmonary in 53% of patients (cervical and mesenteric nodes, the peritoneum, and the GI tract) ; 23% had concurrent HIV infection.
- *M. bovis* patients were more likely to be Hispanic, aged 0-14 years, have extra-pulmonary disease, or have HIV co-infection in a multivariate model. They were less likely to be born in countries outside of the US or Mexico.

Bovine Tuberculosis Screening :

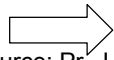
Becoming more difficult because of low prevalence: In more than 60% of cases: identified at slaughterhouse



Tuberculation



Bovine TB: pulmonary lesions



Herd destruction

Source: Pr. J. P. Ganiere, School of Vet. Med., Nantes, France

Brucellosis



Brucella abortus

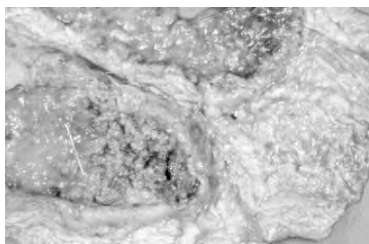


Brucella melitensis



Brucella suis
(biovar 2)

placentite et avortement



**Uterine Content during pregnancy:
main source of contamination**

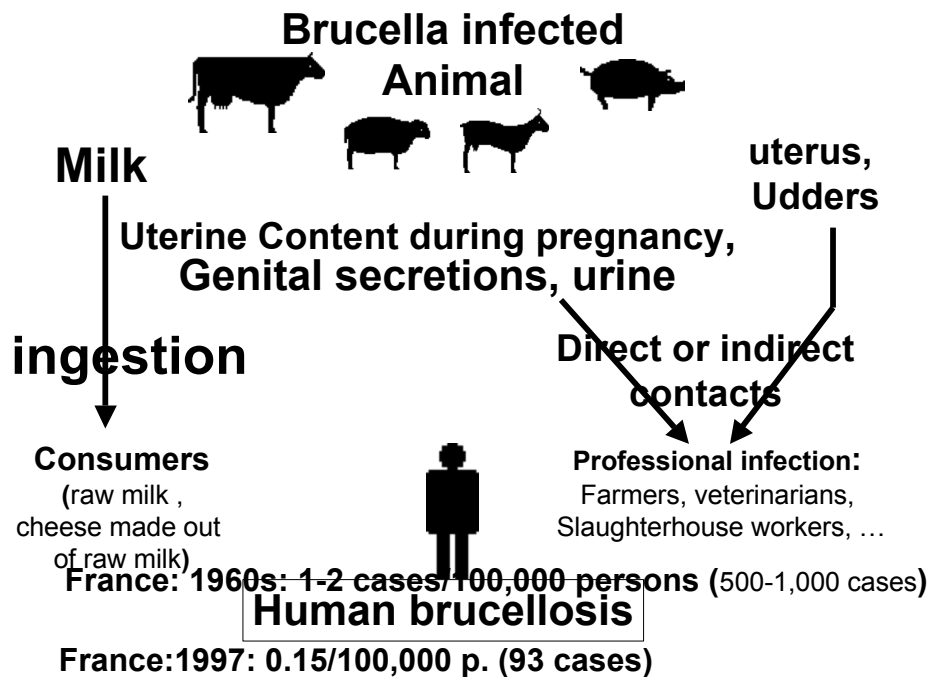
Source: Pr. J. P. Ganiere, School of Vet. Med., Nantes, France

Brucellosis Prevalence in human populations

Source: Med Mal Infect, 2001;31S2:202-216.

| Country | Prevalence per 100,000 persons | |
|----------|--------------------------------|------------------------------------|
| USA | 0.03 | |
| France | 0.15 | (90% <i>B. melitensis</i> in 1997) |
| Italy | 3 | (Sicily: 20) |
| Spain | 4 | |
| Portugal | 10 | |
| Greece | 20 | |
| Iran | 30 | |

Source: Pr. J. P. Ganiere, School of Vet. Med., Nantes, France





Swine Brucellosis

Caused by
Brucella suis 2

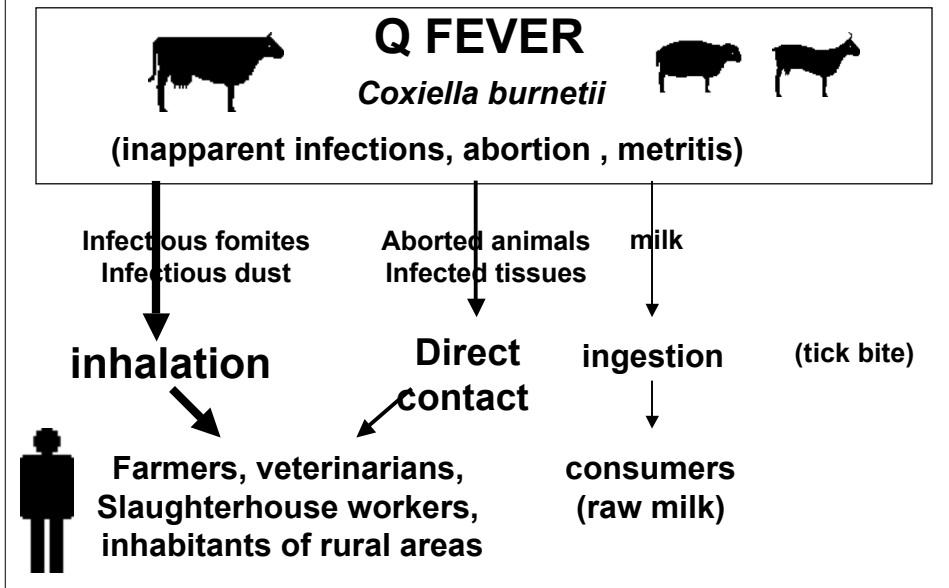
About 30 infected swine herds
since 1993 in France

Source of infection: *Brucella* infection
of wild boar populations

Source: Pr. J. P. Ganiere, School of Vet. Med., Nantes, France

Source: Pr. J. P. Ganiere, School of Vet. Med., Nantes, France

20% to 40 % of sheep flocks infected
in South-East of France



Q fever prevalence studies in human populations: U.K. and Northern Ireland

England & Wales:

**1117 cases reported between 1984 and 1994
(1/3 from southwestern region).**

Mean age 45 yrs; 74% of cases were males,

**47% respiratory symptoms,
7% heart disease and 5% with hepatitis.**

Seroprevalence: 27% (600 persons tested)

Northern Ireland farmers:

Seroprevalence: 28% (N=?)

Q fever prevalence studies in human populations: FRANCE

Source: Rousset et al., Med Mal. Infect. 2001;31S2:233-246.

**Estimates: 600 acute and 60 chronic Q fever cases/year
(reported: 100 acute and 32 chronic cases)**

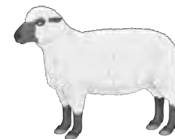
Seroprevalence: 4-5% in southern France

Out of 100 human cases,

40 live in rural areas

23 ate unpasteurized goat cheese

35 had contact with newborn or pregnant animals



Studies of *Coxiella burnetii* infections in dairy herds with special regard to infections in men.

Source: Sting et al.,
Berl Munch Tierarztl Wochenschr. 2002;115:360-365.

- In Germany, investigation of 1167 dairy cows (105 herds) with fertility disorders demonstrated that *C. burnetii* infection is significantly associated with abortions but not with repeated inseminations without success or vaginal excretions.
- Farmers on farms where cows aborted and had a *C. burnetii* antibody prevalence of $> \text{ or } = 20\%$ more likely to be also seropositive for *C. burnetii* than comparison group.

Q fever prevalence studies in human populations: GERMANY

Source:Hellenbrand et al. Emerg Infect Dis. 2001;7:789-796.

- The average annual Q fever incidence nationwide from 1979 to 1989 was 0.8 per million, and from 1990 to 1999, 1.4 per million.
- The mean annual incidence from 1979 to 1999 ranged from:
 - a minimum of 0.1 per million in several northern states to
 - 3.1 per million in Baden-Wurttemberg, in the South.

Q fever prevalence studies in human populations: GERMANY

Source:Hellenbrand et al. Emerg Infect Dis. 2001;7:789-796.

- 40 documented outbreaks were identified since 1947; in 24 of these sheep were implicated as the source of transmission.
- The seasonality of community outbreaks has shifted from predominantly winter- spring to spring-summer, possibly because of changes in sheep husbandry.
- The location of recent outbreaks suggests that urbanization of rural areas may be contributing to the increase in Q fever.

Q fever prevalence studies in human populations: U.S.A.

Source: McQuiston JH, Childs JE. Vector Borne Zoonotic Dis. 2002;2:179-191.

- **For 1948-1986, 1,396 human cases were reported from almost every state, but mainly from California (67%).**
- **Occupational exposures (research facilities, farm environments, slaughterhouses) commonly reported, sheep most frequently implicated as a possible source of infection.**
- **Livestock handlers had a significantly higher prevalence of antibodies to *C. burnetii* than did persons with no known risk.**


Q fever prevalence studies in human populations: U.S.A.

Source: McQuiston JH, Childs JE. Vector Borne Zoonotic Dis. 2002;2:179-191.

Animal studies showed wide variation in seroprevalence, with goats having a significantly higher average seroprevalence (41.6%) than sheep (16.5%) or cattle (3.4%).



Swine streptococcal infection (*Streptococcus suis* 2)

 septicemia, meningitis,
pneumonia, endocarditis

Frequent carriage
(tonsils, mucosa)

Wound Contamination

farmers,
Slaughterhouse workers,
butchers, ..



meningitis
and septicemia

Source: Pr. J. P. Ganiere, School of Vet. Med., Nantes, France

Swine streptococcal infection (*Streptococcus suis* 2)

- Human infection by streptococci was first reported in 1968, when three cases of meningitis with concurrent septicemia were diagnosed in Denmark (Perch et al., *J. Clin. Microbiol.* 1983;17, 993-996). Subsequently, a significant number of cases have also been reported from Holland, France, England, Wales, Hong Kong, Canada and New Zealand (Robertson & Blackmore, *Epidemiol. Infect.* 1989;103: 157-164; Tambyah et al., *Clin. Infect. Dis.* 1997;15:1165-1173).
- The disease in humans appears to be an occupational hazard, as most cases have occurred in pig breeders or abattoir workers. Minor skin cuts, infected wounds and abrasions have been reported as the portal of entry of the organism for humans.

Conclusions

- Rural Zoonoses need to be better investigated, especially in the USA.
- New emerging zoonoses will appear related to international trade, new type of farming.
- Urban/rural encroachment and wildlife interactions are of major concern for on-farm zoonoses.

Recommendations

- Personal hygiene is key for zoonotic prevention.
- Quarantine and testing of incoming animals is very important to prevent spread of zoonotic diseases in animal populations.
- Knowledge of routes of transmission is essential to prevent human infection.

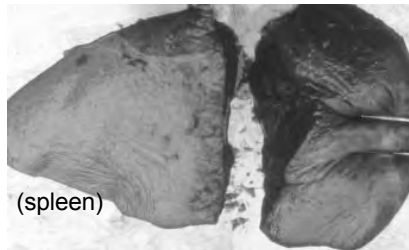


ANTHRAX

(Bacillus anthracis)



Animal: source from soil contamination



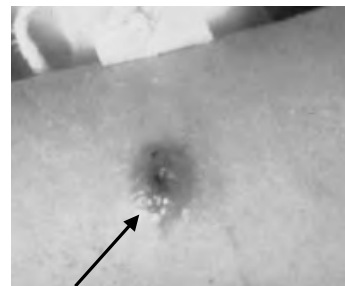
(spleen)

Several outbreaks every year

**Importance
of vaccination
In exposed herds
And incineration
Of infected cadavers**

In humans:

**Mainly anthrax by inoculation
(rarely inhalation or ingestion)**



Anthrax Eschar

Source: Pr. J. P. Ganiere, ENV, Nantes, France

Source: Pr. J. P. Ganiere, School of Vet. Med., Nantes, France



Ovine Chlamydiosis

(enzootic abortion)

Caused by
Chlamydophila abortus

Infection widely spread
In sheep flocks

Important cause
Of abortion

(vaccination possible)

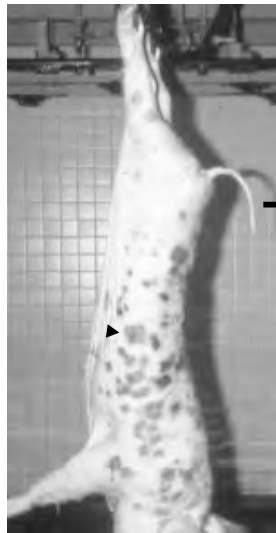
contact with
infected ewes
During lambing



Incriminated in
rare cases of
abortion

Erysipelotrichosis (*Erysipelothrix rhusiopathiae*)

ROSENBACH'S
ERYSIPELOID



inoculation



Source: Pr. J. P. Ganiere, School of Vet. Med., Nantes, France