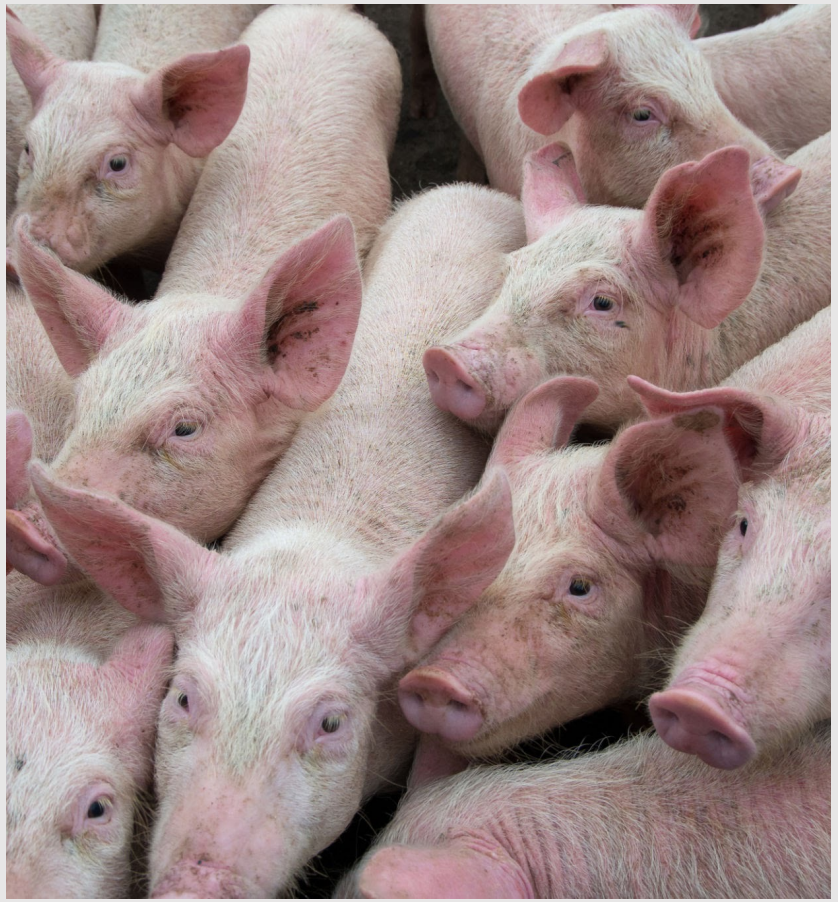






LECTURE 14: ASFARVIRIDAE

Russ Fraser, Fall 2023

Midterm

- October 13, room 218 S (near the Dean's office)

- All materials including today
  - Includes general intro stuff – viral structure, immunology, antivirals, etc
  - Includes rabies.
  - Will not include Tuesday because…

Midterm

- Two groups: A and B – check now
  - A will write at 8:30 AM (sharp!)
  - B will write at 9:30 AM
  - Groups are assigned based on alphabetical order
    - Timing will switch for the final (B will write first, A 2nd)

Midterm

- Please arrive early – you need to log-in, etc.

- Group A – please try to leave promptly following the exam so that Group B can get logged-in on time.
  - **DO NOT** talk about the exam while you are exiting the room.

- Exam is 50 minutes long

Midterm

- Will be MC, similar to quizzes.
- Worth 35 % of your final grade.
  - No team portion on this one.
- Questions?

Your day started like any other…

The sweet aroma of pig manure greeted you as you arrived at your first call – Joe's Pig Paradise



Your call sheet simply said “several pigs dead”

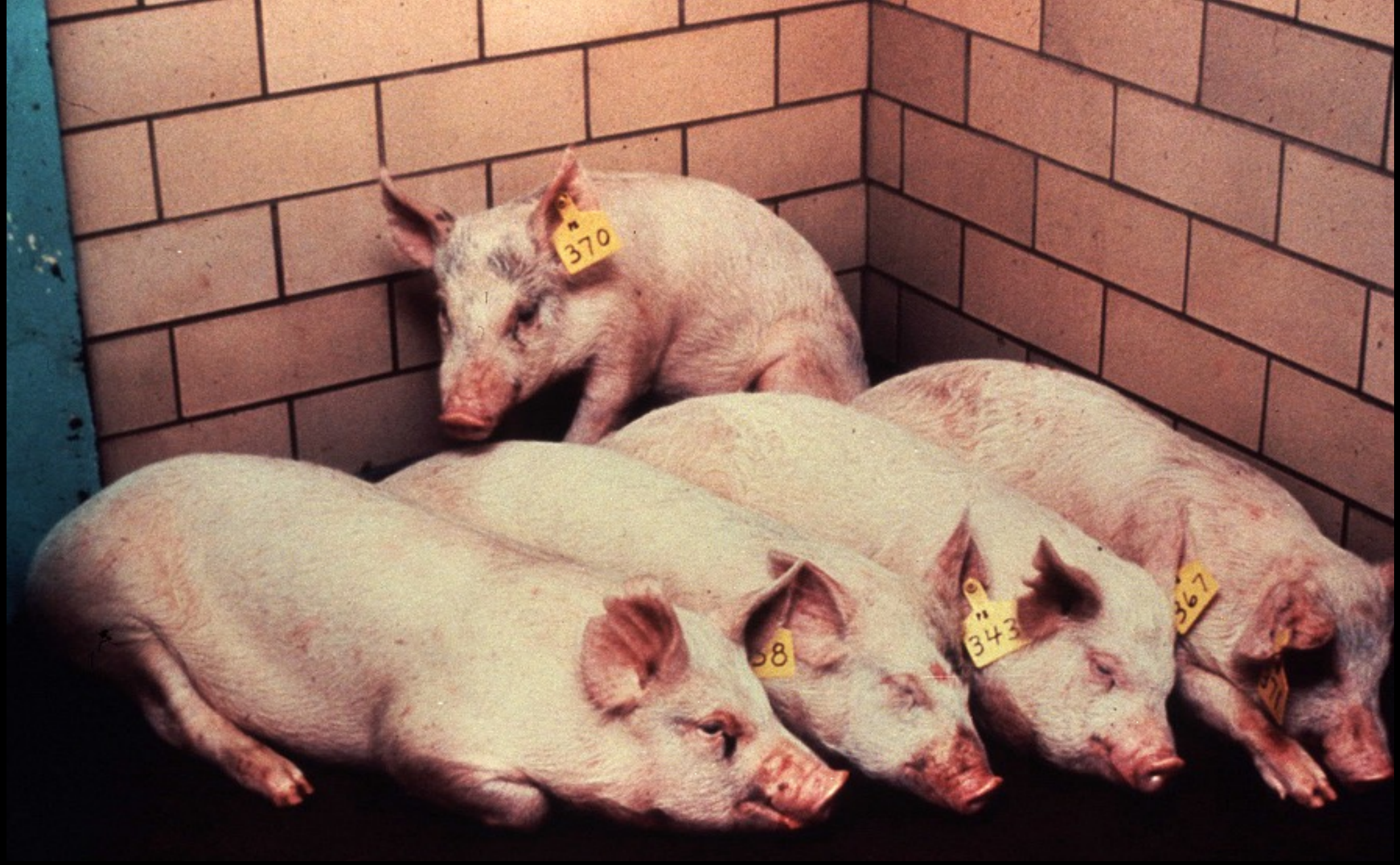
The warm smile that usually greeted you on Joe’s face was absent. His jaw was clenched with concern.

“They’re dyin’, doc, and quick. Only sick for about a week or so, then dead. I don’t know what’s going on.”

“I’ve given ‘em penicillin, ampicillin, ciprofloxacin, enrofloxacin, vancomycin, and even tea tree oil – nothing’s working” he lamented.

“I hear your concern that they’re dying,” you replied, drawing on your skills in reflective listening developed in vet school. Joe instantly looked reassured.

“Let’s go take a look and get to the bottom of this,” you said, as you walked into the barn.



Recumbent… febrile… let’s get closer



Hmmm… bloody and foamy nasal discharge



…and marked hyperemia of the distal limbs…



…and the perineum...

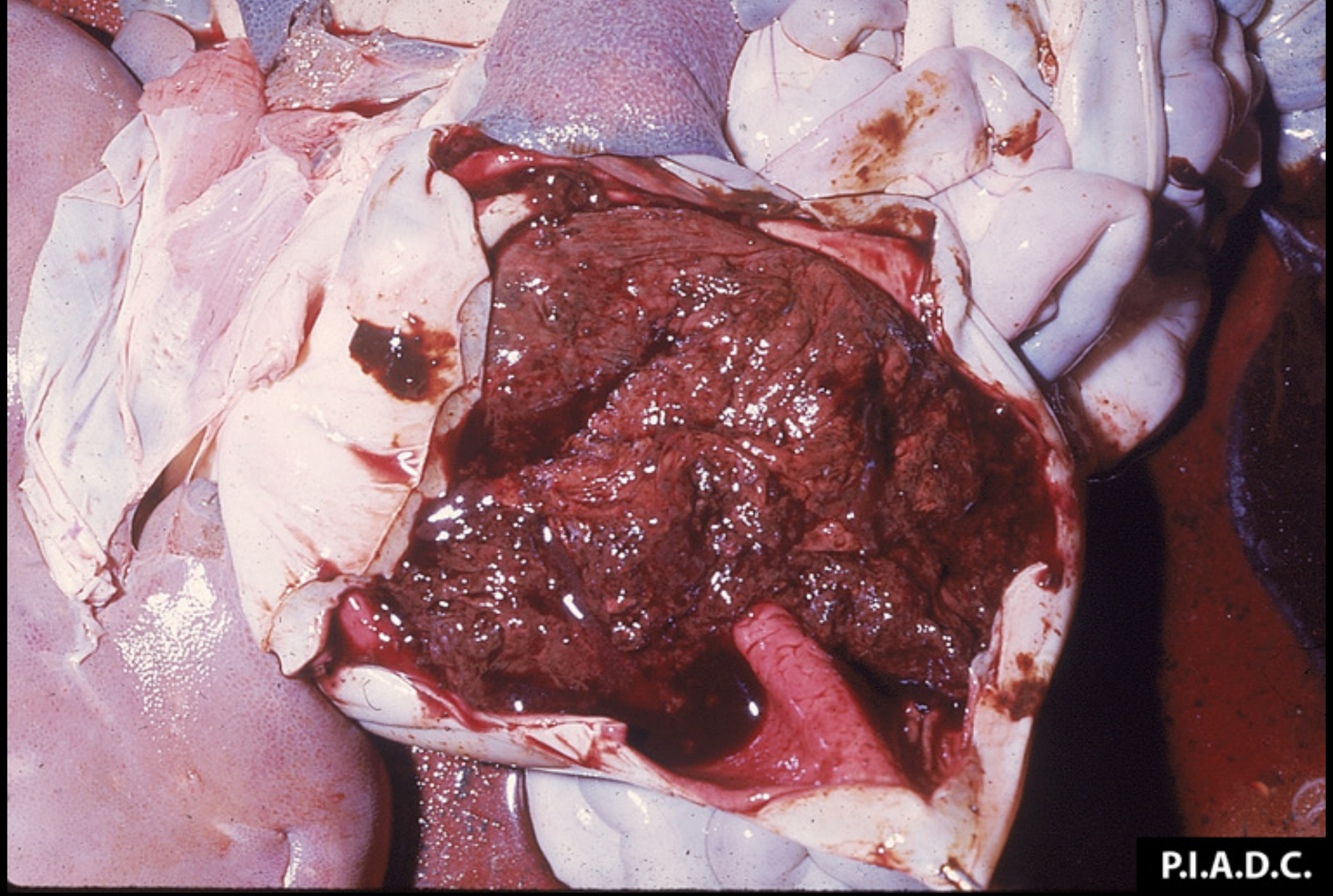
“Did you keep the dead ones, Joe?” you asked, getting a little worried.

“Of course, doc… You always tell me how an understanding of pathology is so important in formulating a differential diagnosis list.”

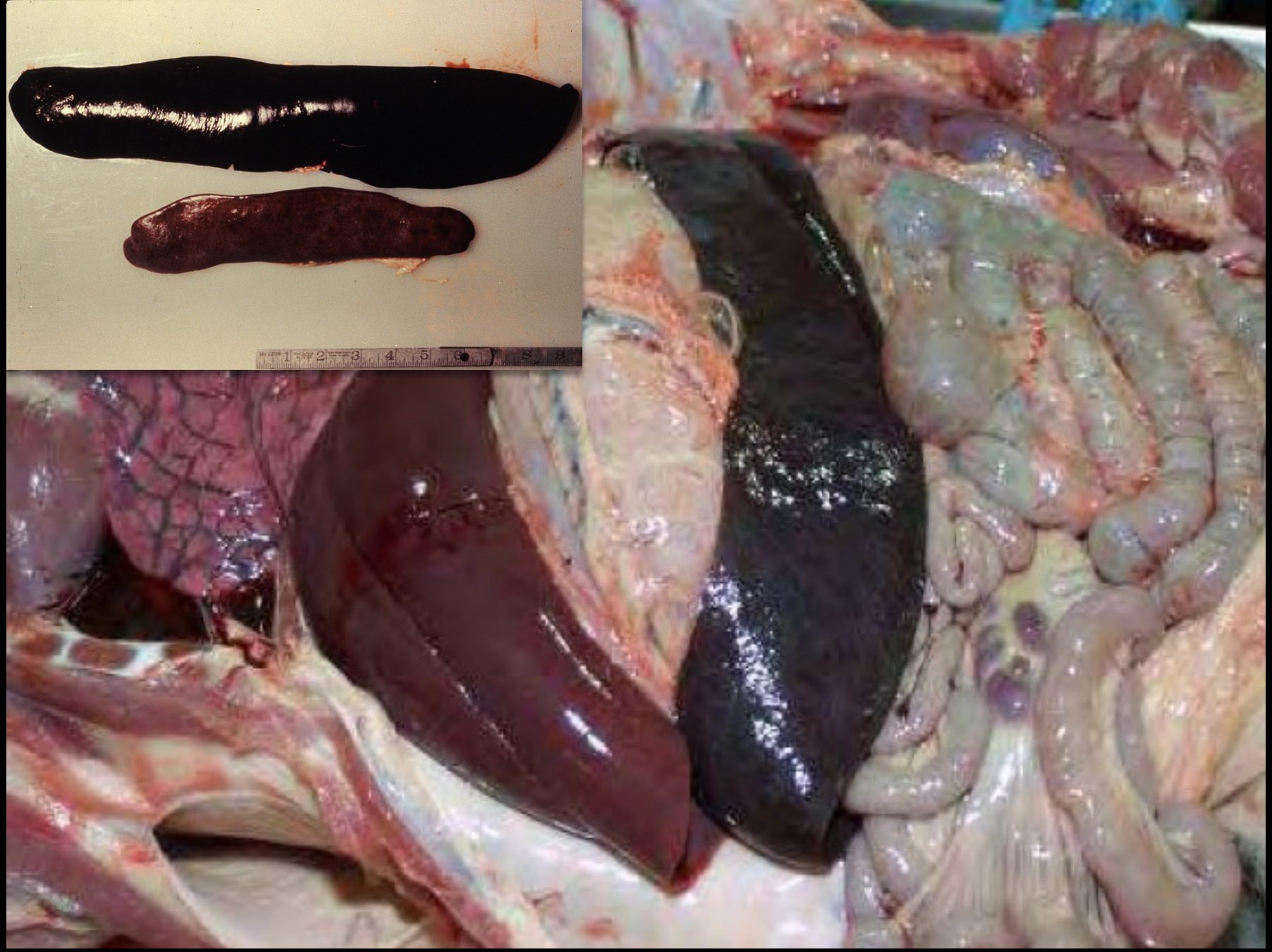
“Oh Joe… You’re the best.”



Multiple sharply demarcated areas of hemorrhage and necrosis



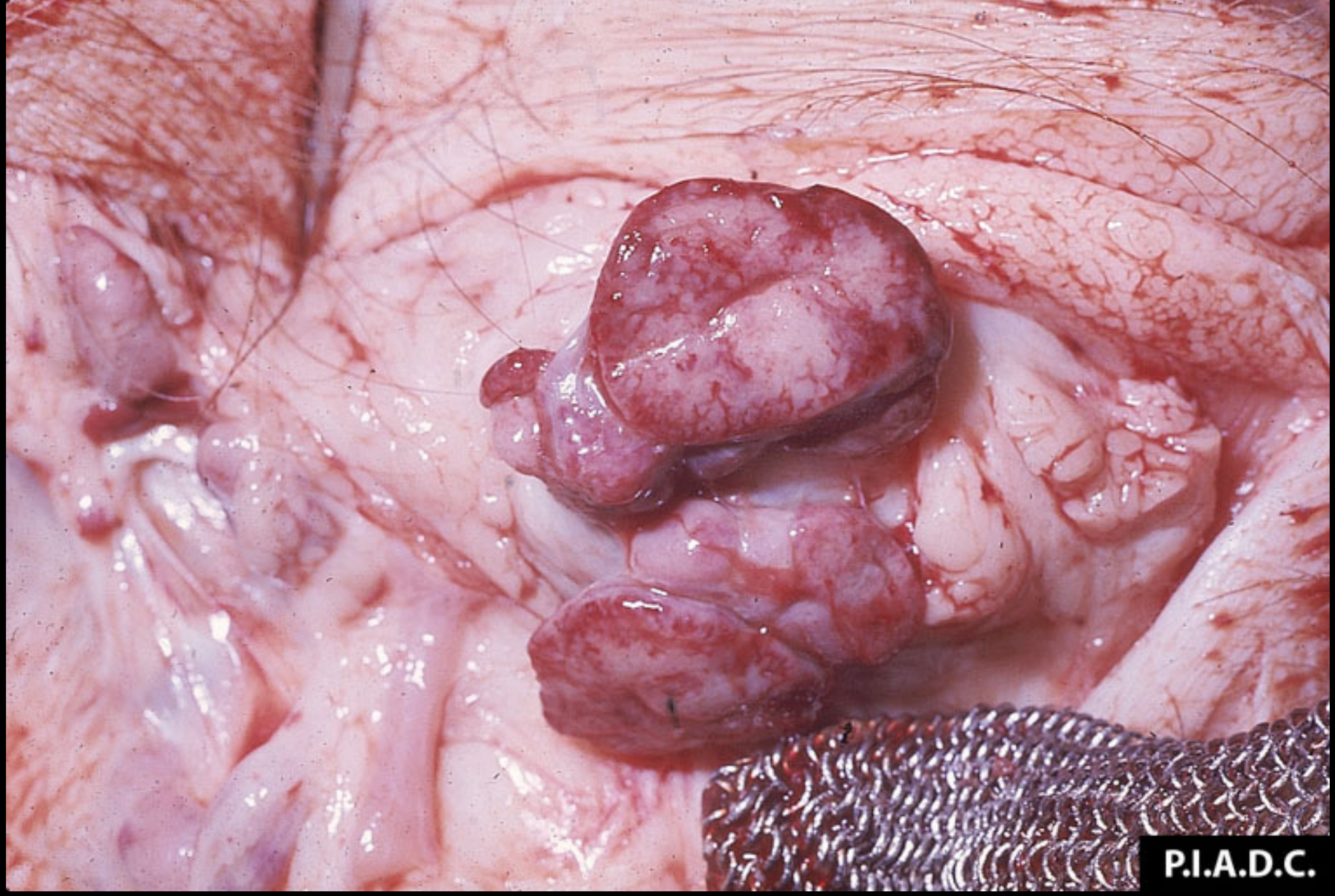
Clotted blood fills the lumen of the stomach



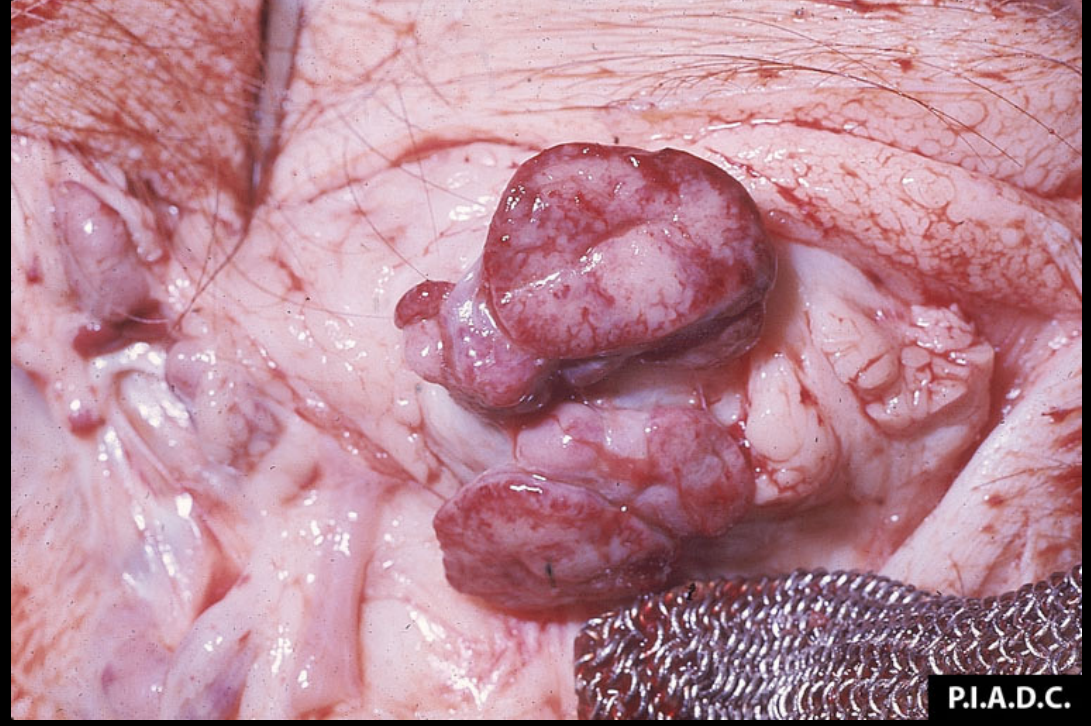
Wow, that’s a big spleen.



Multifocal to coalescing petechia/ecchymoses in the kidney



Swollen and hemorrhagic lymph nodes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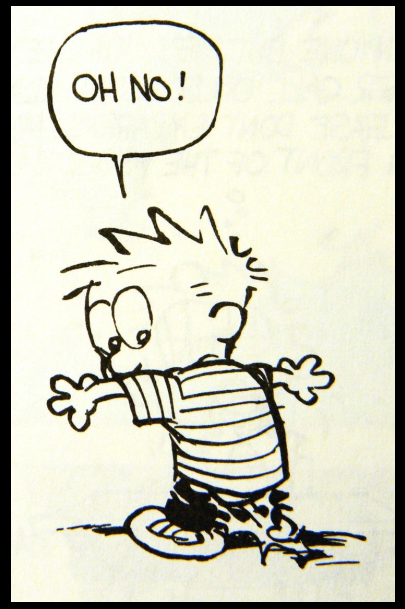
P.I.A.D.C.


OH NO!

“Joe,” you said slowly, “have you been keeping up with the news?”



"Of course," he replied. "I read the *NYTimes* and *WaPo* daily."

"Have you heard about what's going on in China?" you asked.

His face slowly turned pale as realized what you were suggesting.

"You… you don't think… it couldn't be…"



A Vicious, Untreatable Killer Leaves China Guessing

African swine fever, which harms pigs but not humans, has swept across the country, the world's largest pork producer. And the government knows about only some of the cases.



The Wangaofa Animal Husbandry Development Company had to cull thousands of pigs this year after an outbreak of African swine fever. The facility now sits empty, its hallways splattered white with disinfecting lime. Raymond Zhong/The New York Times

By Raymond Zhong and Ailin Tang

April 22, 2019

170

African swine fever has decimated China's hog population. Will it hit the U.S. next?



A pork vendor sits behind the counter of a market stall Monday in Beijing. (Gilles Sabrie/Bloomberg News)

By **Laura Reiley**

May 9, 2019 at 8:00 a.m. ADT

Most Read Business

1 Trump administration blocks testimony of Gordon Sondland, a central figure in the Democrats' impeachment inquiry



2 Poll: Majority of Americans say they endorse opening of House impeachment inquiry of Trump



3 A guy tweeted an ingenious hotel-room hack — and Twitter responded with their own



4 **Opinion**
This will get worse for Trump. Adam Schiff signals what's next.



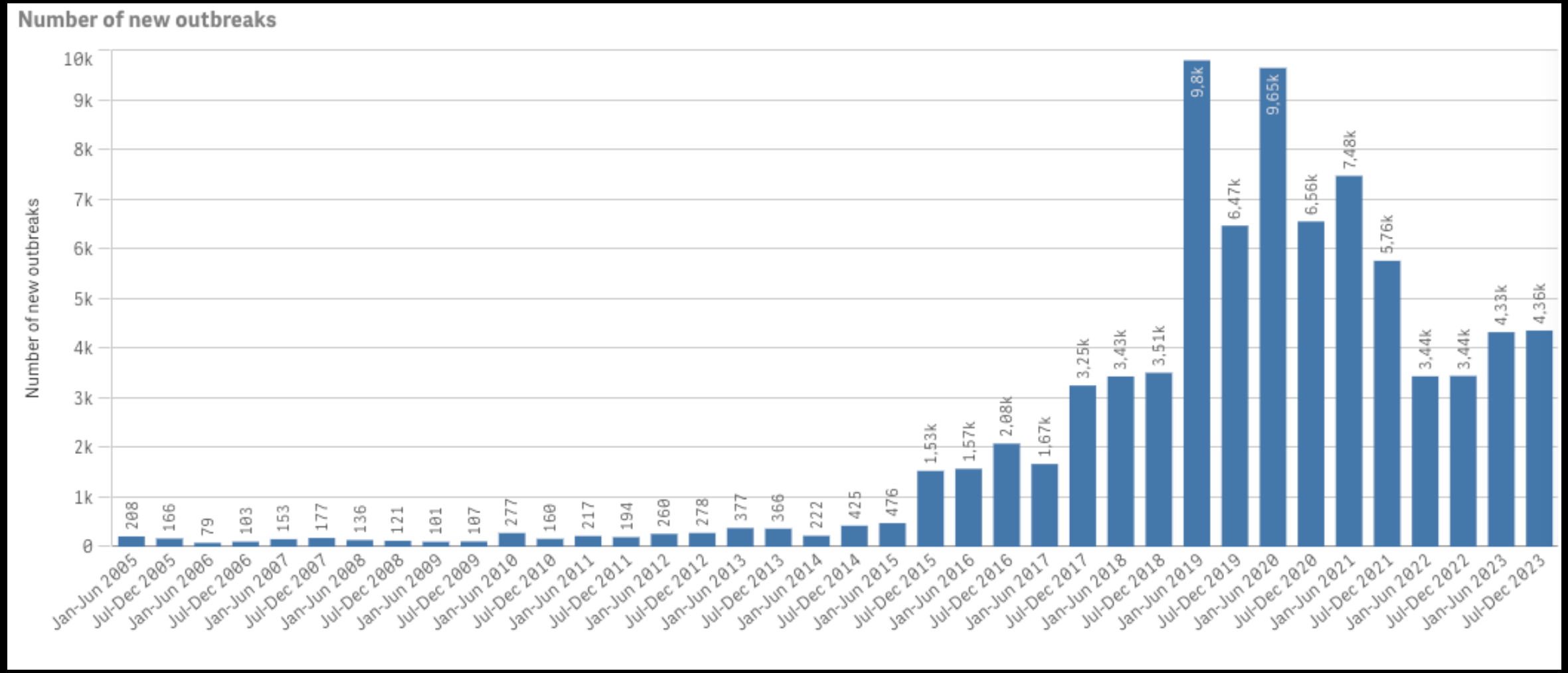
5 **Opinion**
Trump's defense: You can't impeach me. I impeach you.



Podcast

Post Reports

The Washington Post's daily podcast: unparalleled reports, expert insight, clear analysis. For your ears.



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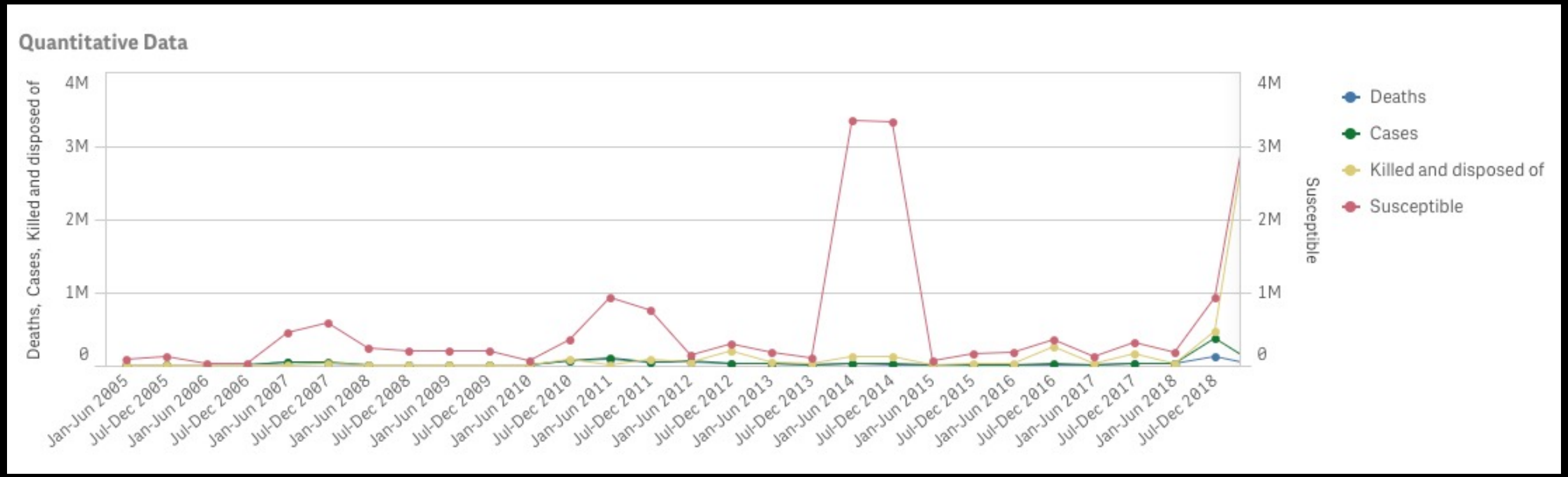

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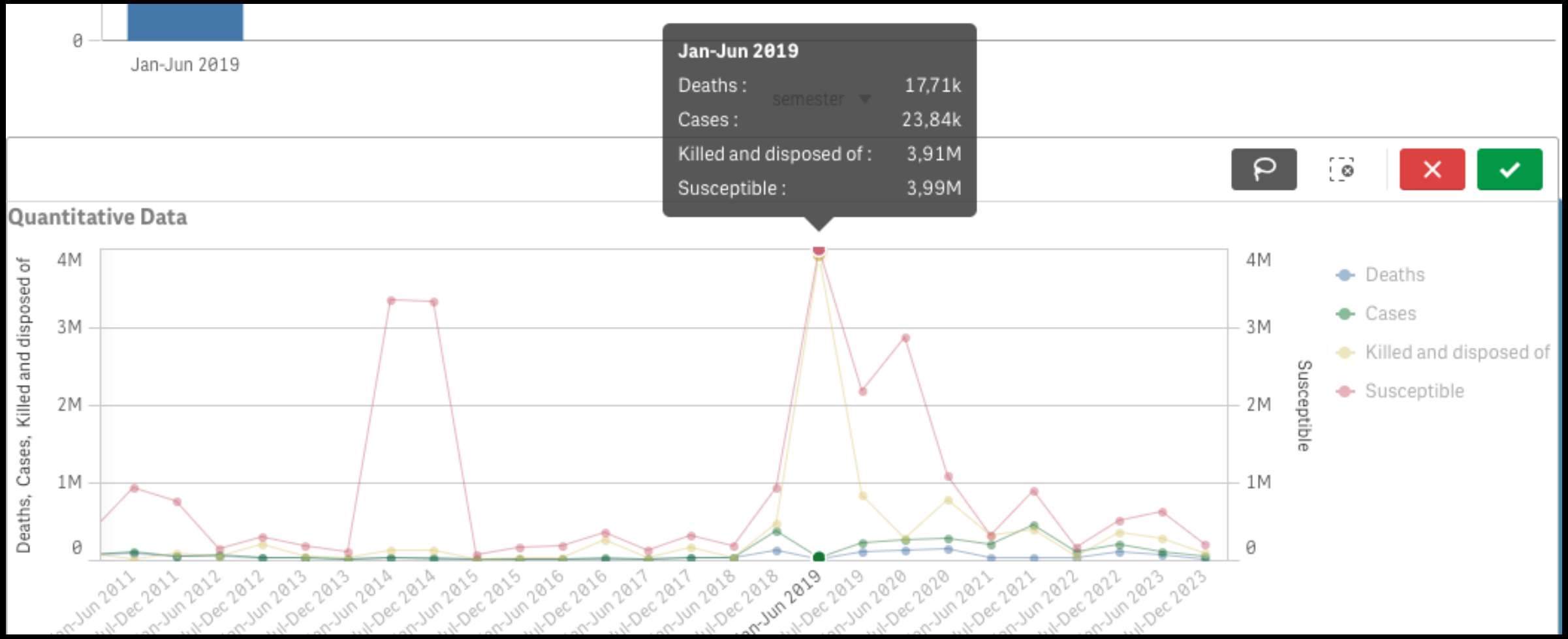

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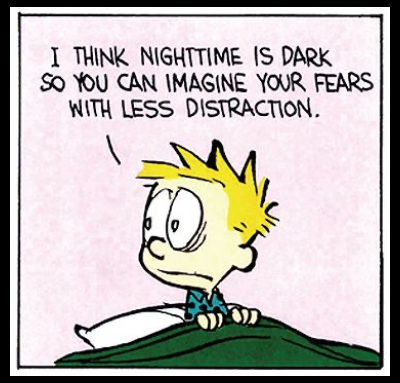


Joe looked at you worriedly. “You know, my son just got back from travelling in Asia a couple of weeks ago.”

Your jaw dropped.

“He didn’t visit any farms or bring back any meat, did he?”

Instructions

All travellers must be identified on a Canada Border Services Agency (CBSA) Declaration Card. You may list up to four people living at the **same address** on one card. **Each traveller is responsible for his or her own declaration. Each traveller is responsible for reporting currency and/or monetary instruments totaling CAN$10,000 or more that are in his or her actual possession or baggage.**

Under the law, failure to properly declare goods, currency and/or monetary instruments brought into Canada may result in seizure action, monetary penalties and/or criminal prosecution.

Information from this declaration will be used for CBSA control purposes, and may be shared with other government departments to enforce Canadian laws. For more information see *Info Source* (ref. no. CBSA PPU 018), at a public library or visit **http://infosource.gc.ca**.

Part B – Visitors to Canada

The following duty-free allowances apply to each visitor entering into Canada:

- Gifts (excludes alcohol and tobacco) valued at no more than CAN$60 **each**.
- 1.5 L of wine **or** 1.14 L of liquor **or** 24 x 355 ml cans or bottles (8.5 L) of beer or ale.
- 200 cigarettes, 200 tobacco sticks, 50 cigars or cigarillos **and** 200 grams of manufactured tobacco.

Part C – Residents of Canada

Each resident returning to Canada is entitled to **one of the following personal exemptions** based on his/her time absent from Canada (include all goods and/or gifts purchased or received abroad):

- **24 hours: CAN$200**
  Not claimable if goods exceed CAN$200. Alcohol and tobacco cannot be claimed.
- **48 hours: CAN$800**
  This includes alcohol and tobacco (see table below).
- **7 days: CAN$800**
  This includes alcohol and tobacco (see table below) and unaccompanied goods.

Alcohol and tobacco exemption table
1.5 L of wine **or** 1.14 L of liquor **or** 24 x 355 ml cans or bottles (8.5 L) of beer or ale. (You must be of legal age in the province of importation.)
200 cigarettes, 200 tobacco sticks, 50 cigars or cigarillos **and** 200 grams of manufactured tobacco (Special Duty may apply).

Fold along line and detach

Fold along line and detach

Canada Border Services Agency / Agence des services frontaliers du Canada

Declaration Card

PAX

– For Agency Use Only –
R U.S. V OV Cr O

Part A All travellers (living at the same address) – Please print in capital letters.

1 Last name, first name and initials
Date of birth: YY - MM - DD (Y Y M M D D) Citizenship:

2 Last name, first name and initials
Date of birth: YY - MM - DD (Y Y M M D D) Citizenship:

3 Last name, first name and initials
Date of birth: YY - MM - DD (Y Y M M D D) Citizenship:

4 Last name, first name and initials
Date of birth: YY - MM - DD (Y Y M M D D) Citizenship:

HOME ADDRESS – Number, street, apartment No. City/Town

Prov./State Country Postal/Zip code

Arriving by: Air Rail Marine Highway
Airline/flight No., train No. or vessel name

Purpose of trip: Study Personal Business

Arriving from: U.S. only Other country direct Other country via U.S.

I am/we are bringing into Canada: Yes No

- Firearms or other weapons (e.g. switchblades, Mace or pepper spray).
- Commercial goods, whether or not for resale (e.g. samples, tools, equipment).
- Meat/meat products; dairy products; fruits; vegetables; seeds; nuts; plants and animals or their parts/products; cut flowers; soil; wood/wood products; birds; insects.
- Currency and/or monetary instruments totalling CAN$10,000 or more.

I/we have unaccompanied goods.

I/we have visited a farm and will be going to a farm in Canada.

Part B Visitors to Canada

Duration of stay in Canada days

Do you or any person listed above exceed the duty-free allowances per person? (See instructions on the left.) Yes No

Part C Residents of Canada

Do you or any person listed above exceed the exemptions per person? (See instructions on the left.) Yes No

Complete in the same order as Part A

	Date left Canada YY - MM - DD	Value of goods – CAN$ purchased or received abroad (including gifts, alcohol & tobacco)		Date left Canada YY - MM - DD	Value of goods – CAN$ purchased or received abroad (including gifts, alcohol & tobacco)
1	Y Y M M D D		3	Y Y M M D D	
2	Y Y M M D D		4	Y Y M M D D	

Part D Signatures (age 16 and older): I certify that my declaration is true and complete.

1 2 3 4 Date YY - MM - DD ▶ (Y Y M M D D)

E311 (12/06) **Protected A when completed** BSF311

Canada

Do not fold Declaration Card

SPECIMEN

“Weellllllll…” said Joe, refusing to meet your eyes, “he may have brought home a ham. And we may have thrown some scraps in with the pig feed…”

“Oh, Joe… I’m so disappointed. You know better than to feed garbage to your pigs!”

“Let me tell you what I’m worried about,” you said to Joe. You took a quick minute to compose yourself, and continued:

"I'm really concerned about a diseased called African Swine Fever. It's caused by a virus (African swine fever virus).

Asfarviridae

- *DNA virus*
- *Enveloped – BUT envelope is not required for infectivity*
- *ONLY known DNA arbovirus*
- *Sensitive to lipid solvents, resistant to pH changes*
- *Can live for months – years in refrigerated meat*

Suidae

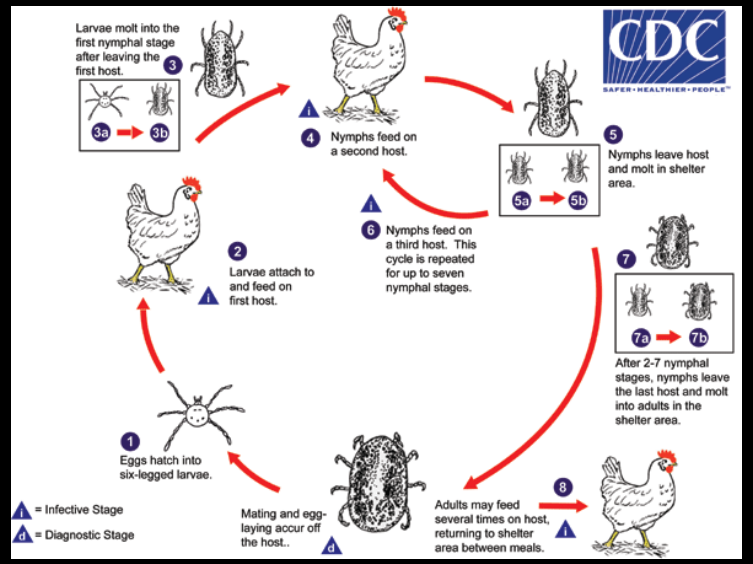
- *Warthogs (natural reservoir – no disease)*
- *Bushpigs*
- *Wild boars*
- *Domestic pigs*

"ASFV, as it's known, only infects members of the *Suidae* family"






"Well," you paused, "that's not entirely true. It's also found in ticks, where it can replicate, and which can serve as vectors"



Ornithodoros (soft-shelled tick)

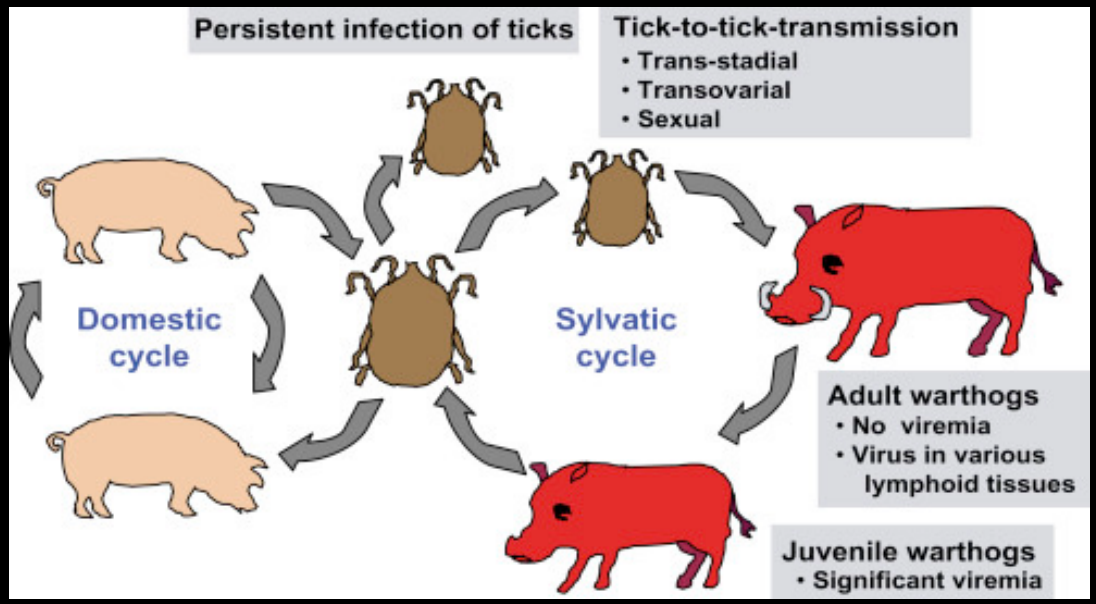


- *Infected for life*
- *Colonies can maintain the virus*
- *Important in transmission (in areas which have the tick – Africa)*

Transmission

- *Direct transmission:*
  - *Usually oronasal, but all secretions contain virus*
- *Indirect transmission:*
  - *Feeding on garbage/swill containing infected meat*
  - *Soft ticks of the genus Ornithodoros*
  - *Fomites include, premises, vehicles, implements, clothes*
- *Within the tick: can pass vertically, sexually, and between life stages*
- *Recovered animals (and warthogs) can be persistently infected*

"In areas that don't have the tick, pigs spread the virus between themselves, or through the contamination of clothing, vehicles, or other fomites."



“So it was that ham that my son brought back that started all this? I’m going to kill that kid!”

“Well, probably, yes. And a very reasonable reaction, I must say. But, we are getting ahead of ourselves: we haven’t confirmed that this is a case of African swine fever virus yet. Let me tell you more about this disease.”

Strains

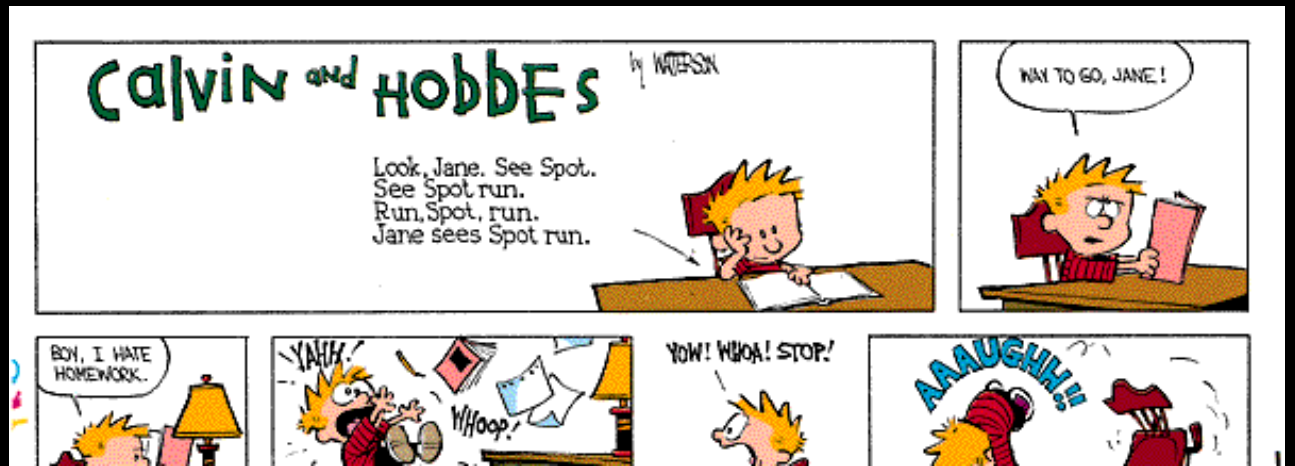
- *In areas free of disease, disease is usually acute or peracute*
  - *↑ ↑ morbidity and mortality*
- *As virus persists in population → attenuates → ↓ morbidity and mortality*

"The severity of disease caused by the virus depends on the strain, and can be high, moderate, or mild," you explain.

“In this un-exposed population, we’re gonna have some serious problems,”
you warned Joe.

"This virus loves to target lymphoid organs – I mean, organs involved in the defense of the body" you explained.

"I know what a lymphoid organ is, doc", said Joe, rolling his eyes. "Spleen, lymph nodes, etc."



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"I know what a lymphoid organ is, doc", said Joe, rolling his eyes. "Spleen, lymph nodes, etc."

Pathogenesis

Oral infection
↓
Viral replication in oronasal lymphoid tissue (tonsils, LNs)
↓
Primary viremia (associated with RBCs and leukocytes)
↓

- *Generalized infection: **all** secretions contain ↑↑ amounts of virus*
- *Infection of macrophages and monocytes → immunomodulation*
- *Infection of leukocytes → Leukopenia (apoptosis of B and T cells)*
- *Infection of endothelial cells → hemorrhage*
- *Infection of spleen and LNs → enlargement & hemorrhage*
- *↑ cytokines → microthrombi ± endothelial cell damage*

Warthogs and ticks do not develop clinical disease.

"About 3-10 days after infection with ASFV pigs usually become feverish, anorexic, and lethargic. Following that, they may stop eating and become incoordinated. Some of them will just die at that point, but many will have trouble breathing, may vomit, or have discharge from their nose or eyes. That blue or red tinge you see on the ears and snout often happens, too."

"Your pregnant sows may abort" you warned him. "And mortality often approaches 100 %"

“A hundo-p??? Ughhhhhhhhhhhh,” Joe moaned. “What a disaster.

“You mentioned you weren’t sure this ASFV. Why not?”

"Great question, Joe!"

"The disease can be indistinguishable from another disease: classical swine fever"

Differential diagnosis

- *Classical swine fever (hog cholera) caused by CSF virus (Pestivirus)*
  - *SPLEENOMEGALY → more of an ASFV lesion*
  - *HEMORRHAGIC & ENLARGED LNs → more of an ASFV lesion*
- *Bacterial septicemia (cyanotic/erythemic extremities)*

“Well,” said Joe, “what’re we going to do about this mess?”

“The bad news keeps coming. Joe, African swine fever virus is a REPORTABLE DISEASE”

Call the CFIA.

Classical swine fever virus is also reportable.

While you waited for the CFIA to arrive, you finished charting the case, and started watching videos on your phone.

Somehow, the YouTube algorithm suggested this video.

You started watching it, and quickly called Joe over to watch with you.

“Well, that was weird. Looked like a kid’s cartoon with a bunch of dead pigs,” observed Joe.

“Yeah,” you agreed, “but that vomiting pig was really well done.”

“True. So, what happens next?” asked Joe.

“Let’s take some samples to confirm the diagnosis.”

Diagnosis
Spleen, lymph node, tonsil, kidney, or blood
PCR, virus isolation

"Joe, I have to warn you, if these pigs test positive for ASFV, the government is going to depopulate your entire farm."

Joe looked sad.

Control

- *Infected herds are destroyed and facilities cleaned, quarantined*
- *Prohibit importation of live swine (which may be persistently infected) & products from countries with disease*
- *Don't feed garbage to pigs*
- *Potential tick vectors - control with acaricides*
- *There is no vaccine for ASFV*

Joe’s pigs tested positive for African swine fever virus and his herd was slaughtered. He received some compensation.

Joe’s son was charged with fraud (or something, I’m not a lawyer)

You changed your clothes and cleaned your truck before your next appointment, went about your day, and had a great (Canadian) Thanksgiving.