Pathology of Swine

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Management Technologies → Disease

Traditional Technologies
- small farms: 50-100 sows, outside
- group farrowing: 2-4 groups/year
- weaning age: 4-8 weeks-of-age
-continuous-flow rearing

Evolution in Management Technologies
- large farms: 1000-5000 sows, inside
- reduced weaning age: 10-21 days-of-age
- age-segregated rearing: AI/AO, SEW
- site-segregated rearing: 2- or 3- site

Ages: Stages

	Conventional	SEW
Suckling	< 3 weeks	< 2 weeks
Nursery	3-8 weeks	3-8 weeks
Grower	2-6 months	2-5 months
Breeding	> 6 months	> 6 months

Generalized Diseases

Organ Systems

- Gastrointestinal
- Respiratory
- Cardiovascular
- Nervous
- Urogenital
- Musculoskeletal
- Integumentary

Veterinary Pathology e-Text Book

Veterinary Pathology Virtual Slide e-Book

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Veterinary Pathology

- Pathology of Swine Diseases by M. Kiupel and I. Langohr
- Pathology of Ferret Diseases by M. Kiupel
- Pathology of Neoplastic Diseases of Domestic Animals by M.Kiupel and R. Smedley

iPath Diagnostics Ltd., 23 University Street, Belfast, BT7 1FY, Email: contact@i-path.co.uk

Salmonella choleraesuis pneumonia

Diffuse hemorhhagic interstitial pneumonia Diagnostic features: 1. Diffuse interstitial pneumonia with expansion of alveolar walls by congested capillaries and interstitium by read more

View Case

Salmonella choleraesuis hepatitis

Multifocal necrotizing hepatitis Diagnostic features: Multifocal randomly distributed foci of coagulative hepatic necrosis infiltrated with epithelioid macrophages, neutrophils, lymphocytes read more

View Case

Salmonella choleraesuis nephritis

Severe fibrinous glomerulonephritis with necrotizing vasculitis. Diagnostic features: 1. Fibrinous glomerulonephritis with mesangial necrosis and exudation of fibrin into the urinary read more

View Case

Salmonella typhimurium hepatitis

Multifocal necrotizing hepatitis Diagnostic features: Multifocal randomly distributed foci of coagulative hepatic necrosis infiltrated with epithelioid macrophages, neutrophils, lymphocytes read more

View Case

Salmonella typhimurium colitis

Severe diffuse fibrinonecrotic typhlocolitis Diagnostic features: 1. Diffuse superficial mucosal necrosis and multifocal mucosal ulceration 2. Fibrinonecrotic read more

View Case

Generalized Diseases

Salmonella

- Gram-negative non-sporing rods (2-4 X 0.5 µm), no capsule
- Classified into groups according to the Kauffman-White classification scheme
- The identification of serotypes is based on:
  - "O" (somatic/ cell wall) antigens (lipopolysaccharide-protein chains exposed on the cell surface)
  - "H" (flagellar) antigens
- Usually motile with long flagella
- Non-motile variants may occur e. g. *S. pullorum*
- Optimal growth between 35-37°C and pH 7-7.5
- Can survive several months away from the host
- Can survive refrigeration, freezing (much reduced growth at temperatures <15°C and above 6°C) and dry conditions
- Sensitive to most disinfectants
- Killed at high temperatures: 60°C for 2-6 min or 70°C for 1 min

Salmonella

- Modulates host cell functions to allow bacterial entry and promote survival in macrophages, endothelial cells
- 2 Type III secretion system (bacterial proteins which lack signal sequence are secreted into cell cytosol, resembles flagellum)
- Pathogenicity islands: SPI (n=5)
  - SPI-1 early in infection for invasion of epithelial cells
  - SPI-2 crucial in systemic growth and survival and proliferation in macrophages
  - SPI-3 genes required for growth in $Mg2^{+}$-limited conditions (e.g., in macrophages)
  - SPI-4: role in invasion
  - SPI-5: required for enteric, not systemic, virulence

Hallmarks

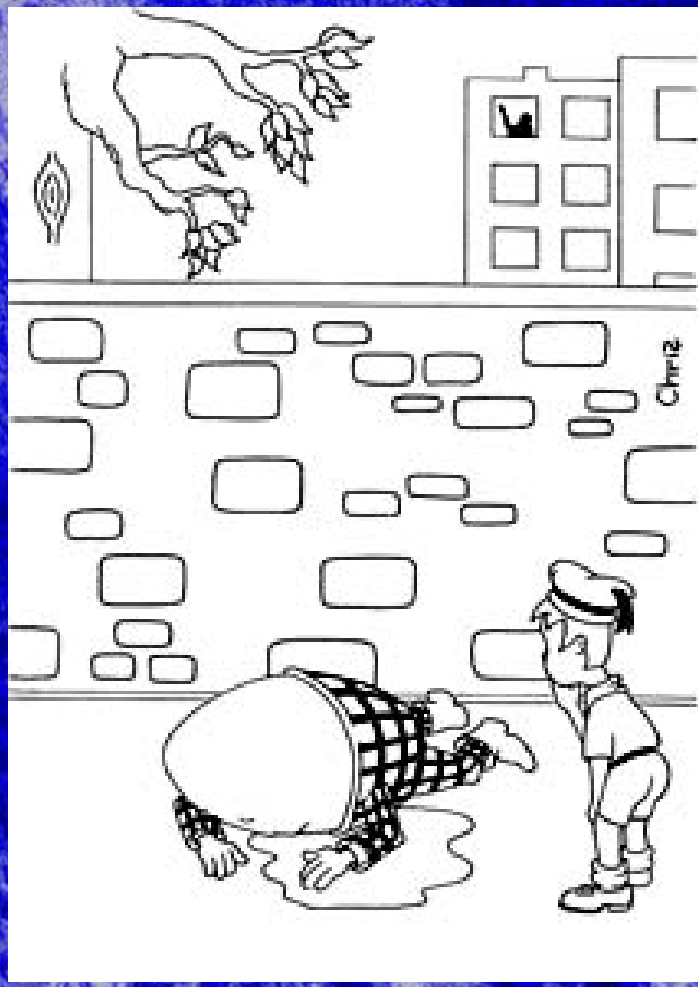
Adherence

Entry by induced phagocytosis

± local damage via uncertain mechanism

± transcytosis, transport to LN

± systemic spread



"Salmonella !"

Salmonella choleraesuis

- Severe septicemia in weaned and grower pigs
- +/- concurrent pneumonia or enterocolitis
- Multifocal hepatic necrosis (paratyphoid nodules)
- Replicates in macrophages as well as extracellularly in lymphoid tissues
- Large amounts of systemic endotoxin activate cytokines and induce vascular damage:
  - hemorrhage, interstitial pneumonia with edema, glomerulonephritis, gastric mucosal venous thrombosis and arterial thrombosis (skin of extremities and colon → ulcers)


Salmonella choleraesuis

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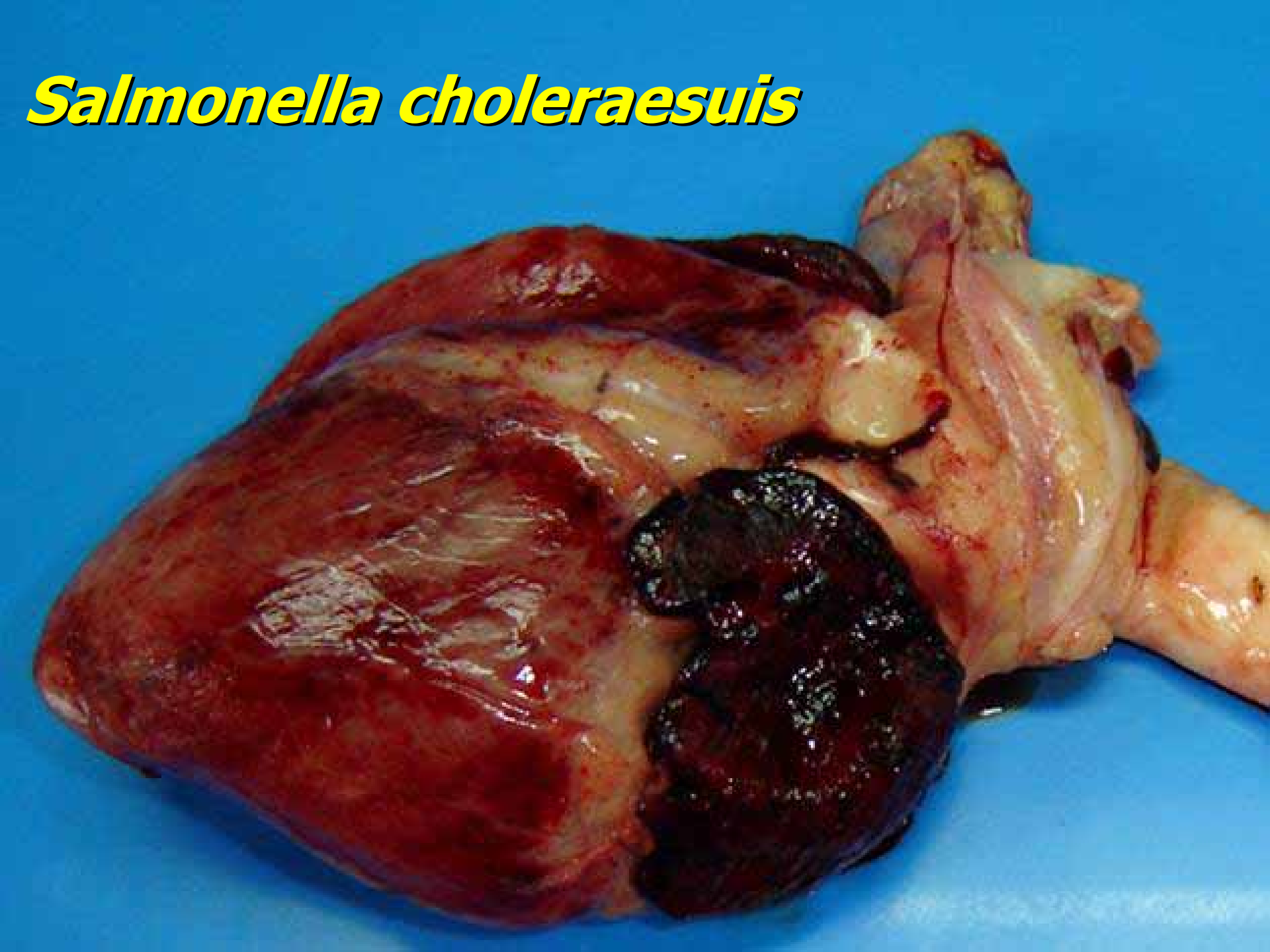
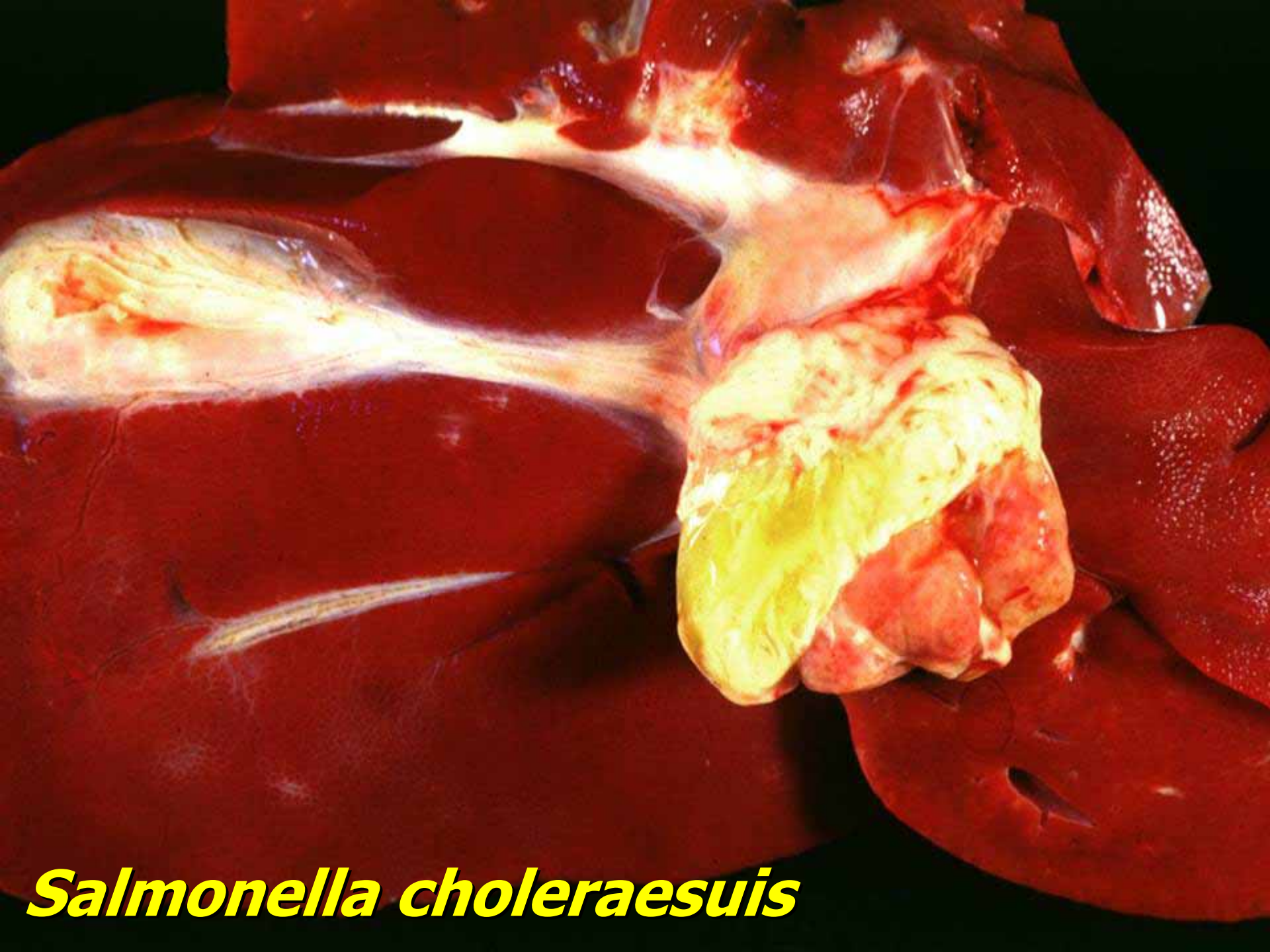
Salmonella choleraesuis




Salmonella choleraesuis


Salmonella choleraesuis


Salmonella choleraesuis


Salmonella choleraesuis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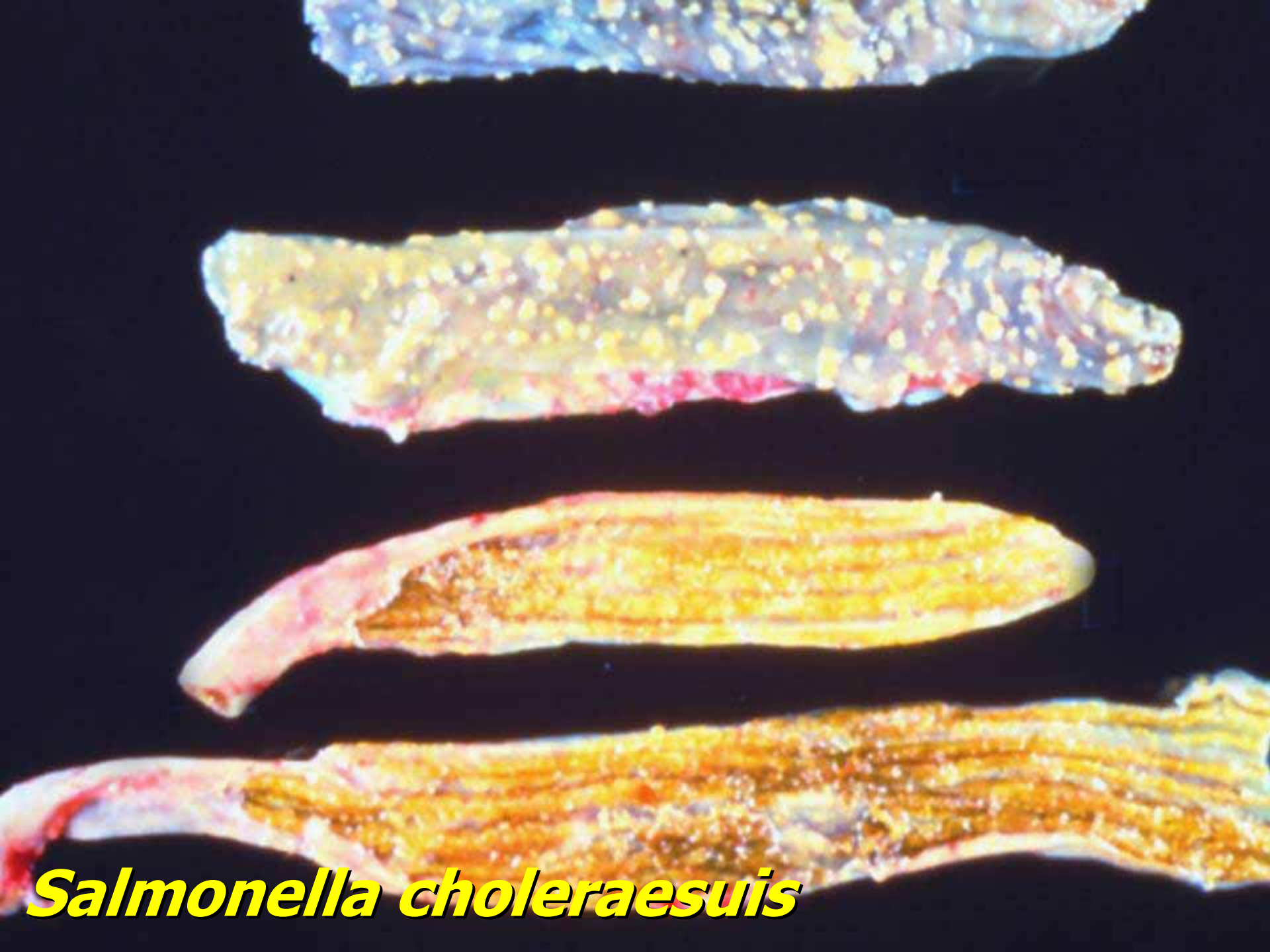
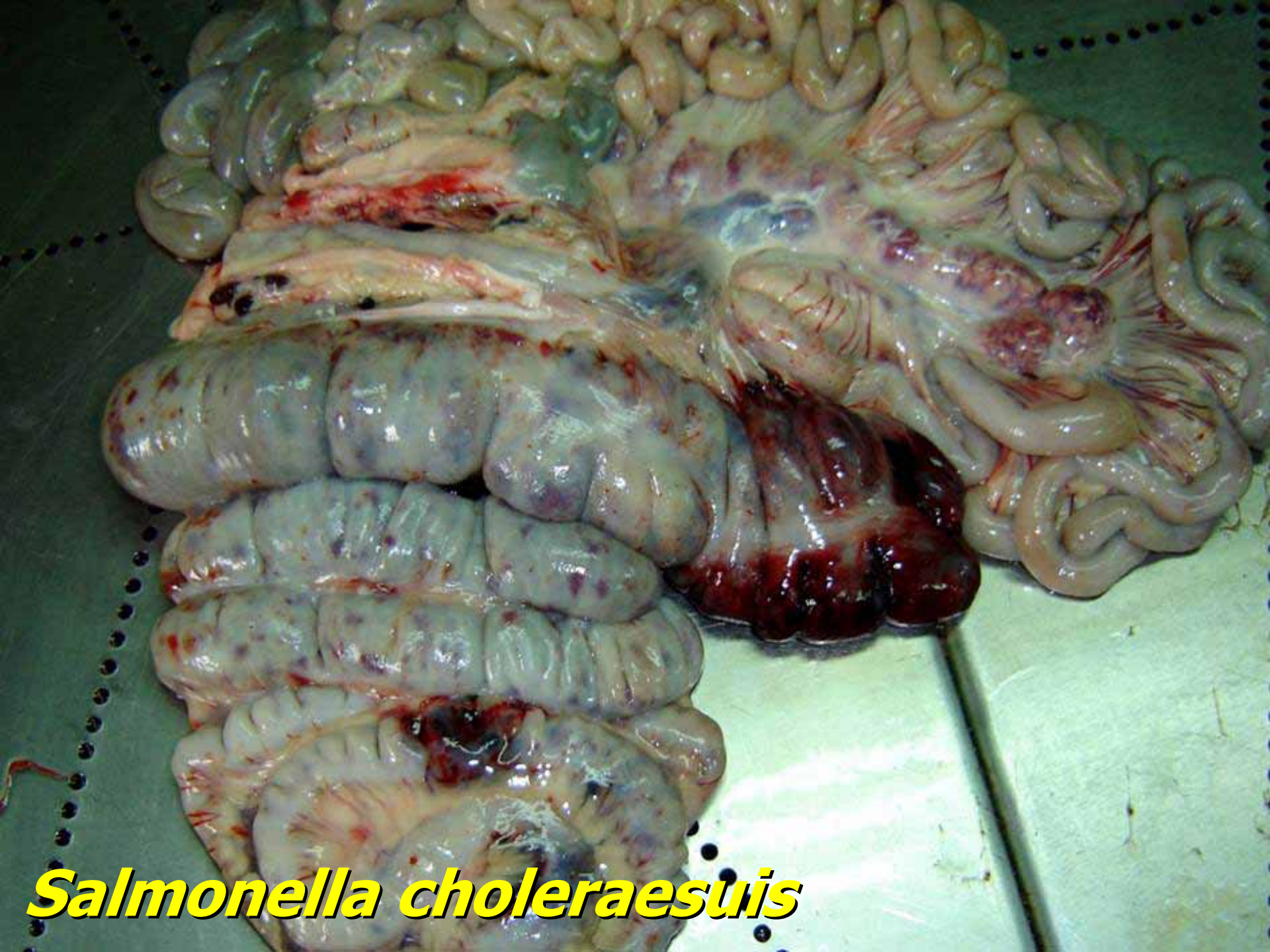
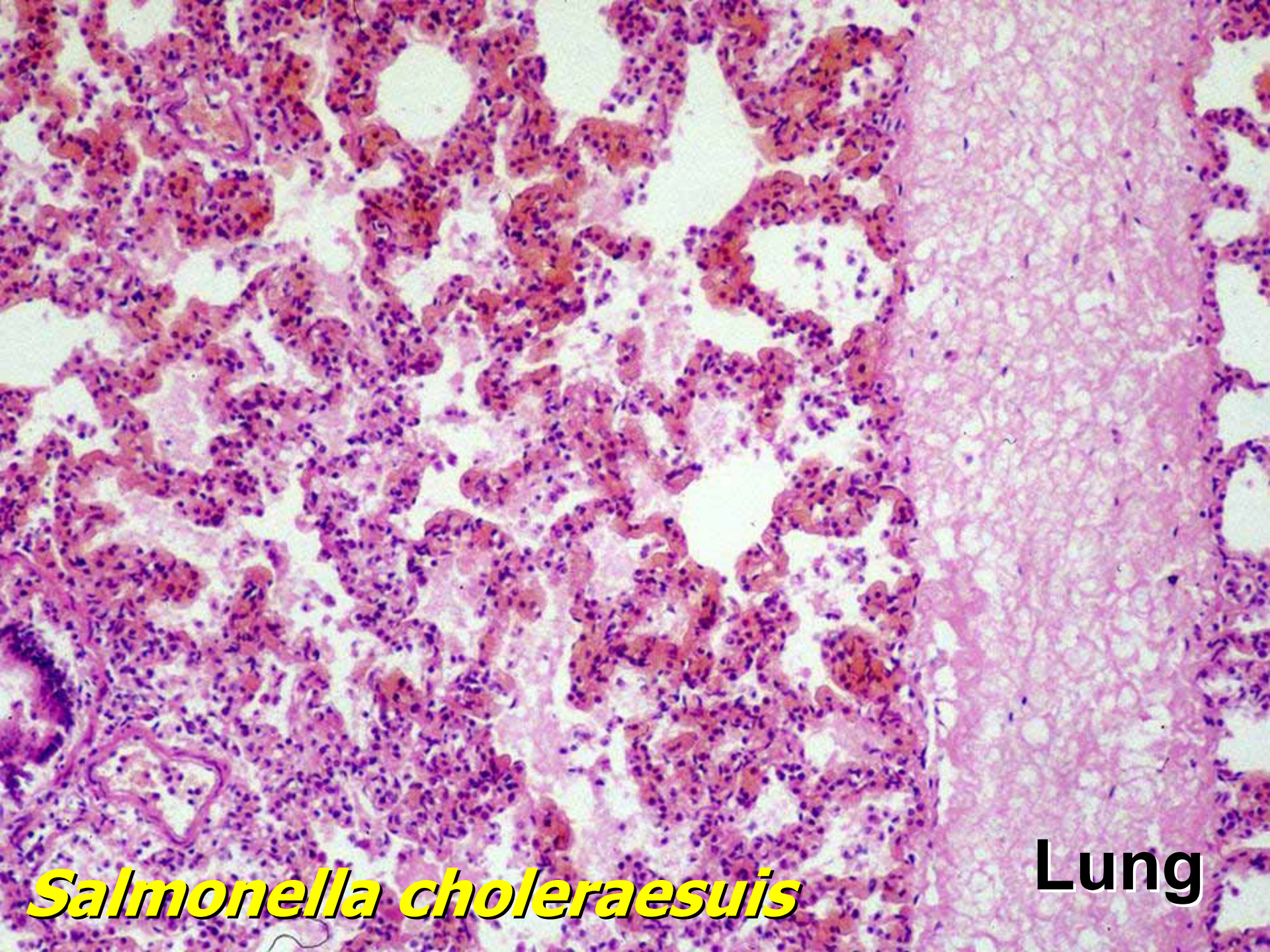
Salmonella choleraesuis

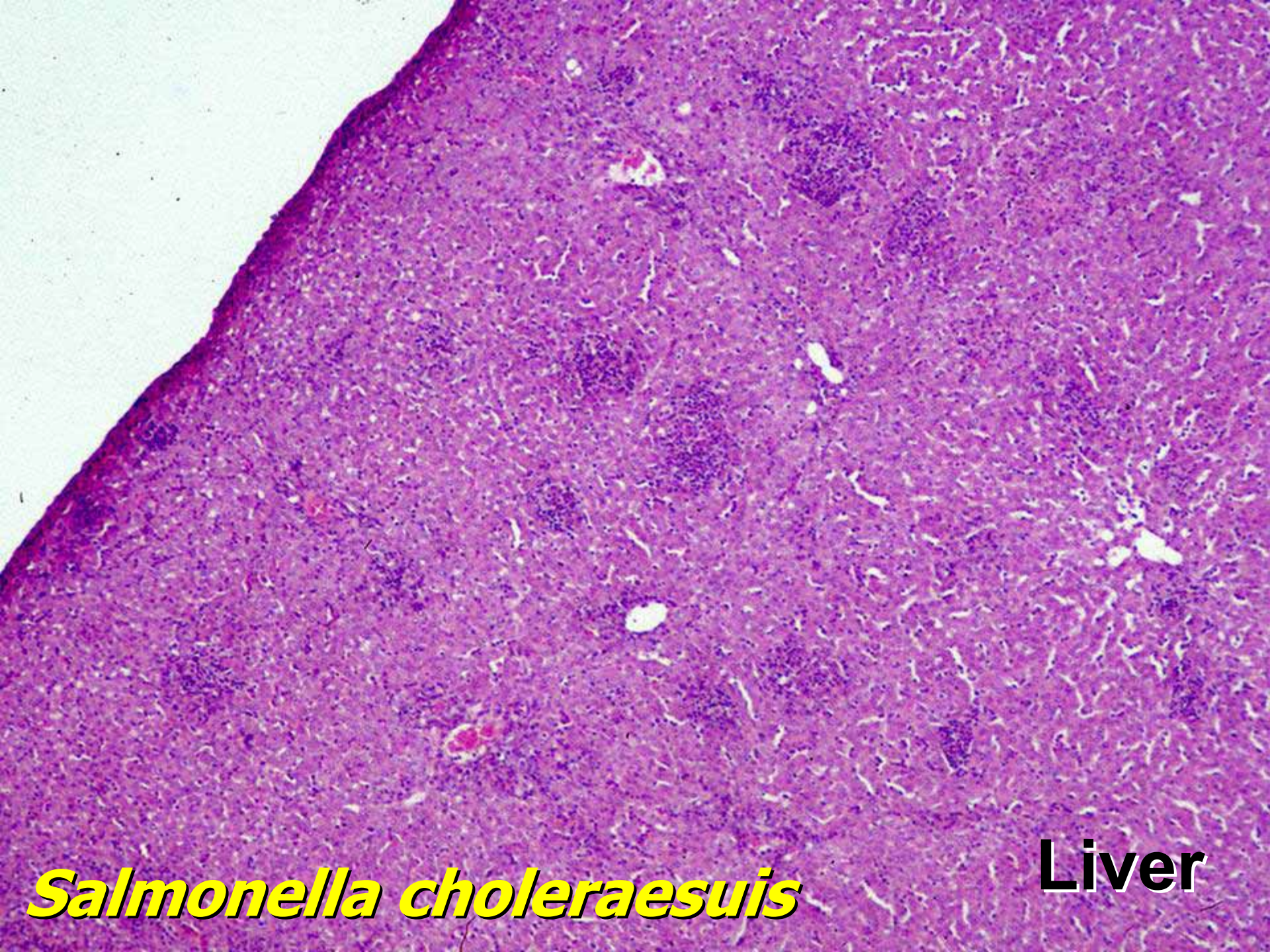

Salmonella choleraesuis

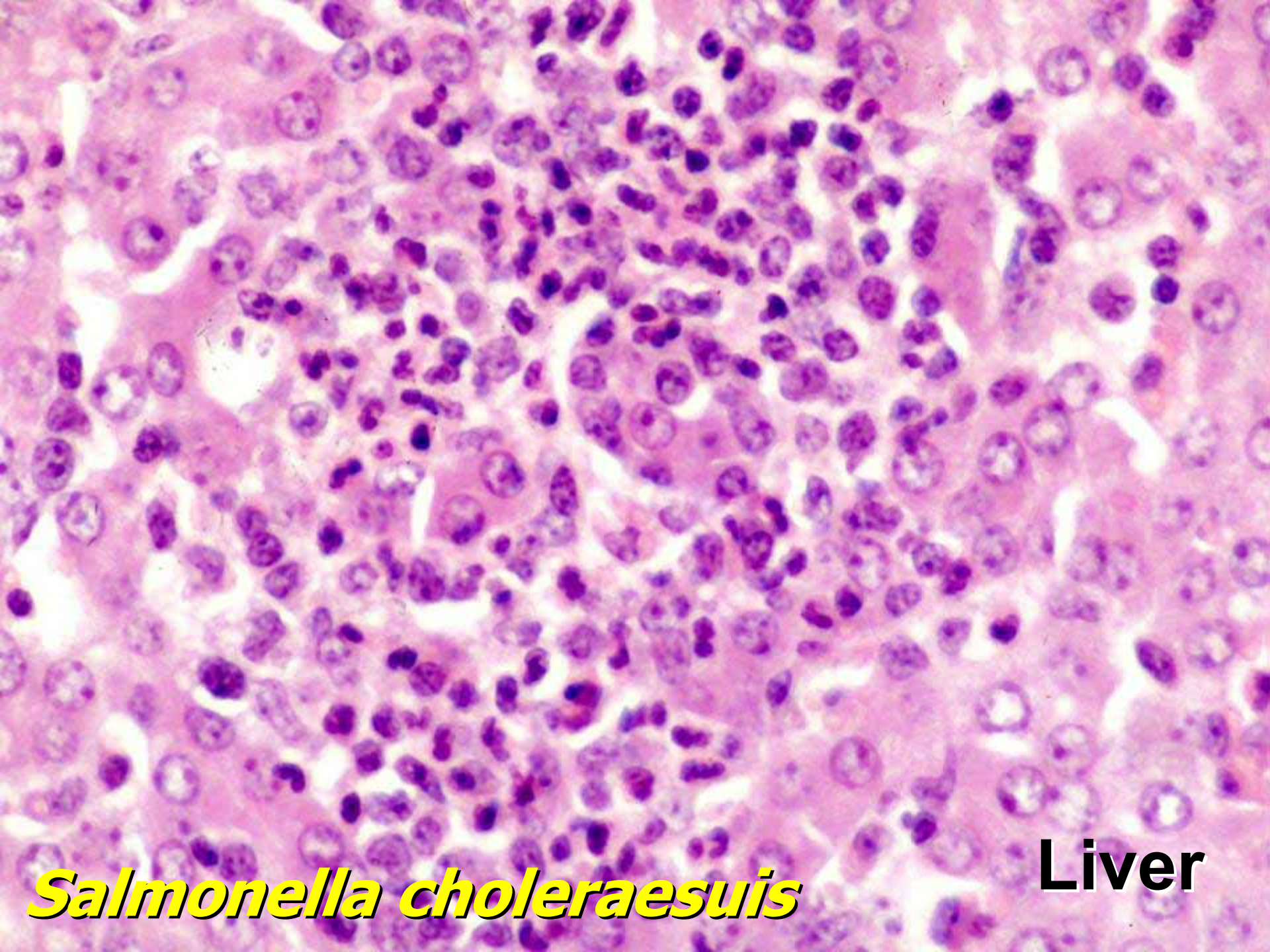

Salmonella choleraesuis


Salmonella choleraesuis

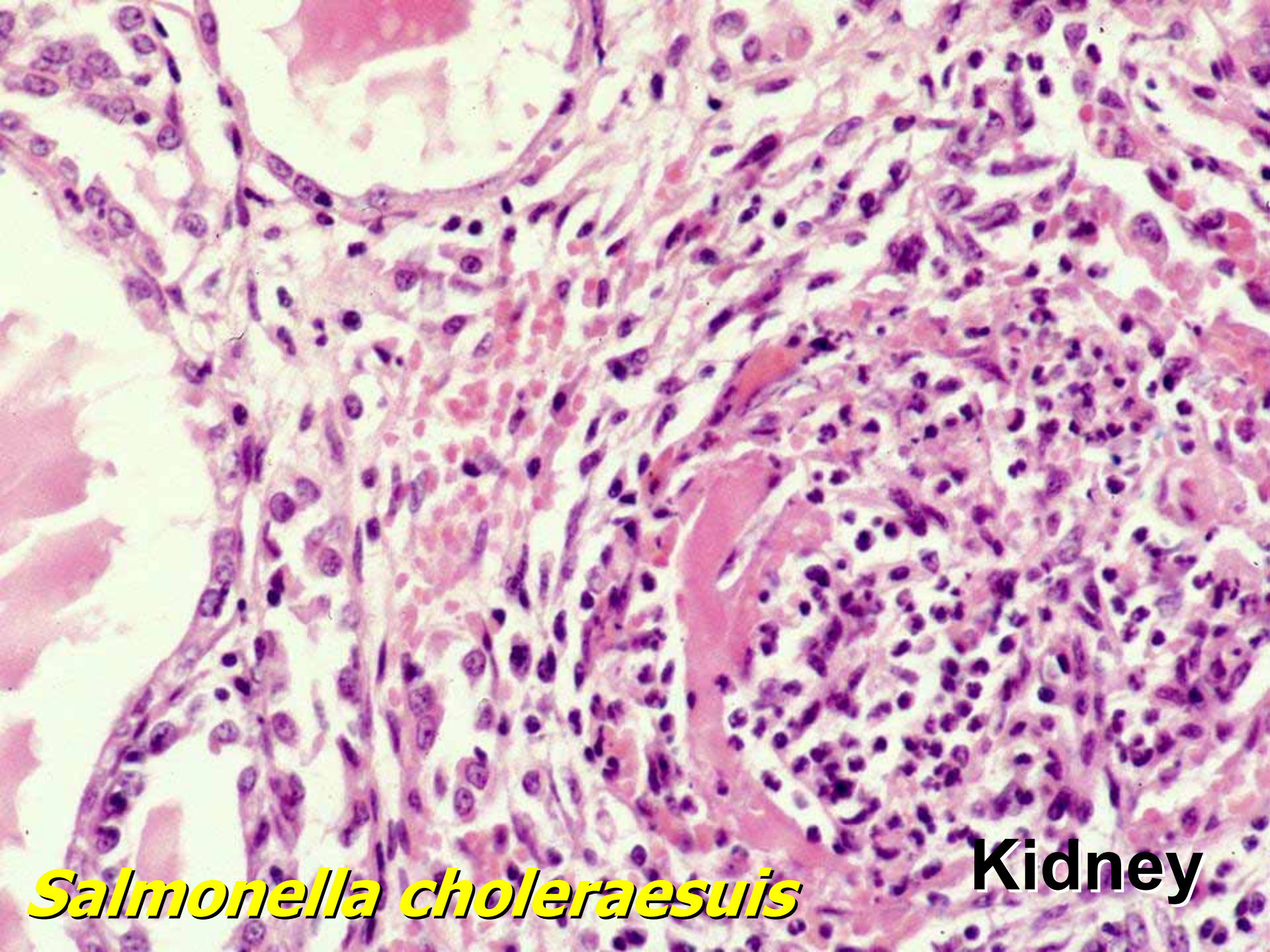
Salmonella choleraesuis

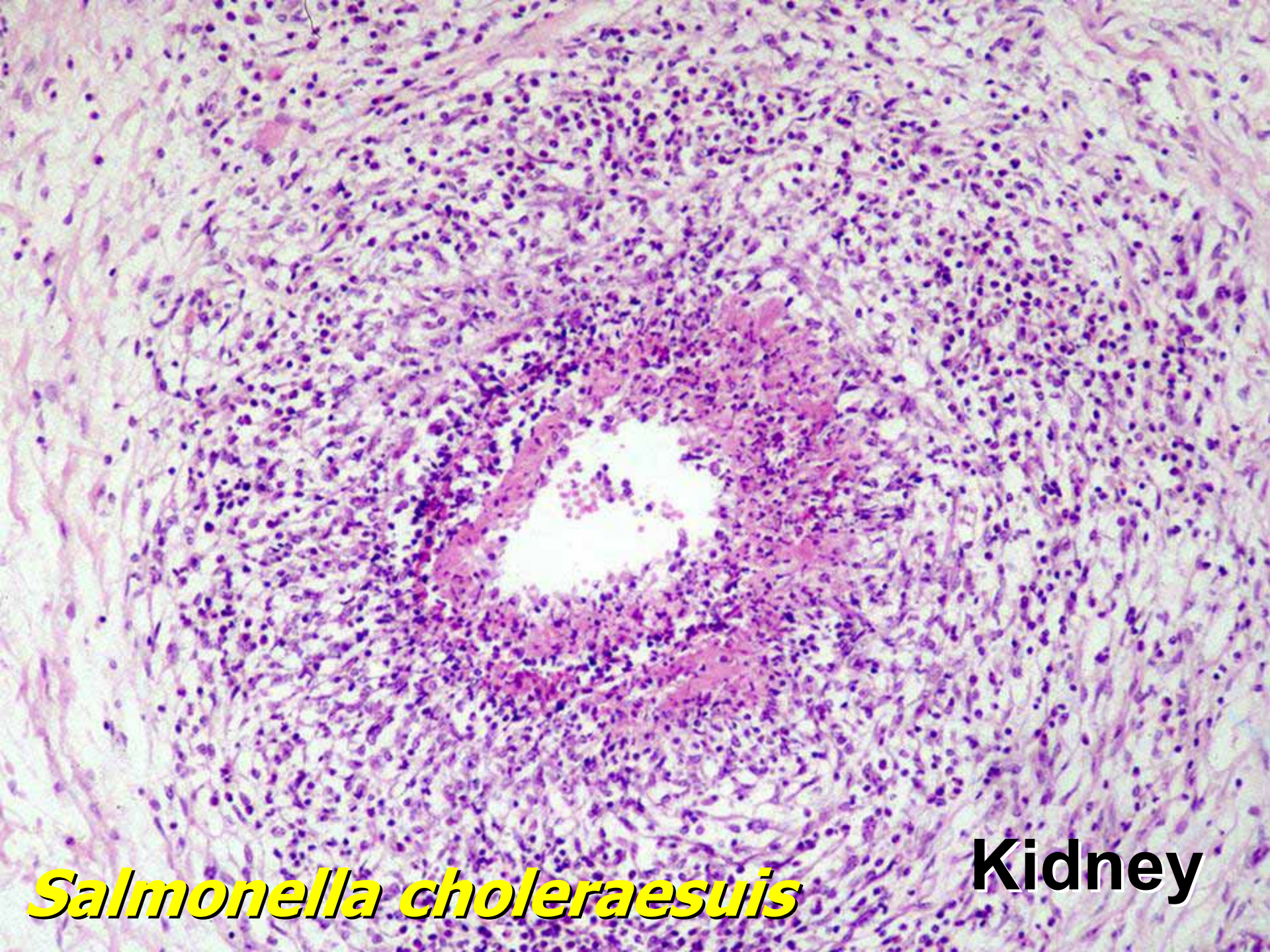

Salmonella choleraesuis
Lung


Salmonella choleraesuis
Liver


Salmonella choleraesuis
Liver


Salmonella choleraesuis
Kidney


Salmonella choleraesuis
Kidney


Salmonella choleraesuis
Kidney

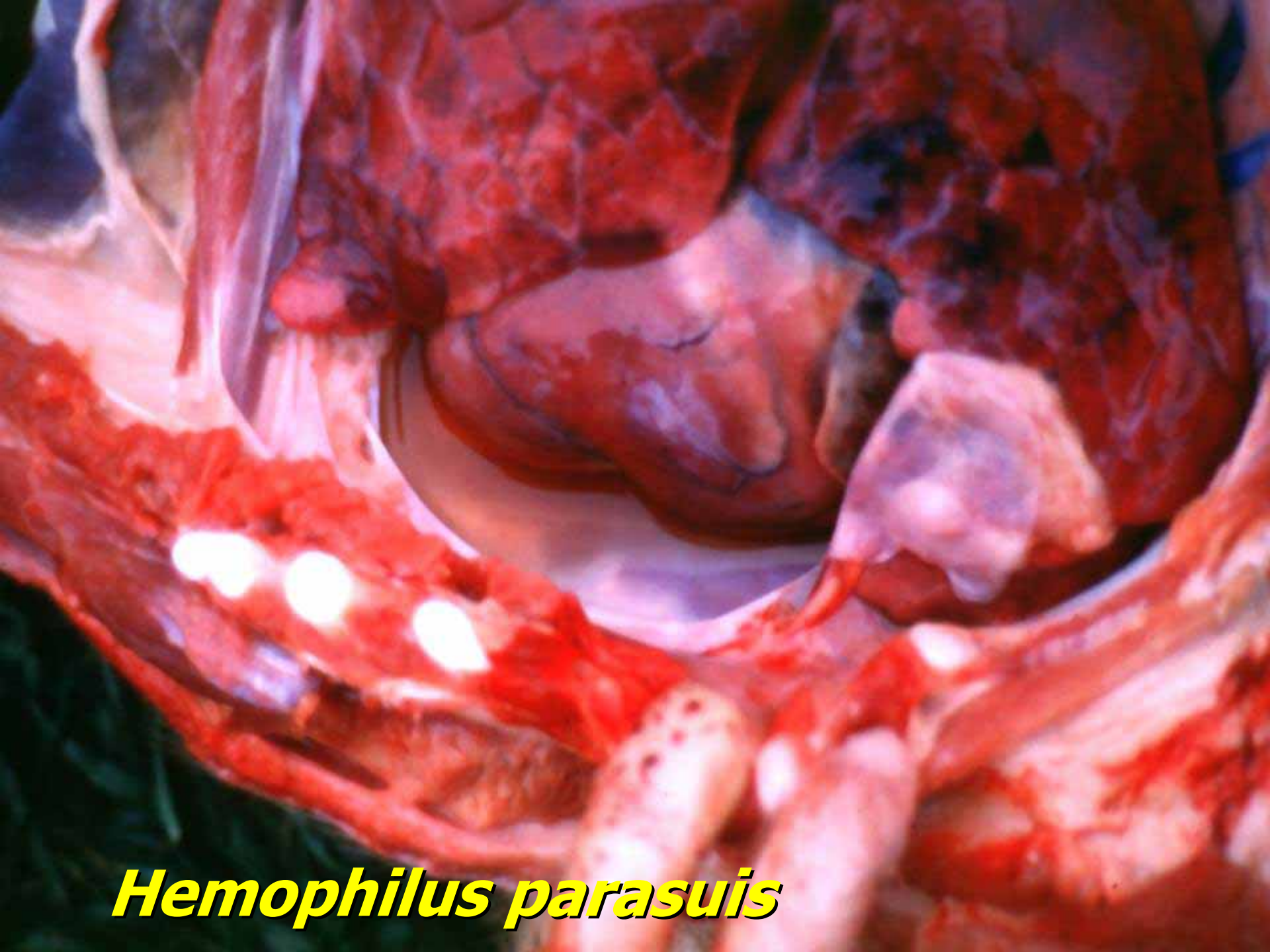
Hemophilus parasuis

- Acute septicemia
- Resembles septicemic Salmonellosis
- More commonly causes polyserositis, polyarthritis and meningitis (Glasser's disease) in weaned pigs
- Neurological clinical signs are uncommon in weaned pigs with Glasser's disease
- Occasional acute outbreaks of highly fatal fibrinosuppurative leptomeningitis in young adult replacement breeding stock shortly after entry into recipient herds
- Eustachitis and temporary otitis media predisposing to ascending secondary pyogenic bacterial otitis media

Haemophilus parasuis

- Gram-negative non-motile, pleomorphic rods (2x5 μm)
- May form coccoid or filamentous forms
- Dependend on V- and X-factor
- V-factor: Diphosphopyridin-nucleotid, coenzyme has the function to accept hydrogen ions, thermolabil
- X-factor: haemin of red blood cells, thermostabil
- Growth on digested blood agar or with nursing streak


Hemophilus parasuis


Hemophilus parasuis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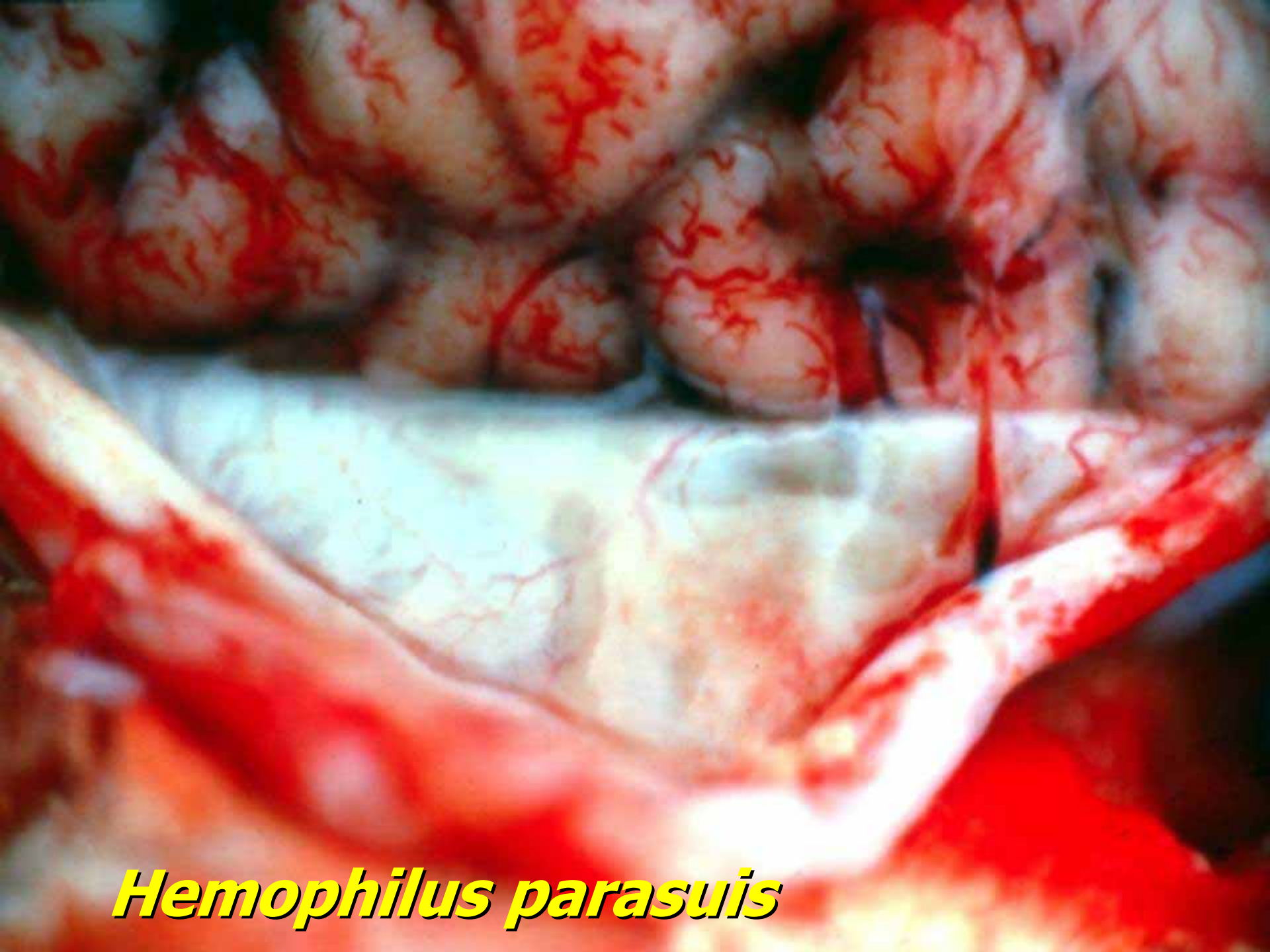
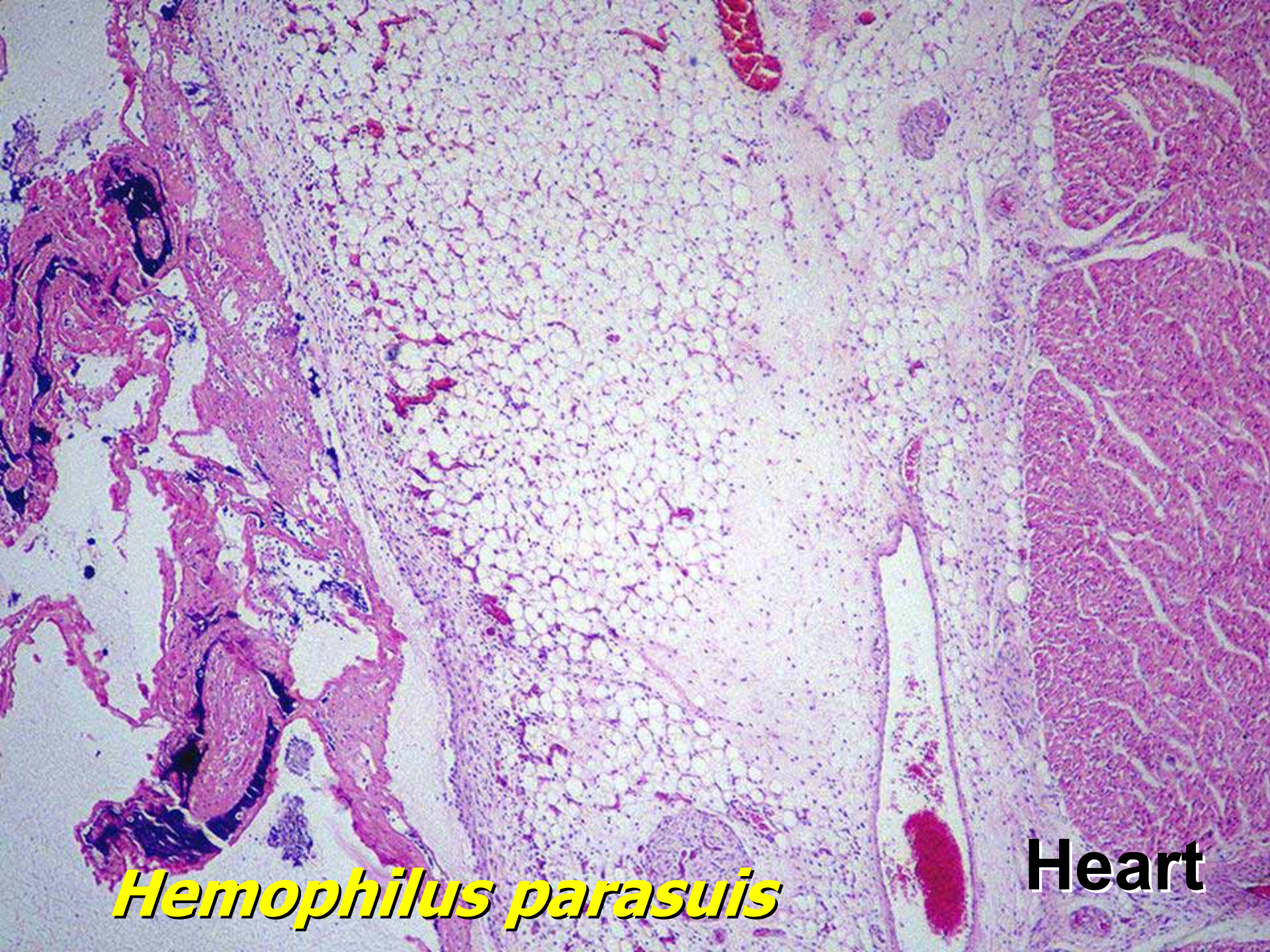
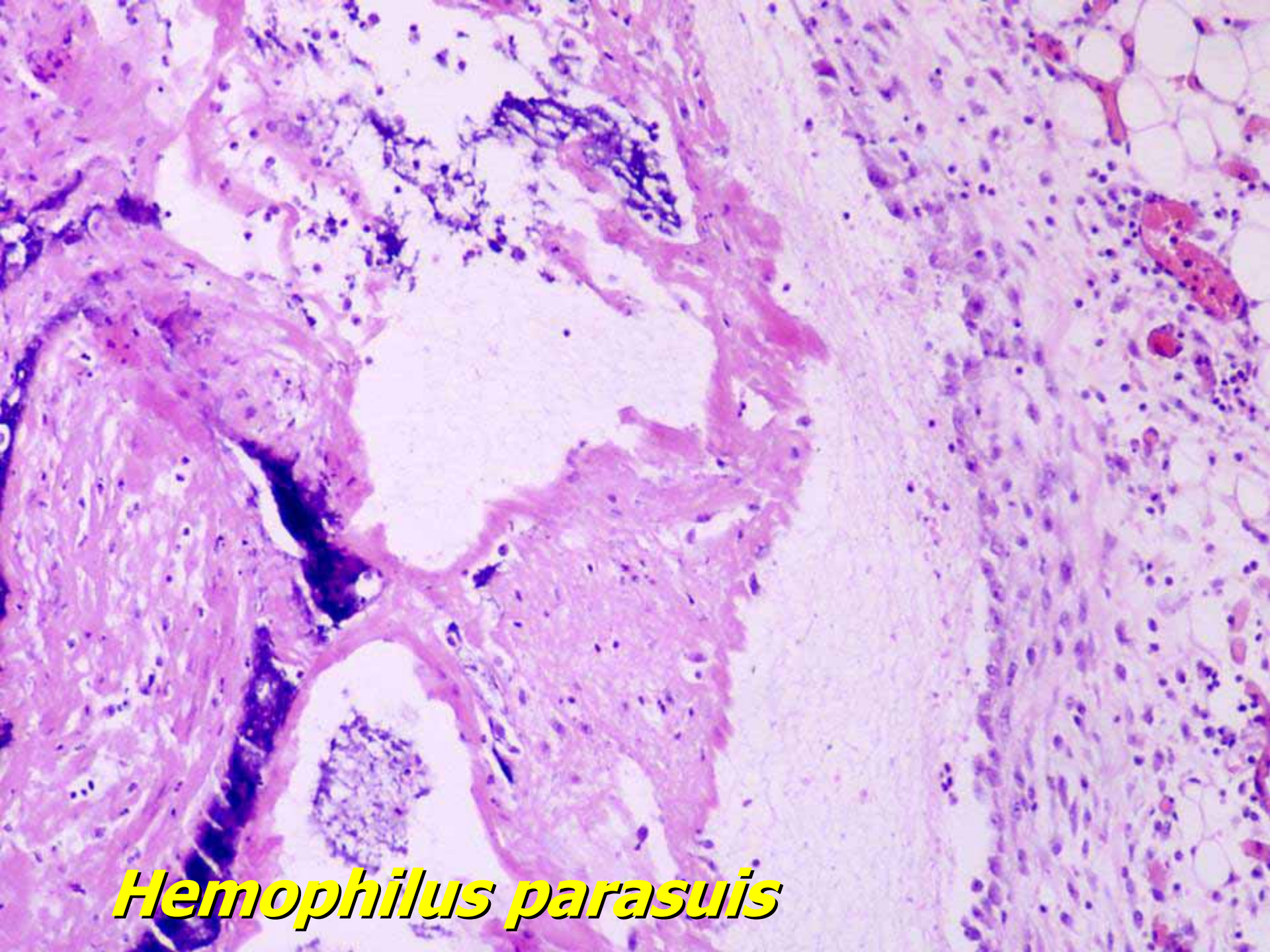
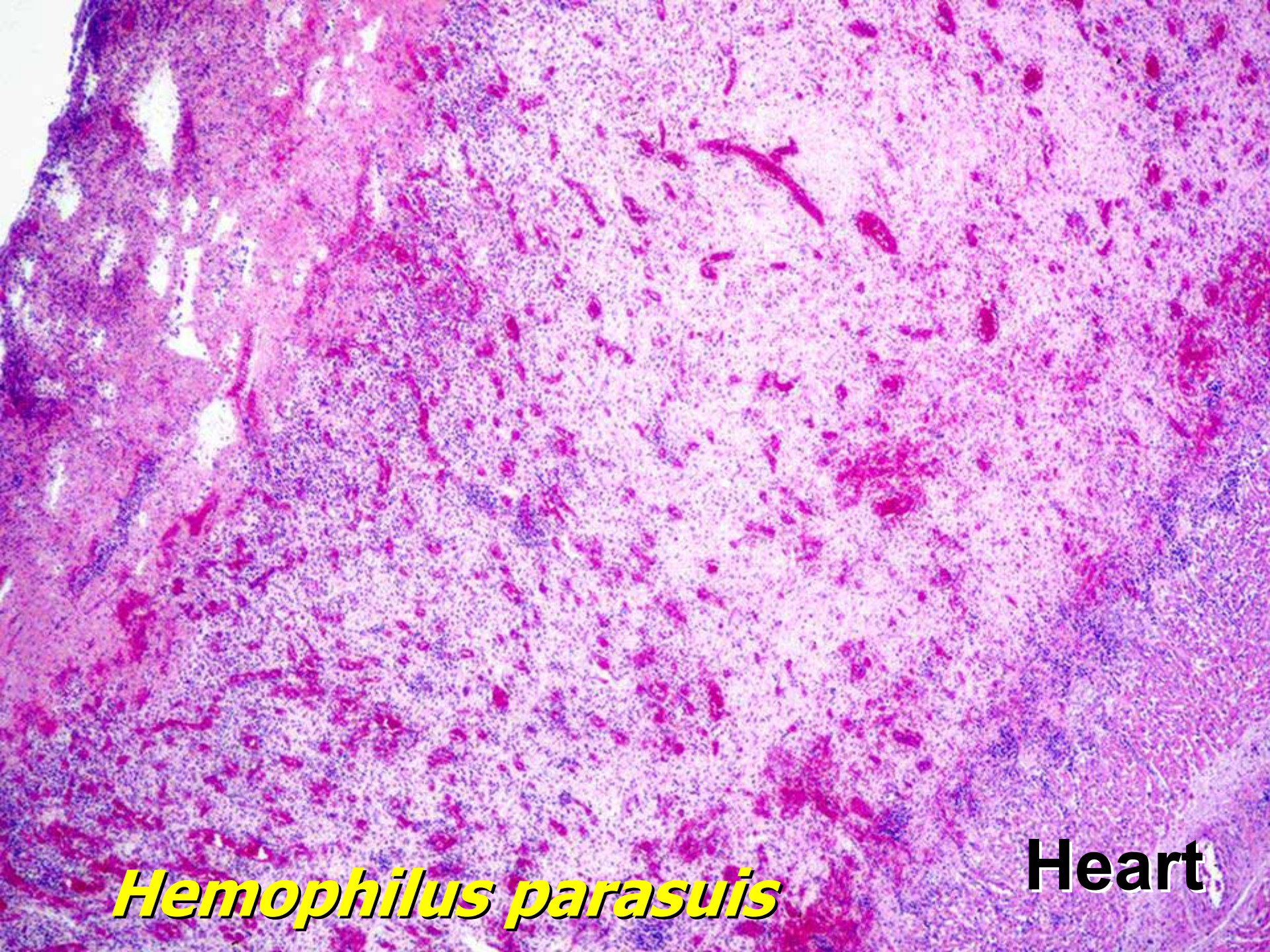
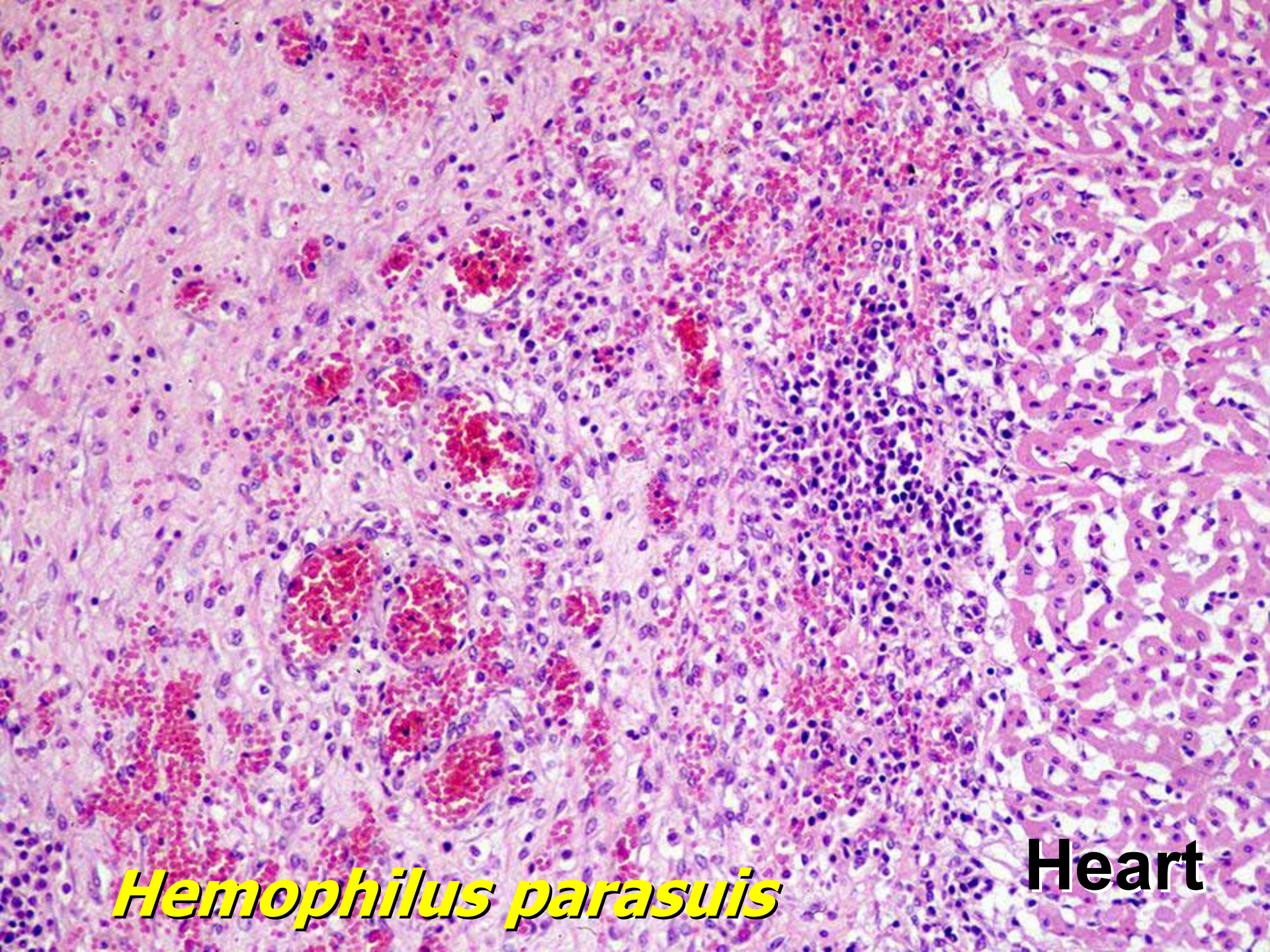

Hemophilus parasuis


Hemophilus parasuis

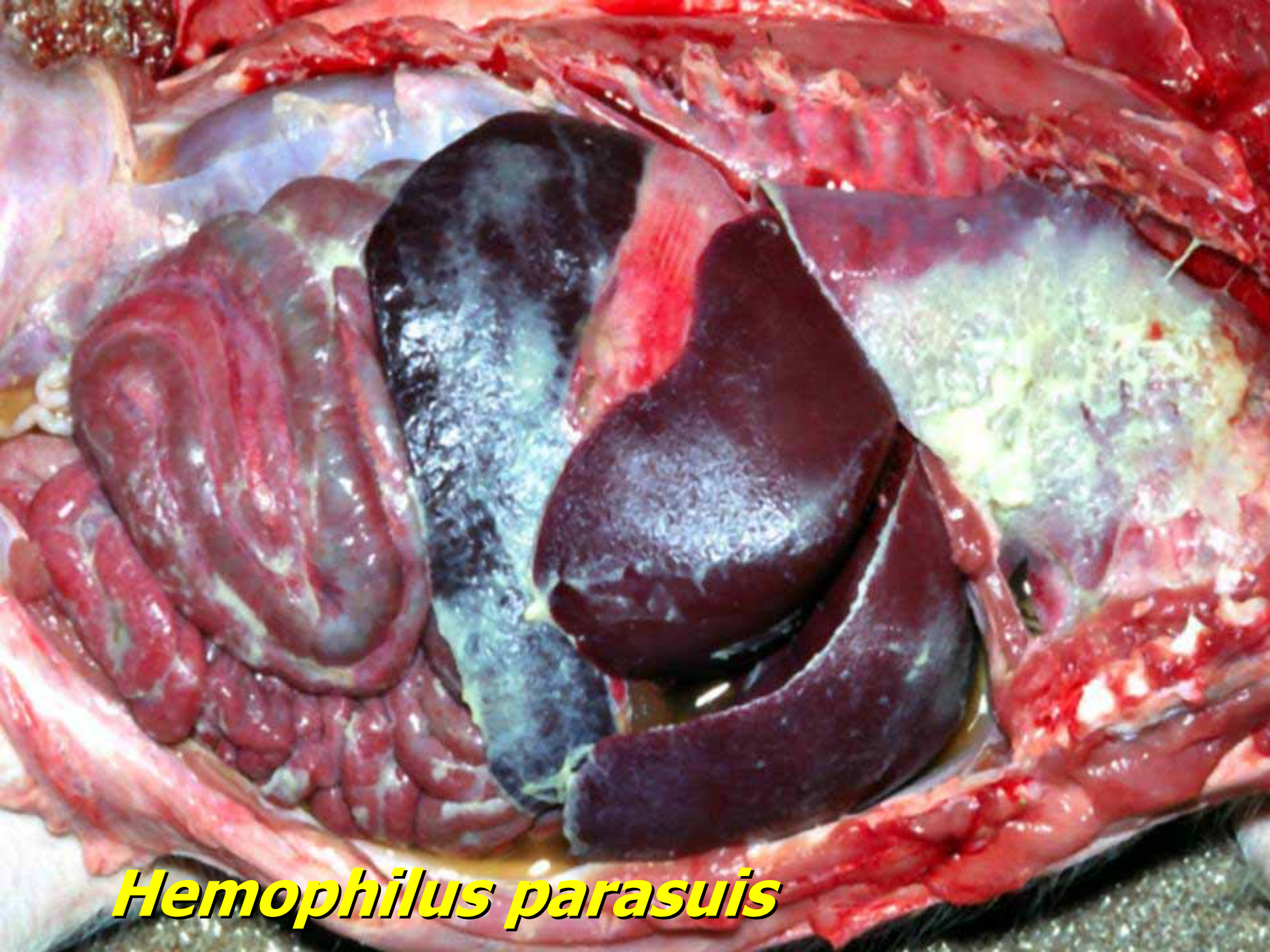

Hemophilus parasuis
Heart

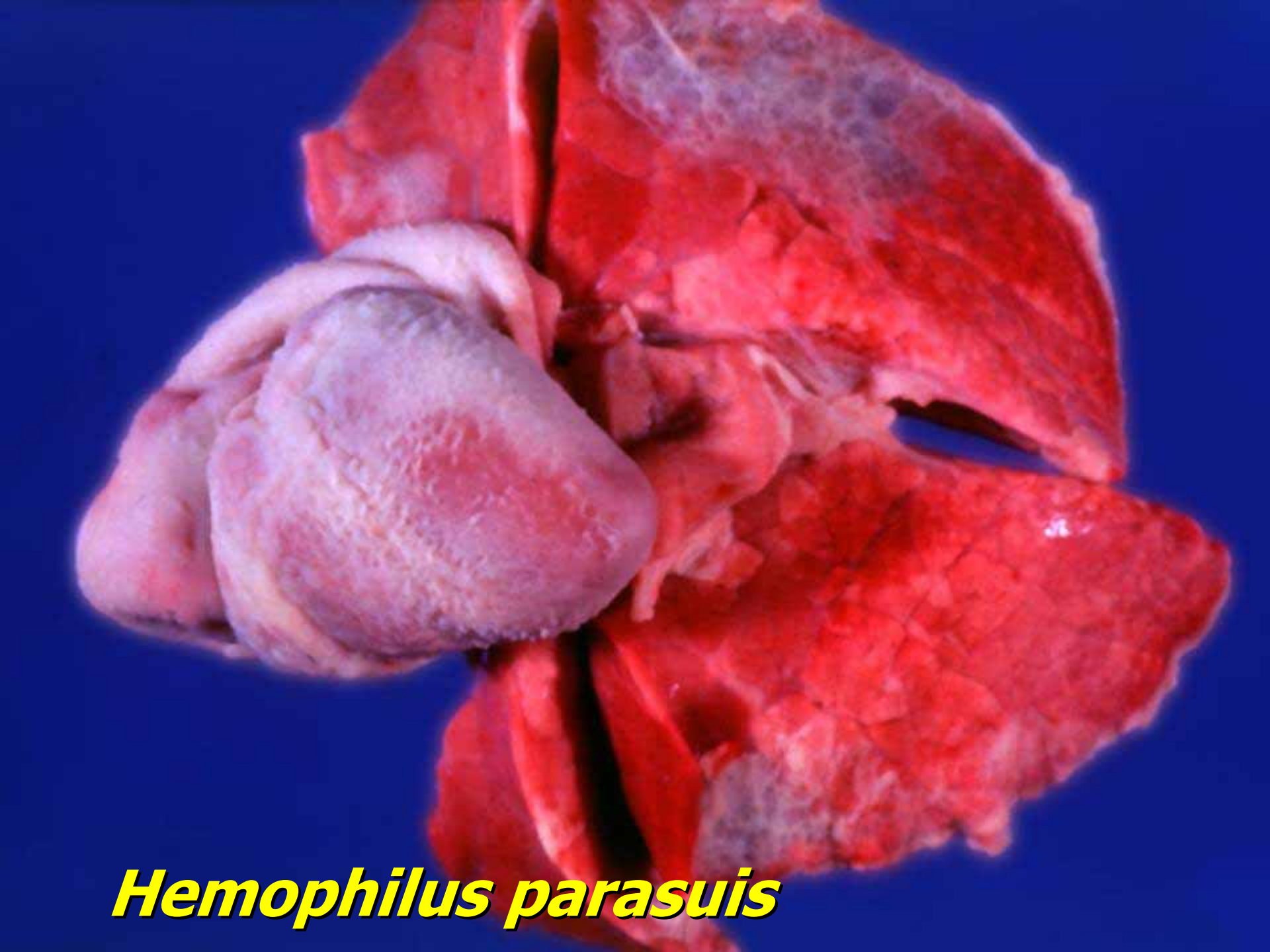

Hemophilus parasuis

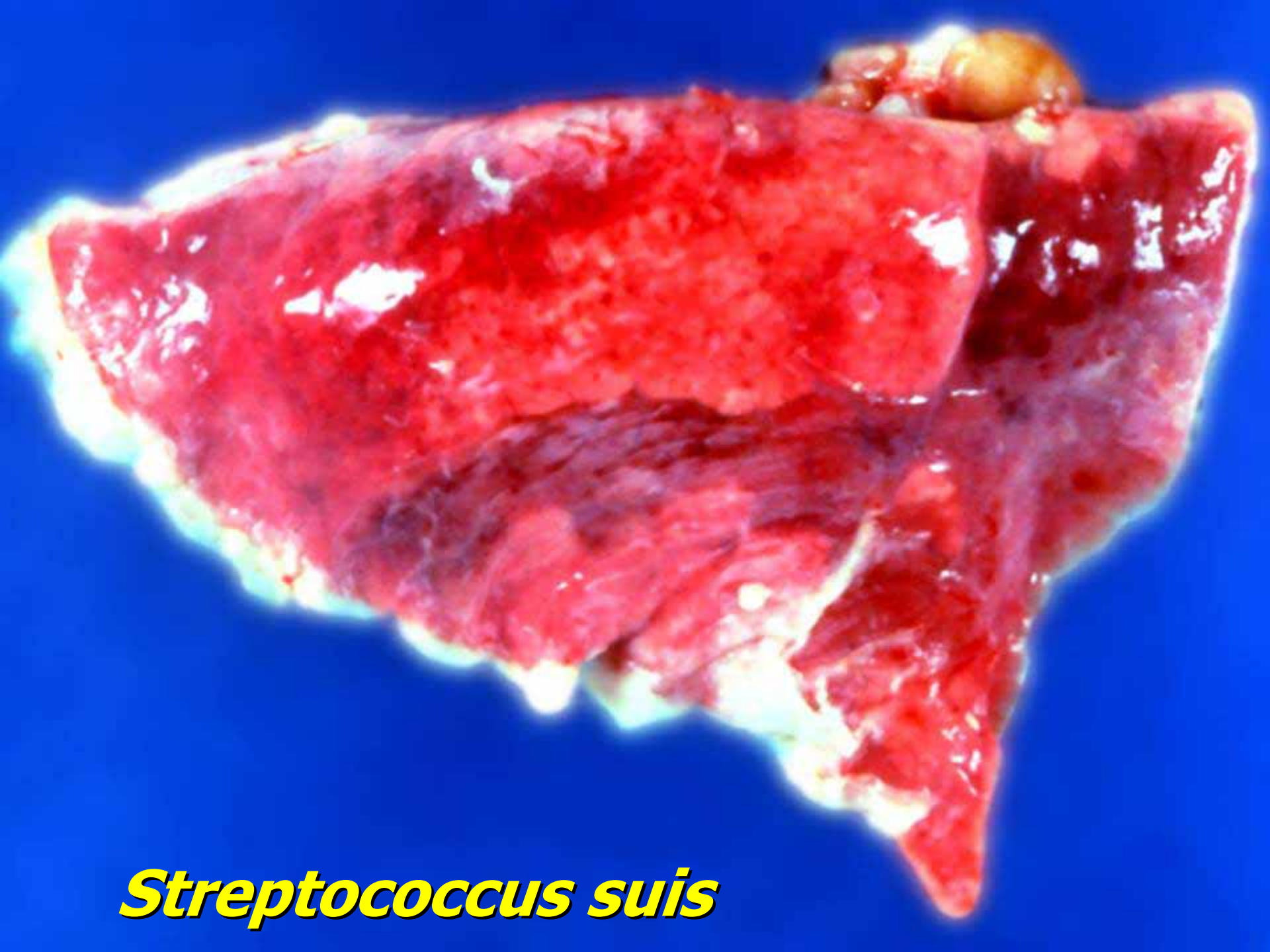

Hemophilus parasuis
Heart

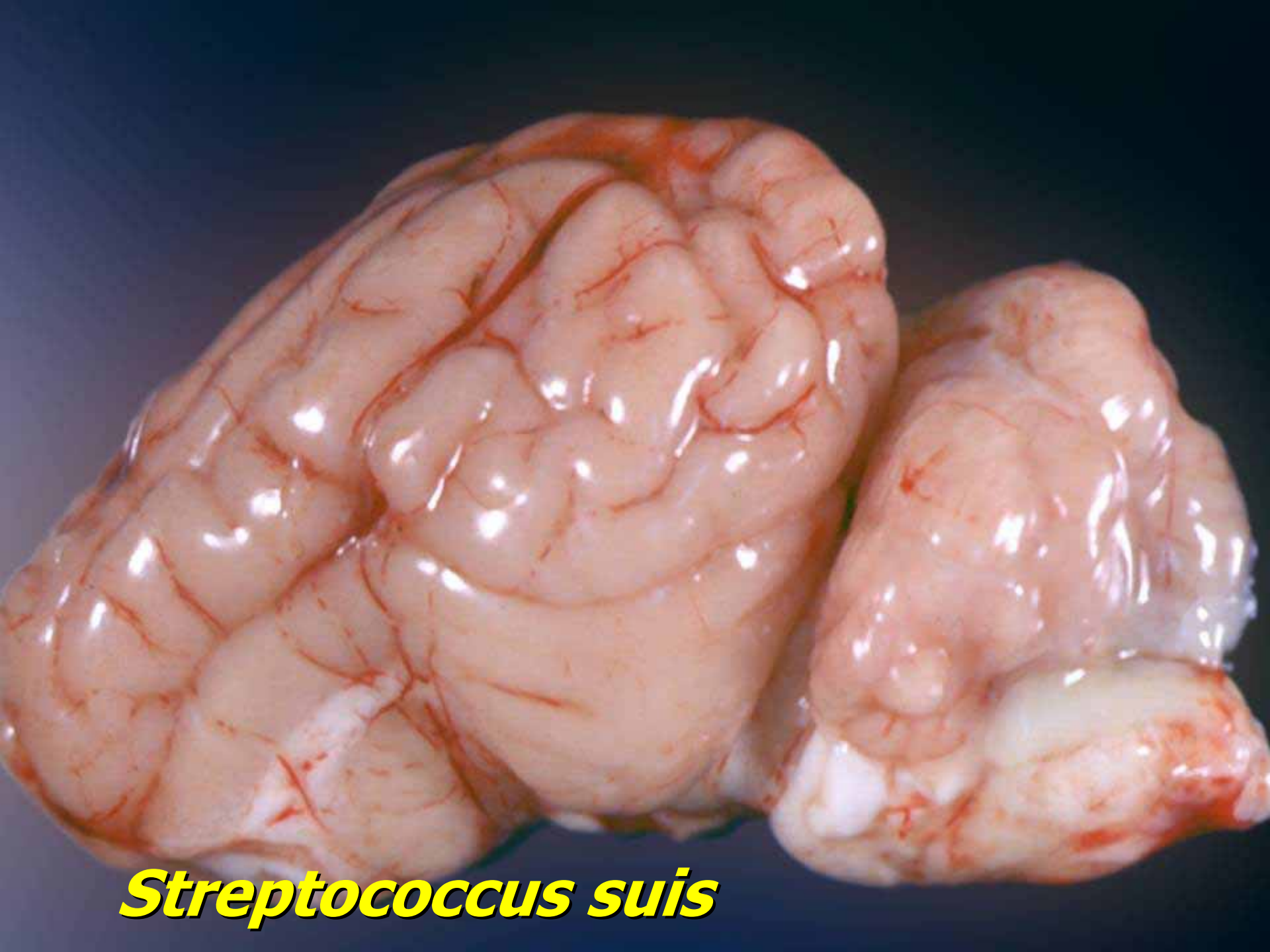

Hemophilus parasuis
Heart


Fibrinous Polyserositis

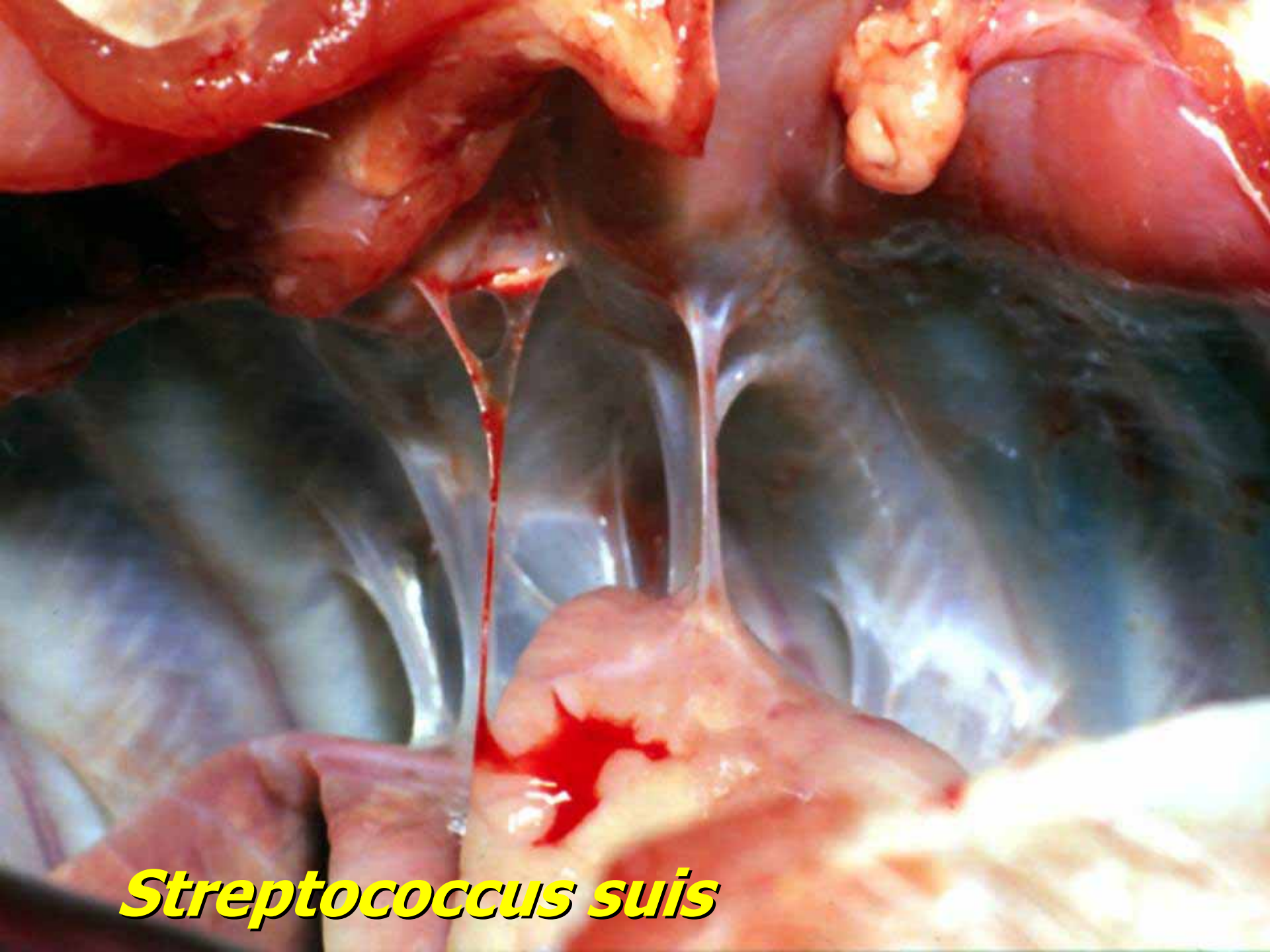

Hemophilus parasuis


Hemophilus parasuis


Streptococcus suis


Streptococcus suis

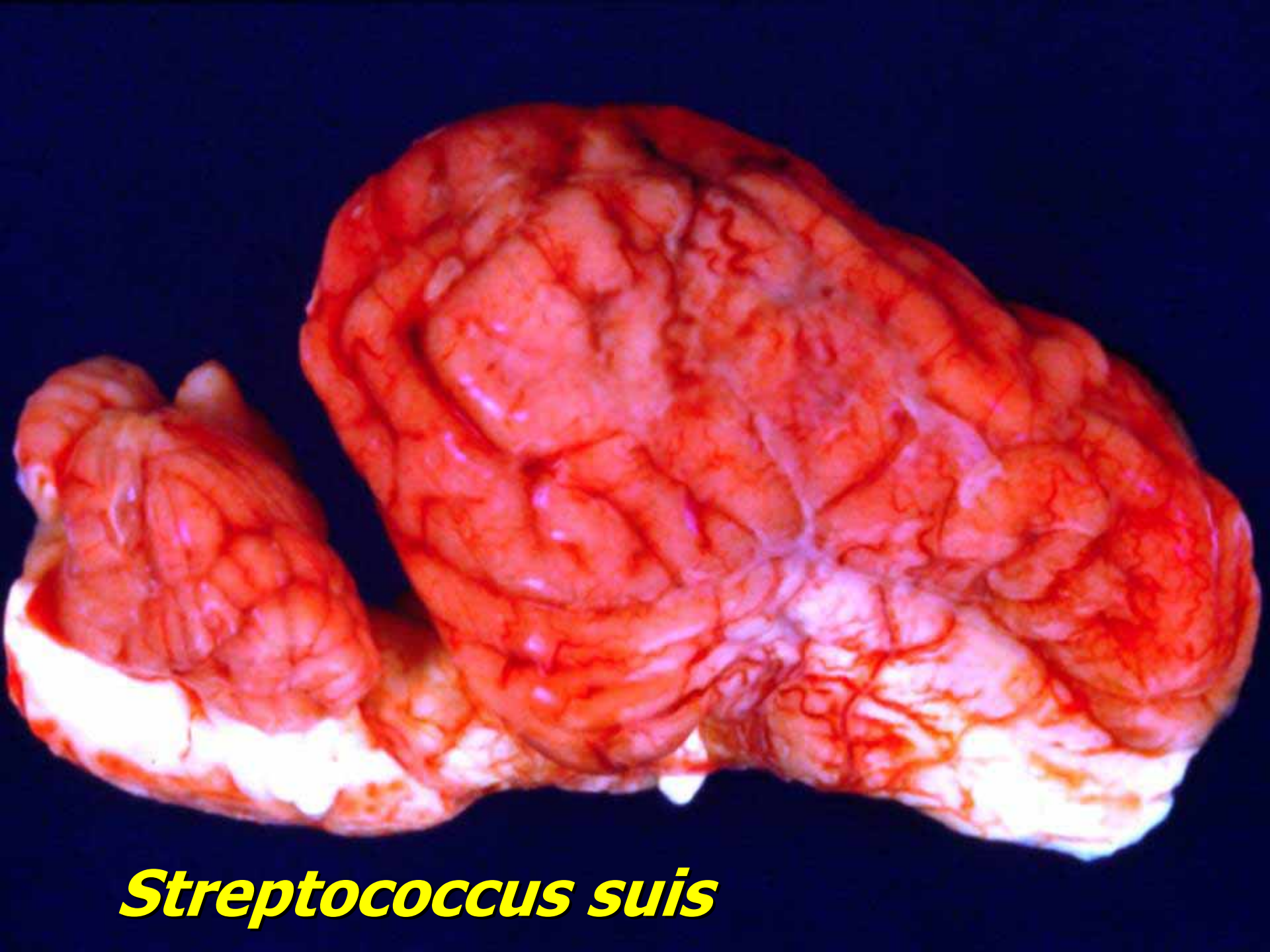

Streptococcus suis

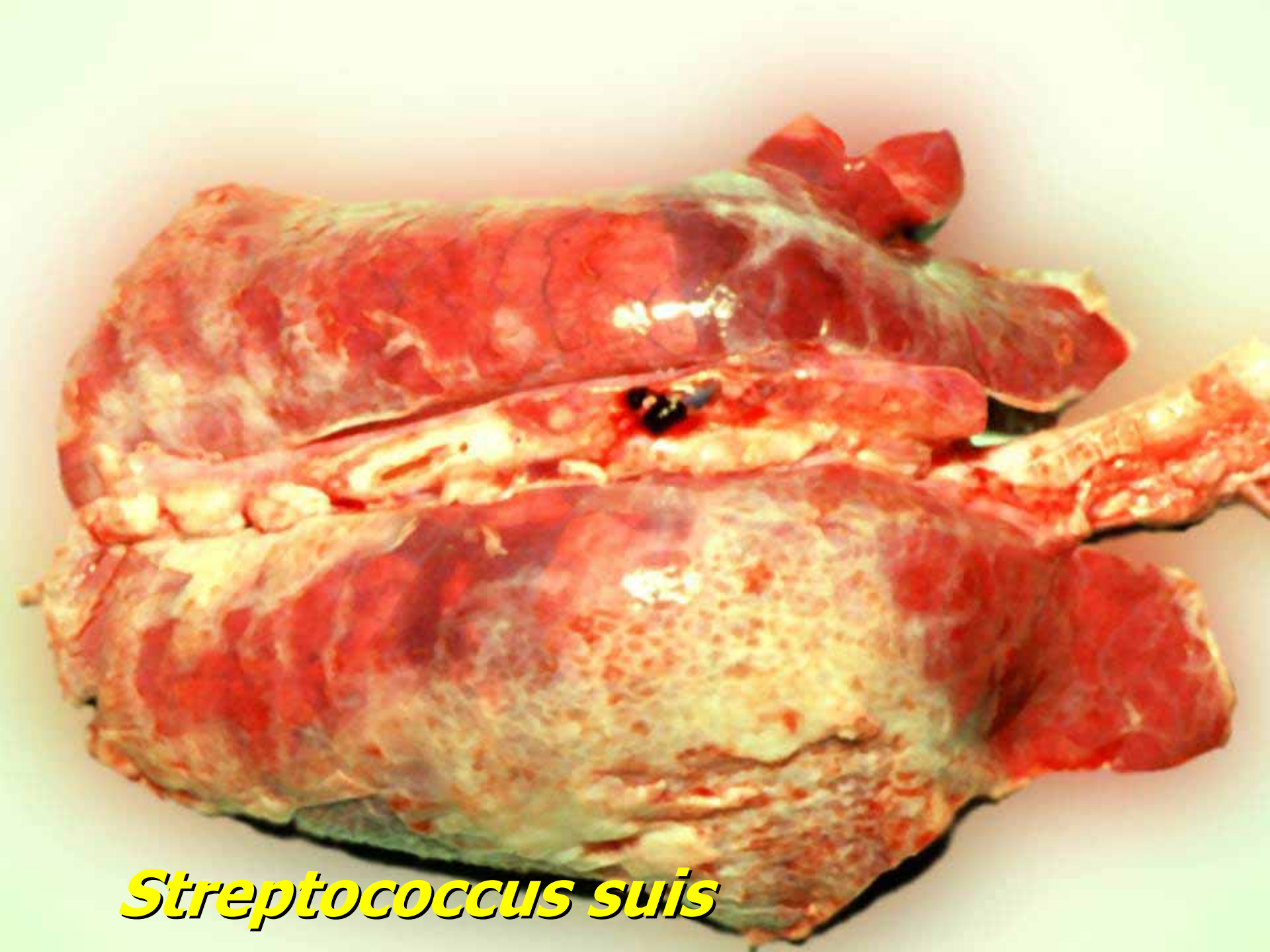

Streptococcus suis

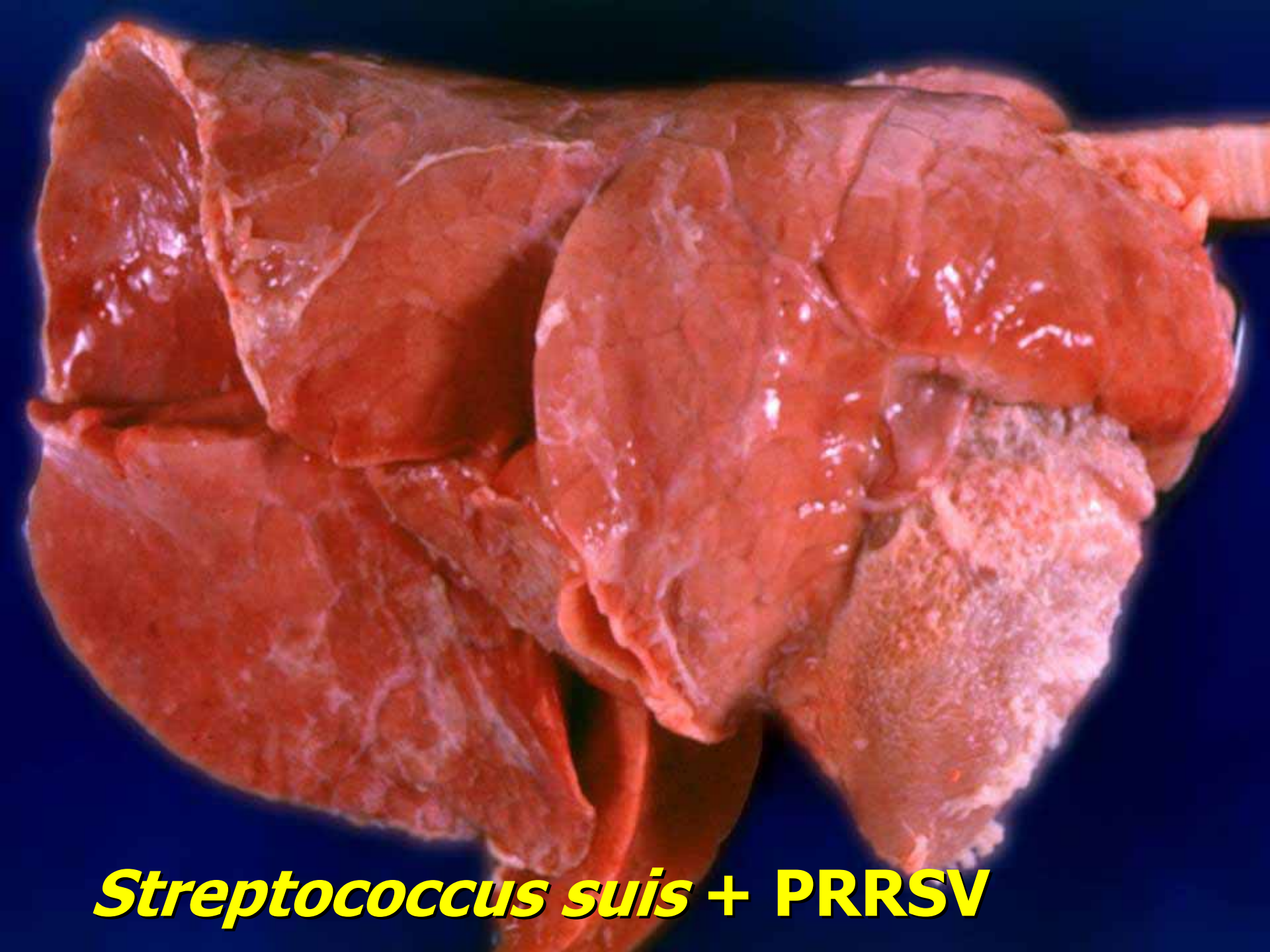
Streptococcus suis

- 35 serotypes: 1-34 and 1/2, disease: 2, 1/2, 3, 4, 7, 8 and 9
- Healthy pigs - nasal cavities: 94% of 4-8 week-old pigs, 71% of these were serotypes 17, 18, 19 and 21
- Nursery-age >> all ages, infected as early as 1 day-of-age
- 3 disease forms: septicemia, pneumonia, reproductive
- Septicemia: splenomegaly, mild interstitial pneumonia, fibrinous polyserositis, polyarthritis and leptomeningitis, vegetative valvular endocarditis
- Bronchopneumonia: suppurative, fibrinohemorrhagic
- Reproductive: abortion, vaginitis
- Commensal of tonsil and nasal mucosa, antibiotics will not clear, MEW and SEW will not eliminate
- Herds and individuals often carry multiple serotypes
- Outbreaks of disease; horizontal transmission of a single serotype; mice are susceptible and may transmit or be a reservoir

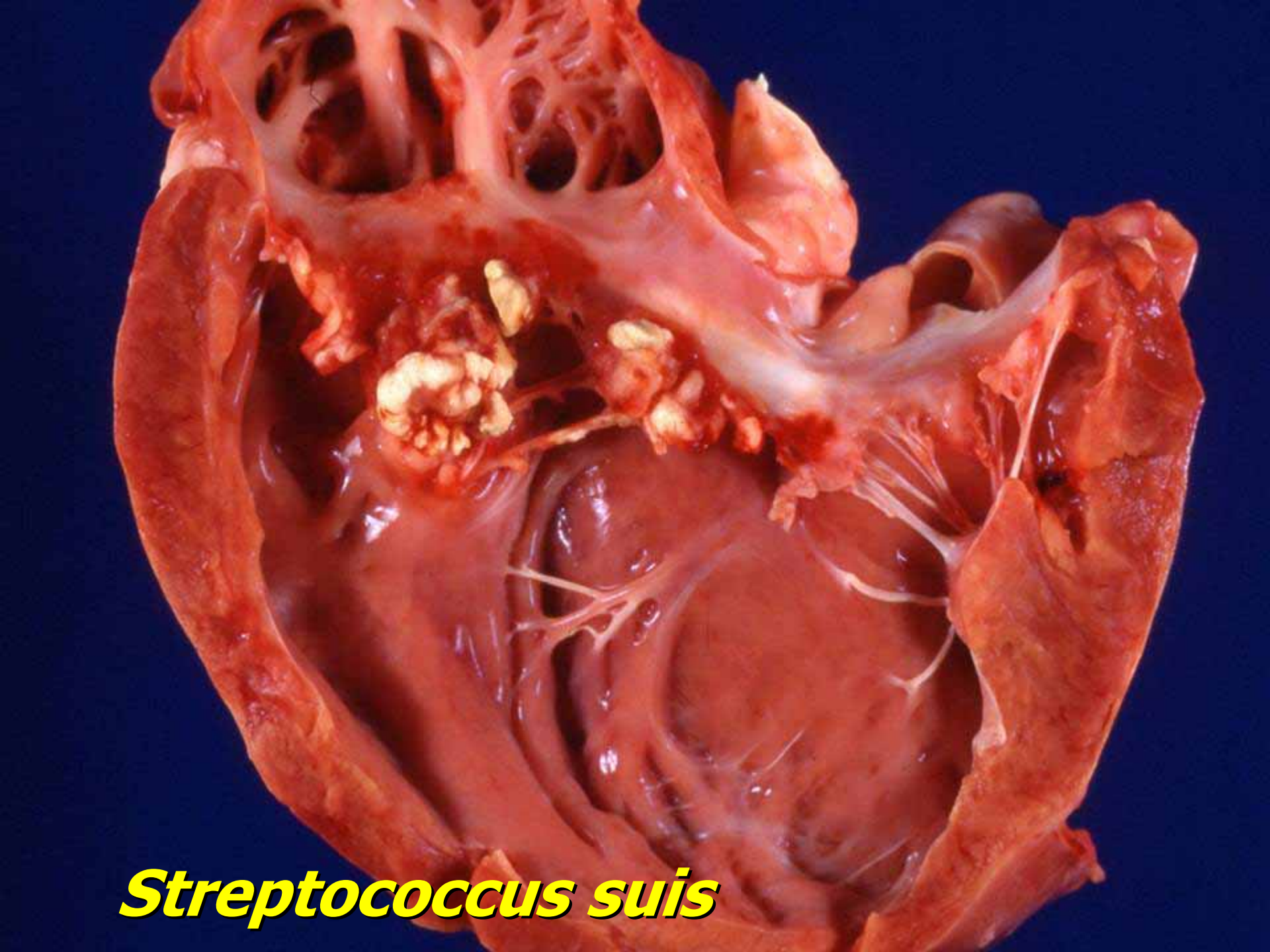

Streptococcus suis


Streptococcus suis

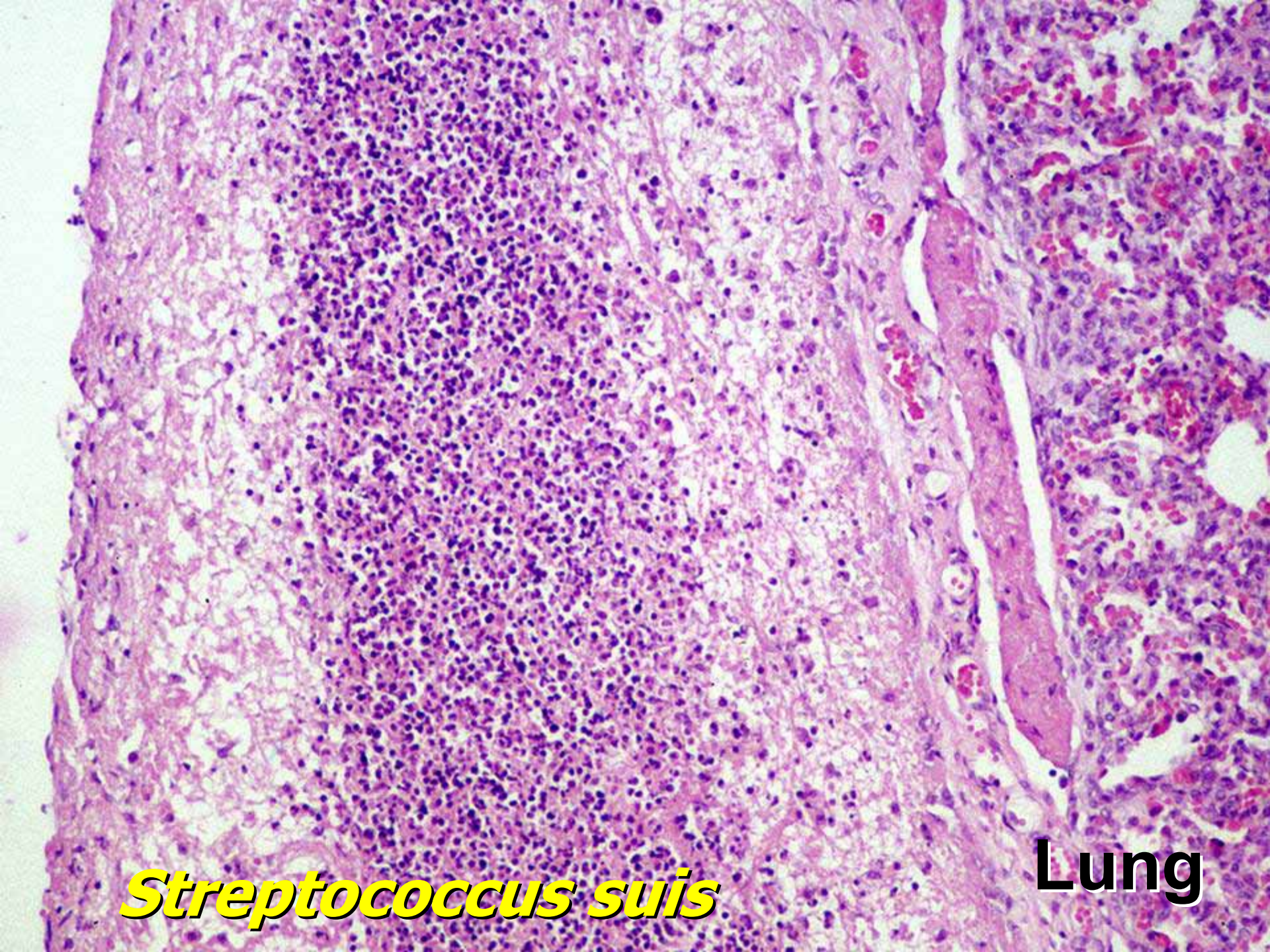

Streptococcus suis

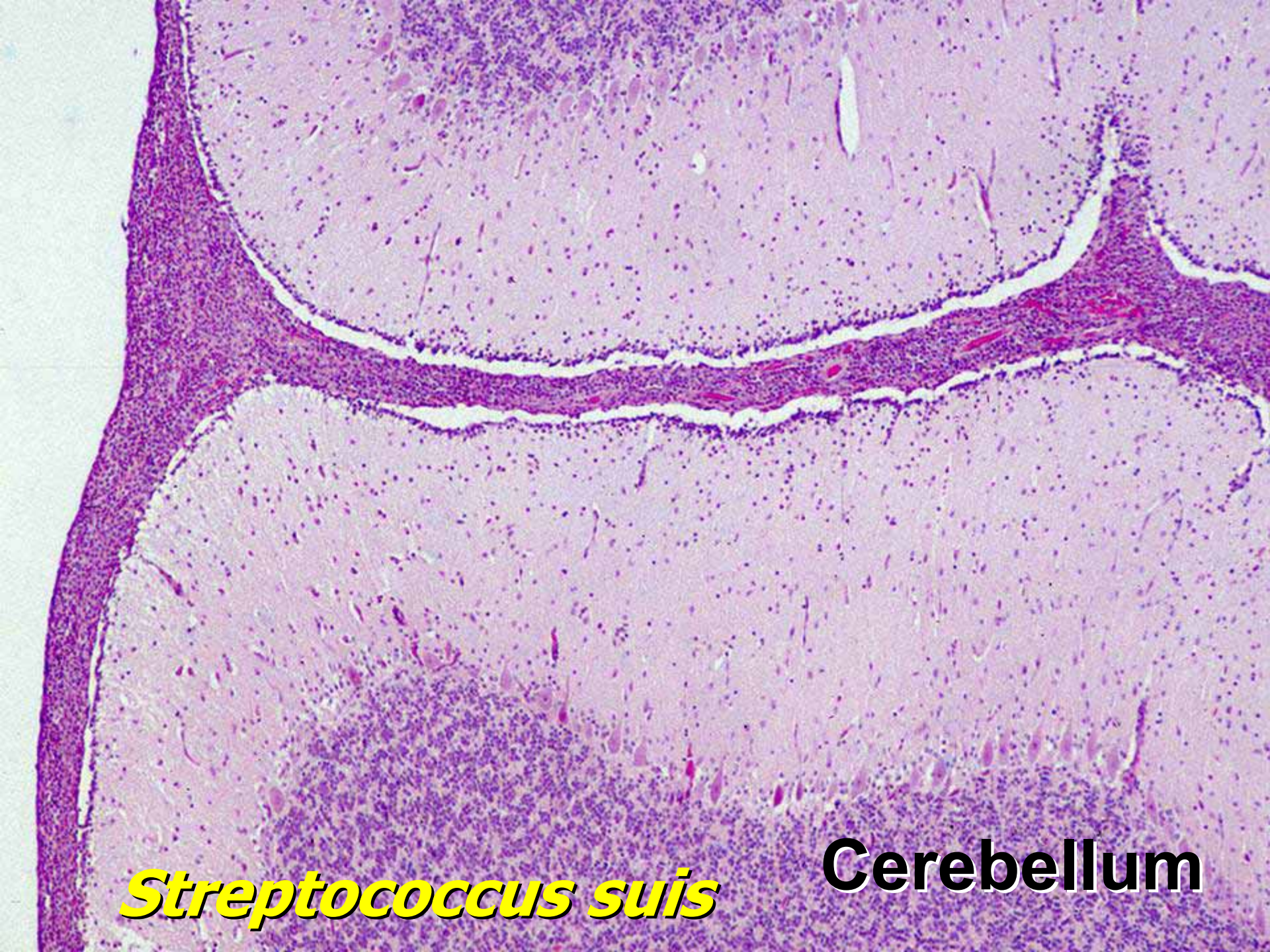

Streptococcus suis + PRRSV

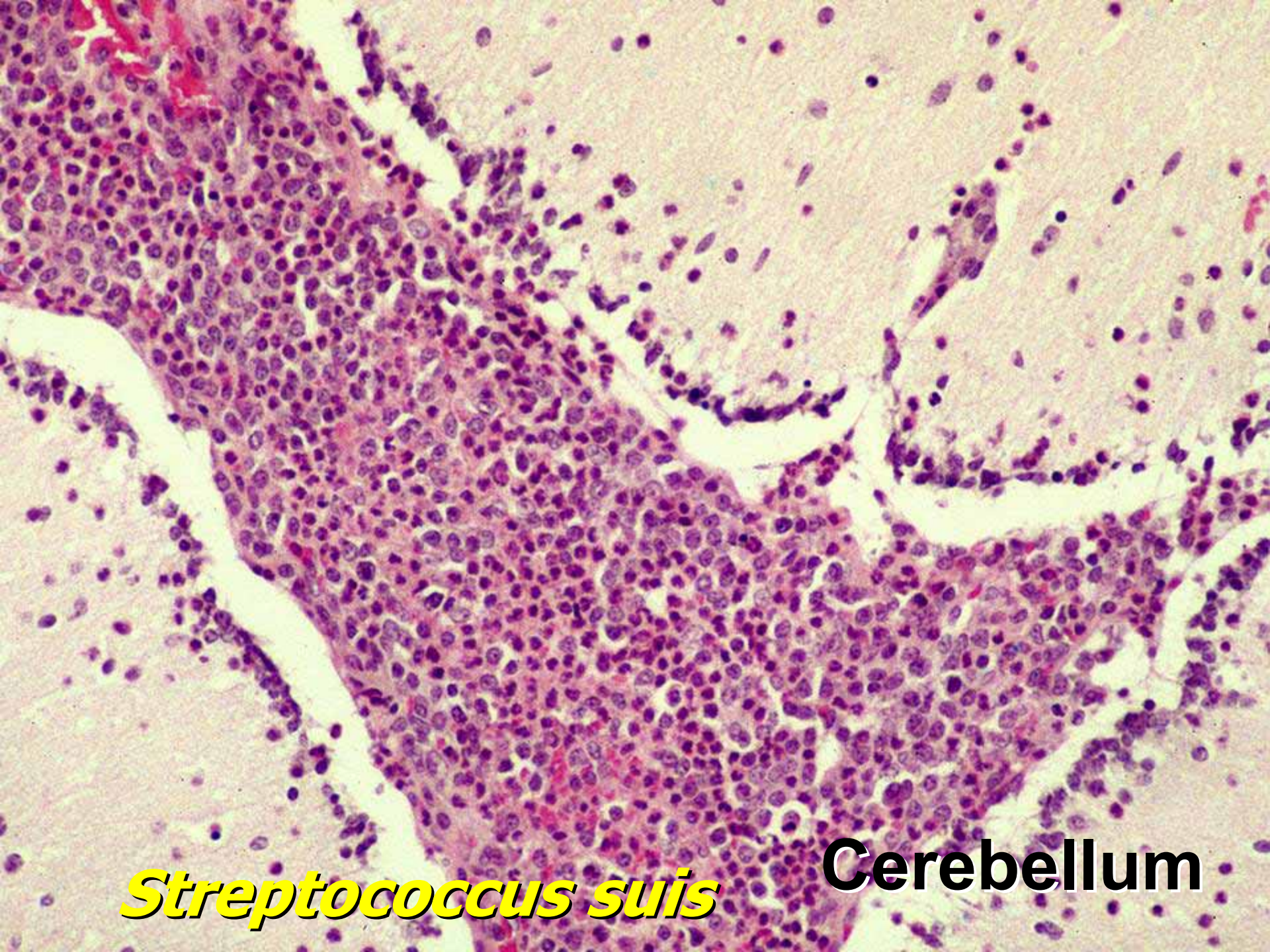

Streptococcus suis

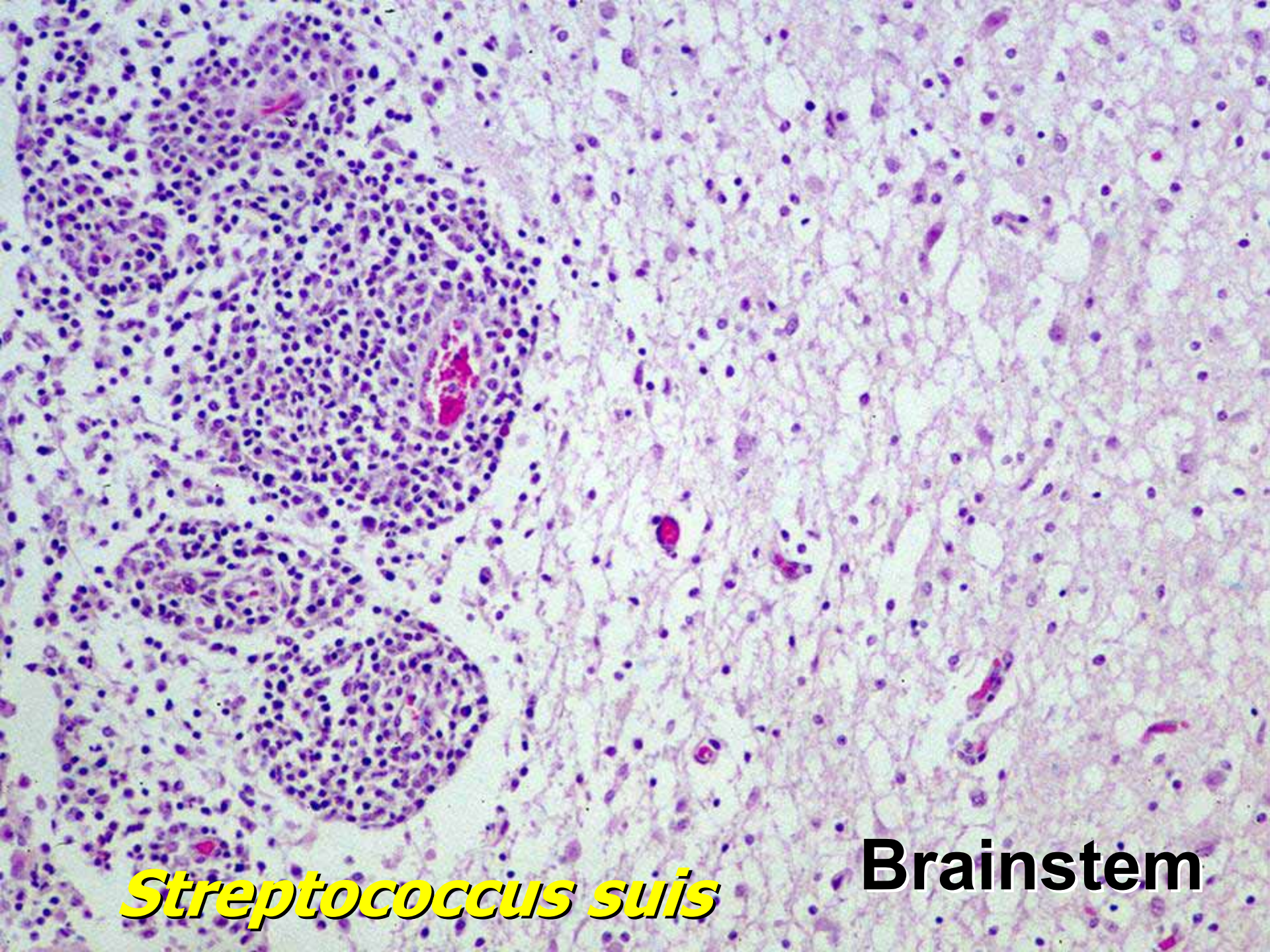

Streptococcus suis


Streptococcus suis


Streptococcus suis
Lung


Streptococcus suis
Cerebellum

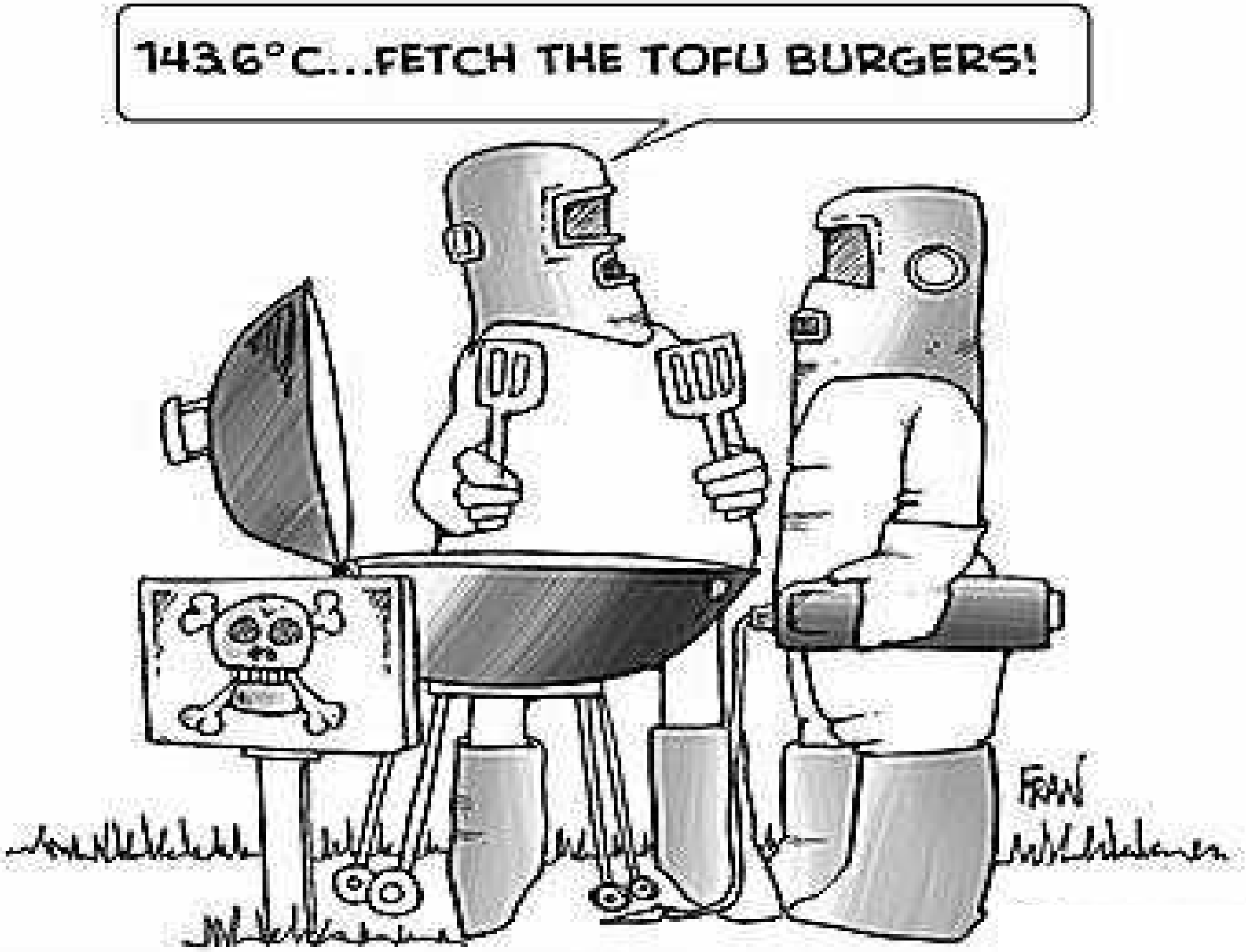

Streptococcus suis
Cerebellum


Streptococcus suis
Brainstem

Streptococcus suis: an emerging zoonotic pathogen

- Human infection with *S. suis* occurs mainly among risk groups that have frequent exposure to pigs or pork
- First case in Denmark in 1968, worldwide more than 200 cases before 2005, most from Europe and Asia
- Large outbreak in July 2005 in Sichuan province, China (third outbreak, two earlier outbreaks in 1998 and 1999)
- In past 8 years in China, at least 237 people infected with *S. suis* and 53 of them died
- All human *S. suis* infections attributed to type 2; except for 2 cases caused by type 1, and 1 case of septicemia caused by type 14
- Manifested as purulent meningitis, less common septic shock with multiple organ failure, endocarditis, pneumonia, arthritis, and peritonitis

Lun et al. Lancet Infect Dis. 7, 201-9, 2007


143.6°C...FETCH THE TOFU BURGERS!
FRANK

Mycoplasma hyorhinis

- Fastidious, pleomorphic - can be isolated from nasal cavities of ≈ 40% of weaners
- Polyserositis in 3-10 week-old pigs
- Role in pneumonia is controversial
  - primary pathogen - mild lesions like *Mycoplasma hyopneumoniae*
  - secondary pathogen?
    - increased volume of pneumonic lung
    - increased localized pleuritis
- Diagnosis: culture, FA or IHC


Mycoplasma hyorhinis


Mycoplasma hyorhinis

Mycoplasma hyorhinis


Mycoplasma hyorhinis