Actual major swine reproduction problems (infectious and non infectious) including clinical investigation methodology and diagnostic traps Part 1

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INP TOULOUSE
ECOLE NATIONALE VETERINAIRE


S. MARTINO
(FOSSANO)
50

Why ?

- Me
  - Swine clinician
    since … a very long time
    - Canada
    - France
  - Problem-solving approach (with vet students)
  - Many investigations (majority with vet students)
  - Take stocks of these many investigations
- You
  - Expert
  - Young (Y generation)
  - Motivation

Proposal

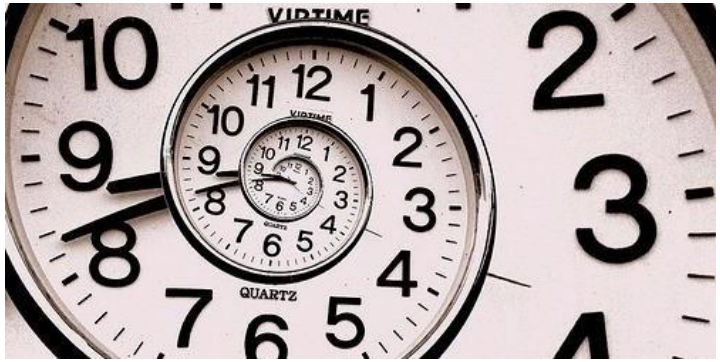
- Part 1
  - Reproduction and infections
  - Reproduction and non-infectious causes
    - Clinical investigation
    - Traps
- Part 2 (if we have time): cliniques cases
  - Trap example with an infectious case
  - Trap example with a non-infectious case

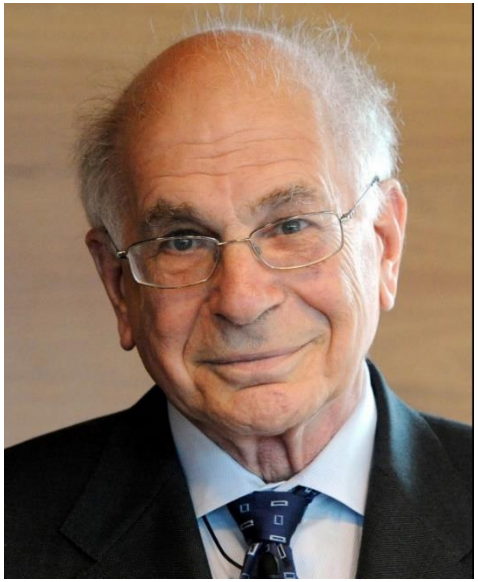
- We are faced with an urgent problem of reproduction
  - Severe **?** Accidental **?**
  - ➢ Infectious / Non infectious **?**
  - ➢ If infectious
    - ➢ Specific agent **?**
    - ➢ Ubiquist agent **?**

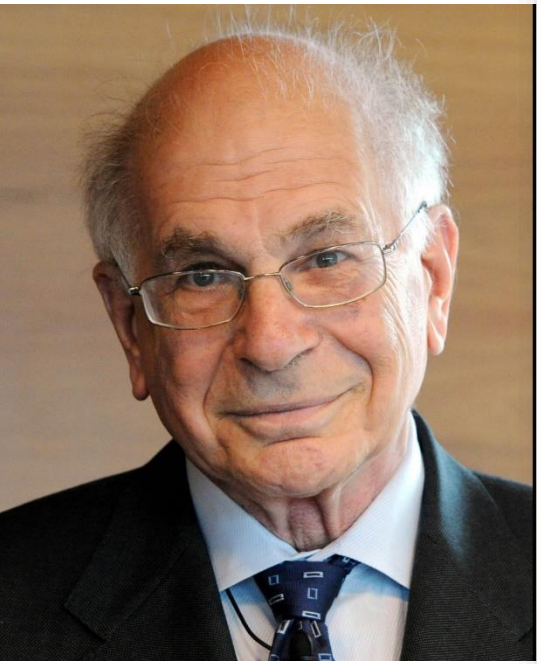
➢ Many **?** and no time

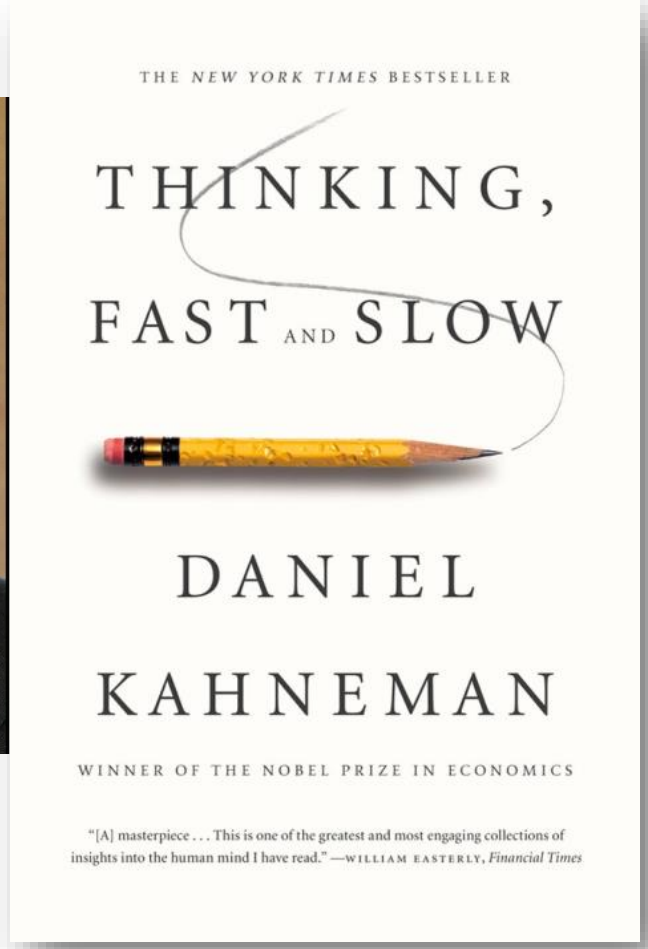
➢ But, luckily, …

  - ➢ intervention of Kanhneman's System 1





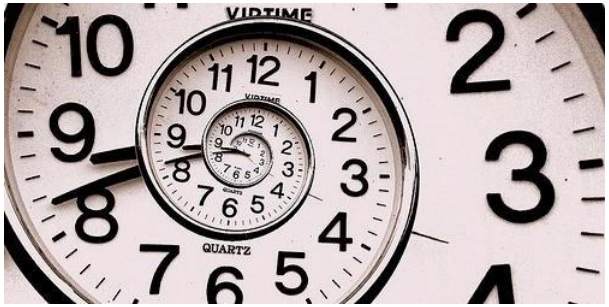


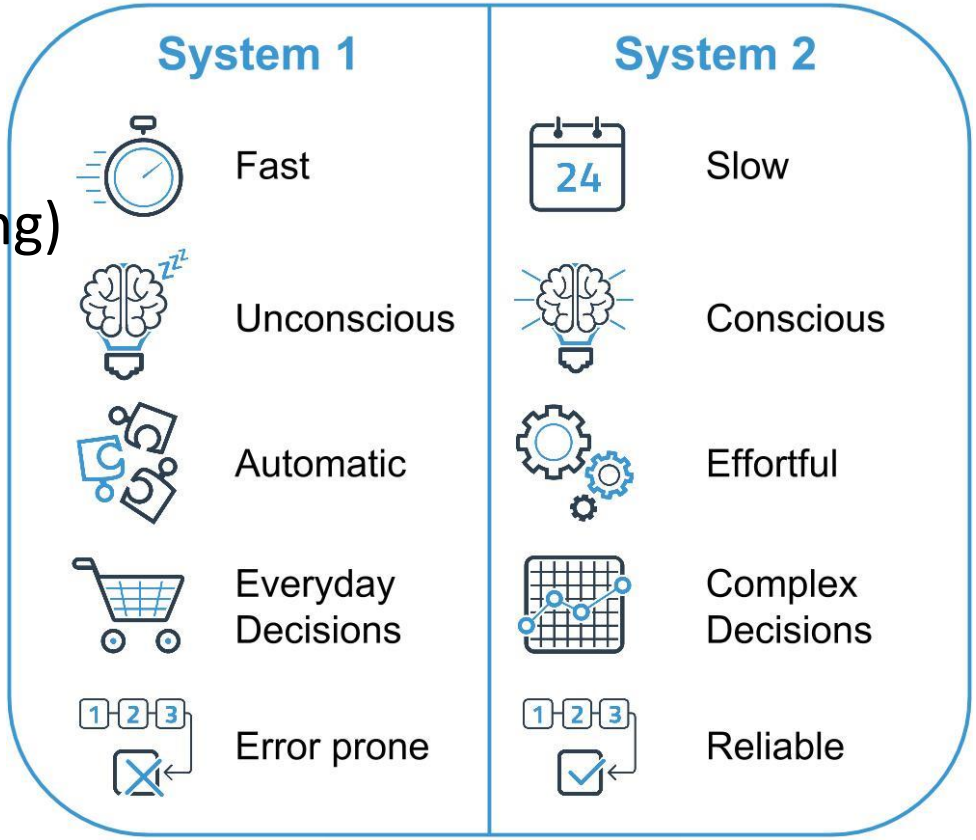


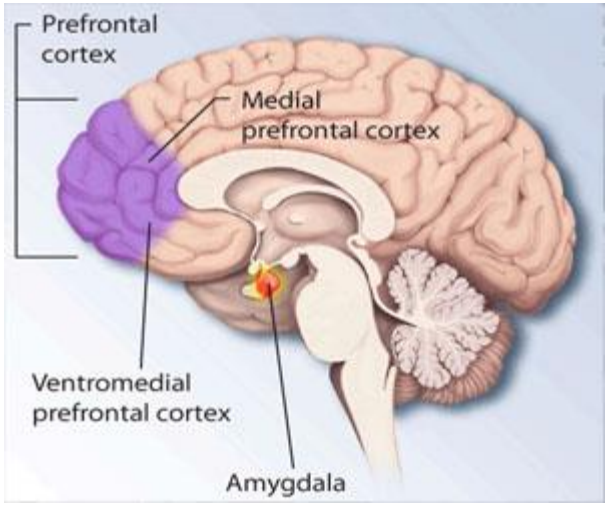
In 2002, Daniel Kahneman is winner of the Nobel Prize in Economics

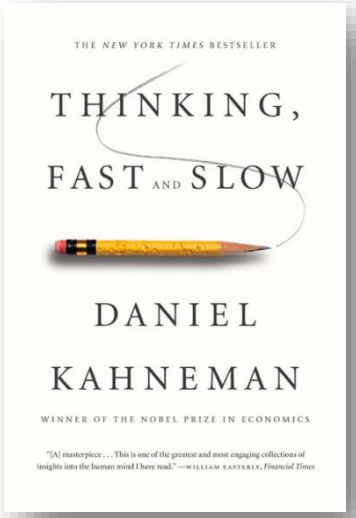
Intuitive reasoning

(pattern recognition is the most well known for of System 1 thinking)



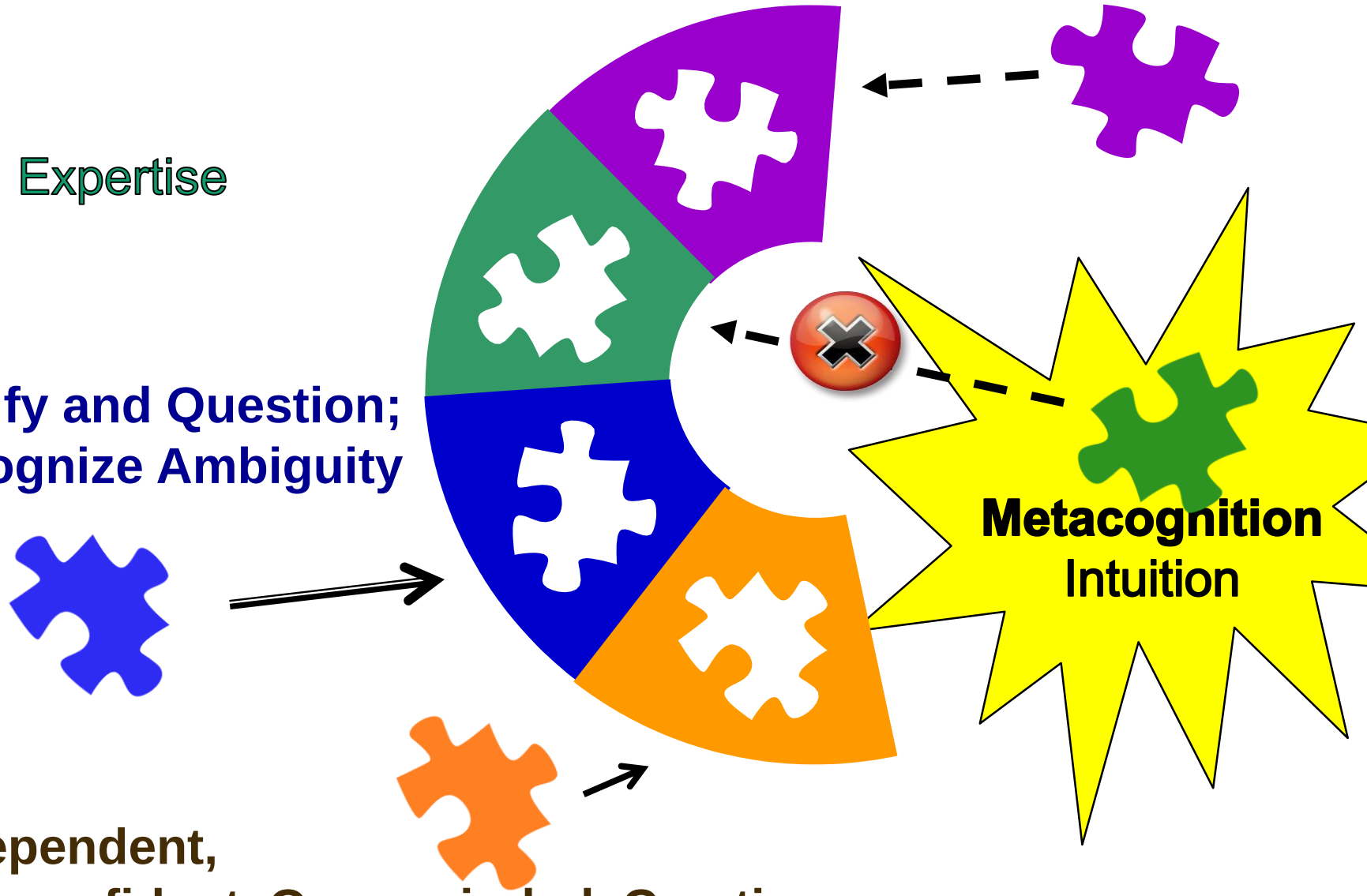




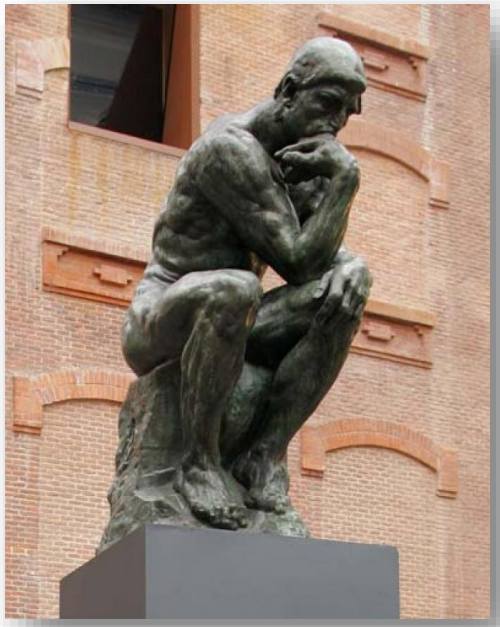


Critical Thinking

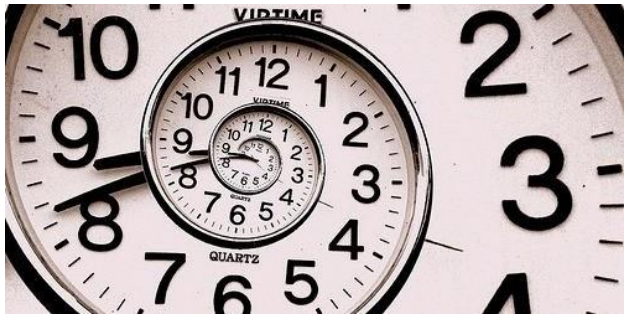
Analysis; Compare and Contrast



Analytical, problem-oriented, forward reasoning approach (as a trained form of System 2 thinking)



Rodin's *The Thinker*



Description

1

Hypotheses

ABDUCTION

Hypotheses

2

Theorical associated
-symptoms and/or lesions
-events
-behaviors

« Previsit » scenarios to confirmed or refute

A
E
L
M
A
R

Most likely scenario

Abduction

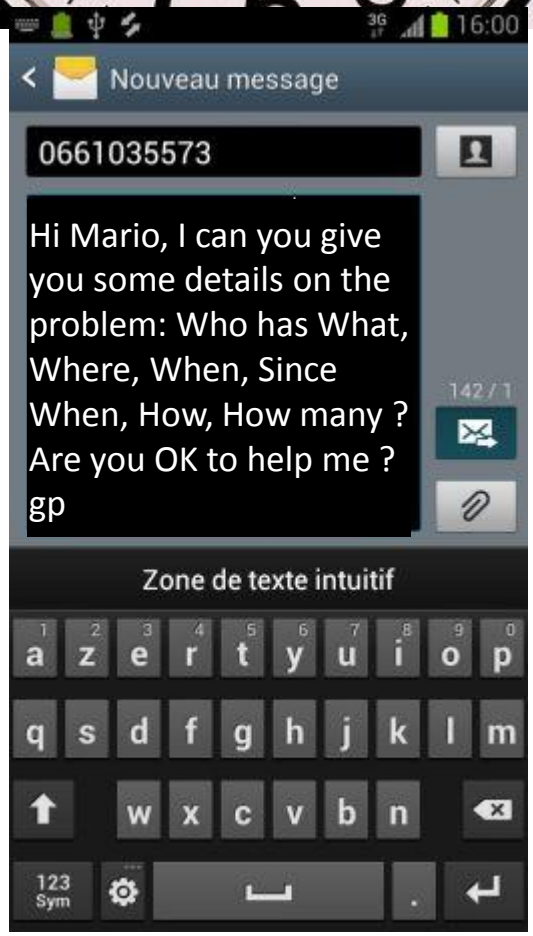
from a sign to a theory (a story)

= science x imagination x intuition x creativity

= « Detective method »

Peirce 1839-1914

Exemple: « a story in 6 words:
For sale: baby shoes, never worn »



Common-sense reasoning

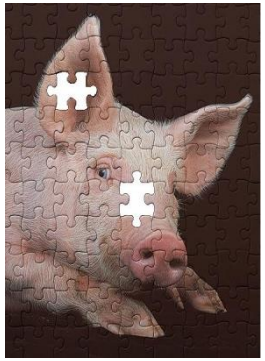
Rarely does one have complete information from which a decision can be made

Clinical characteristics:

Imprecise

Incomplet

Imperfect



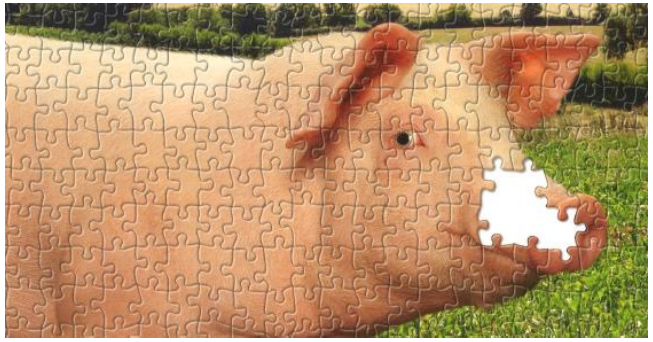
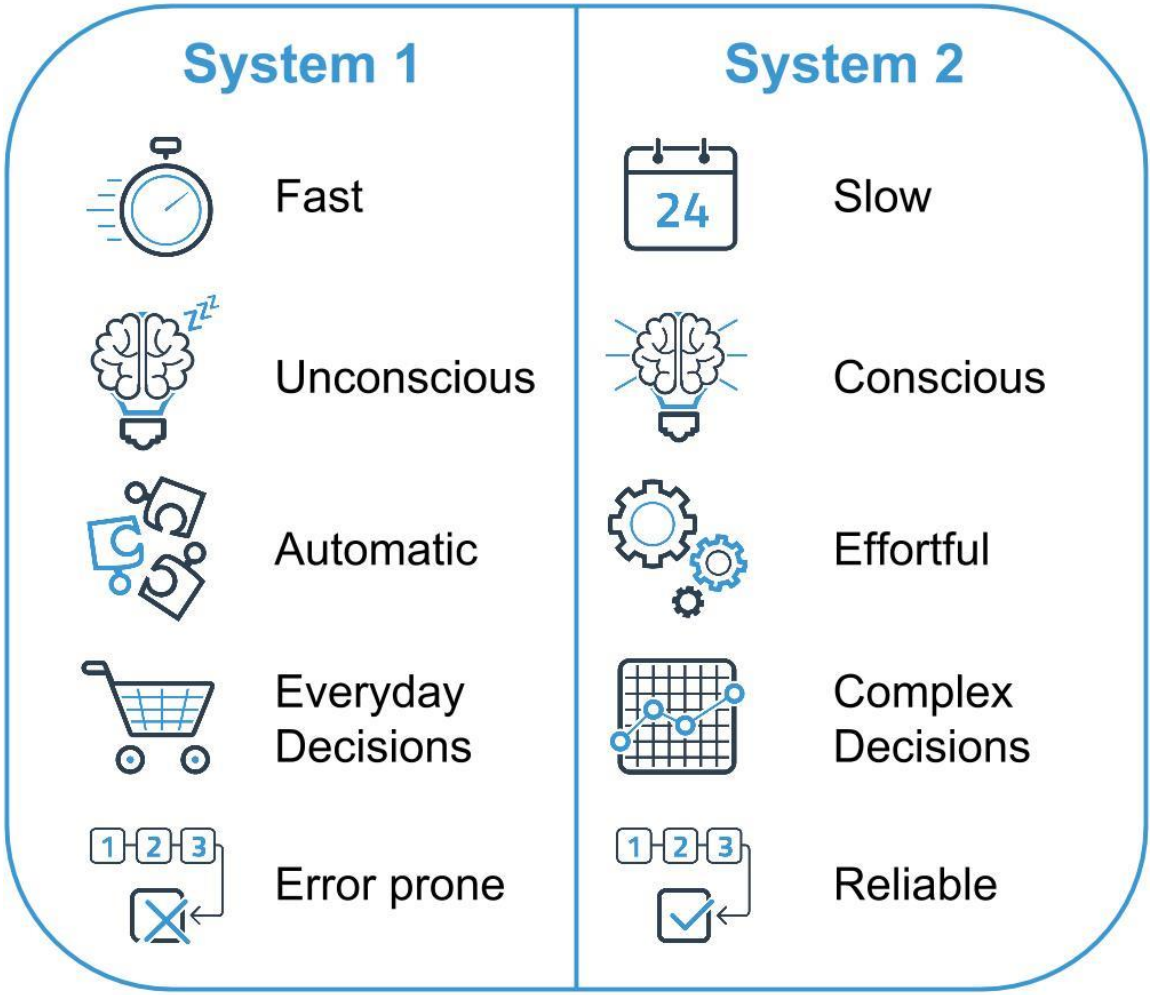


Table 1 Comparison of System 1 and System 2 thinking in relation to clinical reasoning

Intuitive System 1 thinking	Analytical System 2 thinking
Relies heavily on patterns and illness scripts. This is most useful for making judgements on problems which seem familiar and for which rapid action is required	Analytical, problem-oriented approach. This is most useful for making judgements concerning a problem when you find yourself in unfamiliar situations and have more time to make decisions



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A natural system of thinking, which improves with continuing experience and awareness	Can be improved by experience and awareness, as well as formal training prior to and after graduation (ie, 'trained' System 2 thinking)
Judgements are commonly based on intuition, drawing on past experiences and any attached emotion.* This appears unconscious and decisions may be difficult to explain	Judgements are based primarily on critical evaluation of evidence and facts, but some emotion* may be connected to drawn-on past experiences. This trained form of System 2 thinking is always conscious
Fast	Slow, but degree dependent on experience
'The judgement feels right' and uncertainty is often ignored (ie, commonly the focus is on existing evidence and absent evidence is ignored). The most plausible explanation is generally the one accepted	Logical, analytical reasoning, which may be hypothesis-driven and/or data-driven. Uncertainty is tested and options explored
Relies primarily on long-term memory (especially simple patterns and illness scripts based on past experiences, both positive and negative)	Relies primarily on analysis of information through short-term (working) memory. Long-term memories are also important because they contribute to the analysis
Unconscious cognition of perceptual input; appears to operate effortlessly and automatically	Conscious cognition of perceptual input; operates with forced or deliberate effort and control
Heuristics (mental 'short cuts' for reasoning) are commonly employed	Intentional thinking, involving sometimes the use of reasoning strategy heuristics, constructed generic illness scripts and diagnostic algorithms
Used by both novice and experienced clinicians, but most successfully by the latter	Used by both novice and experienced clinicians, but more often by the former
Can be modulated, but cannot be completely overridden, by System 2 thinking	Comes into play particularly when System 1 fails to identify the problem or its solution
Important in prehistoric hunter gatherer groups and could be regarded as the 'default system of thinking' for instant decision-making ('fight or flight' situations)[14]	Developed and refined over time, but likely originating from the need for individual and collective decision-making in prehistory (ie, an extension of System 1 thinking)[14]

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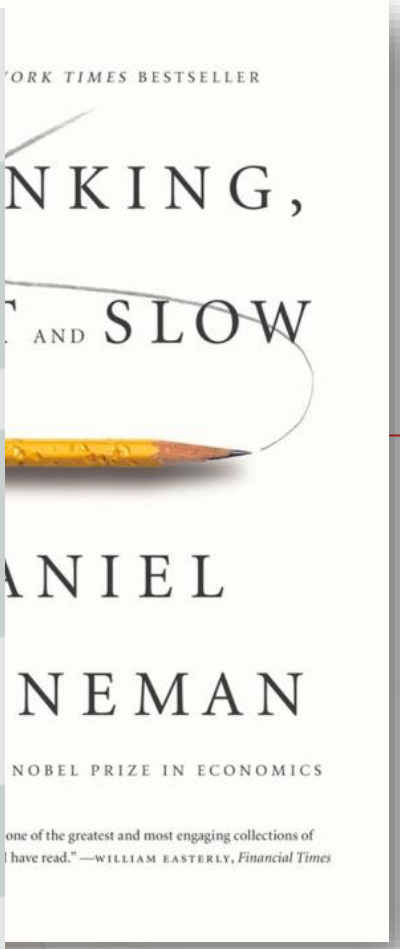
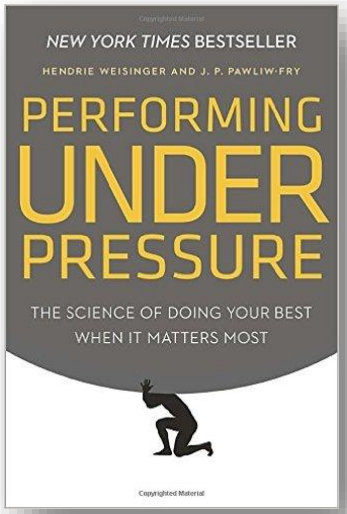


In most of the cases, we know the herd and the producer in whom we are called for a problem



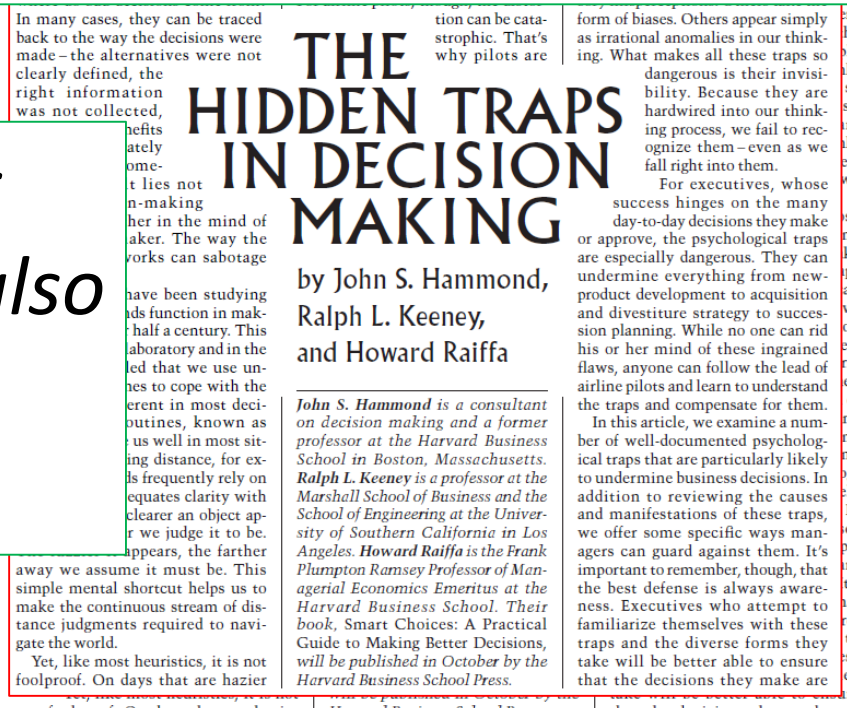
System 1	System 2
Context dependant	Impervious to context

We have thus inevitably preconceived ideas that they are positive or negative, as for example the stressful character of the producer which worries very easily or not or still the history of the already met problems or still that it is about a herd of the top of the pyramid (selection herd) or …

In making decisions, your own mind may be your worst enemy.

It is also because we know the herd and the producer and thus his way of functioning, we shall request (or we shall not request) complementary laboratory investigations for which we would probably not ask (or that we would ask) if it was an unknown herd at first investigation

This knowledge has obvious positive consequences but also leads to hidden traps in decision-making



THE HIDDEN TRAPS IN DECISION MAKING

by John S. Hammond, Ralph L. Keeney, and Howard Raiffa

John S. Hammond is a consultant on decision making and a former professor at the Harvard Business School in Boston, Massachusetts. Ralph L. Keeney is a professor at the Marshall School of Business and the School of Engineering at the University of Southern California in Los Angeles. Howard Raiffa is the Frank Plumpton Ramsey Professor of Managerial Economics Emeritus at the Harvard Business School. Their book, Smart Choices: A Practical Guide to Making Better Decisions, *will be published in October by the Harvard Business School Press.*

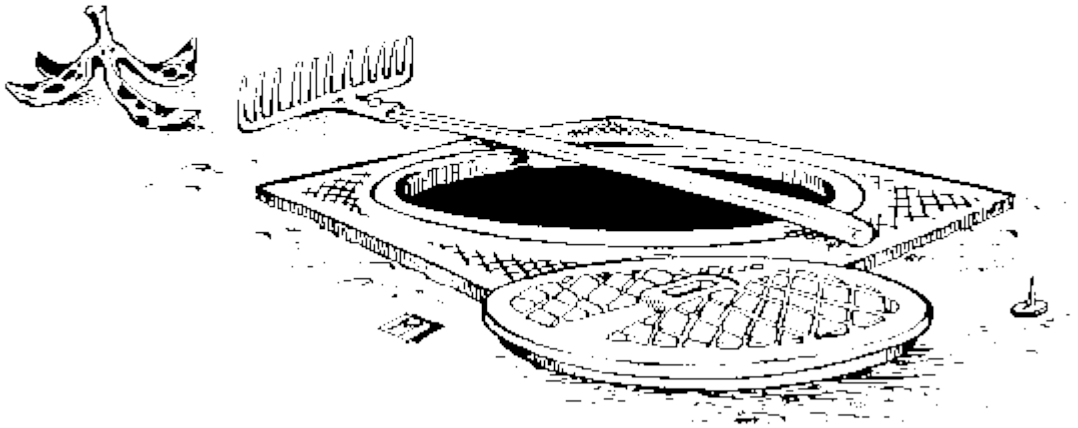
In many cases, they can be traced back to the way the decisions were made – the alternatives were not clearly defined, the right information was not collected,

tion can be catastrophic. That's why pilots are

form of biases. Others appear simply as irrational anomalies in our thinking. What makes all these traps so dangerous is their invisibility. Because they are hardwired into our thinking process, we fail to recognize them – even as we fall right into them.

For executives, whose success hinges on the many day-to-day decisions they make or approve, the psychological traps are especially dangerous. They can undermine everything from new-product development to acquisition and divestiture strategy to succession planning. While no one can rid his or her mind of these ingrained flaws, anyone can follow the lead of airline pilots and learn to understand the traps and compensate for them.

In this article, we examine a number of well-documented psychological traps that are particularly likely to undermine business decisions. In addition to reviewing the causes and manifestations of these traps, we offer some specific ways managers can guard against them. It's important to remember, though, that the best defense is always awareness. Executives who attempt to familiarize themselves with these traps and the diverse forms they take will be better able to ensure that the decisions they make are



THE HIDDEN TRAPS IN DECISION MAKING

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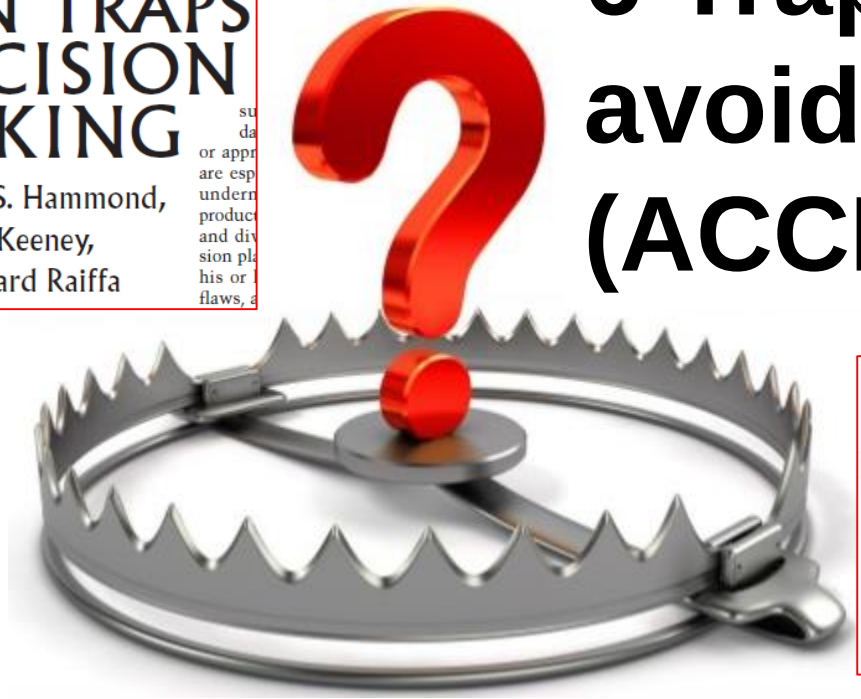
6 Traps to be avoided (ACCESS)



Ancrage

Sur-réactivité

Cadrage

Statu-quo

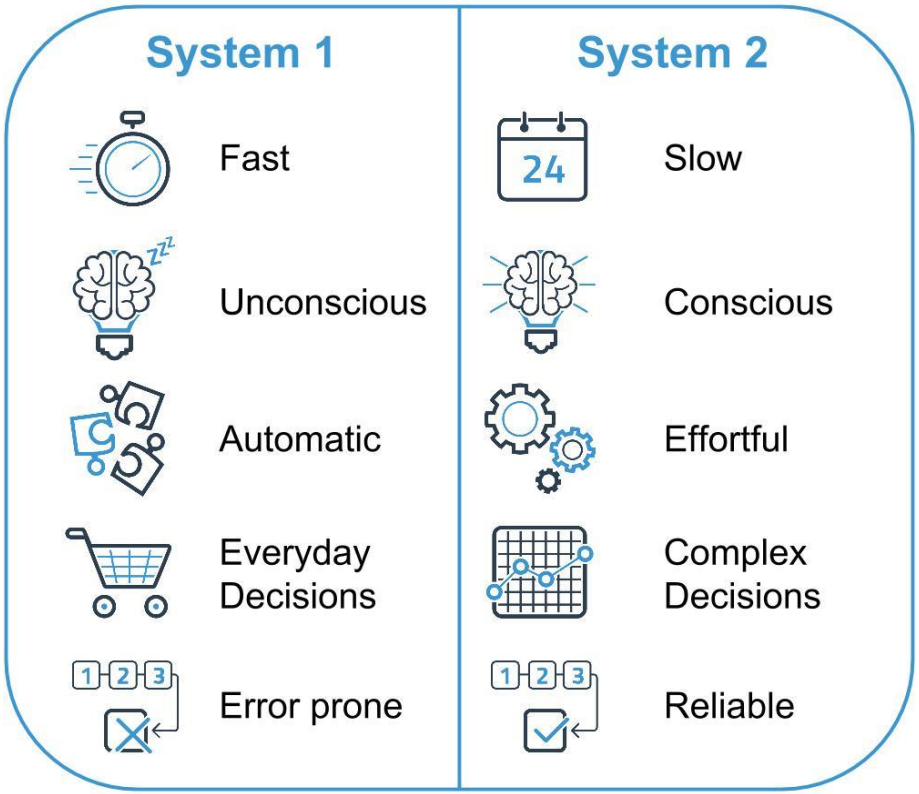
Confirmation

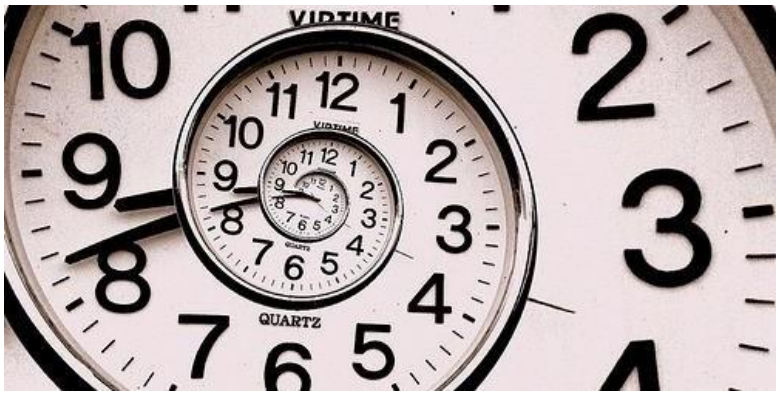
Echantillonnage

Even if we think of being easily available, the lack of time is omnipresent in your day-to-day work

System 1	System 2
Rapids, not much effort, high capacity	The reverse

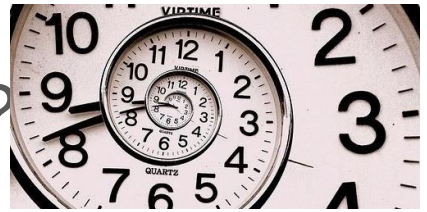
We know that, if we begin a work of analysis, the time will catch up us





If my first hypothesis is valid, what are symptoms and / or events and / or lesions that …

- I should observe / or be aware ?
- I could observe / or be aware ?
- I could **not** observe / or not be aware ?
- I should **not** observe / or not be aware ?



In favor	In disfavor
-- -- -- -- -- -- --	-- -- -- -- -- -- --

Reproductive diseases in sows (*Sus scrofa domestica*): A Review

Pozzi, P.S.[1] and Alborali, G.L.[2]

[1] Kimron Veterinary Institute, 50250 Bet Dagan, Israel

[2] Animal Health Institute "IZS-LER", 25124, Brescia, Italy.

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ABSTRACT

Almost all the fertility parameters in sows (reproductive and productive) may be affected by different infectious diseases. Changes in reproductive parameters may also occur without the appearance of appreciable pathological findings or with clinical signs often overlapping or similar to different diseases or pathogens. All the clinical aspects and the pathological findings should be taken into account to address a tentative diagnosis with the support of laboratory findings. All the pathologic material available in the course of reproductive problems in sows should be taken into account for laboratory investigations, including examination of reproductive and urinary tract of reformed sows from the abattoir. Laboratory investigations include pathogen identification or isolation, antibody titer evaluations, chemical investigations of toxins with activity on the reproductive tract and tissue histology. For the control of reproductive diseases in sows, antibiotic therapy, prophylaxis and immunization programs should be taken into account.

Key words: Sow, reproductive disease, abortion, vaccination.

DIFFERENTIAL DIAGNOSIS

Infectious ? / non infectious ?		
Infectious: in favor	**Common symptoms**	**Non infectious: in favor**

Table 3: Infectious diseases responsible of reproductive pathology; main clinical signs.

Diseases	Clinical signs	Infertility	Abortion		Mummification	Still	Early
		RIE	early	late	maceration	birth	mortality
Viral		Y	Y	Y	M	Y	Y
Bacterial V		Y		Y	M m	Y	Y
Mixed V		Y	Y	Y			Y

V present in Israel; **V??** suspected to be present in Israel, not confirmed; **Y** yes; **N** no; **M** mummification; **m** maceration; **RIE** Return In Estrus

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Bacterial V		Y		Y	M m	Y	Y
Mixed V		Y	Y	Y			Y

V present in Israel ... s; **N** no; **M** mummification; **m** maceration; **RIE** Return In Estrus

Table 4: Clinical signs in sow during first and second pregnancy-half and pathologic material available for laboratory investigation (3, modified)

First half of pregnancy	Material available	Pathogen possibly involved
Return in estrus Embryo-deaths and absorption	Swabs from vaginal discharges	PRRS PPV AD *E. rhusiopathiae* Other bacterial
Return in estrus – Anaestrus	Feed	Zearalenone
Return in estrus Vaginals discharges	Swabs from vaginal discharges Concentrated boar semen or diluted	PRRS PPV AD *E. rhusiopathiae* Other bacterial
	Blood / Oviduct	*Leptospira bratislava*
Second half of pregnancy		
Abortions Stillbirths Sub-vital piglets	Fetuses Placenta Blood Nasal swabs	PRRS PPV AD PCV2 SIV *E. rhusiopathiae* *Leptospira spp.* Other bacterial
Stillbirths	Blood	Hypoxia
Post-partum; puberal gilts		
Anaestrus	Feed Genital system of reformed sow Boars' semen	Zearalenone Management failure Bacterial / viral agents
Any stage		
Vaginal discharges Sudden deaths	Urine (about 20% of cases) Urinary tract	Bacterial infections

In favor	In disfavor
-- -- --	-- -- --

Theriogenology

IER

Theriogenology 70 (2008) 270–285

Infectious causes of embryonic and fetal mortality

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[b] *Department of Pathobiology, College of Veterinary Medicine, Auburn University, Auburn, AL 36849, United States*

Table 1
Infectious causes of infertility and abortion in domestic animals

In pigs (luteal-dépendant specie)

Bacterial	Fungal	Protozoan	Viral
Brucella suis[a,f,b,c]		*Toxoplasma gondii*[f]	Porcine parvovirus[a,f,b,j,k,g,e]
Erysipelothrix rhusiopathiae[k]			Porcine enterovirus and teschovirus[a,f,j,k,e]
Leptospira pomona[b,c,e]			Pseudorabies[a,f,b,c,j,k,l,g,e]
Streptococcus suis[b,e]			Classical swine fever[a,f,b,c,k,e]
Chlamydia spp.[c,k]			Porcine reproductive and respiratory syndrome[j]
Actinobacillus[i]			Encephalomyocarditis virus[k]
Mycoplasma suis[b]			Porcine cytomegalovirus[k]
			Rubulavirus[k]
			virus[k]
			ircovirus type 2[c,k]
			encephalitis virus[f,b]
			wine fever

Brucella suis[a,f,b,c]
Erysipelothrix rhusiopathiae[k]
Leptospira pomona[b,c,e]
Streptococcus suis[b,e]
Chlamydia spp.[c,k]
Actinobacillus[i]
Mycoplasma suis[b]

J Vet Diagn Invest 1:160-l64 (1989)

Etiologic studies on late-term swine abortions

Judith N. Nielsen, Charles H. Armstrong, John J. Turek,
Niels C. Nielsen

Abstract. One hundred thirty-eight swine abortions were studied in detail in an effort to identify an etiologic agent. A viral agent was implicated in 7 cases. Bacteria were isolated in less than half of the examined cases; however, in 61% of the cases, motile, filamentous organisms were observed in tissues and fluids. Although swine sera from farms experiencing reproductive problems had a high reactor rate to *Leptospira bratislava* antigen, electron microscopy of the observed organism revealed a wall-free prokaryote morphologically typical of the class Mollicutes.

Table 1. Bacterial isolates from 130 swine abortion cases.

Bacteria	Number	
	Isolations	Histologically compatible
E. coli	22	11
Streptococcus sp.	7	4
Staphylococcus sp.	4	2
Nocardia sp.	2	2
Leptospira sp.	3	3
Corynebacterium sp.	2	1
Micrococcus sp.	1	0
Unidentified G+ rod	1	0
Multiple organisms	15	3

Table 1
Infectious causes of infertility and abortion in domestic animals

chez le porc (espèce lutéale-dépendante)

Bacterial	Fungal	Protozoan	Viral
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			encephalitis virus[f,b]
			wine fever

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ARTICLE IN PRESS

Theriogenology xxx (2016) 1–8

Contents lists available at ScienceDirect

Theriogenology

journal homepage: www.theriojournal.com

Extended semen for artificial insemination in swine as a potential transmission mechanism for infectious *Chlamydia suis*

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[c] *INRA, UMR1300 Biology, Epidemiology and Risk Analysis in Animal Health, Nantes, France*

A B S T R A C T

Although typically unnoticed, Chlamydia infections in swine have been shown to be both widespread and may impact production characteristics and reproductive performance in swine. Serum titers suggest Chlamydia infection within boar studs is common, and infected boars are known to shed chlamydia in their ejaculates. Although the transmission of viruses in chilled extended semen (ES) is well established, the inclusion of antibiotics in commercially available extender is generally believed to limit or preclude the transmission of infectious bacteria. The objective of this study was to evaluate the potential of ES used in artificial insemination to support transmission of the obligate intracellular bacteria *Chlamydia suis* (*C suis*) under standard industry conditions. First, the effect of *C suis* on sperm quality during storage was assessed by flow cytometry. Only concentrations above 5×10^5 viable *C suis*/mL caused significant spermicidal effects which only became evident after 7 days of storage at 17 °C. No significant effect on acrosome reaction was observed using any chlamydial concentration. Next, an *in vitro* infection model of swine testicular fibroblast cells was established and used to evaluate the effect of chilled storage on *C suis* viability under variable conditions. Storage in Androhep ES reduced viability by 34.4% at a multiplicity of infection of 1.25, an effect which increased to 53.3% when the multiplicity of infection decreased to 0.1. Interestingly, storage in semen extender alone (SE) or ES with additional antibiotics had no effect on bacterial viability. To rule out a secondary effect on extender resulting from metabolically active sperm, *C suis* was stored in fresh and expended SE and again no significant effect on bacterial viability was observed. Fluorescent microscopy of *C suis* in ES shows an association between bacteria and the remaining gel fraction after storage suggesting that the apparent reduction of bacterial viability in the presence of semen is due to adherence to gel fraction. Taken together, the results of this study suggest that *C suis* remains viable and infectious during chilled storage and is globally unaffected by antibiotics in extender. Thus, ES used in artificial insemination may act as a viable transmission mechanism for *C suis* in swine.

Table 1
Infectious causes of infertility and abortion in domestic animals

chez le porc (espèce lutéale-dépendante)

Bacterial	Fungal	Protozoan	Viral
Brucella suis[a,f,b,c]		*Toxoplasma gondii*[f]	Porcine parvovirus[a,f,b,j,k,g,e]
Erysipelothrix rhusiopathiae[k]			Porcine enterovirus and teschovirus[a,f,j,k,e]
Leptospira pomona[b,c,e]			Pseudorabies[a,f,b,c,j,k,l,g,e]
Streptococcus suis[b,e]			Classical swine fever[a,f,b,c,k,e]
Chlamydia spp.[c,k]			Porcine reproductive and respiratory syndrome[j]
Actinobacillus[i]			Encephalomyocarditis virus[k]
Mycoplasma suis[b]			Porcine cytomegalovirus[k]
			Rubulavirus[k]
			Menangle virus[k]
			Porcine circovirus type 2[c,k]
			Japanese encephalitis virus[f,b]
			African swine fever

Brucella suis[a,f,b,c]

Erysipelothrix rhusiopathiae[k]

Leptospira pomona[b,c,e]

Streptococcus suis[b,e]

Chlamydia spp.[c,k]

Actinobacillus[i]

Mycoplasma suis[b]

Leptospirosis: double classification: serological and genomic

Genomic classification

22 genomic species
13 pathogen species
2 intermediate
7 saprophytes

Serological classification >300 sérovars, 30 sérogroupes

Problems:

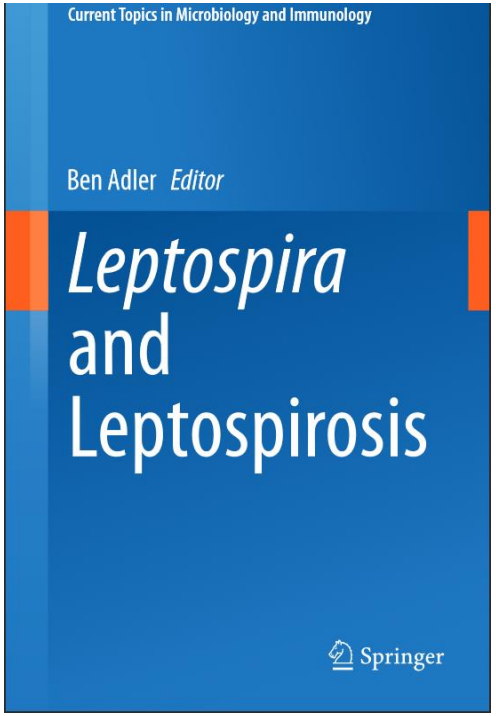
1-**no** superposition between serological and genomic classification.
2-scientific information not easy to extrapolate
3-connexion between the two classifications is often only speculation

- 13 pathogenic species in the genus

Leptospira alexanderi
Leptospira alstonii
Leptospira borgpetersenii
Leptospira inadai
Leptospira interrogans
Leptospira fainei
Leptospira kirschneri
Leptospira licerasiae
Leptospira noguchi
Leptospira santorosai
Leptospira terpstrae
Leptospira weilii
Leptospira wolffii

L. interrogans is the most important pathogenic species

- 260 serovars (related to serum testing)
  - *Genus Species* serovar Serovar_name
    Leptospira interrogans serovar Hardjo
    Salmonella enterica serovar Typhimurium



Serological classification
(>300 identified serovars, in 30 serogroupes):

4.3 Swine

Leptospirosis is a common disease of swine throughout the world and can be a significant cause of reproductive loss. Knowledge of the incidence and economic impact of the disease is biased towards the intensive pig industries of the northern hemisphere, Australia, New Zealand, Argentina, and Brazil. The serogroups most commonly associated with infection of pigs are the Pomona, Australis, and Tarassovi groups, and include strains maintained by pigs, but all of which have alternative wildlife maintenance hosts. Significant incidental infections include strains belonging to the Grippotyphosa, Icterohaemorrhagiae, and Canicola serogroups.

The three host-maintained infections differ in terms of available information, geographical distribution, clinical impact, disease patterns and how they have been affected by industry moves to modern, total confinement systems.

Table 2. *Leptospira* spp. seropositive and IHC positive cases identified at the AHL, 2015

Leptospira* spp. serovar	**Bovine**	**Swine**	**Equine**	**Canine**	**Other & not specified**
L. autumnalis	17	1	11	33	1
L. bratislava	23	3	9	10	1
L .canicola	27	0	4	14	0
L. grippotyphosa	7	1	3	25	0
L. hardjo	24	0	1	3	0
L. icterohaemorrhagiae	25	1	8	20	1
L. pomona	33	1	6	14	1
IHC or urine PCR positive	0	0	0	1	0

IHC ImmunoHistoChemistry

Canada, 2016 (country with available vaccines)

EXPERT REVIEWS

Leptospirosis: current situation and trends of specific laboratory tests

Expert Rev. Clin. Immunol. 9(3), 263–280 (2013)

Stefan Schreier[1,2], Galayanee Doungchawee[1], Sudarat Chadsuthi[3], Darapond Triampo[3,4] and Wannapong Triampo*[2,3,5]

[1]*Department of Pathobiology, Faculty of Science, Mahidol University, Bangkok 10400, Thailand*

Leptospirosis is re-emerging as a worldwide zoonosis and is caused by bacteria of the genus *Leptospira*. Human leptospirosis is associated with high temperature and humidity. Laboratory tests are indispensible for the early diagnosis and proper disease management. The demand for suitable leptospirosis point-of-care diagnostic tests grows with the awareness and number of incidences. Confirmation is achieved by the microscopic agglutination test, bacterial cultivation, PCR or histopathologic methods. However, high costs, poor standardization and/or elaborate sample preparation prevent routine use at the point of care. Cost-efficient, but insensitive serological methods dominate the diagnostic landscape and, likewise, urgently need improvement toward greater compliance with some of the point-of-care criteria. Combined application of antigen and antibody detection methods increases accuracy, but also new development or transfer of diagnostic technologies should be considered useful. Nano- and

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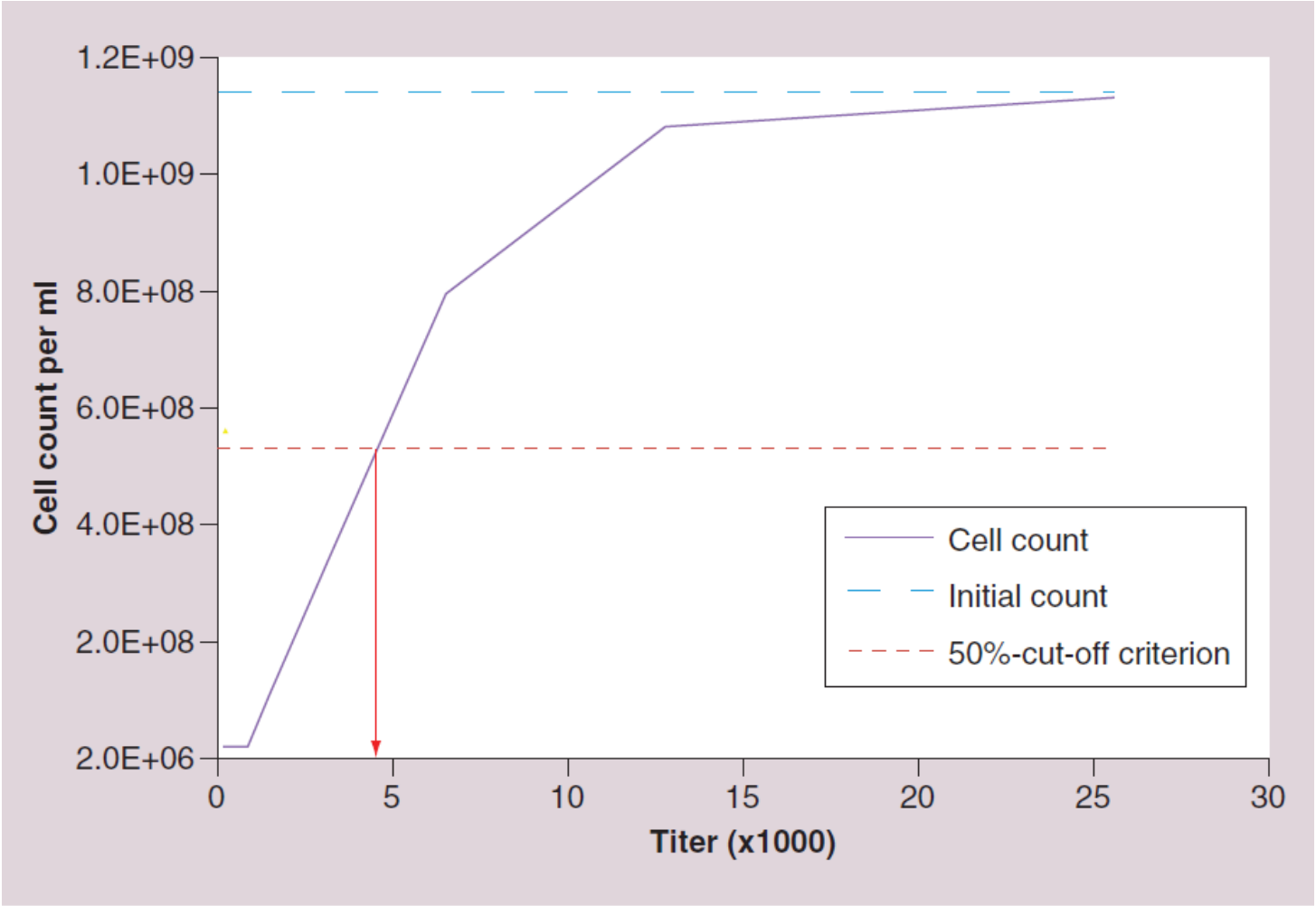


Figure 1. Microscopic agglutination test: end-point titer analysis. Aliquots of 25 µl concentrated suspension of *Leptospira* serovar Canicola (1.1 × 10^9 cells per ml; long dashed line) were incubated with an equal volume of twofold serial dilution (1: 200–1: 25,600) of rabbit antiserum produced against Canicola in phosphate-buffered saline for 2 h. The resulting leptospiral concentration was measured and plotted against the respective dilution point (solid line) after incubation. The end-titer (arrow) is represented as the dilution point where the recorded cell concentration curve (solid line) intersects with the 50% level of the initial cell concentration (short dashed line).

-Microscopy
-Bacterial culture
-Agglutination assays
-Immuno assays
-Molecular methods
-Histopathology
-Others

Table 1. List of special diagnostic tests for leptospirosis.

Test class	Test	Application	Early-phase detection[†]	Ref.
Microscopy	DFM	Confirmation, genus-specific, read by DFM	-1	[32]
Bacterial culture	Isolation in EMJH medium	Reference test, read by DFM	Not relevant for early diagnosis	[39]
Agglutination assays	MAT	Serological reference test, serogroup-specific, read by DFM	Reference	[13,20]
	SAT	Rapid screening test, genus-specific, read by naked eye	1	[77,80]
	LAT		1	[84]
	MCAT		1	[96,210]
	IHA		-1	[89,92]
	Counter immuno-electrophoresis	Screening, genus-specific, read by naked eye	1[†]	[99]
	Gold nanoparticle agglutination	Screening, serovar-specific, read by naked eye	No data available[§]	[100]
Immuno assays	LeptoStick®/ICT	Rapid screening test, genus-specific, read by naked eye	-1	[106,211]
	ELISA	Standardized screening test, serovar- and genus-specific, analyzed by ELISA reader	1[¶]	[73,111]
	FAT/IFA	Rapid confirmation test, serovar- and genus-specific, read by fluorescence microscope or fluorometer	1[¶]	[129,132]
	IIP	Rapid presumptive test, genus-specific, read by light microscopy	1	[134]
	ERIA	Screening test, serovar- and genus-specific, read by liquid scintillation counting	No data available	[126]
	IgM immunoblot	Screening, genus-specific, read by naked eye	1	[127]
	Chemiluminescent immunoassay	Screening, serovar-specific, luminescence analyzer	No data available	[139]
Molecular methods	PCR[††]	Confirmation test, mainly genus-specific, read by fluorescence light detection (real-time PCR), gel electrophoresis	2	[156,212]
Histopathology	Silver staining	Confirmation, genus-specific, read by bright-field microscopy	No data available[‡‡]	[45]
	IGSS	Confirmation, serovar-specific, read by bright-field microscopy		[45,142]
	IP	Confirmation, serovar-specific, read by microscopy		[144]
	IF	Confirmation, serovar level, read by fluorescence microscopy		[44]
	ISH	Confirmation test, mainly genus-/strain-specific, read by fluorescence microscopy		[153,154]
Others	CF	Rapid screening test, genus-specific, read by naked eye	Not relevant	[20,198]
	Leptospirin allergy test		-1	[200]

JIDC | THE JOURNAL OF INFECTION IN DEVELOPING COUNTRIES

Brief Original Article

Detection and genotyping of *Leptospira* spp. from the kidneys of a seemingly healthy pig slaughtered for human consumption

Ashutosh Verma, Esteban Soto, Oscar Illanes, Souvik Ghosh, Carmen Fuentealba

Center for Integrative Mammalian Research, and Department of Biomedical Sciences, Ross University School of Veterinary Medicine, Basseterre, St. Kitts

Abstract

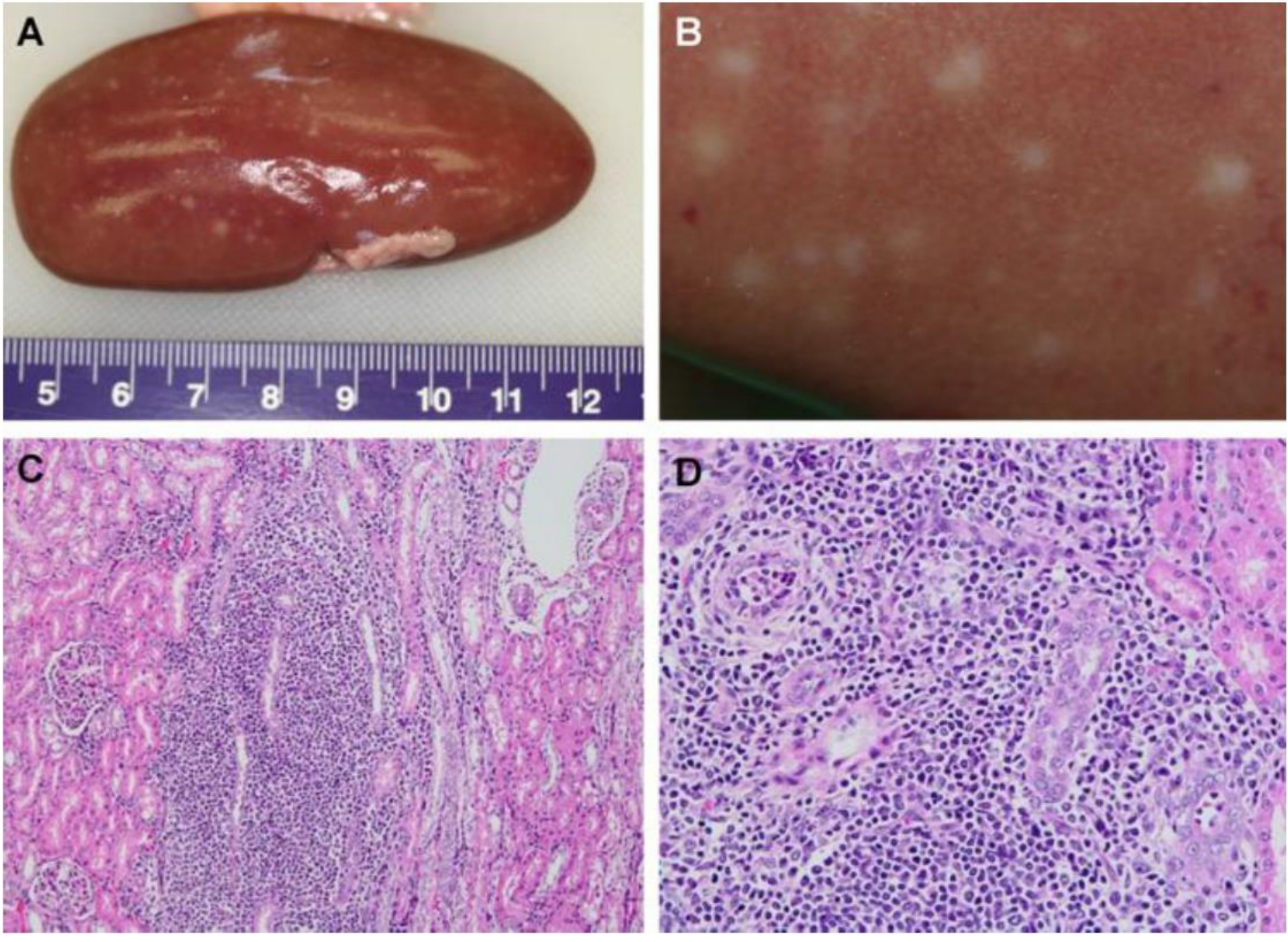
Introduction: Leptospirosis is a zoonotic disease caused by pathogenic *Leptospira* spp. Leptospirosis is maintained in an environment due to chronic kidney infection of a wide variety of domestic, peridomestic and wild reservoir mammals. In this study the role of pigs in maintenance of leptospires on the Caribbean island of St. Kitts was investigated.

Methodology: The condemned kidneys of 60 pigs slaughtered at a St. Kitts abattoir were screened by a quantitative-PCR for the presence of *Leptospira* spp. Positive samples were genotyped using a six-gene based multilocus sequence typing scheme.

Results: Leptospiral DNA was detected in the kidneys of one of the 60 pigs. Multilocus sequence typing identified the infecting species to be *L. interrogans*.

Conclusions: Detection of this zoonotic pathogen in the kidneys of a seemingly healthy pig raises concerns regarding the subclinical carriers of the disease among the island's swine population.

Key words: Leptospirosis; *Leptospira*; swine; genotyping; Multi-locus sequence typing (MLST).


A
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D

J Vet Diagn Invest 1:160-l64 (1989)

Etiologic studies on late-term swine abortions

Judith N. Nielsen, Charles H. Armstrong, John J. Turek,
Niels C. Nielsen

Table 2. Leptospiral reactor rates (%) of 1,414 sera from Indiana swine (October 1986-June 1987).

Serovar	Titer*		
	≥ 1:lOO	≥ 1:200	≥ 1:400
bratislava	52	12	4
icterohaemorrhagiae	44	16	6
grippotyphosa	16	6	3
canicola	11	2	1
pomona	7	2	2
hardjo	3	0	0

* Obtained by microagglutination test.

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Infectious causes of infertility and abortion in domestic animals

chez le porc (espèce lutéale-dépendante)

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Porcine enterovirus and teschovirus[a,f,j,k,e]
Pseudorabies[a,f,b,c,j,k,l,g,e]
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Leptospira			
Streptococ			
Chlamydia			
Actinobac			
Mycoplasm			

Porcine parvovirus[a,f,b,j,k,g,e]
Porcine enterovirus and teschovirus[a,f,j,k,e]
Pseudorabies[a,f,b,c,j,k,l,g,e]
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Porcine circovirus type 2[c,k]
Japanese encephalitis virus[f,b]
African swine fever

Quid influenza virus ?
Quid Seneca virus ?

Year	Author /Country	Infection expérimentale	Infection naturelle
2015 2015 2014	Kwit Poland	H1N2 1/3 gestation: NOTHING 2/3 gestation : NOTHING 3/3 gestation : NOTHING	
2011	Grontvedt Norway		pH1N1 118 herds; reproductive problems: 40% of herds
2005	Pejsak Poland		H1N1 Abortions between d23 and d92; Fertility : -20%
2004	Wesley USA	H3N2 Reproductive problems + (mild)	
2002	Direksin USA		H3N2 Reproductive problems only if H3N2 + PRRS
1989	Gourreau France		Early gestation effects +++ Mi-gestation effects + Late gestation 1 abortion/18 sows
1985	Gourreau France		Transplacental infection
1984	Madec France		H3N2 Respiratory AND reproductive (some) abortions or early farrowings (with virus isolation on Stillbirth and fetuses) decrease litter size
1982	Brown, USA	NOTHING	
1979	Wallace USA	H1N1 Transplacental infection + (few sows)	
1962	Mensik	Transplacental infection	
1949	Young et		Suspicion of reproductive problems



Karniychuk and Nauwynck *Veterinary Research* 2013, **44**:95
http://www.veterinaryresearch.org/content/44/1/95

VETERINARY RESEARCH

REVIEW Open Access

Pathogenesis and prevention of placental and transplacental porcine reproductive and respiratory syndrome virus infection

Uladzimir U Karniychuk* and Hans J Nauwynck

PRRS

PLOS ONE

Published: March 10, 2016

Pathologic Evaluation of Type 2 Porcine Reproductive and Respiratory Syndrome Virus Infection at the Maternal-Fetal Interface of Late Gestation Pregnant Gilts

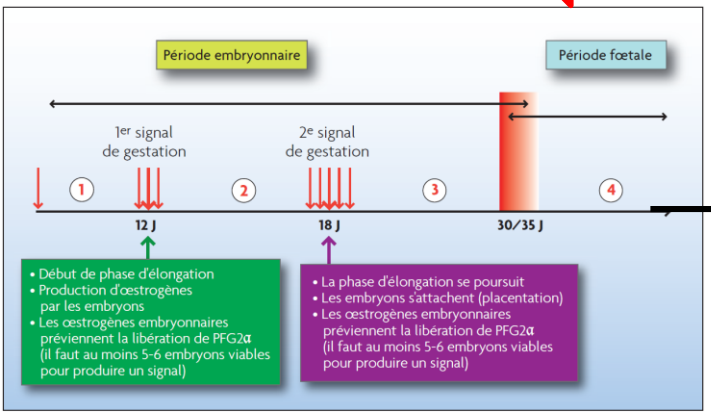
Predrag Novakovic[1]*, John C. S. Harding[2], Ahmad N. Al-Dissi[1], Andrea Ladinig[2,3], Susan E. Detmer[1]

The pathogenesis of fetal death caused by porcine reproductive and respiratory syndrome virus (PRRSV) remains unclear.

Abortions: définition**S**

Abortion

Abortion



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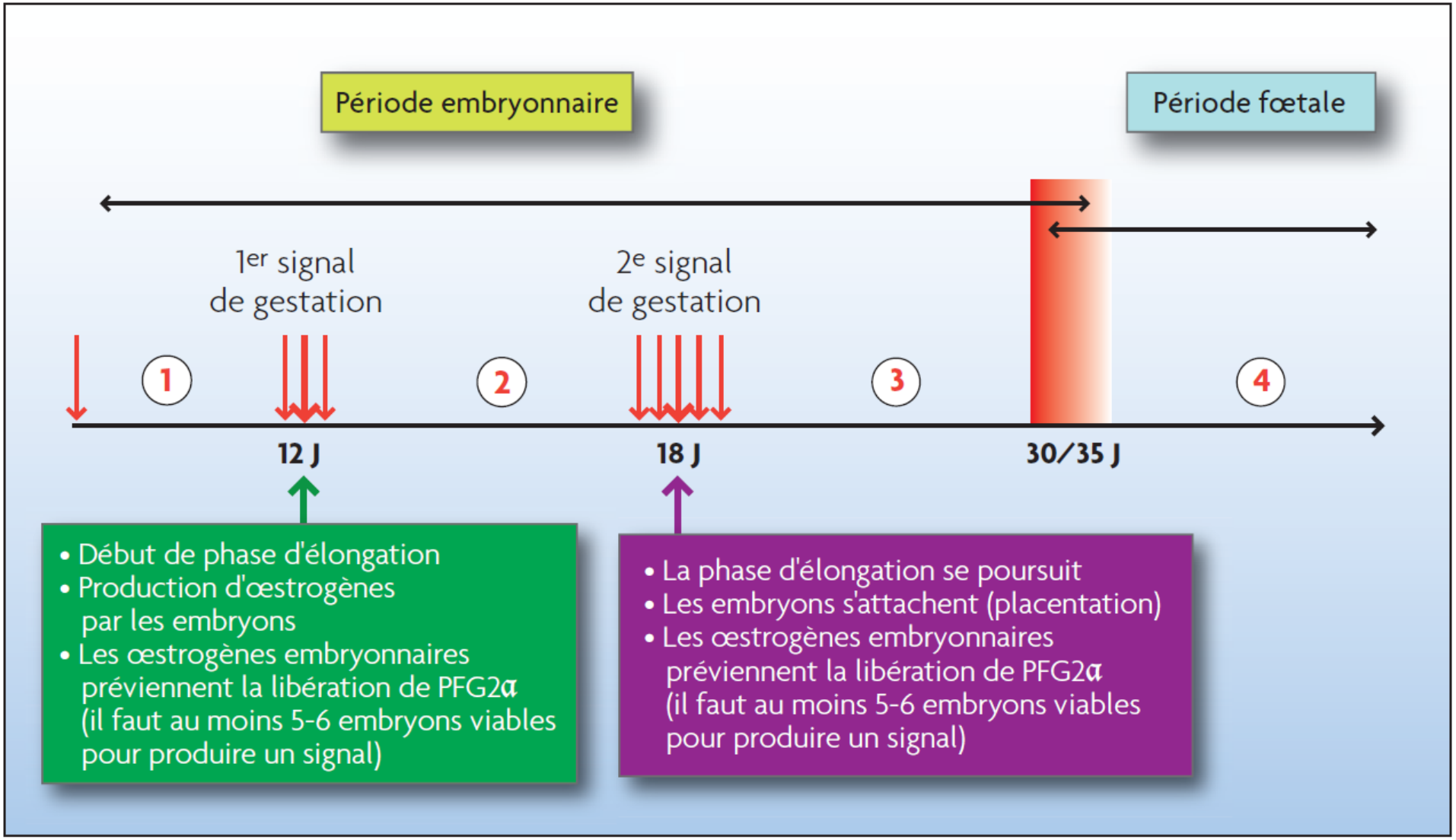

Période embryonnaire
Période fœtale
1er signal de gestation
2e signal de gestation
1
2
3
4
12 J
18 J
30/35 J
• Début de phase d'élongation
• Production d'œstrogènes par les embryons
• Les œstrogènes embryonnaires préviennent la libération de PFG2α (il faut au moins 5-6 embryons viables pour produire un signal)
• La phase d'élongation se poursuit
• Les embryons s'attachent (placentation)
• Les œstrogènes embryonnaires préviennent la libération de PFG2α (il faut au moins 5-6 embryons viables pour produire un signal)

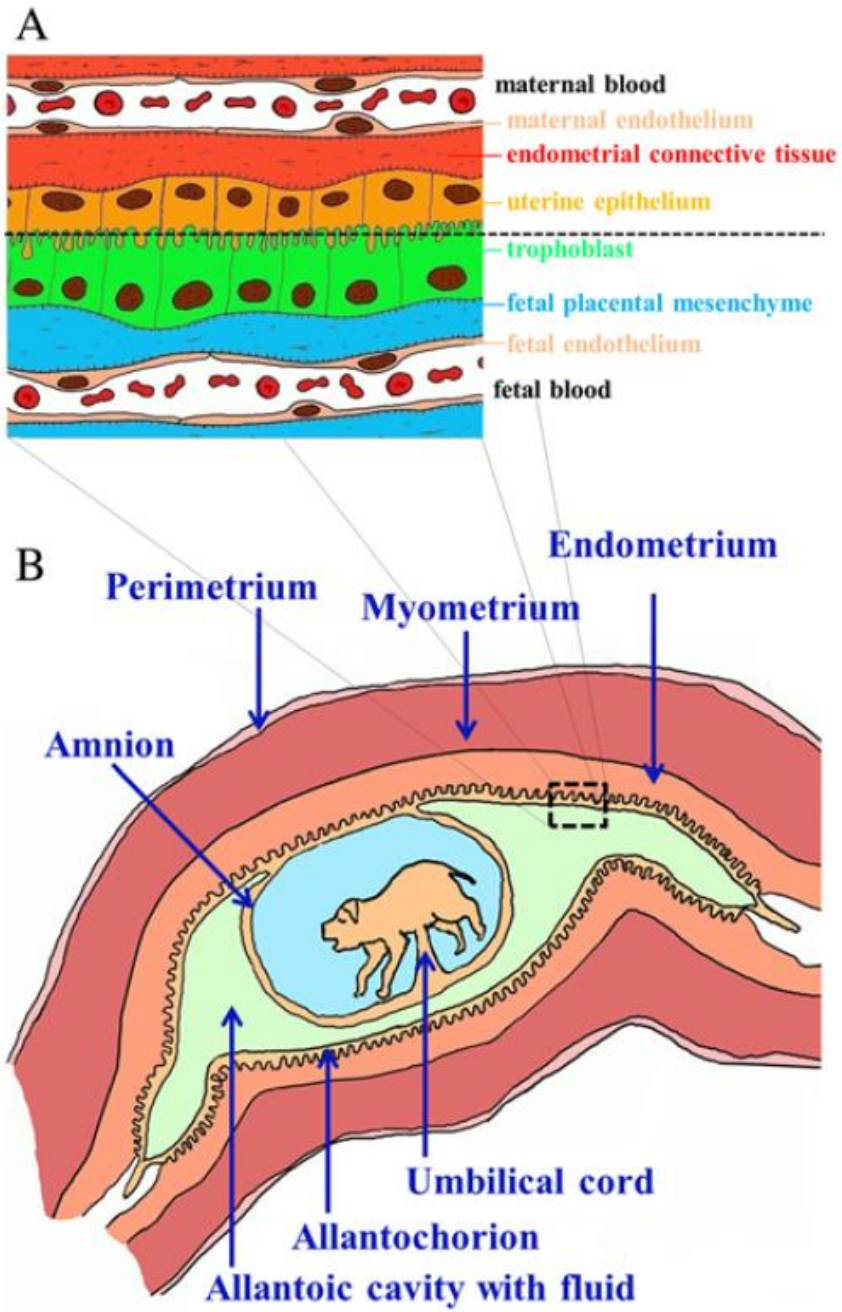
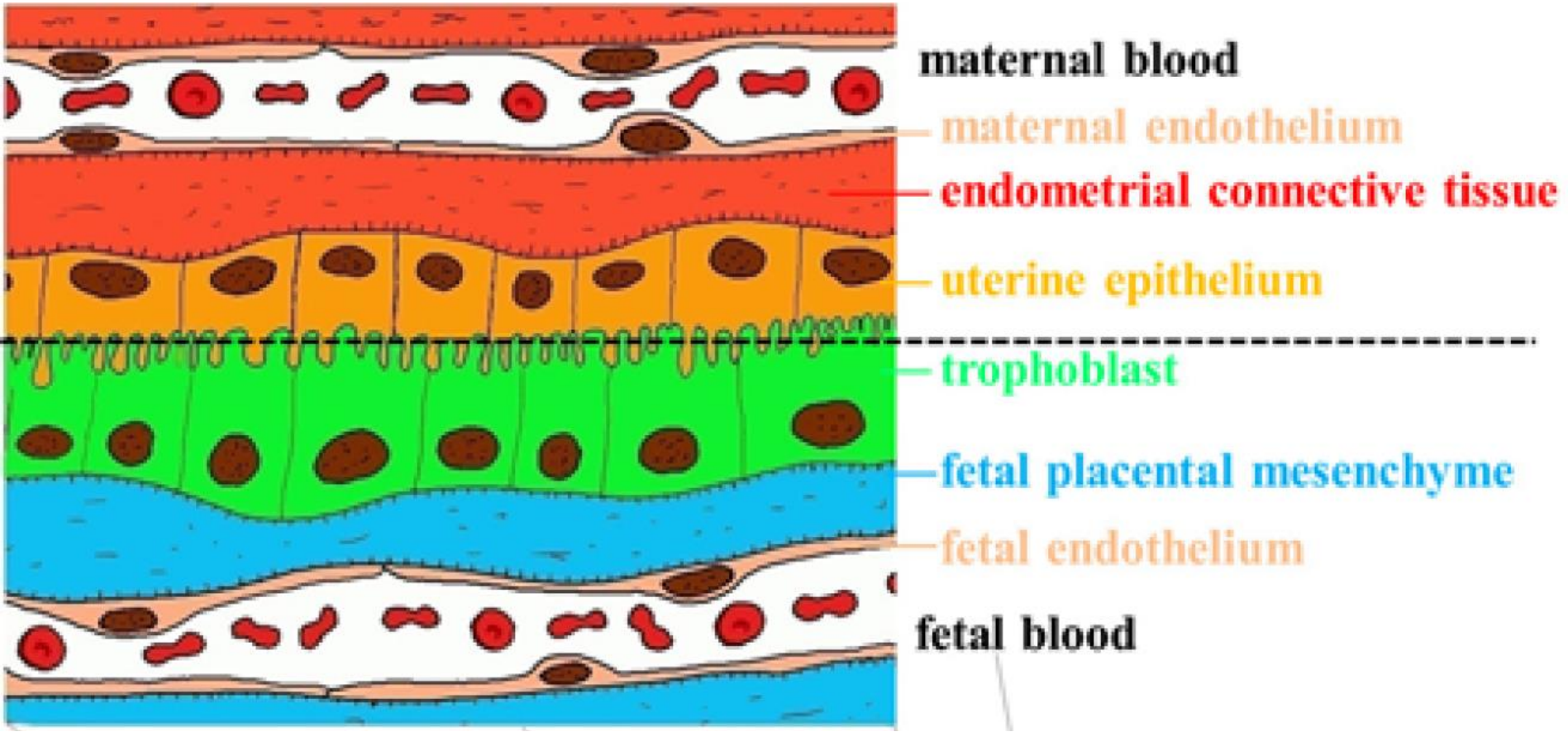
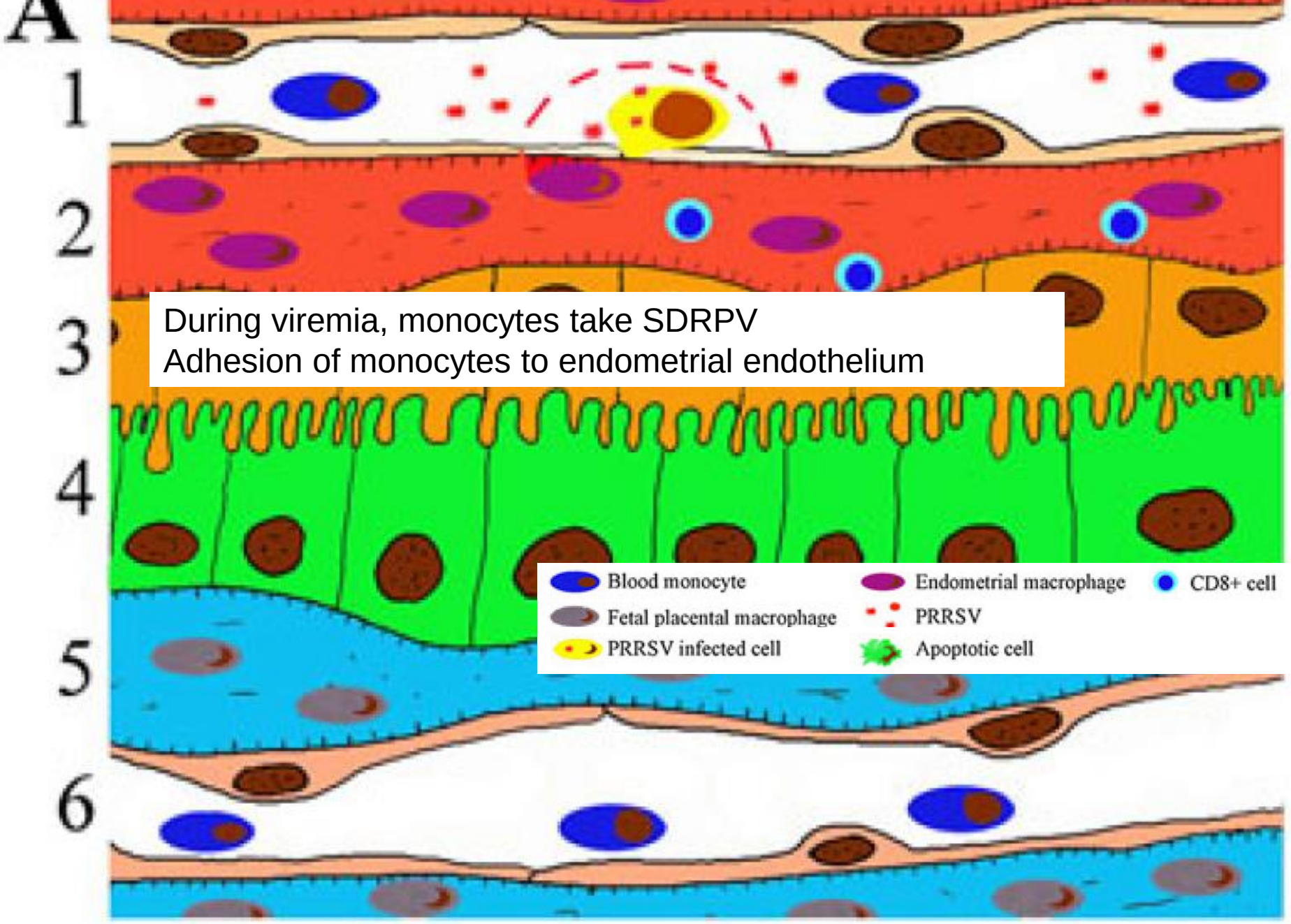


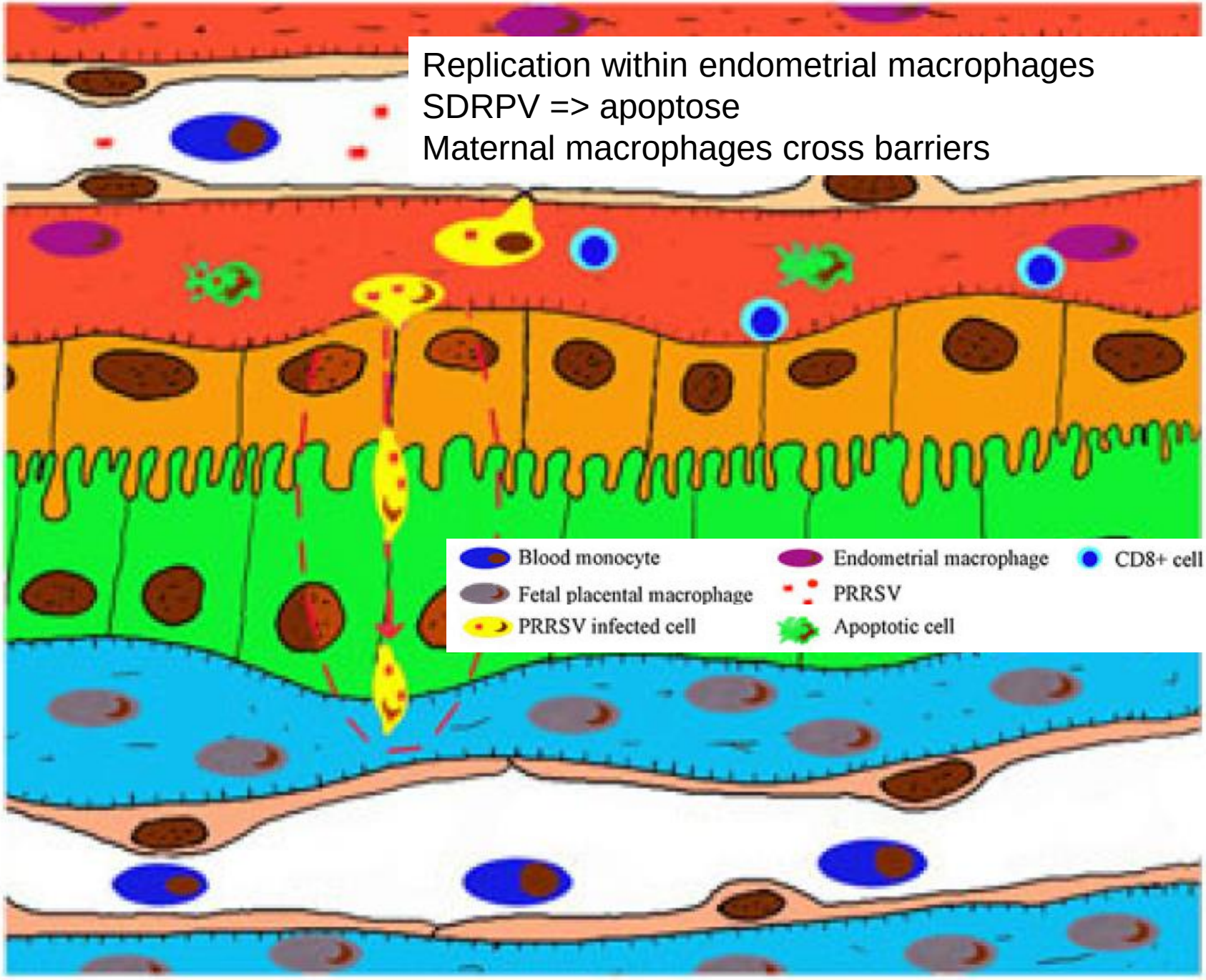
Figure 1 Porcine placental barrier and conceptus. Representations of the placental barrier in swine **(A)** and conceptus within the uterine horn **(B)**.

Hemi-placentation: 6 layers with a accurate distinction between maternal and fetal tissues

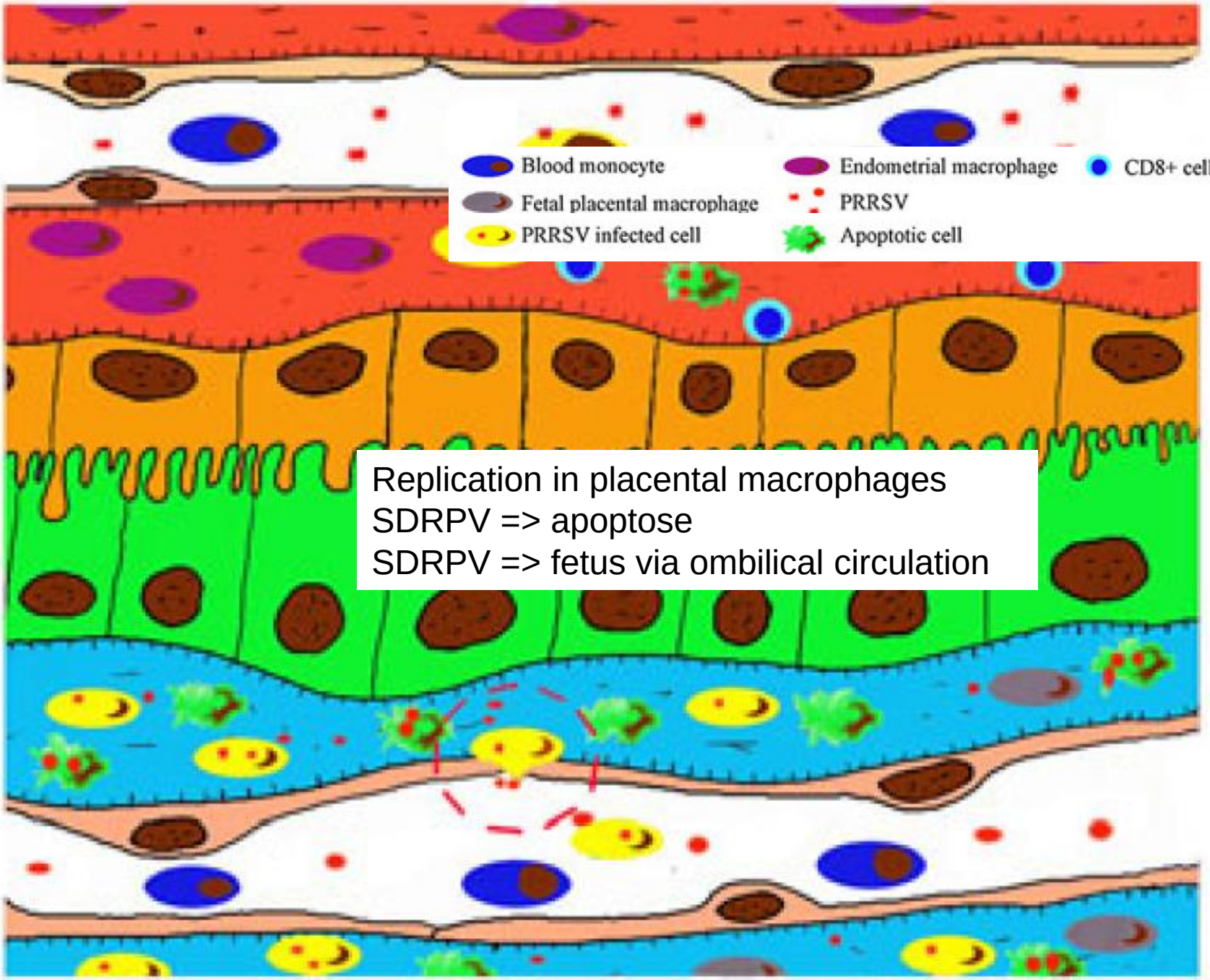


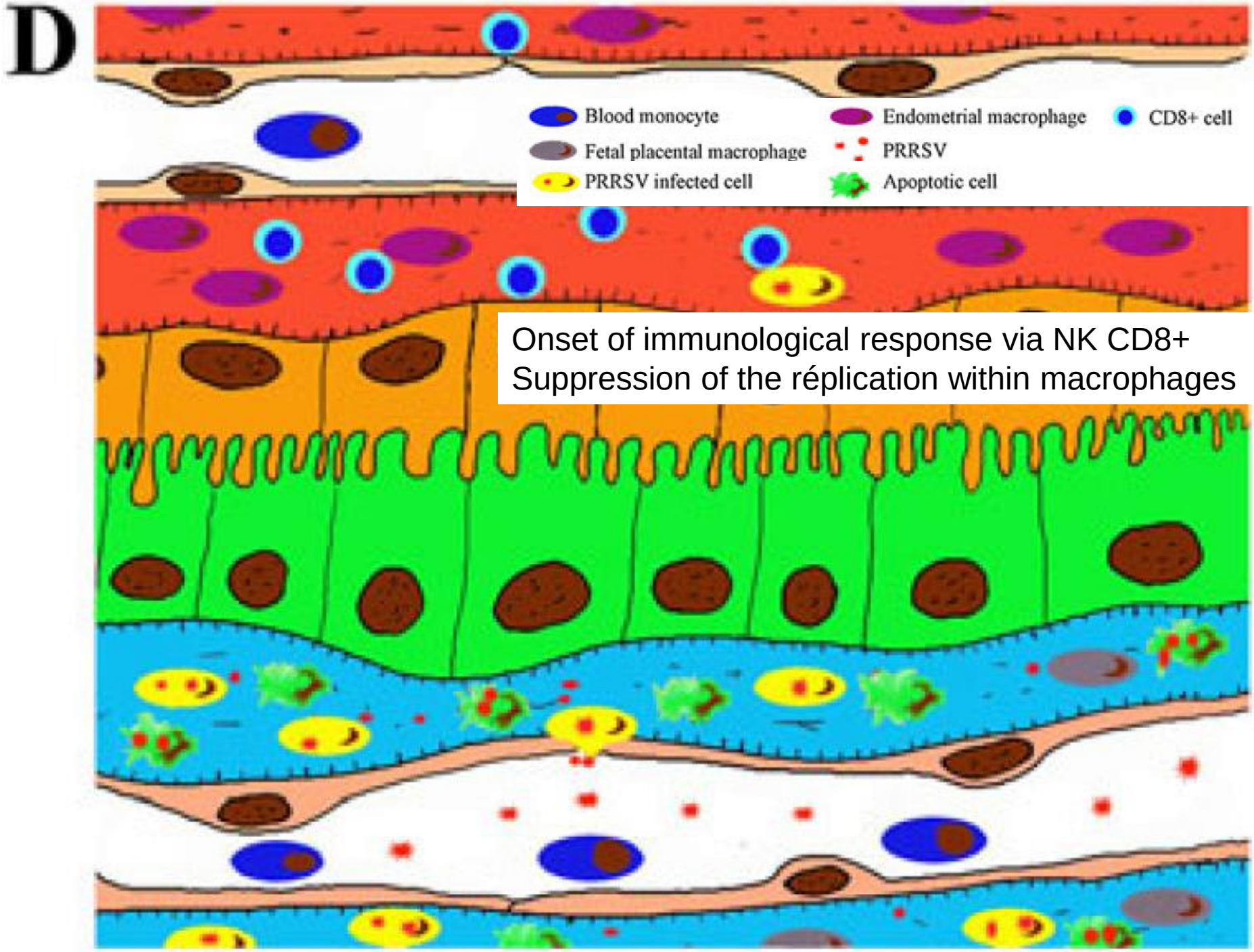

A
1
2
3
4
5
6
During viremia, monocytes take SDRPV
Adhesion of monocytes to endometrial endothelium
Blood monocyte
Endometrial macrophage
CD8+ cell
Fetal placental macrophage
PRRSV
PRRSV infected cell
Apoptotic cell

B

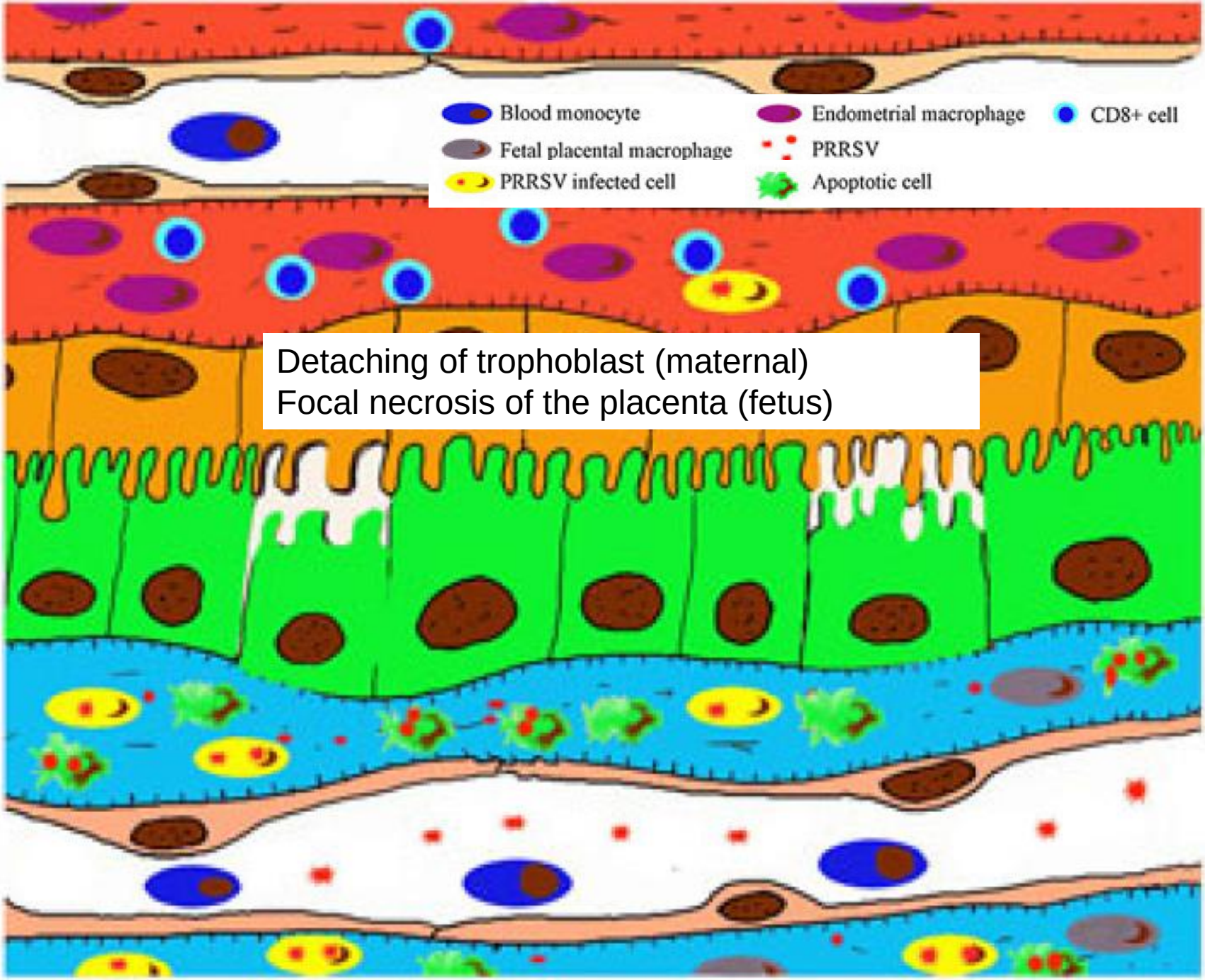

Replication within endometrial macrophages
SDRPV => apoptose
Maternal macrophages cross barriers
Blood monocyte
Endometrial macrophage
CD8+ cell
Fetal placental macrophage
PRRSV
PRRSV infected cell
Apoptotic cell

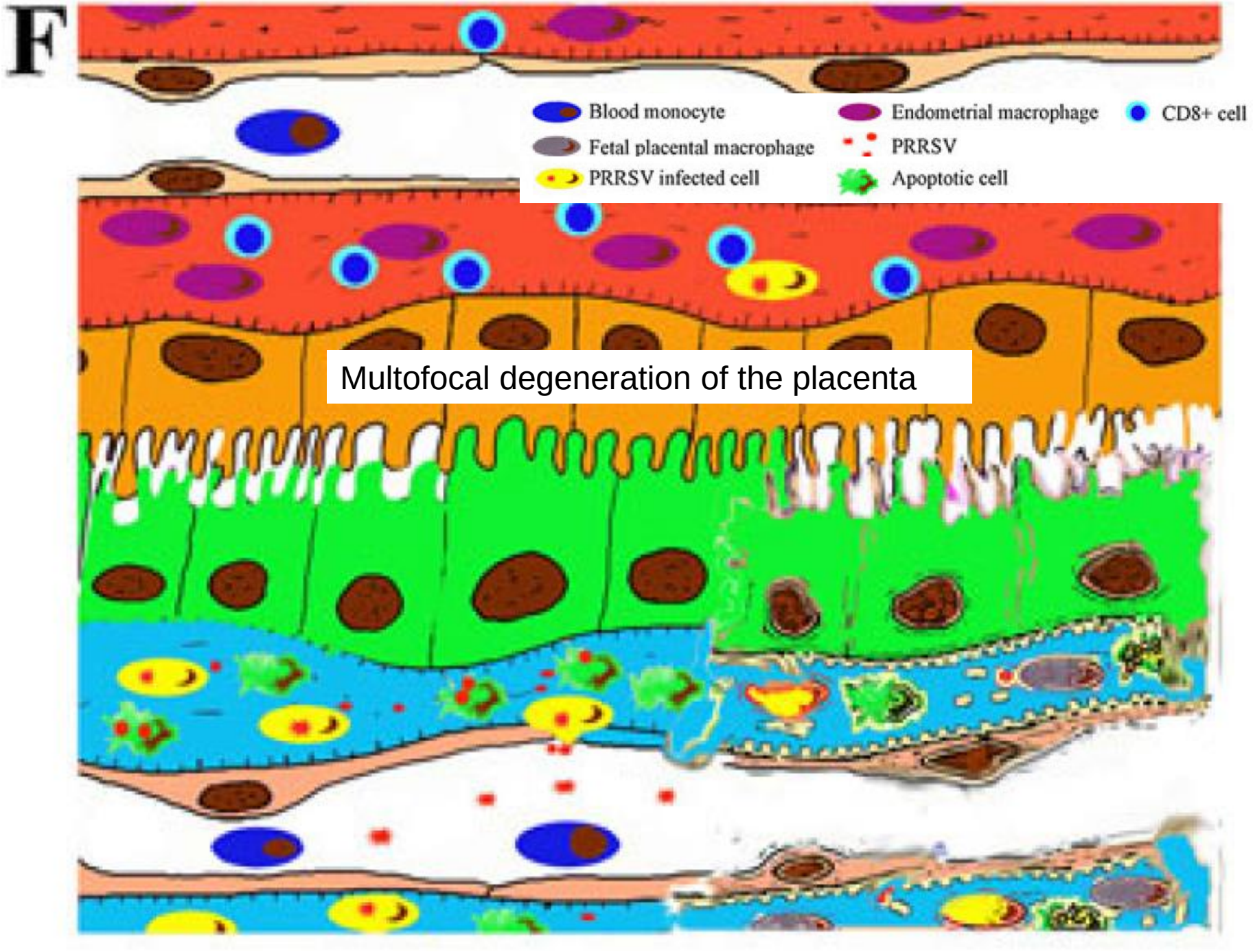
C


Blood monocyte
Endometrial macrophage
CD8+ cell
Fetal placental macrophage
PRRSV
PRRSV infected cell
Apoptotic cell
Replication in placental macrophages
SDRPV => apoptose
SDRPV => fetus via ombilical circulation

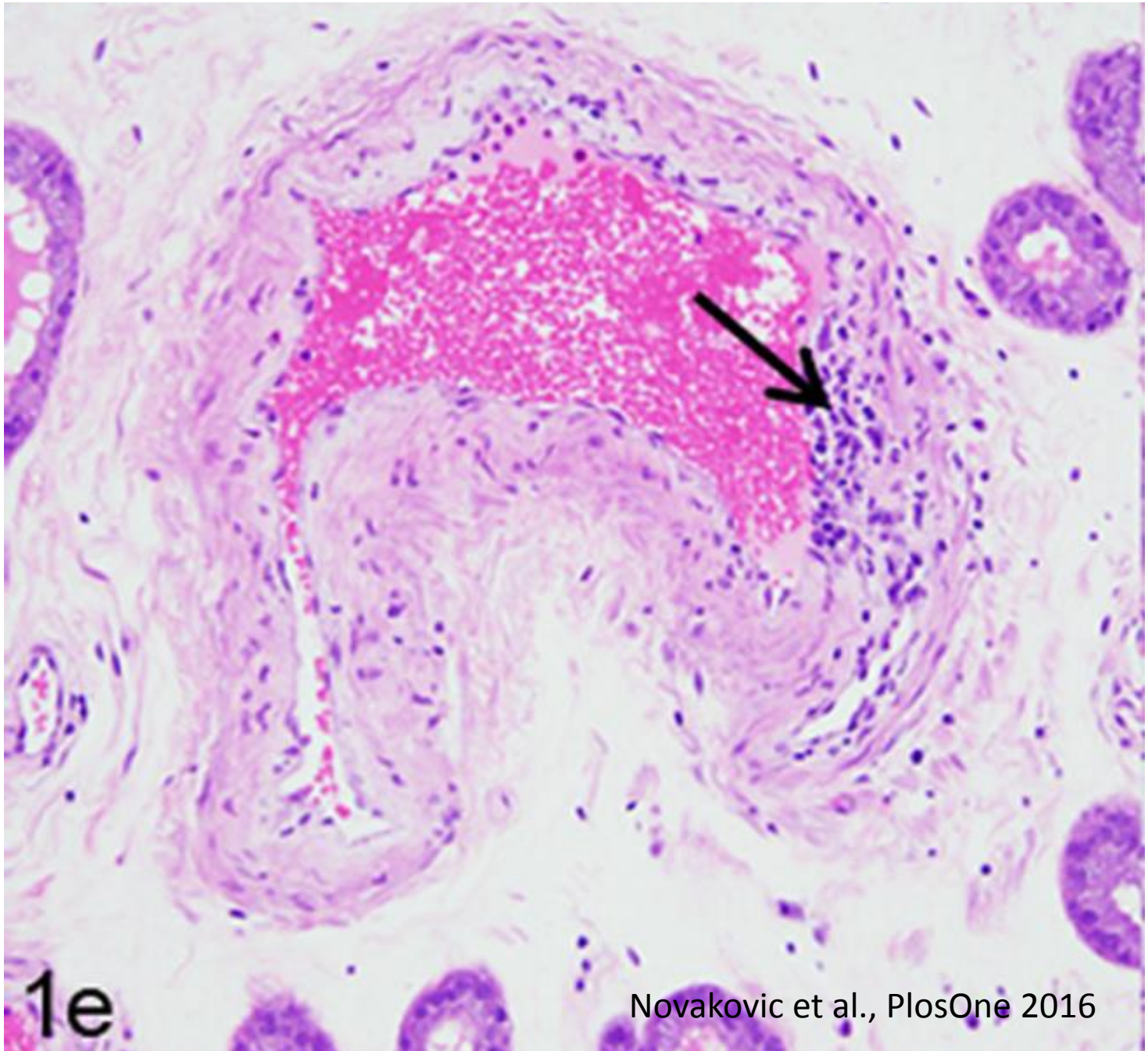

D
Blood monocyte
Endometrial macrophage
CD8+ cell
Fetal placental macrophage
PRRSV
PRRSV infected cell
Apoptotic cell
Onset of immunological response via NK CD8+
Suppression of the réplication within macrophages

E


Blood monocyte
Endometrial macrophage
CD8+ cell
Fetal placental macrophage
PRRSV
PRRSV infected cell
Apoptotic cell
Detaching of trophoblast (maternal)
Focal necrosis of the placenta (fetus)


F
Blood monocyte
Endometrial macrophage
CD8+ cell
Fetal placental macrophage
PRRSV
PRRSV infected cell
Apoptotic cell
Multofocal degeneration of the placenta

(e) Uterus, endometrium, blood vessel; PRRSV-infected pregnant gilt; HE. Lymphocytic vasculitis



Novakovic et al., PlosOne 2016

Veterinary Microbiology 177 (2015) 229–24

Contents lists available at ScienceDire

Veterinary Microbiology

journal homepage: www.elsevier.com/locate/vetmic

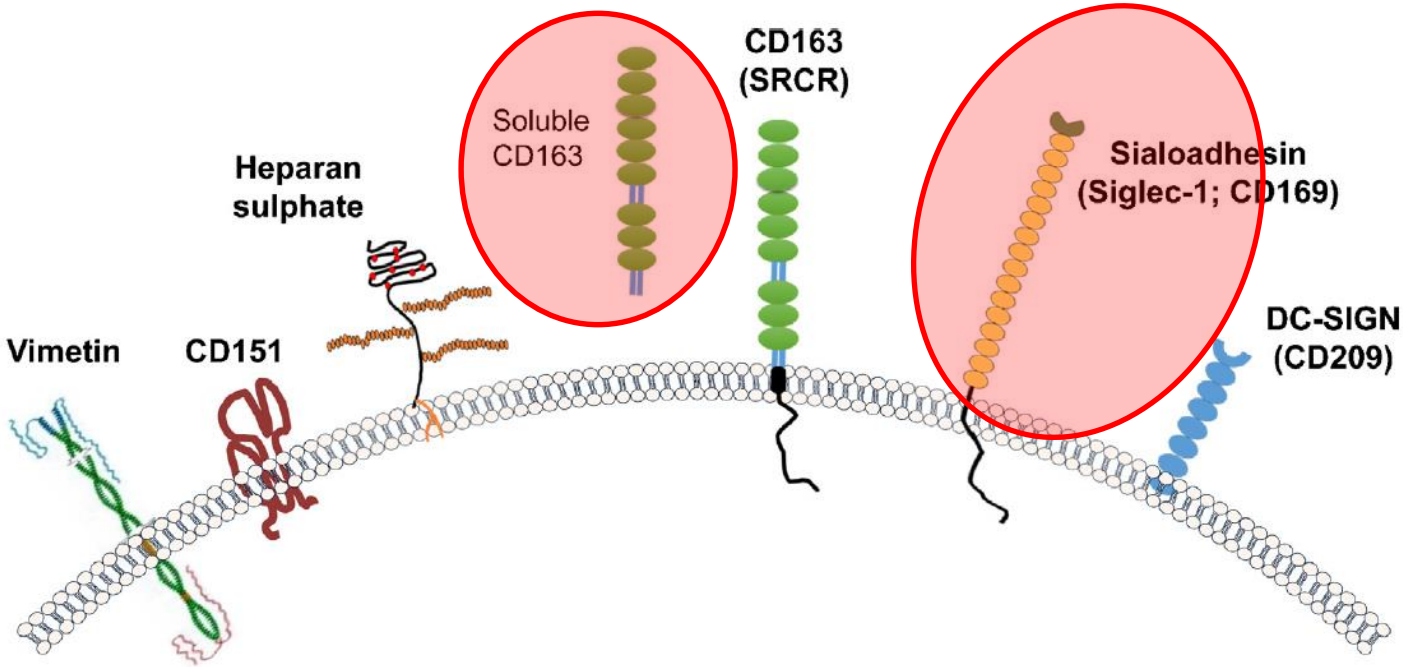
Au moins 6 molécules sont rapportées comme récepteurs au SDRPV

Review

PRRS virus receptors and their role for pathogenesis

Qingzhan Zhang, Dongwan Yoo *

Department of Pathobiology, University of Illinois at Urbana-Champaign, Urbana, IL, United States



National Hog Farmer

2015 Research Review: Looking for genetic answers in PRRS fight

Research by John Harding, Carolyn Ashley, Predrag Novakovic and Susan Detmer, all from the Western College of Veterinary Medicine, University of Saskatchewan; Andrea Ladinig, Western College of Veterinary Medicine, University of Saskatchewan and the University of Veterinary Medicine, Vienna; Jamie Wilkinson, Tianfu Yang and Graham Plastow, all from the Department of Agricultural, Food and Nutritional Science, University of Alberta; and Joan Lunney, Beltsville Agricultural Research Center, USDA-ARS, Beltsville, Md.

Mon, 2015-12-21 13:19

Porcine reproductive and respiratory syndrome virus costs U.S. hog producers substantially every year. According to a pork checkoff-Iowa State University study from 2011, the U.S. swine industry loses $664 million per year at the hands of PRRSV, with 45% of that loss attributable to the breeding herd.

lesions are not observed in infected fetuses. It has been shown that the number of sialoadhesin–positive (CD169) and CD163-positive macrophages in endometrium and placenta, and virus replication in fetal implantation sites, which causes apoptosis of infected and surrounding cells, play a role in fetal death. Thus, it is postulated that fetal demise is mainly associated with events occurring at the maternal-fetal interface that lead to the separation of the fetal placenta from the uterus.

Although transplacental PRRSV infection mainly occurs in late gestation, the exact mechanisms by which PRRSV transmits from the dam to her fetuses have yet to be determined. It has been suggested that fetal death may not be a direct result of PRRSV infection of fetal tissues since severe microscopic lesions are not observed in infected fetuses. It has been shown that the number of sialoadhesin–positive (CD169) and CD163-positive macrophages in endometrium and placenta, and virus replication in fetal implantation sites, which causes apoptosis of infected and surrounding cells, play a role in fetal death. Thus, it is postulated that fetal demise is mainly associated with events occurring at the maternal-fetal interface that lead to the separation of the fetal placenta from the uterus.

sialoadhesin–positive (CD169) and CD163-positive macrophages

Novel findings from the Pregnant Gilt Model will contribute to the development of genetic lines that are more resilient to reproductive PRRSV, helping to mitigate losses in the event of a reproductive outbreak.

The PGM involves the experimental infection at the University of Saskatchewan of more than 150 pregnant gilts with a highly virulent strain of PRRSV. The objectives were to improve understanding of the mechanisms resulting in fetal infection and death, and to investigate the genomic basis of resistance to reproductive PRRSV.

Undertaken in collaboration with a number of domestic and international research partners (Figure 1), the PGM included a pilot experiment (15 gilts) to develop laboratory methods and evaluate the relative virulence of three North American type 2 PRRSV strains. This was followed by the main experiment using purebred pregnant Landrace gilts that were selected on the basis of their average litter birth weight — about 50% were from low birth rate litters, and

PCV2 and reproduction

- Classical case
  - New herd / new breeding stock
    (Lebret et al., 2015)
  - Late abortions/ mummified/ stillbirth
- In question
  - « Could » be (Mateusen et al., 2007)
    - PCV2 replication in embryos
    - Embryonic death
  - « May be » PCV2 and endometritis
    (Limsaranrom et al., 2015)

Virus Research 164 (2012) 43–45

Contents lists available at SciVerse ScienceDirect

Virus Research

journal homepage: www.elsevier.com/locate/virusres

Review

Cell tropism and entry of porcine circovirus 2

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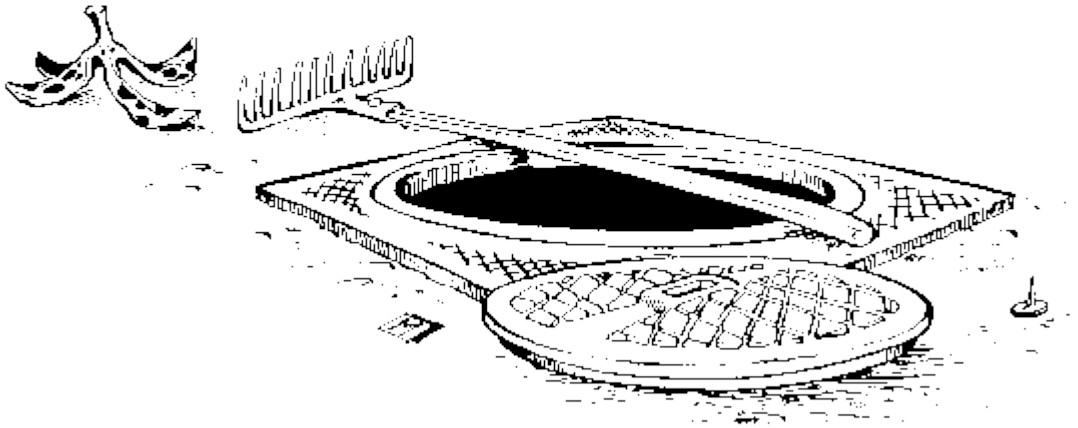
ABSTRACT

Porcine circovirus 2 (PCV2) may induce reproductive failure (return to oestrus, embryonic death, mummification, weak- and stillborn piglets) and postweaning multisystemic wasting syndrome (PMWS). Furthermore, it may modulate the immunity in such a way that it aggravates the outcome of many bacterial and viral infections. In the present paper, the cellular tropism and entry of PCV2 are described and linked with the pathological and clinical consequences.

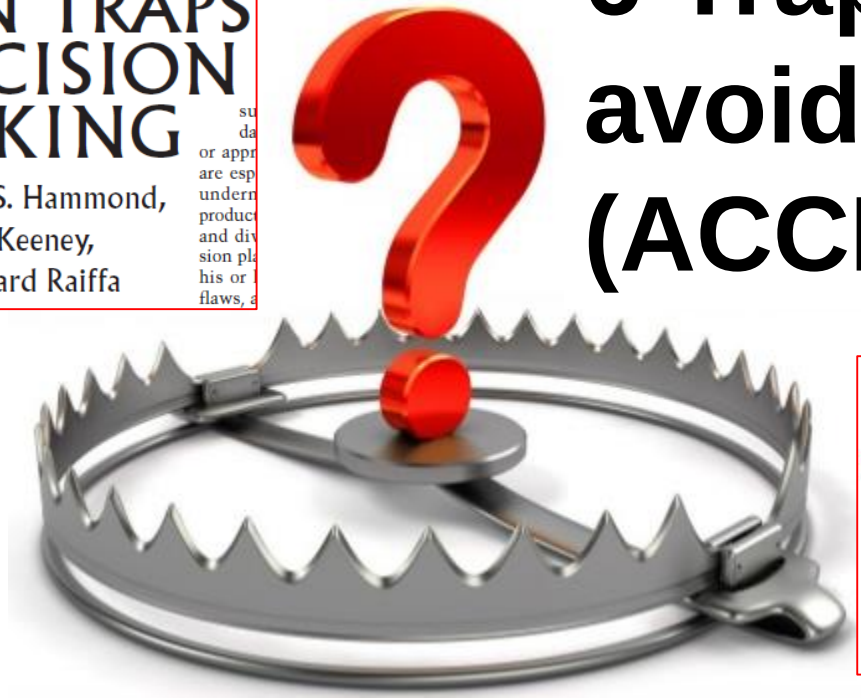
TRAPS AND CRITERIA OF THE DIAGNOSTIC DECISION DISORDERS IN SWINE REPRODUCTION



THE HIDDEN TRAPS IN DECISION MAKING

by John S. Hammond, Ralph L. Keeney, and Howard Raiffa

6 Traps to be avoided (ACCESS)



Ancrage

Sur-réactivité

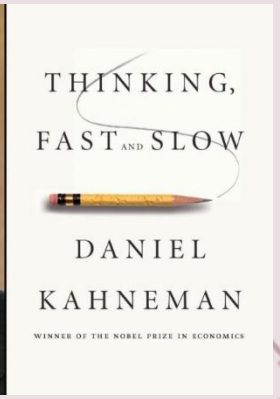
Cadrage

Statu-quo

Confirmation

Echantillonnage

How do we think when we are in investigation ?



How clinicians might use Systems 1 and 2 thinking alone and in tandem

CLINICIANS (NOVICE OR EXPERT)
Consciously decide that the animal is ill from initial presentation and history, and then utilise either:

ystem 1 thinking

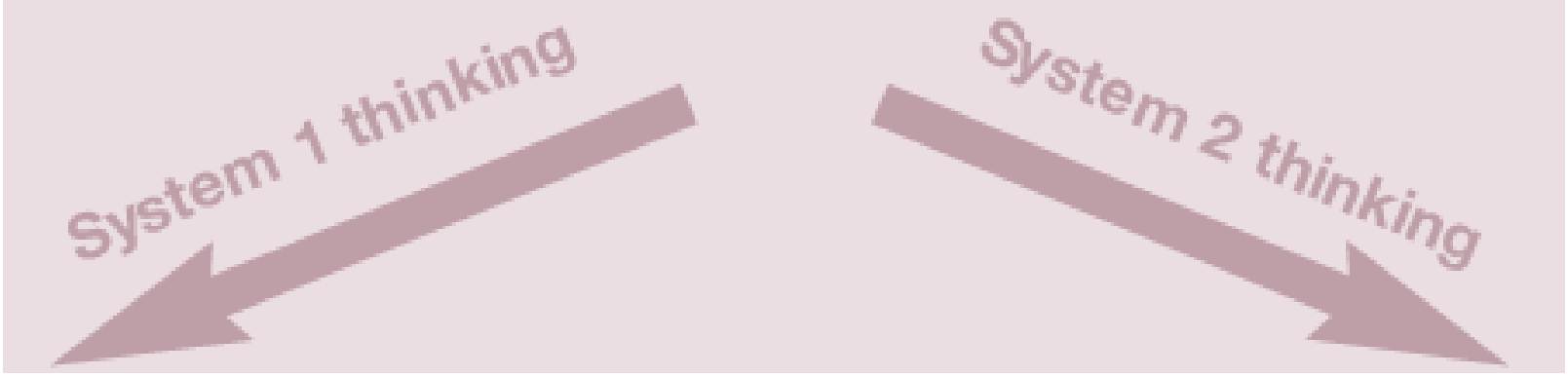
System 2 thinking

Expert
Case information often triggers retrieval of a simple pattern of signs or a more complete illness script from long-term memory for a plausible diagnosis (hypothesis). The diagnosis may or may not be tested depending on how sure the expert is.

Novice
A pattern or illness script is only likely to be triggered if prior exposure to a similar case has occurred. Patterns and scripts for diseases may be poorly developed and lack rigour.

Novice
Short-term (working) memory is used to consciously work through problem lists to reach one or more hypotheses. The process commonly develops patterns of clinical signs or more complete illness scripts in long-term memory, which can be used for System 1 thinking in the future.

Expert
If a plausible diagnosis is not obvious through intuitive System 1 thinking, the expert may resort to this analytical style of thinking intially to reach hypotheses.



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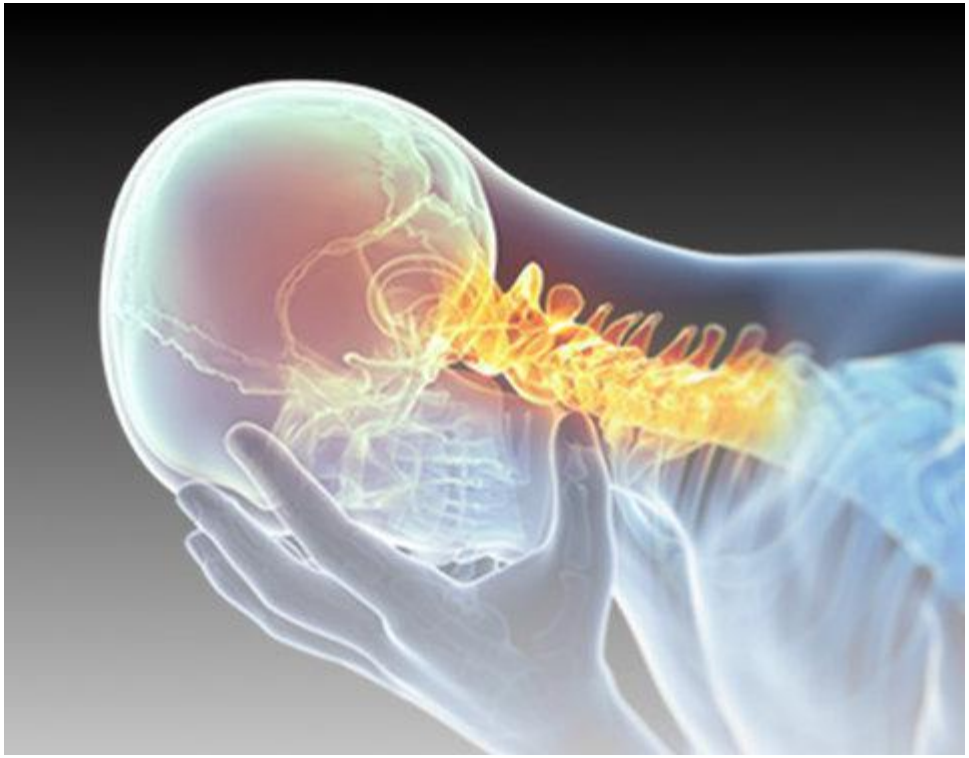
Expert

If a plausible diagnosis is not obvious through intuitive System 1 thinking, the expert may resort to this analytical style of thinking intially to reach hypotheses.

Experience is like a lantern hanging from your back; it only ever lights up the path we have already travelled

Clinical investigation

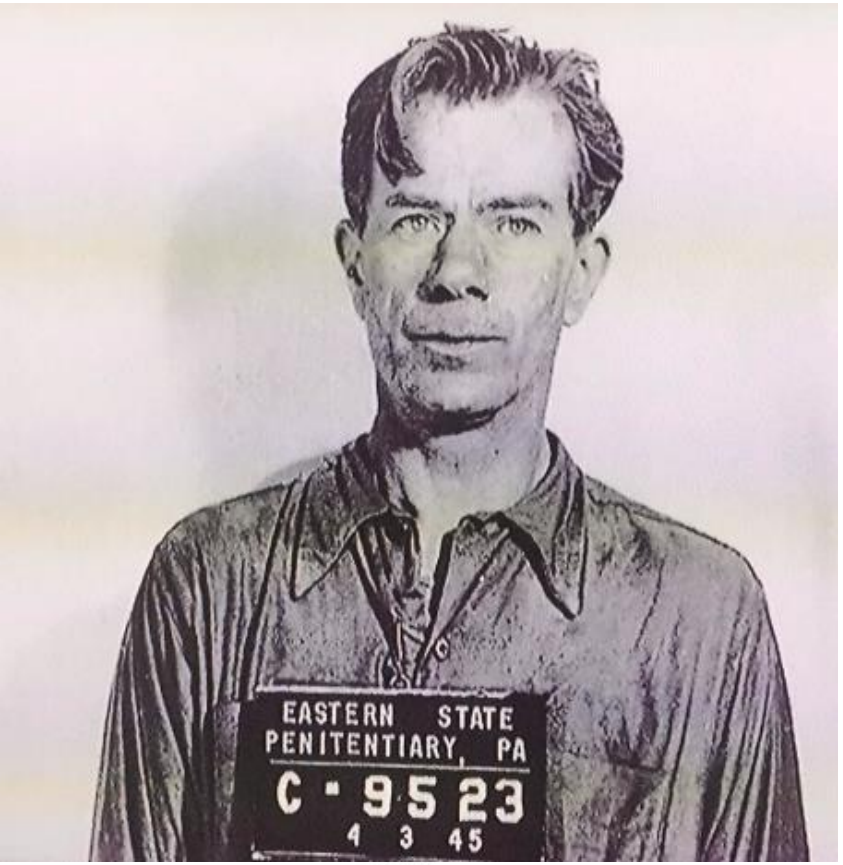
By Willie Sutton and Guillaume d'Occam

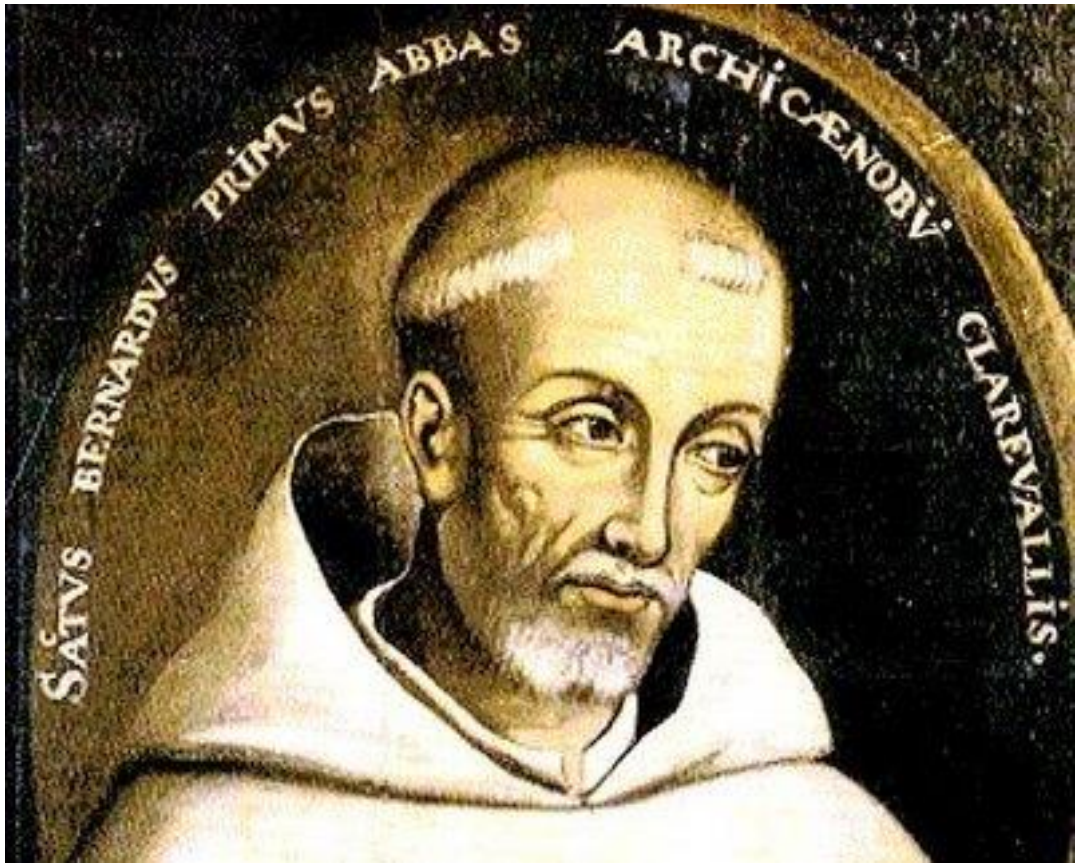


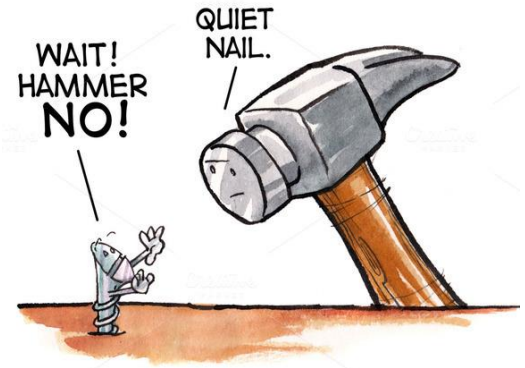
Willie Sutton
1901-1980

and

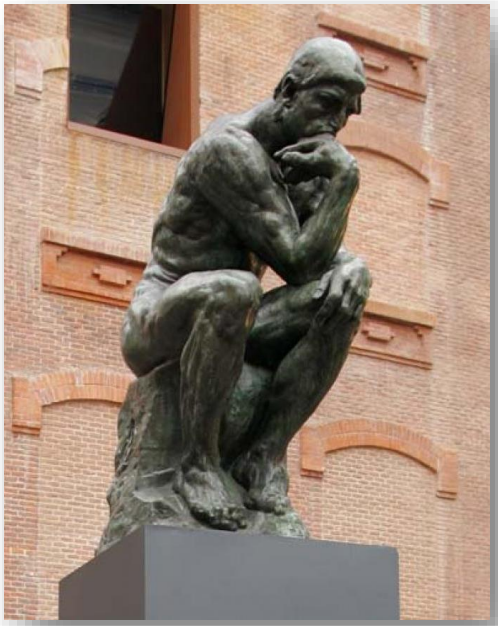
Guillaume d'Occam
1285-1347



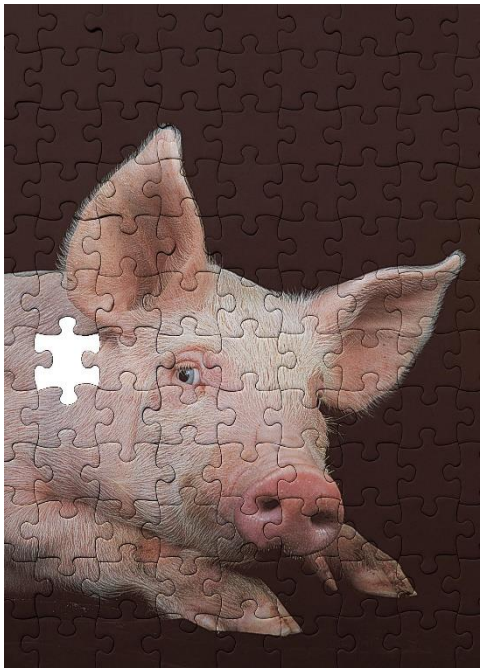




Pluralitas non est ponenda sine necessitate



Rodin's *The Thinker*



System 1	System 2
Heuristic, intuition	Analytic, systematic

BEFORE

Description

ABDUCTION

Hypotheses

Hypotheses

DEDUCTION

Theorical associated
-symptoms and/or lesions
-events
-behaviors

« Illness script »

« Previsit » scenarios to confirmed or refute

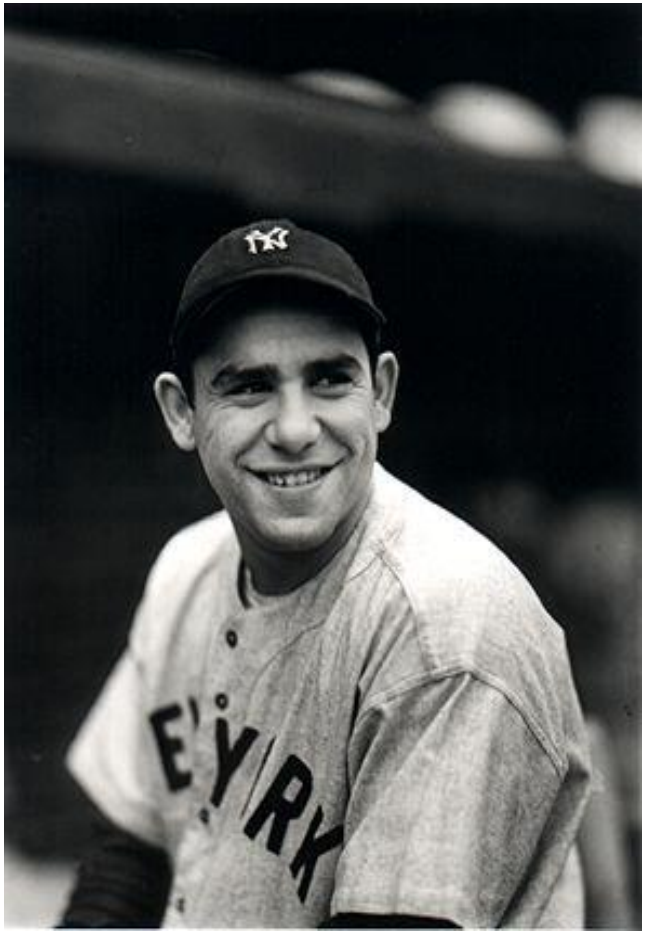
A
E
L
M
A
R

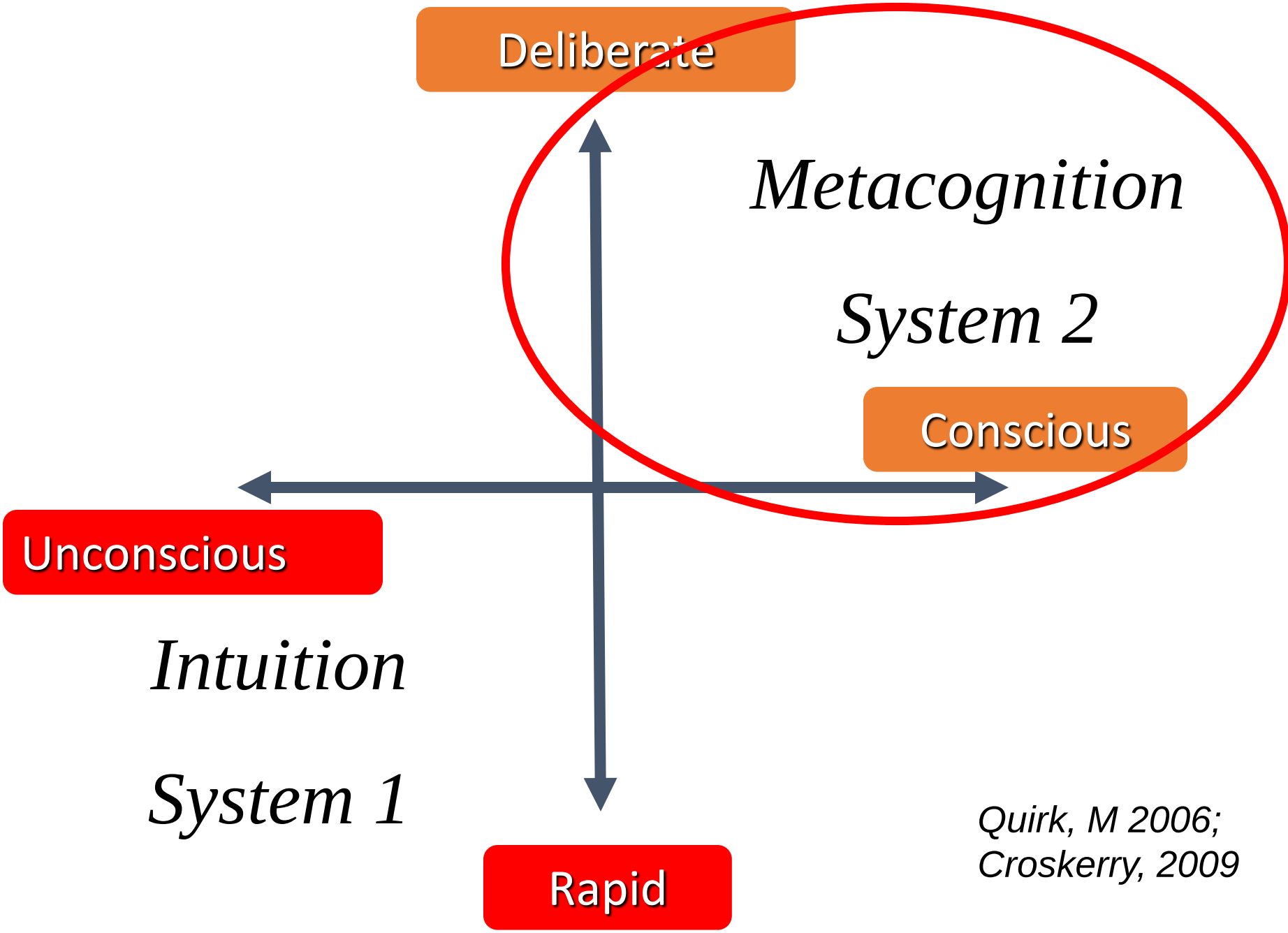
Most likely scenario

« Illness script »

Yogi Berra

"If you don't know where you are going you might end up someplace else"





Quirk, M 2006;
Croskerry, 2009

Abduction

from a sign to a theory (a story)

= science x imagination x intuition x creativity

= « Detective method »

Peirce 1839-1914

Exemple: « a story in 6 words:
For sale: baby shoes, never worn »

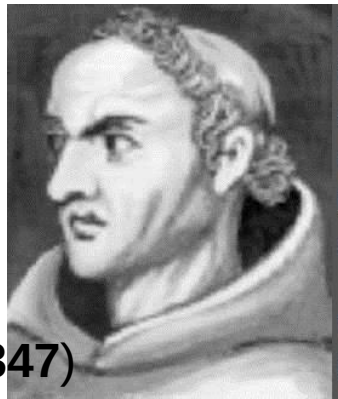
science x imagination x intuition x creativity

Novice

Expert

Occam's razor (also written as **Ockham's razor**, and *lex parsimoniae* in Latin, which means **law of parsimony**) is a problem-solving principle

Among competing hypotheses, the one with the fewest assumptions should be selected.



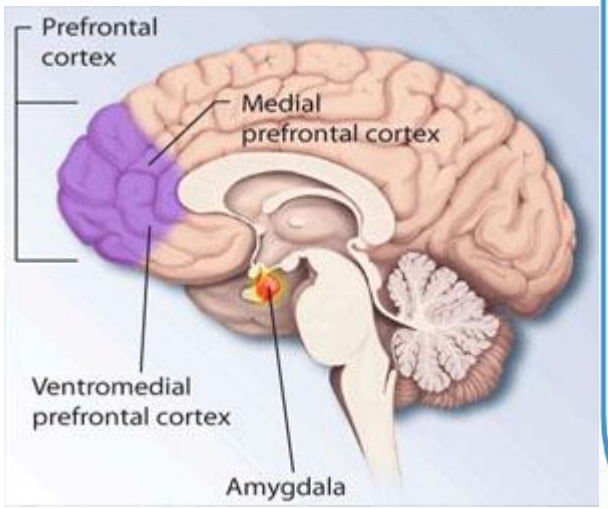
"With all things being equal, the simplest explanation tends to be the right one."

William of Ockham

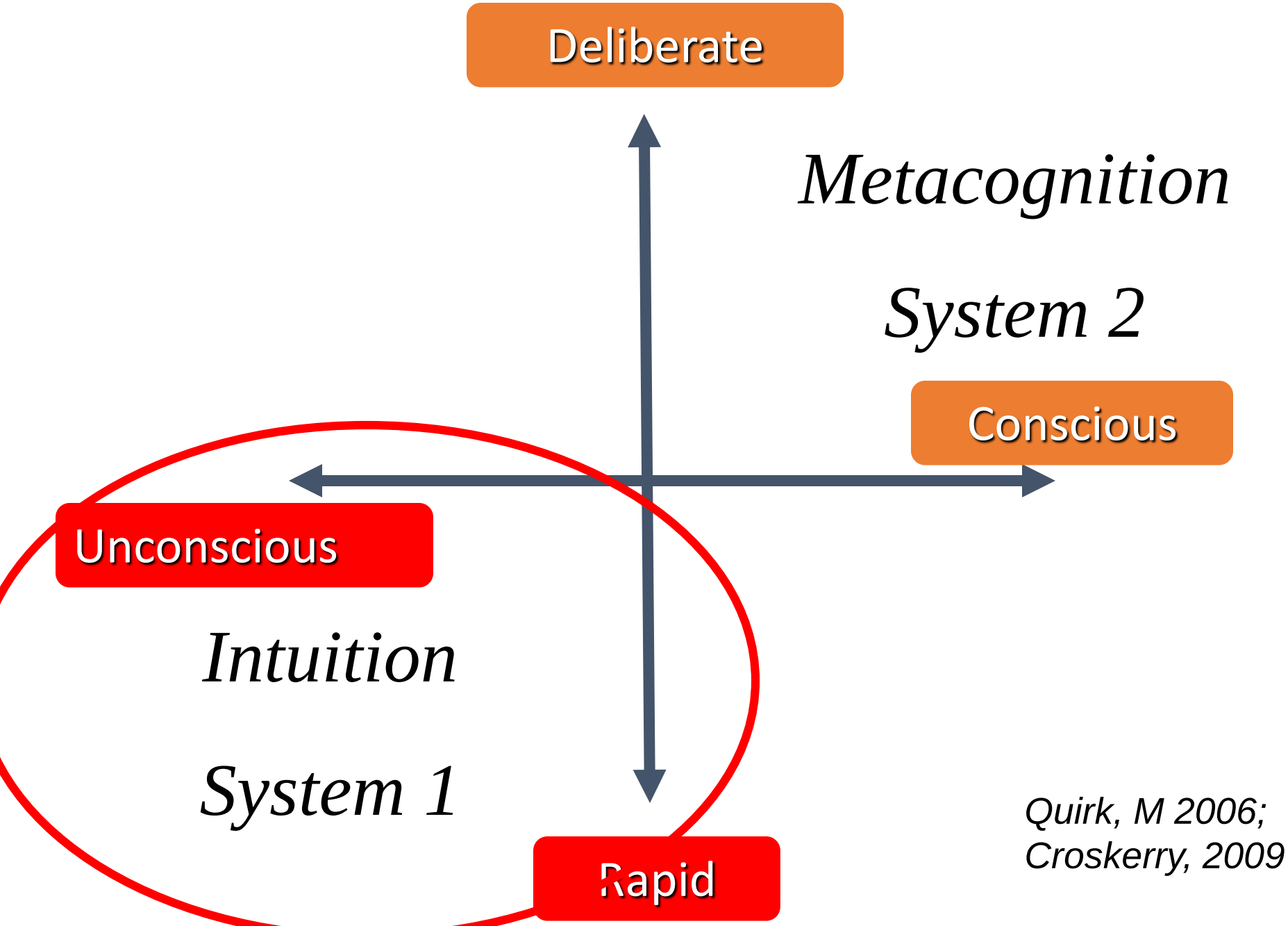
Guillaume d'Ockham or **Guillaume d'Occam (v. 1285-1347)**

A razor is used to cut all which exceeds (cf. the technic of hairstyle used by the franciscan monks), that is here the useless hypotheses

System 1	System 2
Heuristic, intuition	Analytic, systematic



System 1	System 2
Fast	Slow
Unconscious	Conscious
Automatic	Effortful
Everyday Decisions	Complex Decisions
Error prone	Reliable



Quirk, M 2006;
Croskerry, 2009

What are heuristics and dow they play a role in diagnostic reasoning ?

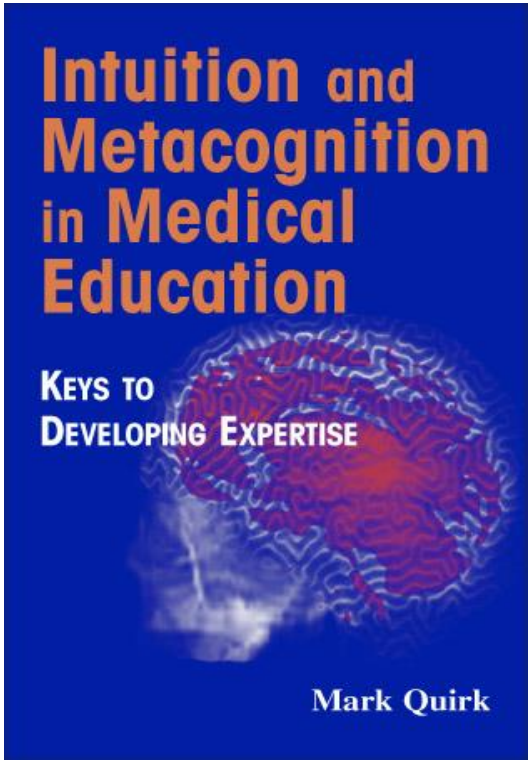
« Why do I need to know anything about heuristics ? »

System 1	System 2
Heuristic, intuition	Analytic, systematic

"Eureka" comes from the Greek word εὕρηκα, meaning "I have found (it)", is closely related to heuristic, which refers to experience-based techniques for problem solving, learning, and discovery

Intuition and evidence — uneasy bedfellows?

Trisha Greenhalgh



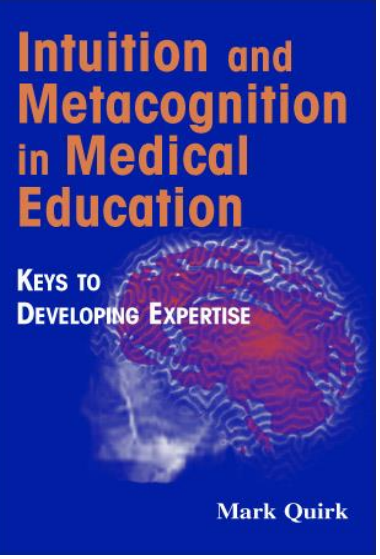
Intuition is a decision-making method that is used unconsciously by experienced practitioners but is inaccessible to the novice. It is rapid, subtle, contextual, and does not follow simple, cause-and-effect logic. Evidence-based medicine offers exciting opportunities for improving patient outcomes, but the 'evidence-burdened' approach of the inexperienced, protocol-driven clinician is well documented.

Intuition is not unscientific. It is a highly creative process, fundamental to hypothesis generation in science. The experienced practitioner should generate and follow clinical hunches as well as (not instead of) applying the deductive principles of evidence-based medicine.

The educational research literature suggests that we can improve our intuitive powers through systematic critical reflection about intuitive judgements — for example, through creative writing and dialogue with professional colleagues.

It is time to revive and celebrate clinical storytelling as a method for professional education and development. The stage is surely set for a new, improved — and, indeed, evidence-based — 'Balint' group.

British Journal of General Practice, May 2002

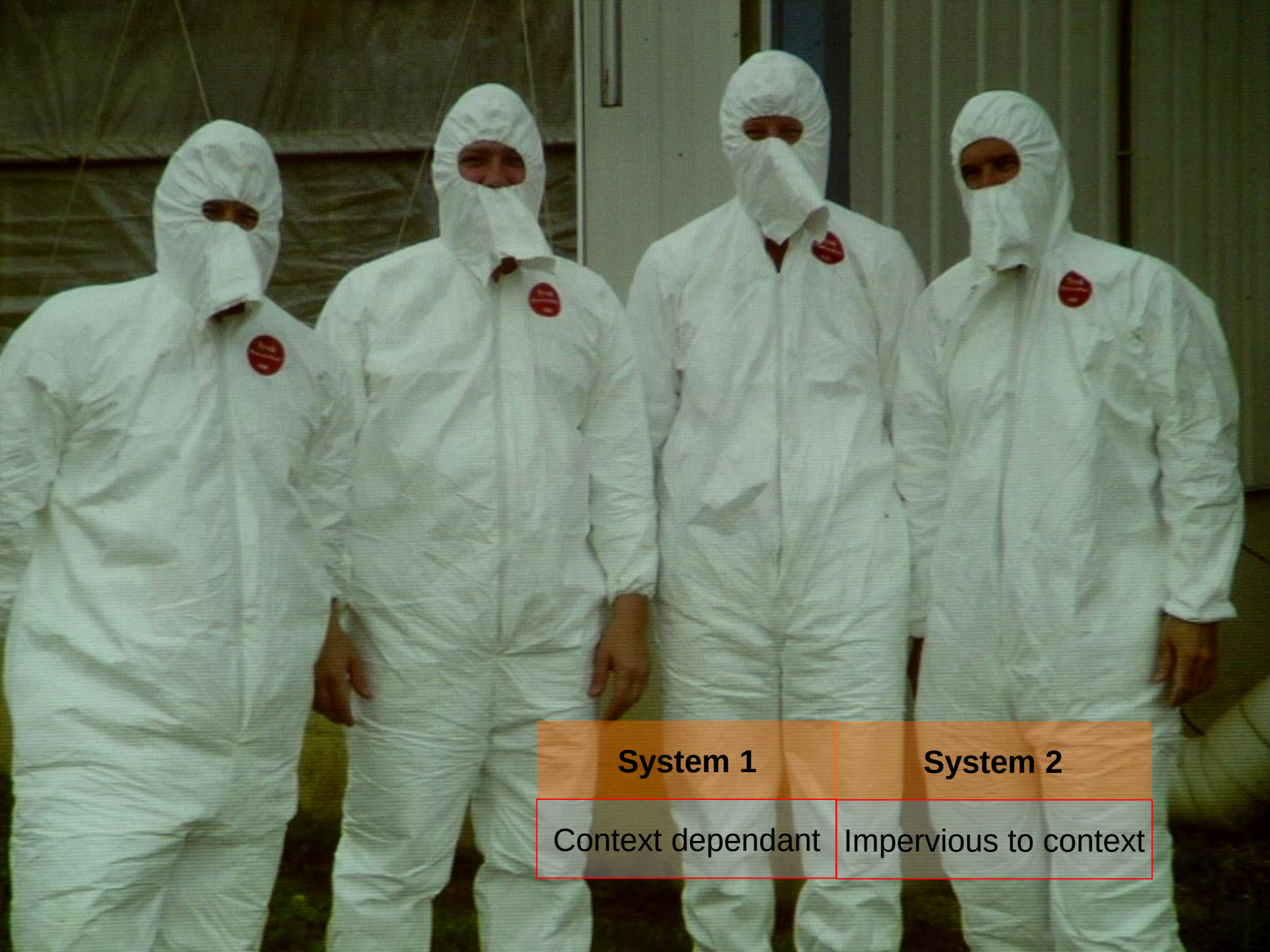


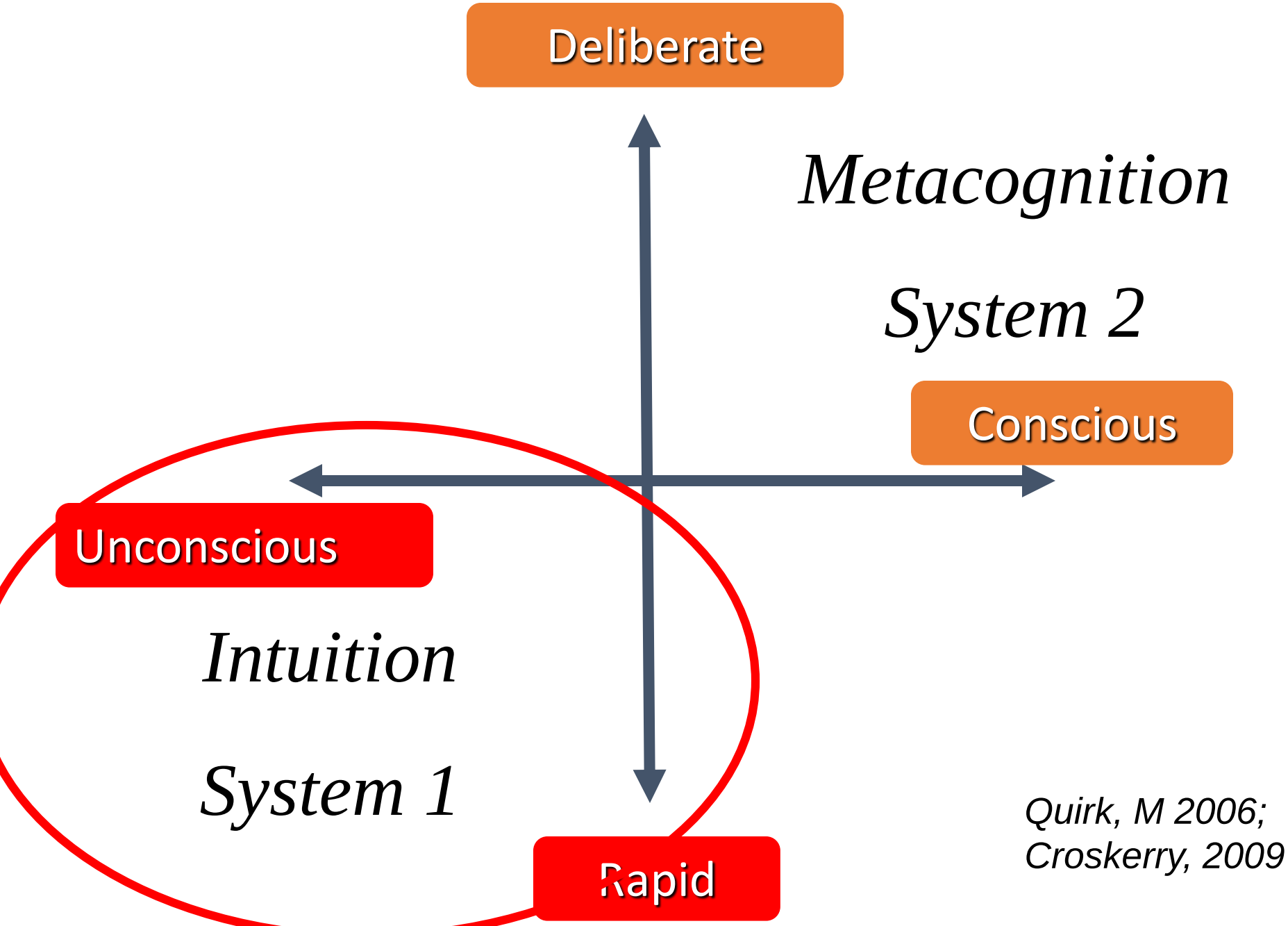
Characteristics of intuition

In most of the cases, we know the herd and the producer in whom we are called for a problem

We have thus inevitably preconceived ideas that they are positive or negative, as for example the stressful character of the producer which worries very easily or not or still the history of the already met problems or still that it is about a herd of the top of the pyramide (selection herd) or …

- rapid, unconscious process
- context-sensitive
- comes with practice
- involves selective attention to small details
- cannot be reduced to cause-and-effect logic (i.e. B happened because of A)
- addresses, integrates, and makes sense of, multiple complex pieces of data


System 1
System 2
Context dependant
Impervious to context



Quirk, M 2006;
Croskerry, 2009

Errors

"Our propensity for certain types of error is the price we pay for the brain's remarkable ability to think and act intuitively. Heuristics play the odds: sometimes, particularly under unusual circumstances, these rules of thumb lead to wrong decisions."

M. Graber, Acad Med 2002

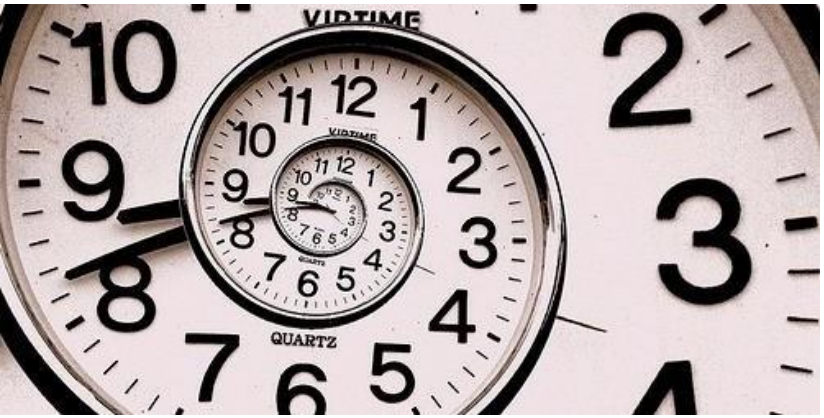
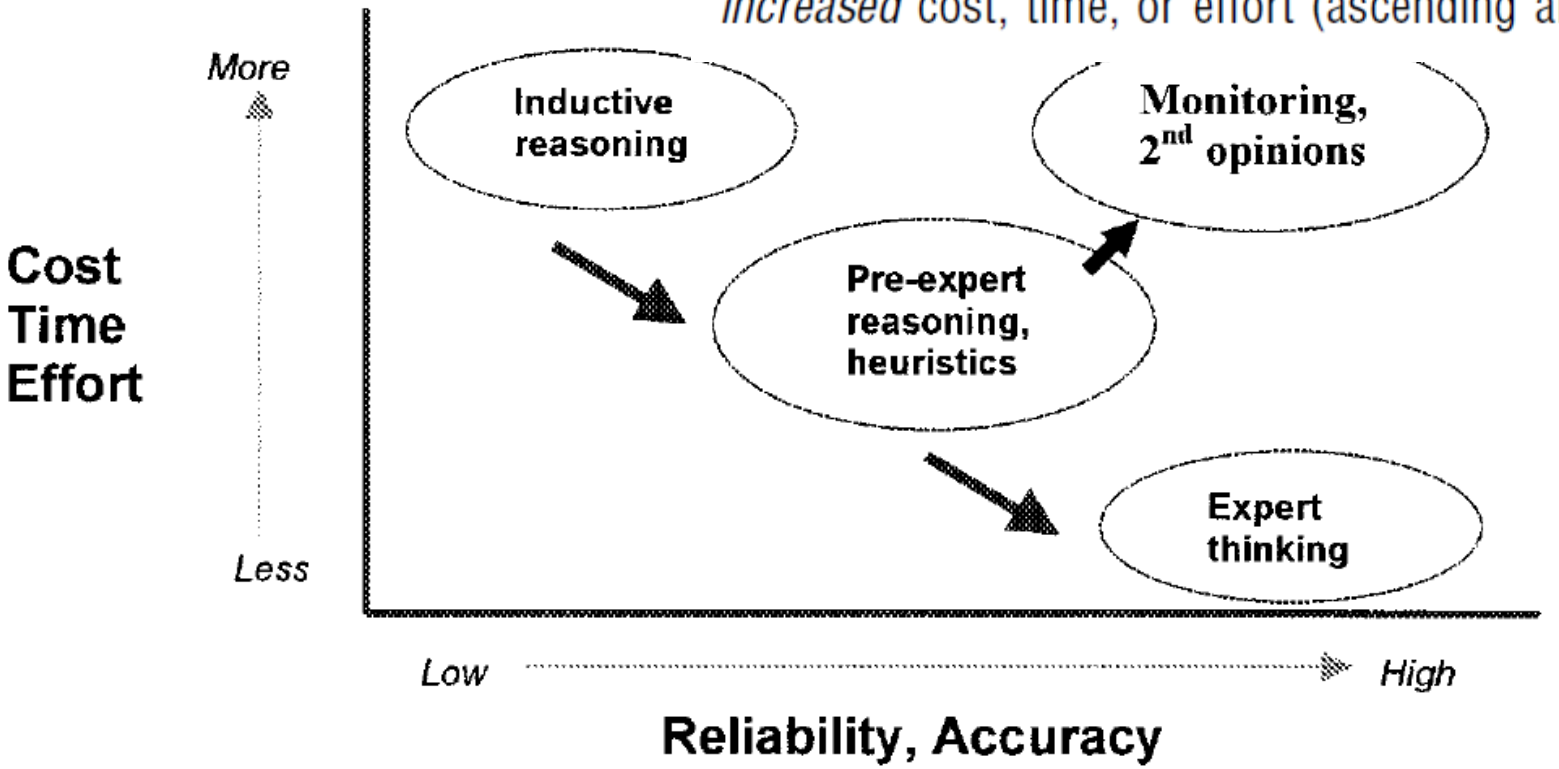


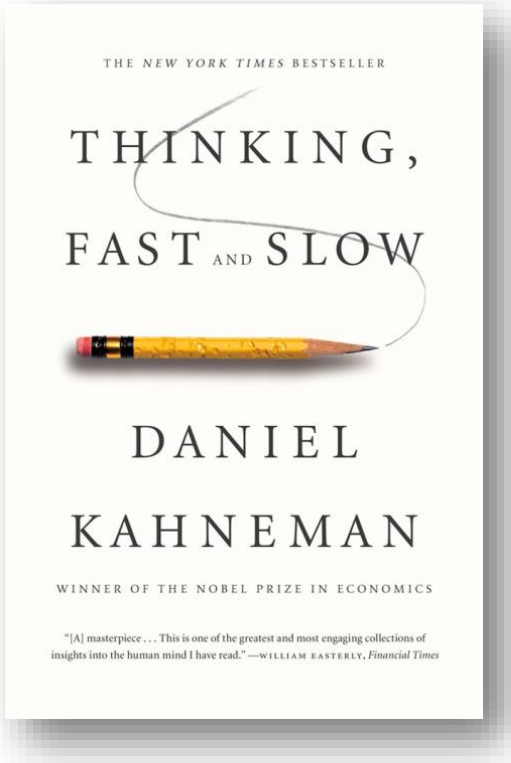
Figure 1. The relationships between reliability and cost in diagnostic decision making. As clinicians improve their diagnostic competencies from beginning level skills (use of inductive reasoning) to intermediate levels (use of heuristics) to expert level skills, reliability and accuracy improve, with *decreased* cost and effort (descending arrows). In any given case we can improve diagnostic accuracy (e.g., with second opinions or monitoring) but with *increased* cost, time, or effort (ascending arrow).



Clinical expertise –alignment of different descriptors

Schmidt et al (1990)	*Dreyfus and Dreyfus (1986)*	*Coderre et al (2003)*
		Greater emphasis on type 2 reasoning
	Novice	
Elaborated Causal Networks		Hypothetico-deductive
	Advanced Beginner	
Abridged Networks	Competence	Schema-inductive
Illness Scripts	Proficiency	
Instance Scripts	Expert	Pattern Recognition
		Greater emphasis on type 1 reasoning

Figure 1: Clinical expertise—alignment of different descriptions

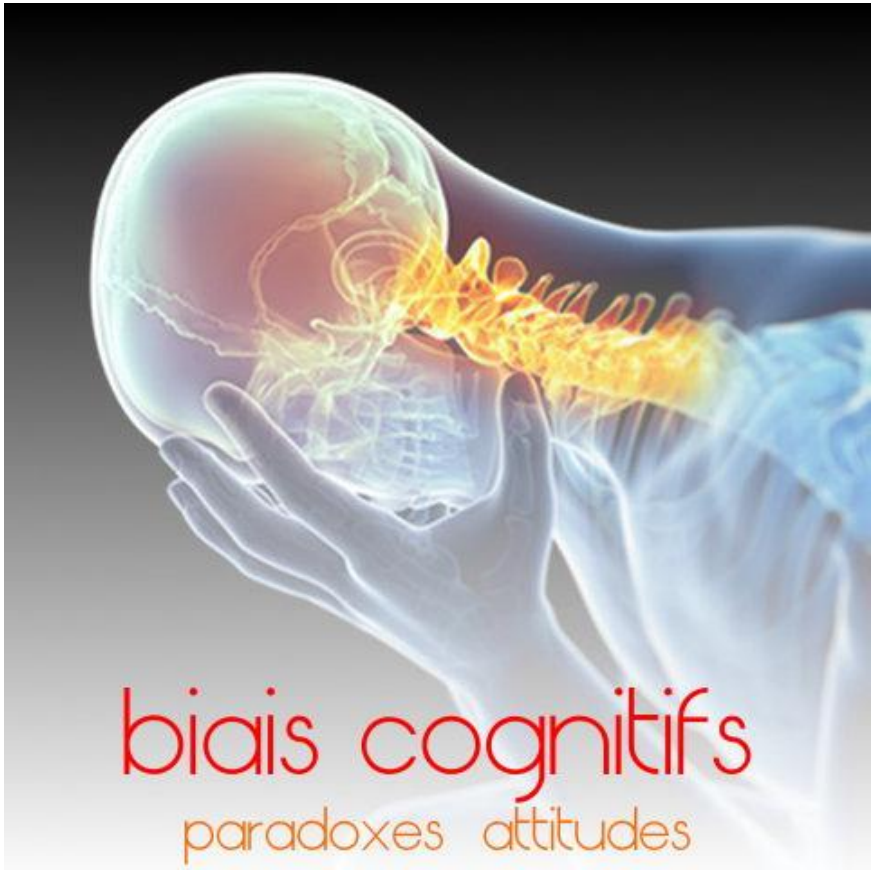


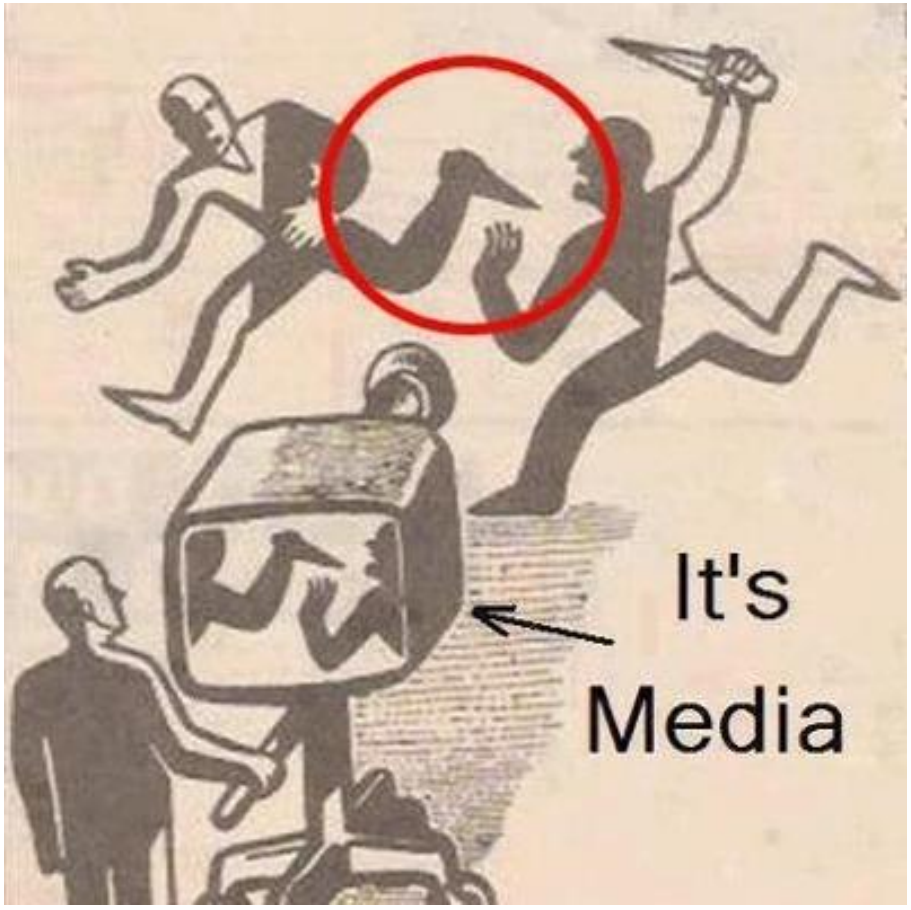
The knowledge of the herd has positive and also negative consequences:

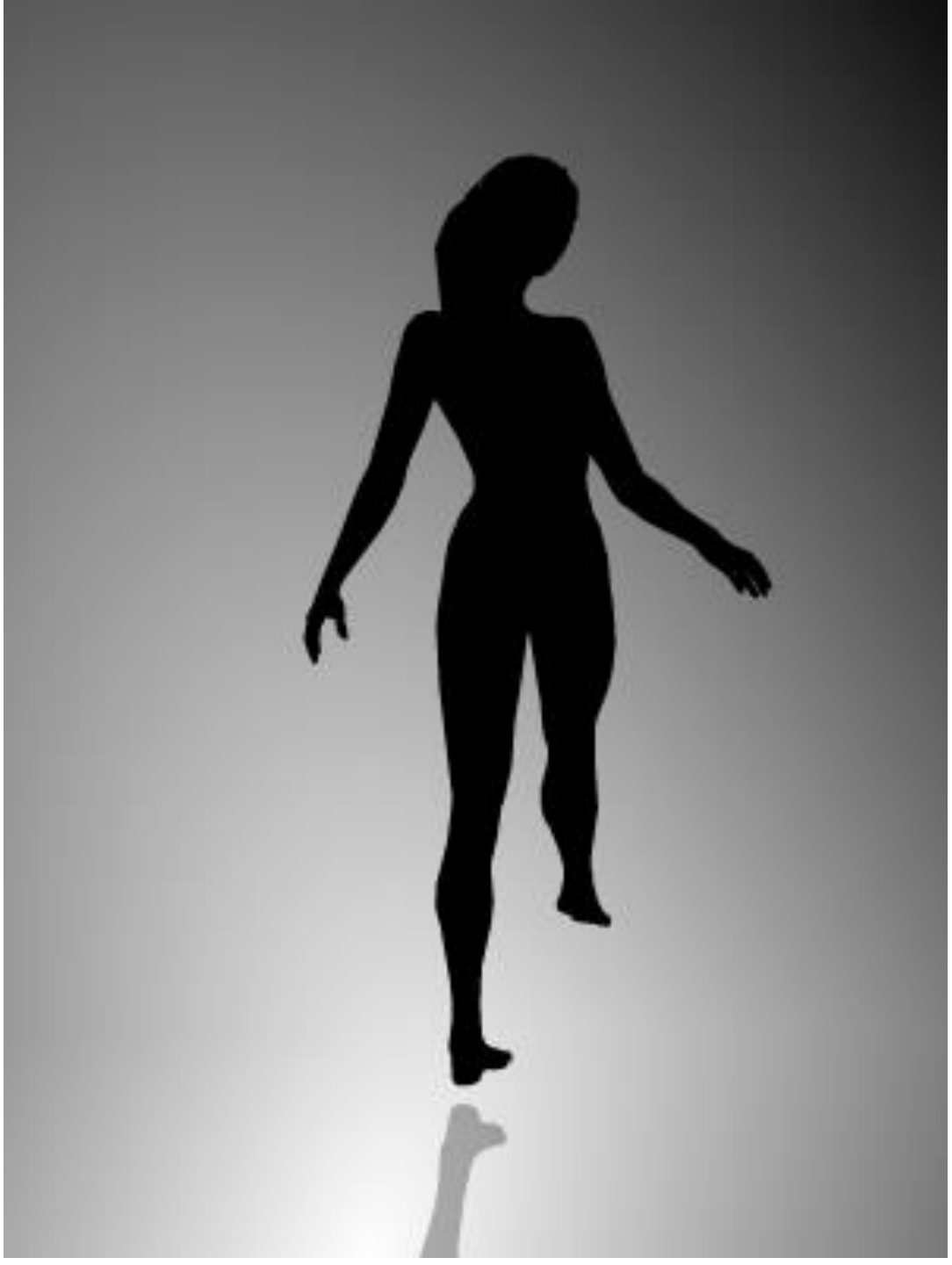
-preconceptions

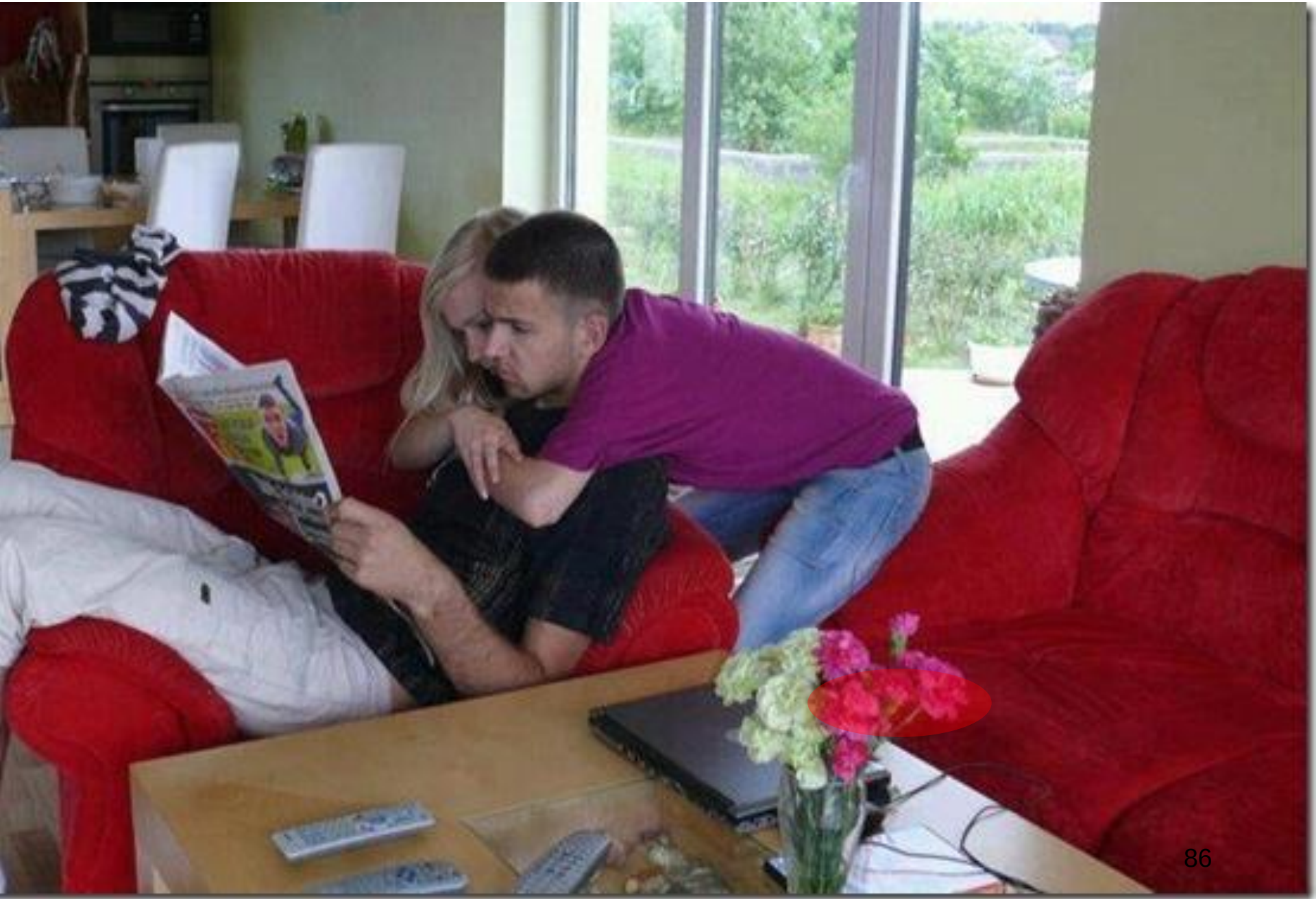
-traps

-herd visit

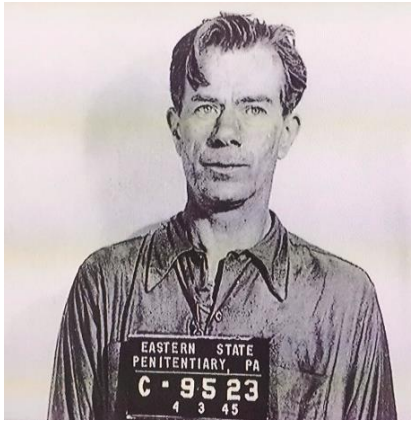


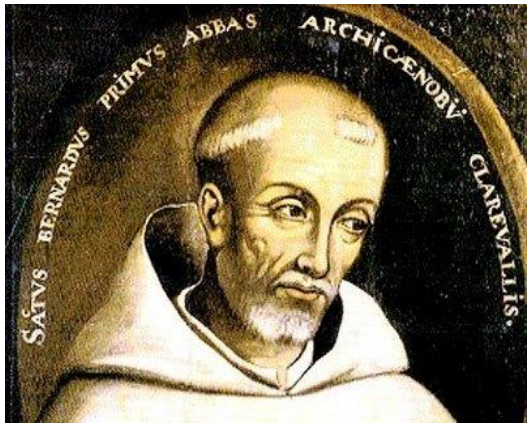






Willie Sutton et Guillaume d'Occam





Sutton's slip is used when possibilities other than the obvious **<u>are not</u>** considered
(*When you've got a hammer in your hand, everything looks like a nail*)

Sutton's law states that when diagnosing, one should first consider the obvious

Uncommon diseases are … uncommon

Confirmation bias

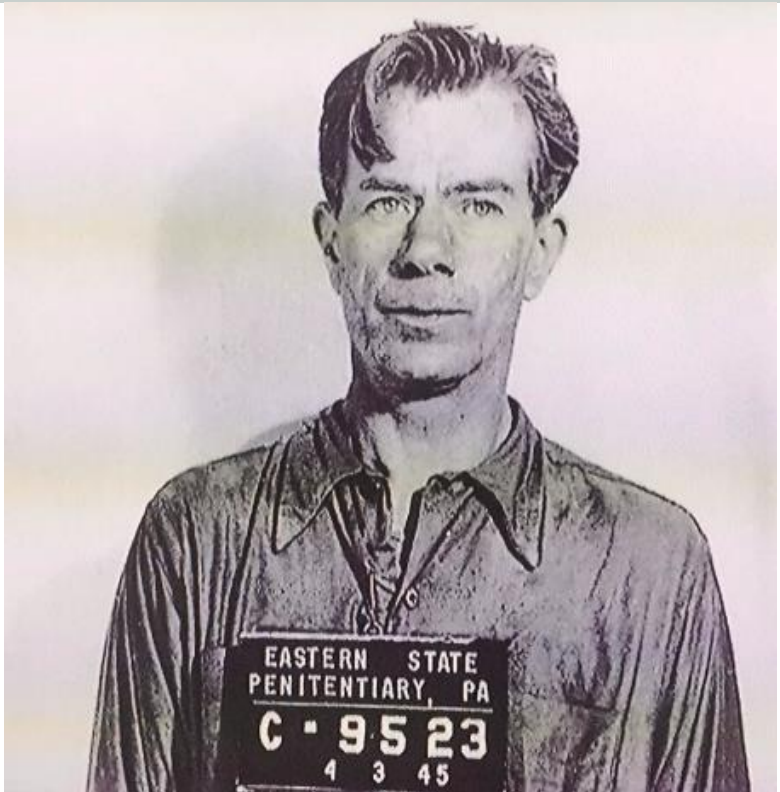
The tendency to search for, interpret, focus on and remember information in a way that confirms one's preconceptions about a case

– This is related to the so-called premature closure bias, where other possibilities are ignored or discounted too soon

– It is also related to the diagnostic strategy of going for the obvious (Sutton's Law) and ignoring other possibilities (Sutton's Slip)

– Confirmation bias is common in new graduates because of their lack of domain knowledge and consequent willingness to latch onto a diagnosis they know about

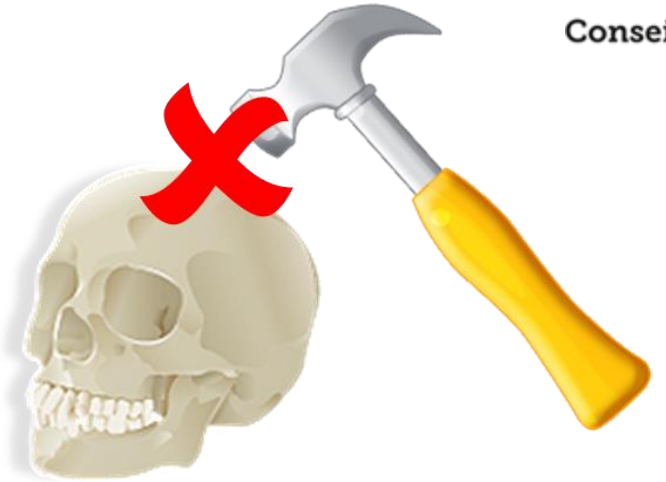
Willie Sutton
1901-1980




2

LABOCEA

Laboratoire public
Conseil, Expertise et Analyse en Bretagne



Hippra lab

Anchoring bias

The tendency to rely too heavily, or 'anchor', on one trait or piece of information when making decisions. Often this anchor is inflicted on you by others

– This might be viewed as focusing on one piece of the puzzle, at the expense of understanding the 'big picture'

– Related to the anchoring and adjustment heuristic (a reasoning strategy used in System 2 thinking – discussed

Gambler's fallacy

– Remember, each case is usually an independent event, except for contagious and environmental diseases when case clusters are common (eg, viral upper respiratory disease)

Table 3: Stage of production, type of death, and most common lesions found in 70 necropsied sows that died in a herd of 5200 when room temperature was ≥ 32°C during a 20-week period (May to October)

Category	Sows represented (%)
Production stage	
Gestation	40
Lactation	34
Breeding	18
Type of death	
Euthanized	41
Expected to die	30
Sudden death	29
Most commonly affected systems	
Locomotor	20
Digestive	19
Reproductive	17
Urinary	11

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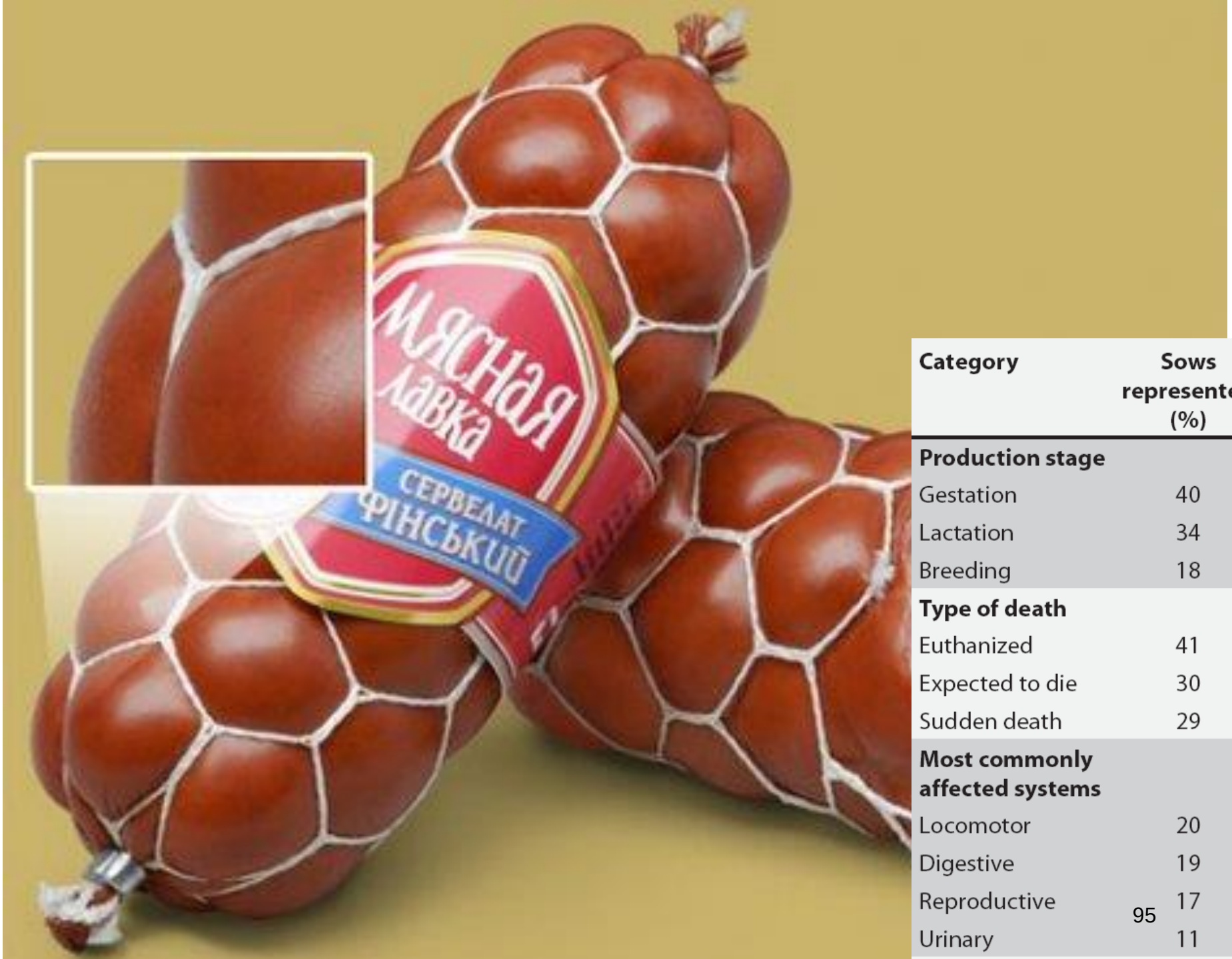

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Urinary	11

Availability bias

The tendency to overestimate the likelihood of events that have greater 'availability' in memory. Availability can be influenced by how recent the memories are or how unusual or emotionally charged they may be. In other words, choosing a diagnosis because it is in the forefront of your mind, especially if the last case left a strong impression
– The availability bias is referred to as the availability heuristic when it gives you the right answer (discussed in Article 3)

System 1	System 2
Heuristic, intuition	Analytic, systematic

"Eureka" comes from the Greek word εὕρηκα, meaning "I have found (it)", is closely related to heuristic, which refers to experience-based techniques for problem solving, learning, and discovery

Overconfidence bias

Boldness in diagnosis based on a belief of infallibility. Often, this leads to not asking for advice, when that advice may have helped forge the path to the right diagnosis
– This bias, in combination with commission bias (the tendency towards action, rather than inaction, in making a diagnosis), can lead to a quick but erroneous diagnosis based on inadequate or incorrect evidence

Shared information bias

Known as the tendency for group members to spend more time and energy discussing information that all members are already familiar with (ie, shared information), and less time and energy discussing information that only some members are aware of (ie, unshared information)

– The impact of this bias is dependent on your experience and personality, and the personalities of your colleagues

Frame biais

Influence of the formulation of a problem.
The transfer of information with the protagonists (owner, herd manager, worker, technician) contains errors or partial information

-Emphasize infectious diseases (stop making the pig producer feel guilty, reassure the vet because of action: vaccines, antibiotics, …)

- A great deal of lab exams difficult to interpret (interpretation of the tests ?)

-Emphasize on uncommun disease (but not infections such as Lepto, PCV2)

-Emphasize « passive » informations / observations (herd visit constraints / batch farrowing)

-Emphasize a single source of information (employee versus owner)

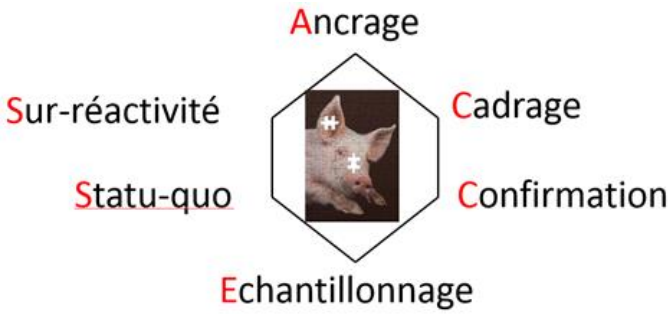
Statut quo biais

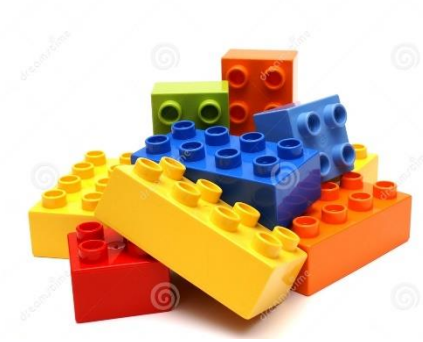
Favor the status which asks for less effort (of conviction, no risk-taking) as well on behalf of the veterinarian as of the producer.

From the point of view of the veterinarian: make it a lot to spare our égo.

From the point of view of the producer: " nothing changed! " While everything changes all the time.

Excess of faith in our own opinions which can lead the trend to pass fewer time in search of proofs. Action on partial information or on intuitions





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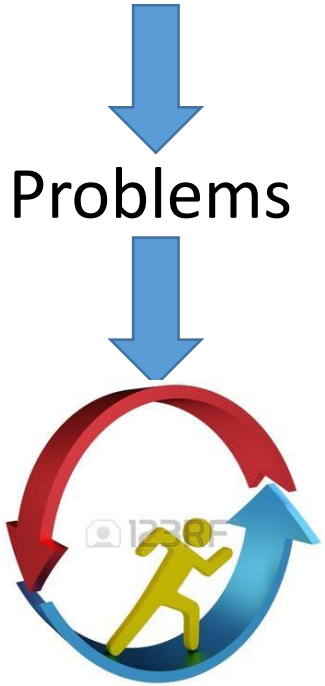
MANIPULATION, ENDOCTRINEMENT, FAUX SOUVENIRS : COMMENT LE CERVEAU RÉSISTE

AVRIL 2016

Very well done

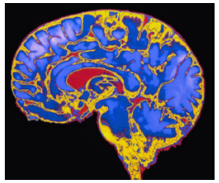


Problems

The « going overboard» syndrome (“GOS”) an emerging problem in swine herd management

G-P Martineau, INP-ENVT, A Durivage, Université du Québec en Outaouais,
J-P Vaillancourt, Université de Montréal

In almost 70 years of combined clinical experience in several countries in swine (GPM) and poultry (JPV) medicine, we have observed on numerous occasions what we call the « going overboard » syndrome. It occurs when, in an effort to do the very best to correct a situation or improve productivity, producers exaggerate in their intervention (hence the expression “going overboard”), exacerbating the problem or creating a new one. To illustrate, we propose to use Kahneman's “Thinking, Fast and Slow” that divides thought processes between two systems, System ① and System②



Why① → How → Why②

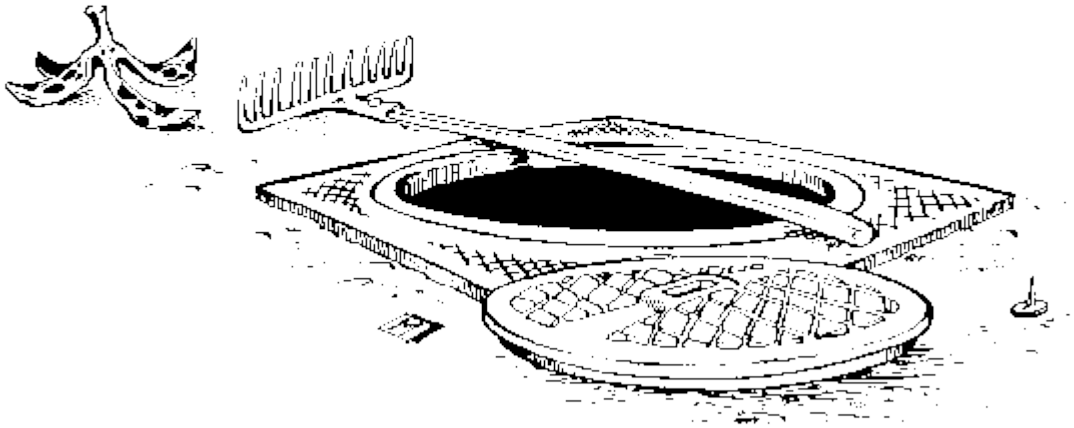
System 1 is fast; *it's intuitive, associative, metaphorical, automatic, impressionistic, and it can't be switched off. Its operations involve no sense of intentional control, but it's the "secret author of many of the choices and judgments we make"*

System 2 is slow, *deliberate, effortful. Its operations require attention. System 2 is slothful, and tires easily (a process called "ego depletion") – so it usually accepts what System 1 tells it.*

Table 1: GOS –psychological aspects associated with the behavior of overreacting when trying to solve an animal health problem (going overboard)

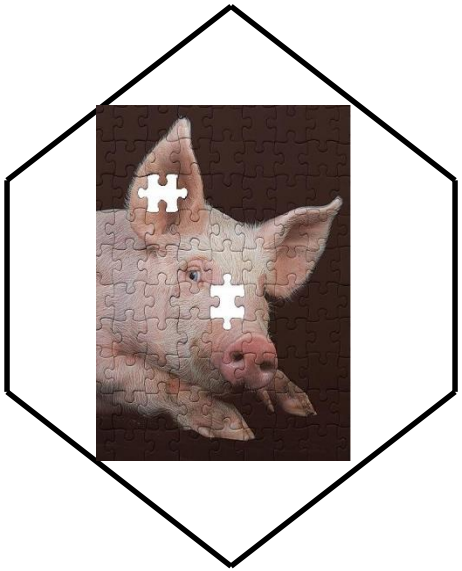
Hypothesis	When trying to solve a health problem, a producer may exhibits behaviors leading to treatment decisions and actions that clearly exceed what is normally required. The exact reasons that would push one to go overboard when treating animals are not known.

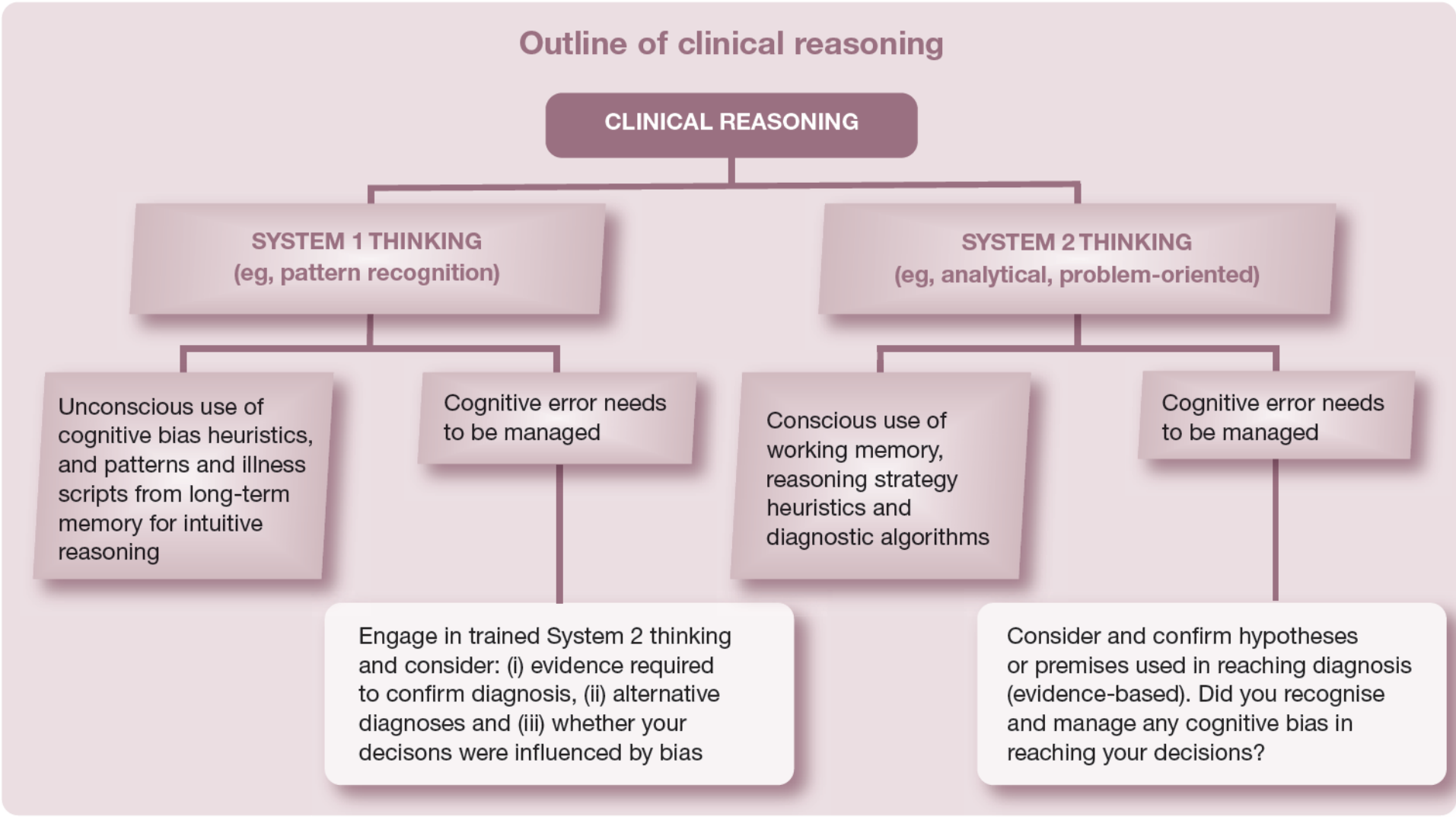
Abduction



THE HIDDEN TRAPS IN DECISION MAKING

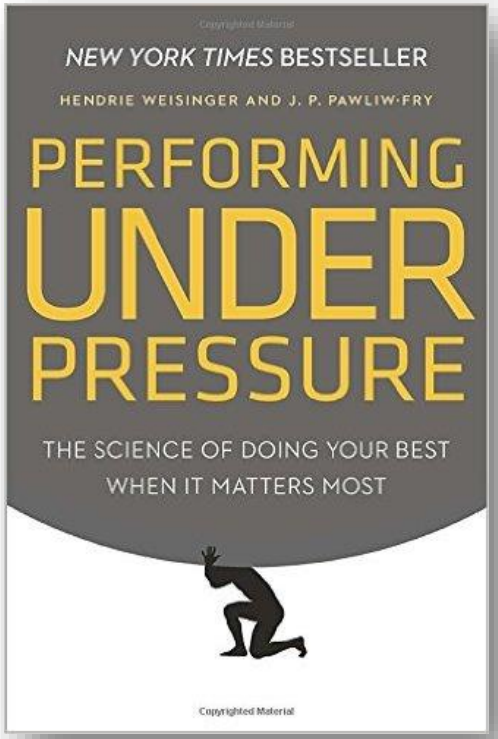
by John S. Hammond, Ralph L. Keeney, and Howard Raiffa




Outline of clinical reasoning
CLINICAL REASONING
SYSTEM 1 THINKING
(eg, pattern recognition)
SYSTEM 2 THINKING
(eg, analytical, problem-oriented)
Unconscious use of cognitive bias heuristics, and patterns and illness scripts from long-term memory for intuitive reasoning
Cognitive error needs to be managed
Conscious use of working memory, reasoning strategy heuristics and diagnostic algorithms
Cognitive error needs to be managed
Engage in trained System 2 thinking and consider: (i) evidence required to confirm diagnosis, (ii) alternative diagnoses and (iii) whether your decisons were influenced by bias
Consider and confirm hypotheses or premises used in reaching diagnosis (evidence-based). Did you recognise and manage any cognitive bias in reaching your decisions?

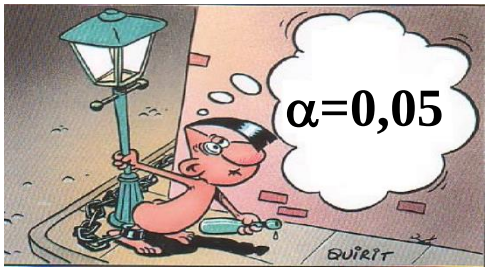
Conclusion 1/4

- Clinical approach(initiative) is the spearhead of the approach for problems in swine medicine
  - Expert
  - Novice
- Traps are numerous and fearsome
  - Expert
  - Novice
- Be careful concerning « Laboratory God »
- Non infectious >>>>> infectious



Conclusion 2/4

- The producer is the central element of enzootic problems in reproductive (as well as others) area
- Clinical approach is a Science even if we faced inaccuracies, imperfections, uncertainties AND traps



Conclusion 3/4

KNOWLEDGE

Veterinary expertise

INFORMATION

Data analysis

Conclusion 4/4

… « *a diagnosis is a matter of fact. It is not a matter of opinion* »

Steve Henry, « *for each mistake we make by not knowing, we shall make ten mistakes by not looking* »

It was:

Actual swine reproduction problems (infectious and non infectious) including clinical investigation methodology and diagnostic traps

Part 1

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