

Strong impact of the genetic background of both virus and host in the evolutionary battle of porcine circovirus type 2 with pigs



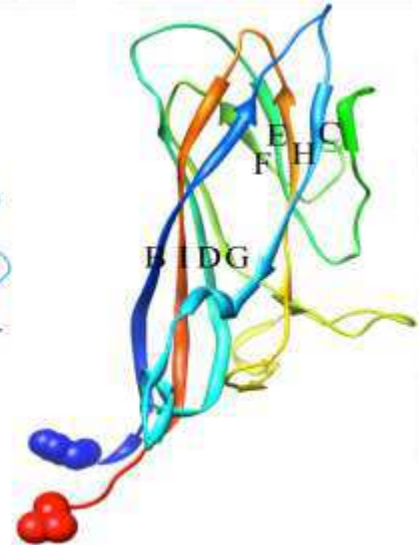
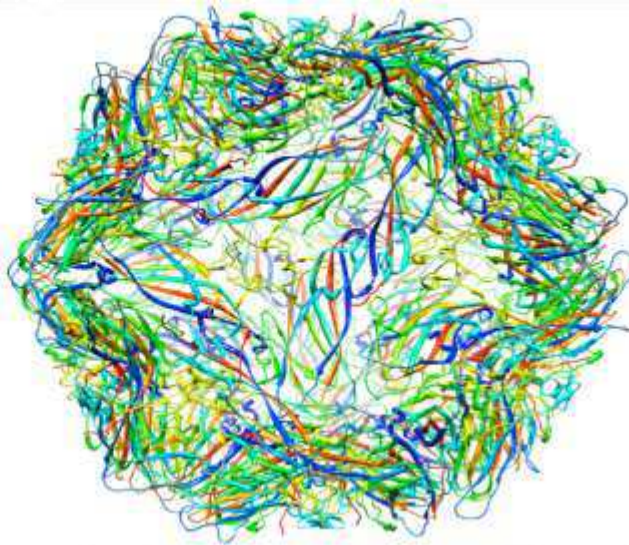
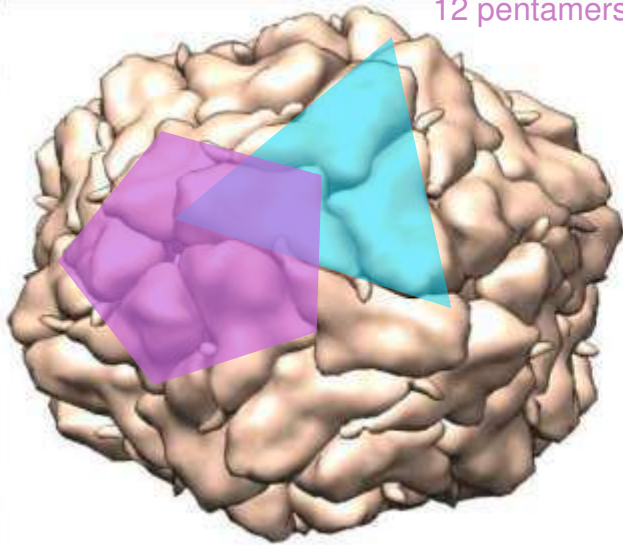
Hans Nauwynck



PCV2

Virus

60 capsomers
20 trimers
12 pentamers



David Lefebvre



Dipongkor Saha

Genetic changes (PCV2a, b, d) -> amino acid changes (different Mab recognition)

PCV2

Historical background

Reproductive problems



2-8 cells
(0-4dpins)



morula
(4-5dpins)



blastocyst
(5-7dpins)



hatched blastocyst
(>7dpins)

PCV2
replication

-

-

-

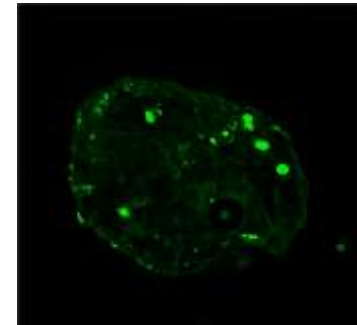
+



Bart Mateusen

PCV2 infection of embryos

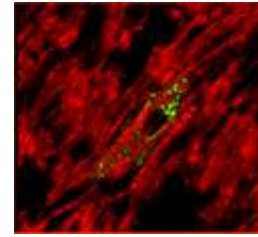
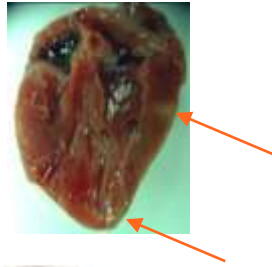
- embryonic death
- return to oestrus of sow



PCV2

Historical background

Reproductive problems



Innoculated (days of gestation)	Aspect at birth	Virus	Antibodies	Intra-uterine spread	Interruption of gestation
50	mummified	+	-	+	-
75	stillborn, autolytic	+	+	-	-
92	normal	+	+	-	-



Romeo Sanchez

SMEDI

PCV2

Historical background

Postweaning Multisystemic Wasting Syndrome (PMWS)
~ immunostimulations
(co-infections/vaccination)



Big debate on the pathogenesis
How do pigs develop PMWS?
Belgium - no big problems



PCV2

Historical background

Postweaning Multisystemic Wasting Syndrome (PMWS)
~ immunostimulations
(co-infections/vaccination)

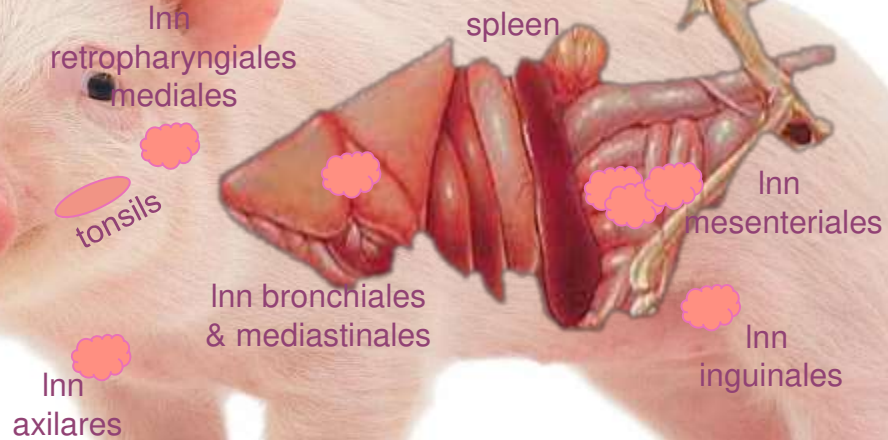


Peter Meerts

Increased PCV2 replication
in gnotobiotic pigs by Con A stimulation
~ lymphoblastogenesis

PCV2

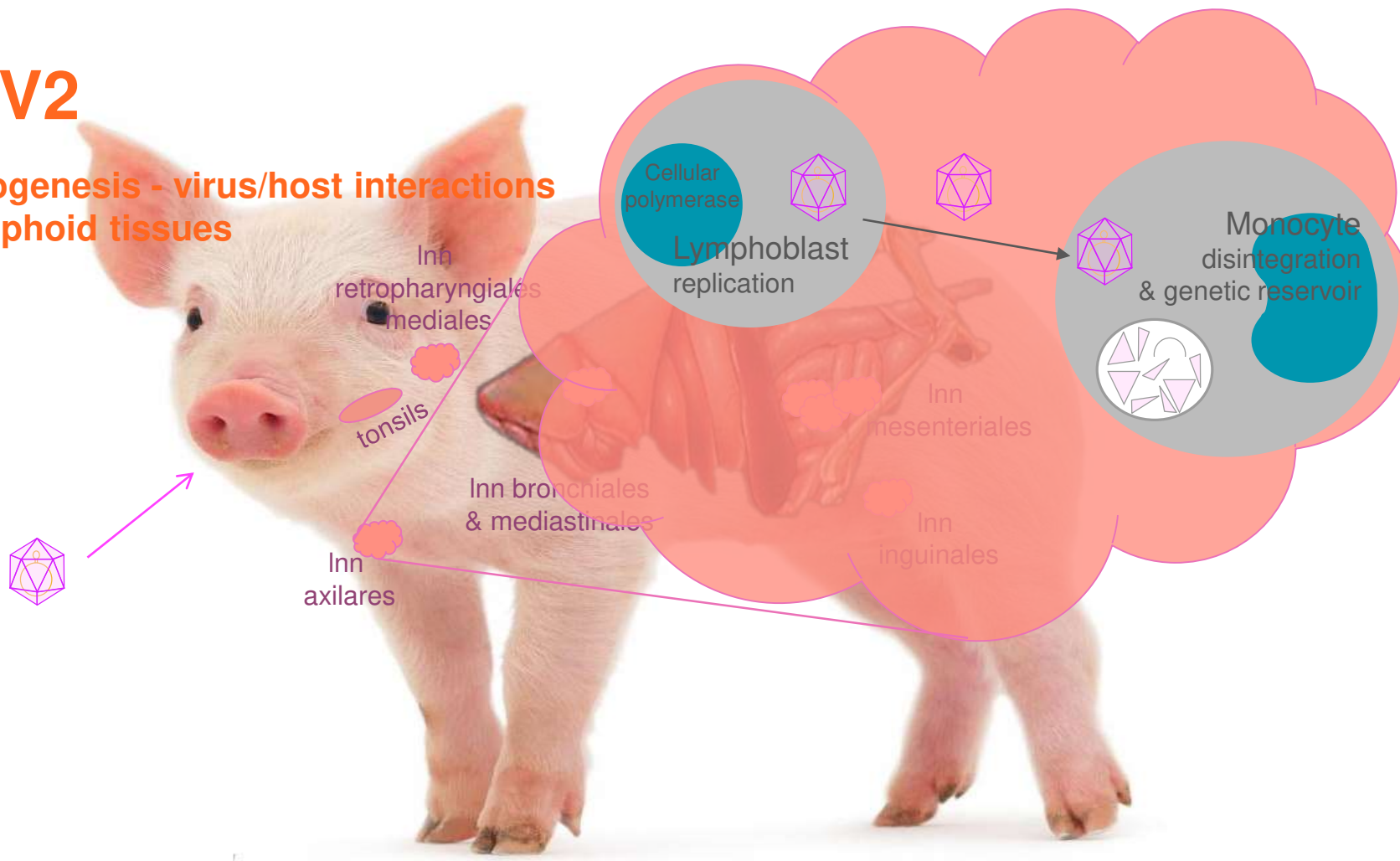
Pathogenesis - virus/host interactions ~ lymphoid tissues



Romeo Sanchez

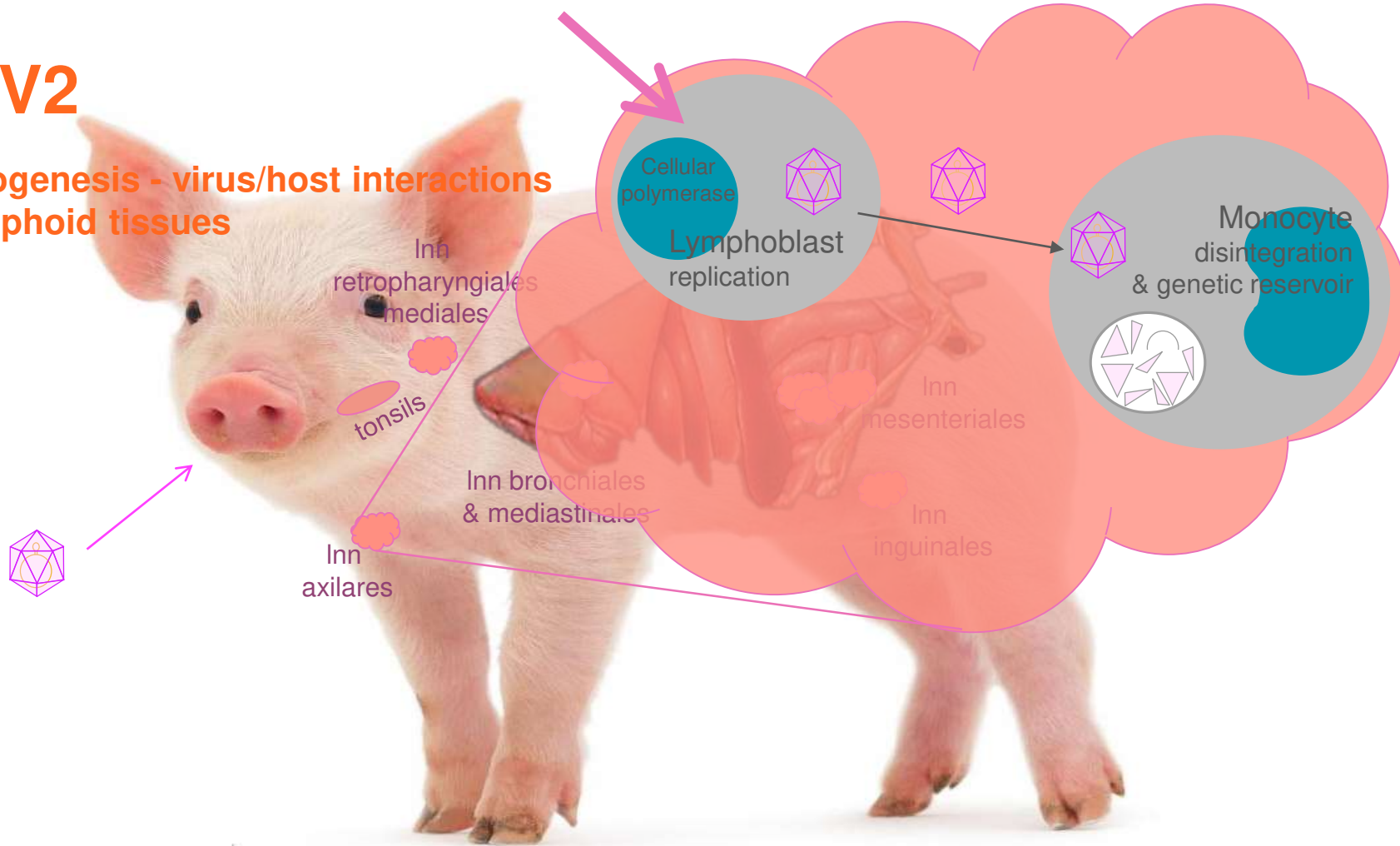
PCV2

Pathogenesis - virus/host interactions ~ lymphoid tissues



PCV2

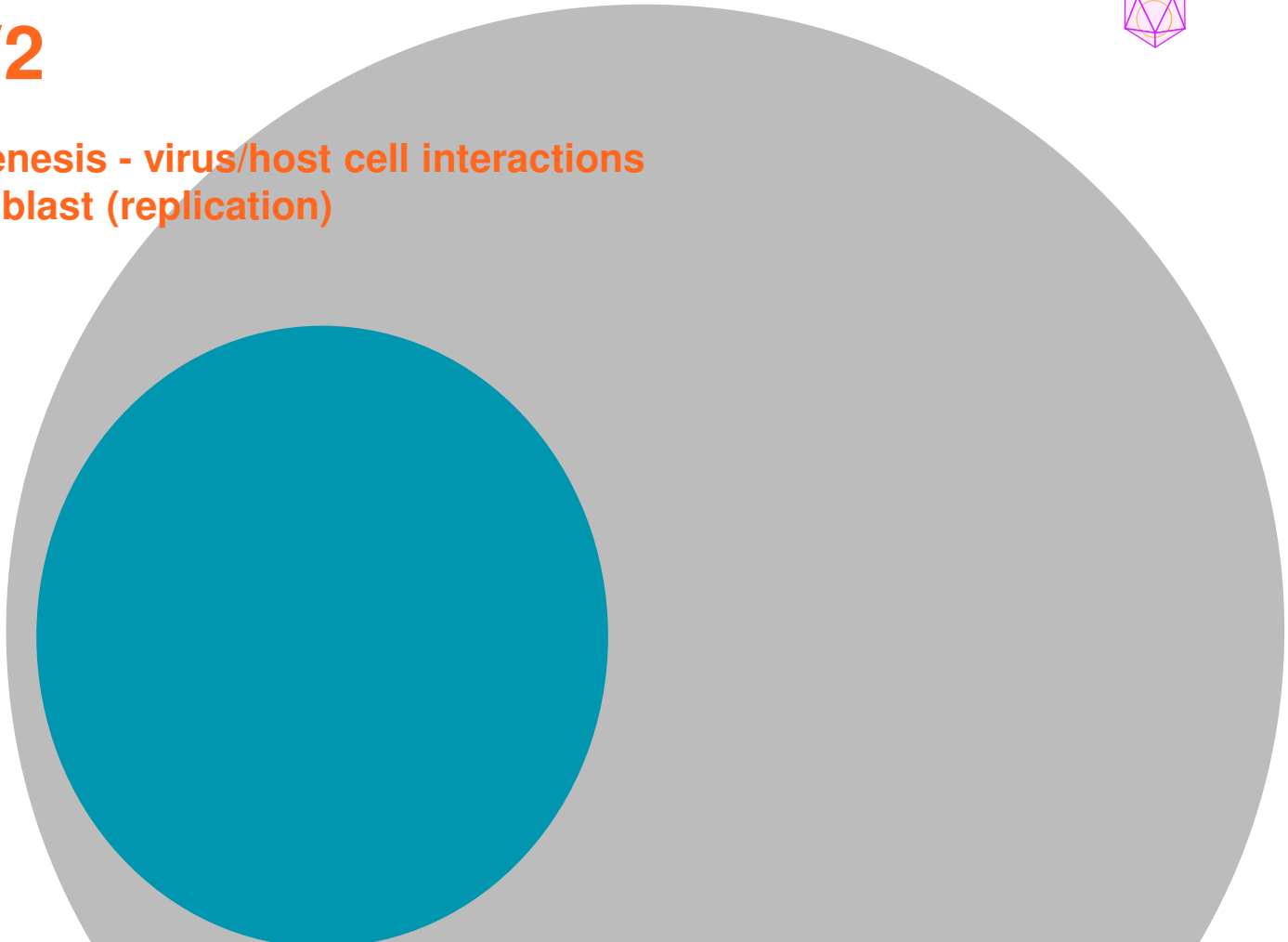
Pathogenesis - virus/host interactions ~ lymphoid tissues



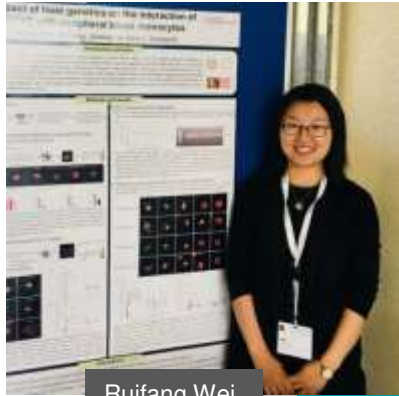


PCV2

Pathogenesis - virus/host cell interactions
Lymphoblast (replication)



PCV2

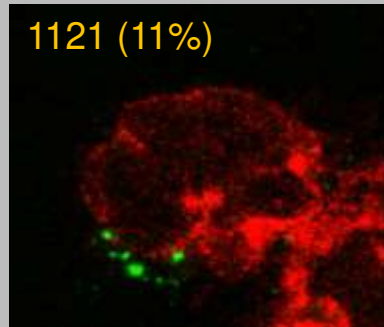


Ruifang Wei

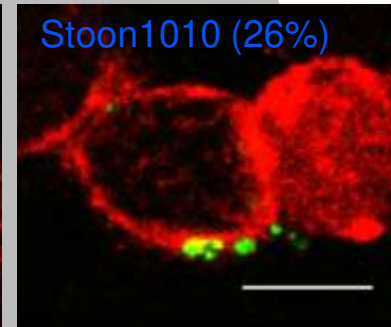


Gerald Misinzo

PCV2a



1121 (11%)



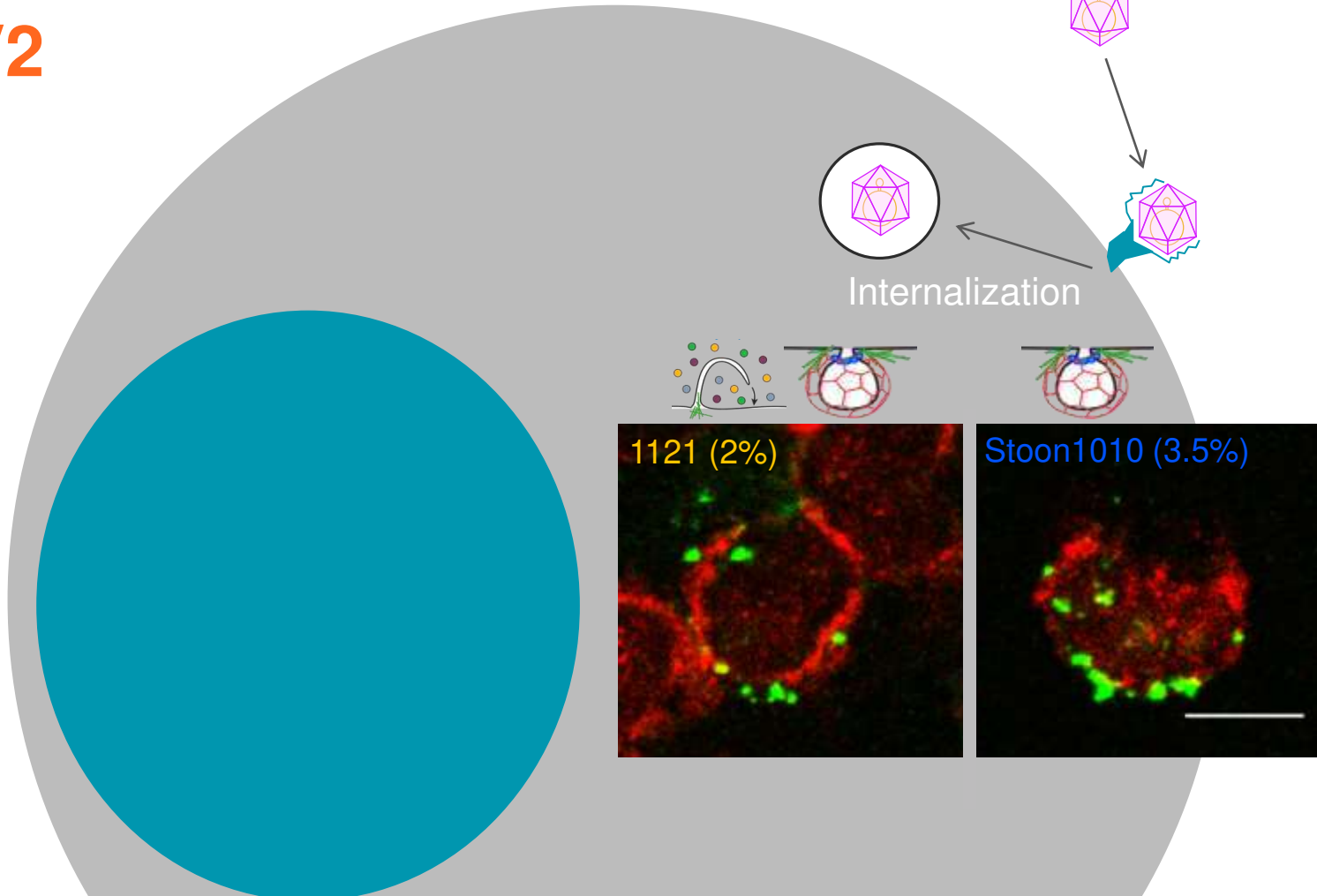
Stoon1010 (26%)



- Binding
- chondroitin sulphate (34%)
 - receptor X (66%)

~ PCV2b and d

PCV2

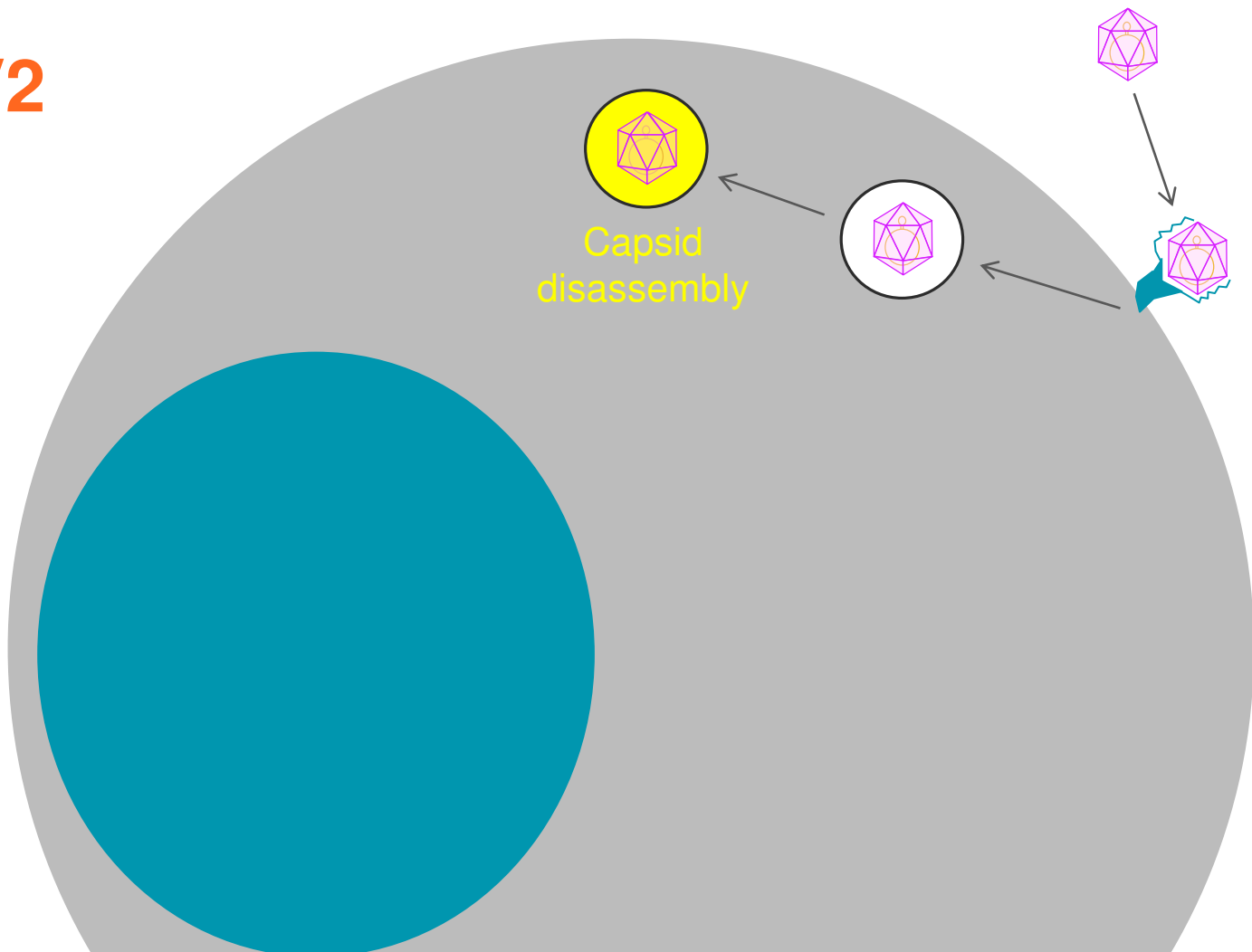


Internalization

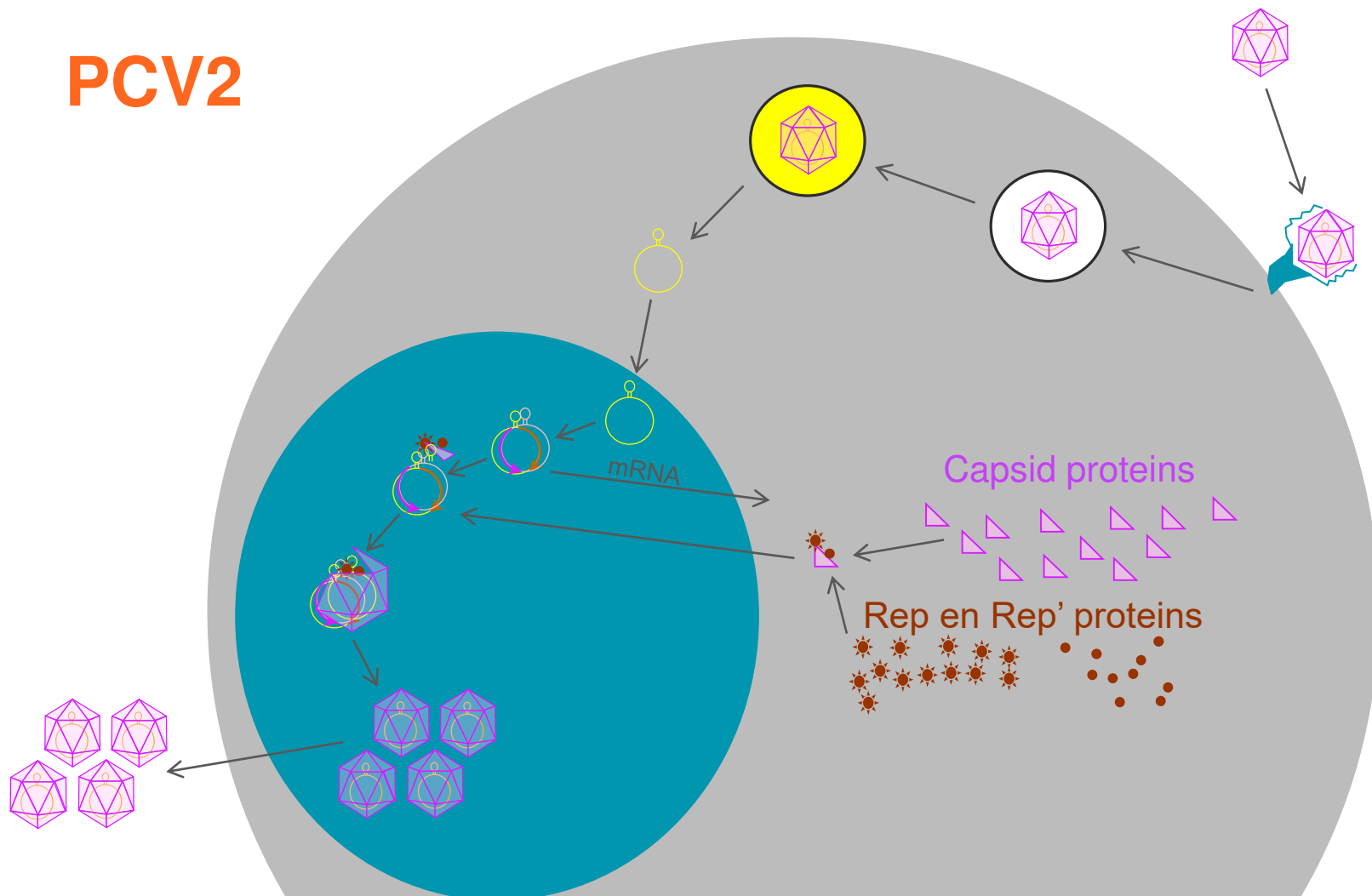
1121 (2%)

Stoon1010 (3.5%)

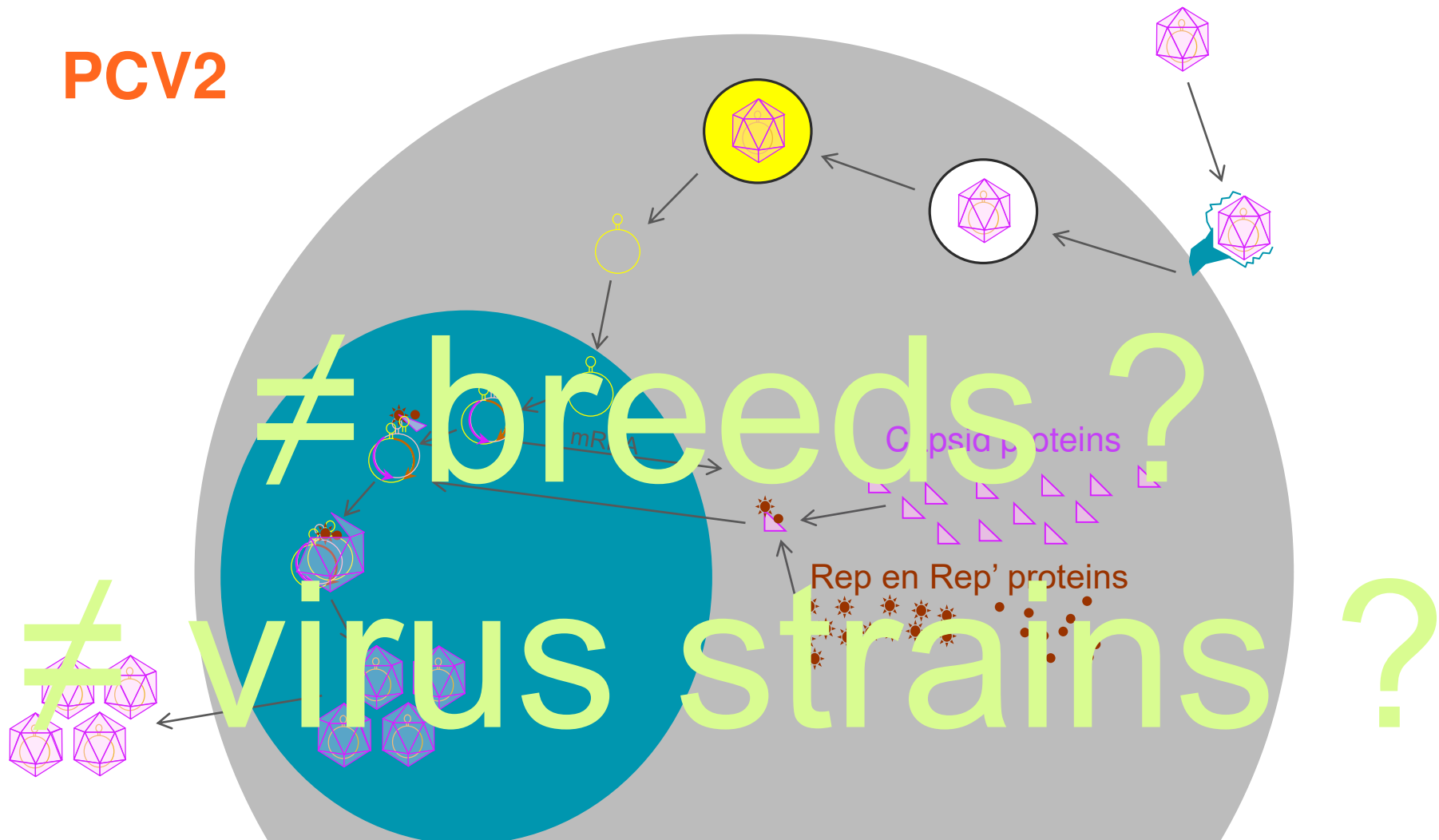
PCV2



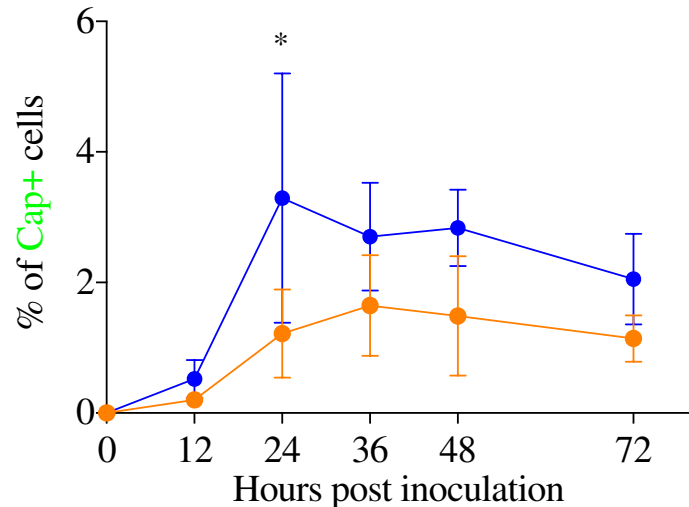
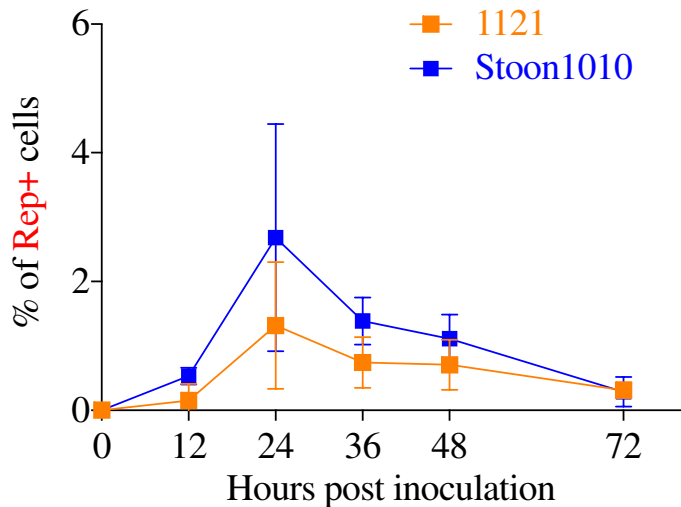
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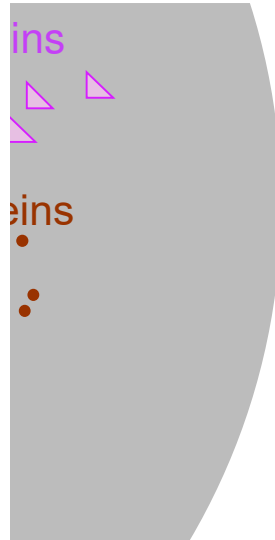
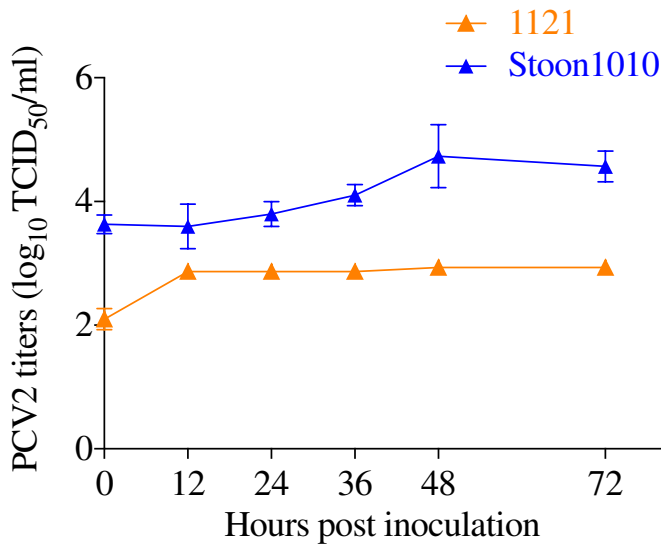
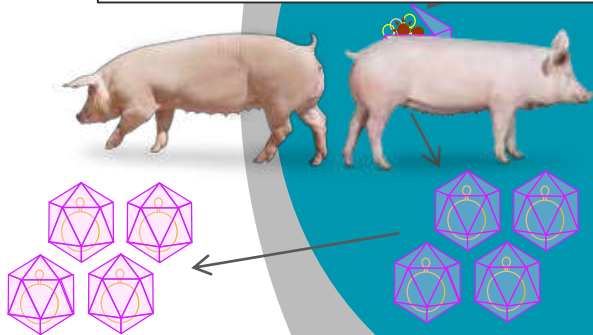
PCV2



PCV2

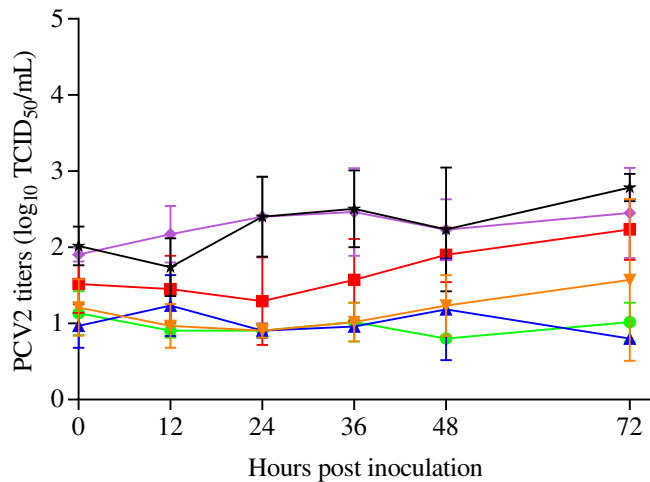
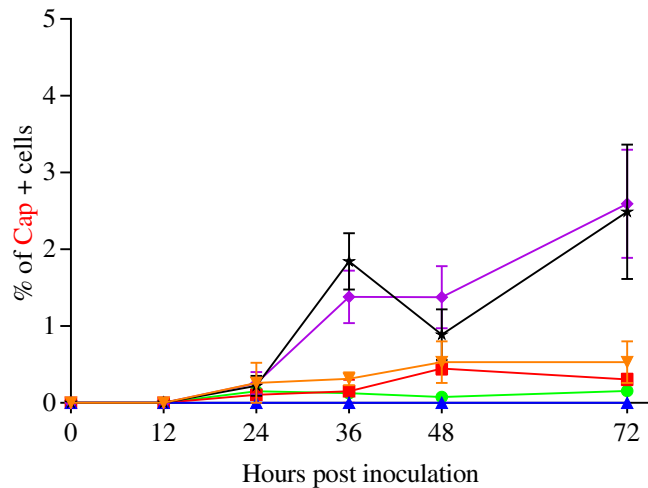
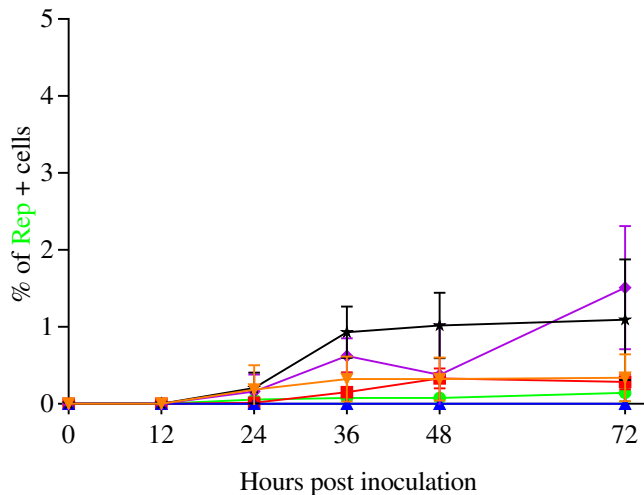


♂ Piétrain x
♀ [Landrace x LW]

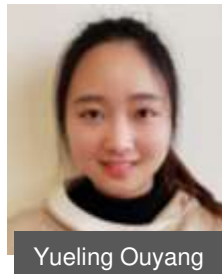
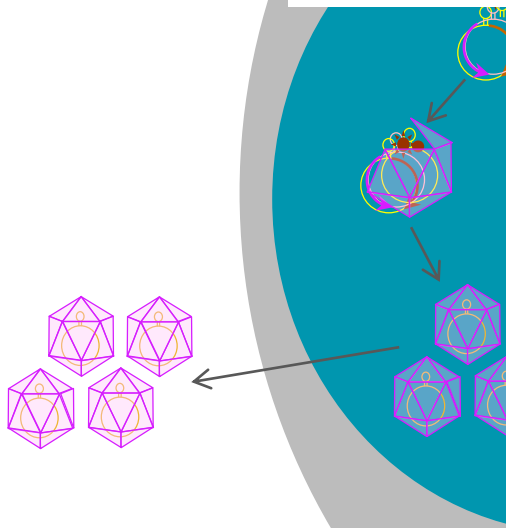


PCV2

Purebred
Piétrain



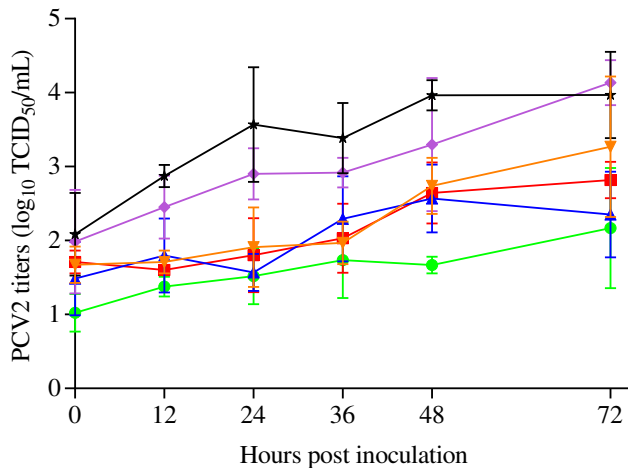
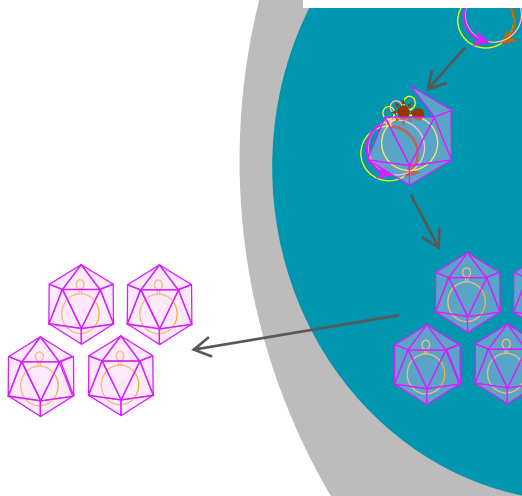
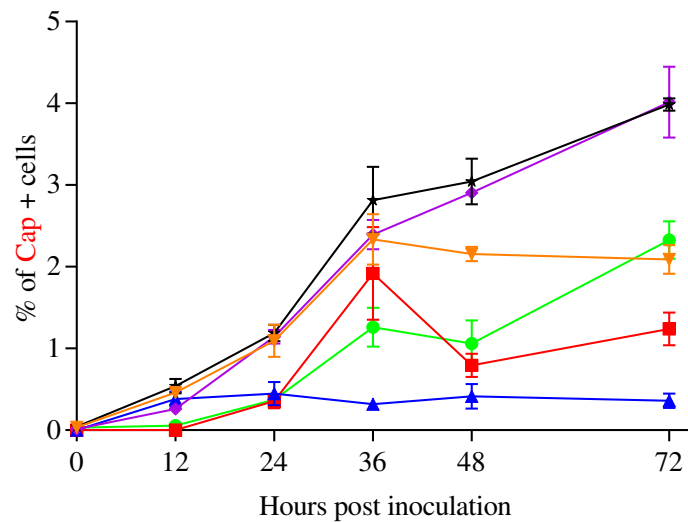
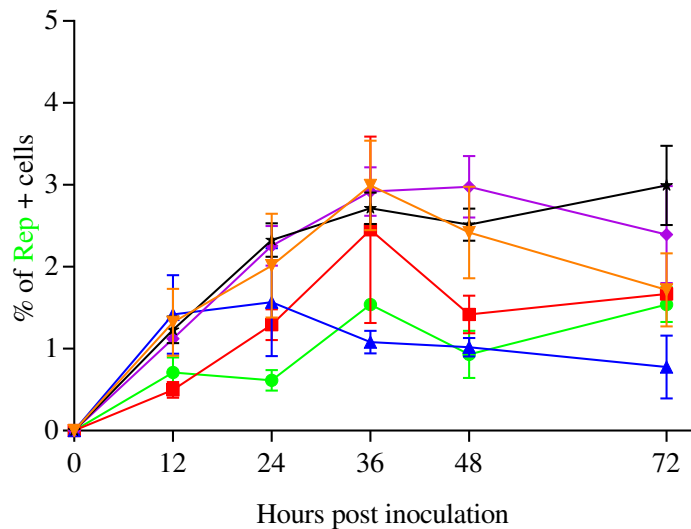
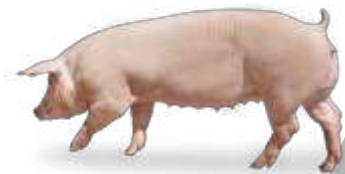
- 1121 PCV2a
- 1010 PCV2a
- ▲ 1147 PCV2b
- ▼ 09V448 PCV2d-1
- ◆ DE222-13 PCV2d-2
- ★ 19V245 PCV2d-2



Yueling Ouyang

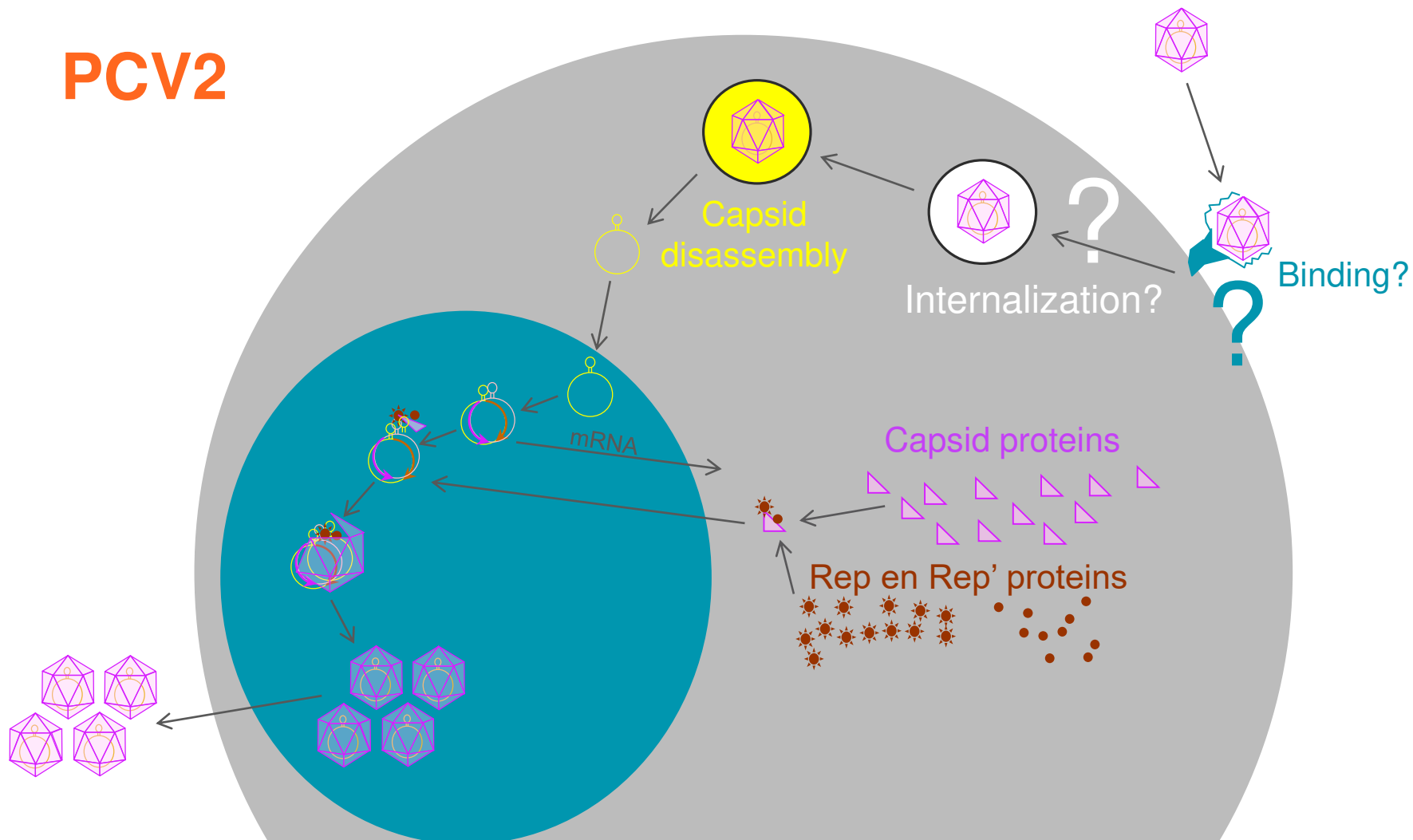
PCV2

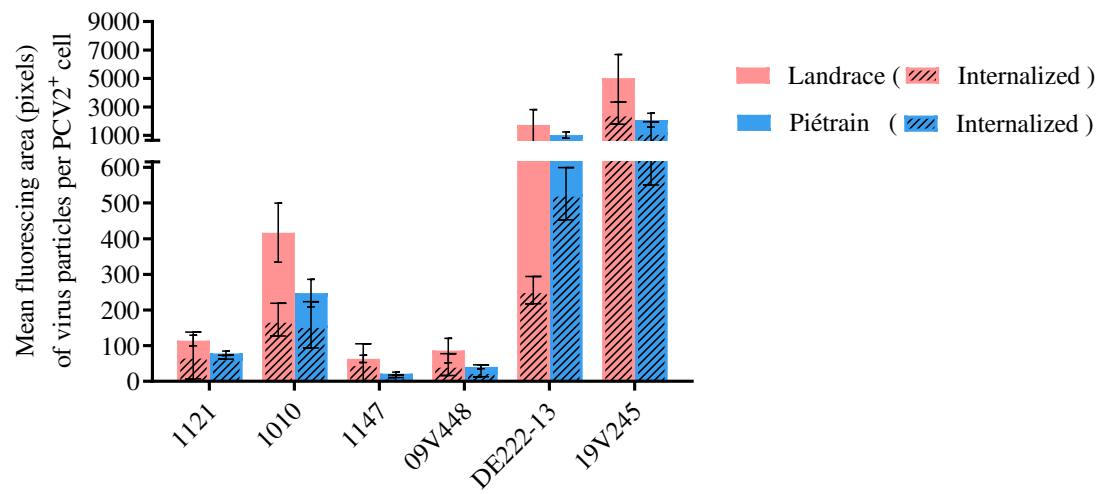
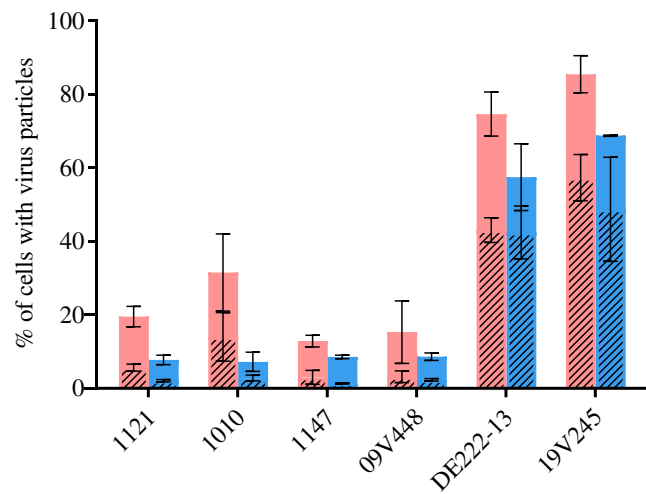
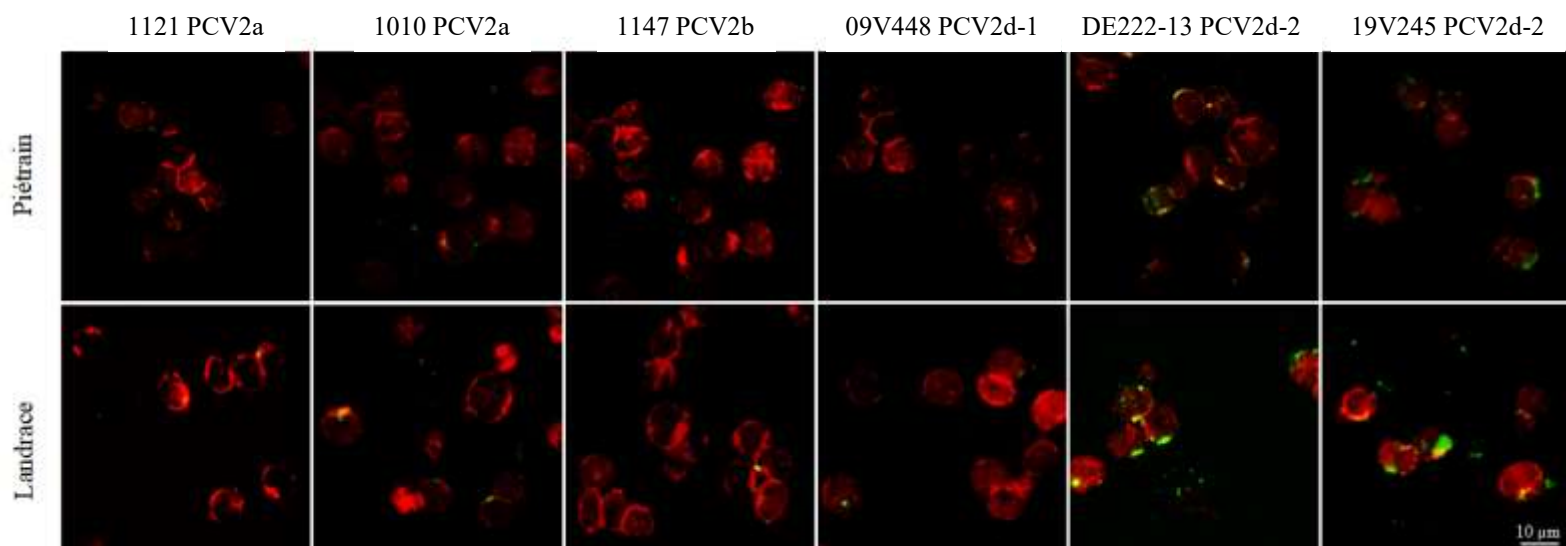
Purebred
Landrace



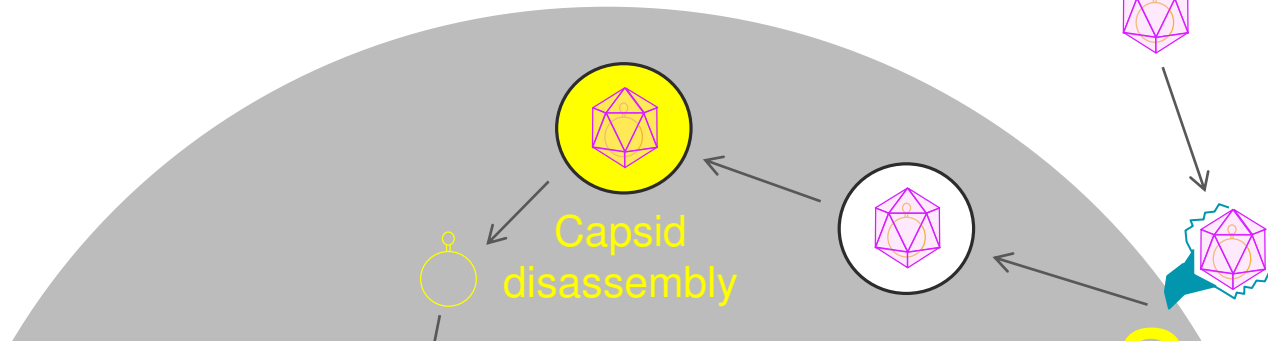
- 1121 PCV2a
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- ▼ 09V448 PCV2d-1
- ◆ DE222-13 PCV2d-2
- ★ 19V245 PCV2d-2

PCV2





PCV2



PCV2a - 1121

PCV2b - 1147

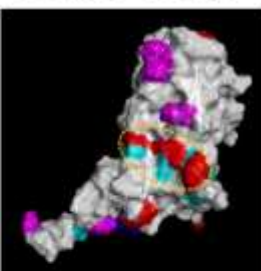
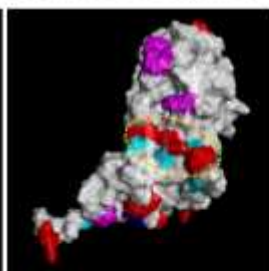
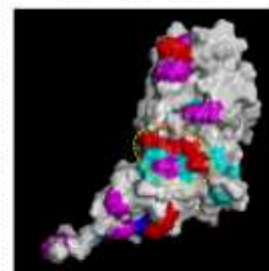
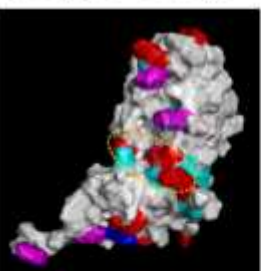
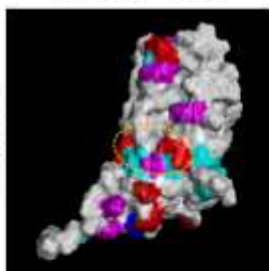
PCV2d-1 - 09V448

PCV2a - 1010

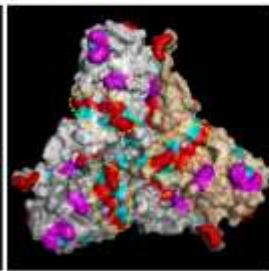
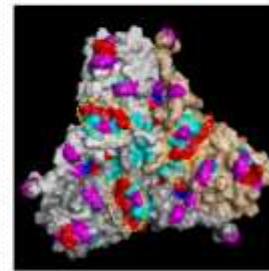
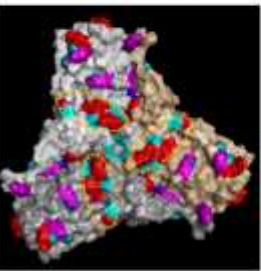
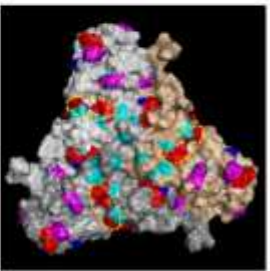
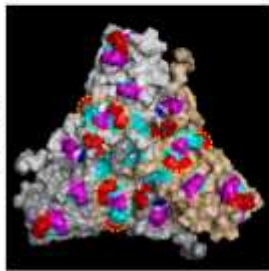
PCV2d-2 - DE222-13

PCV2d-2 - 19V245

Monomer



Trimer

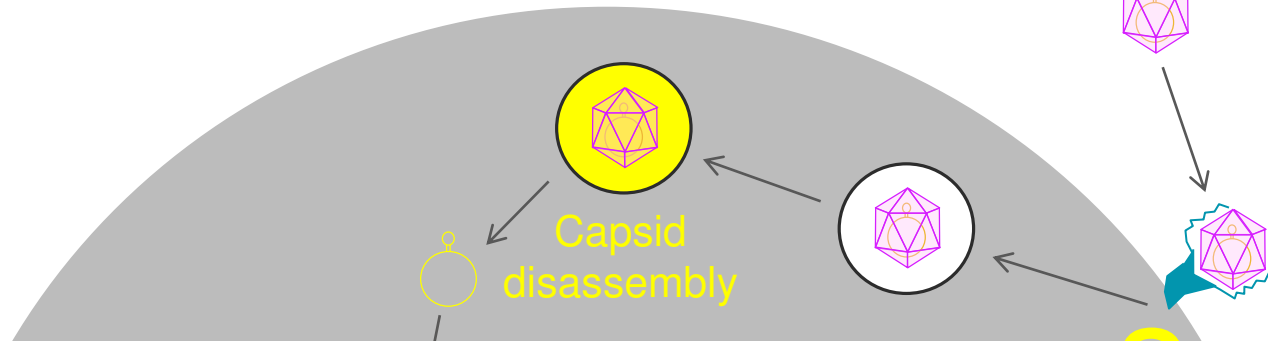


Configuration 1

Configuration 2

- + arginin
- + lysine
- aspartic acid
- glutamic acid

PCV2



PCV2a - 1121

PCV2b - 1147

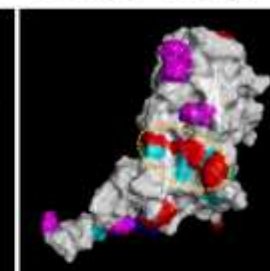
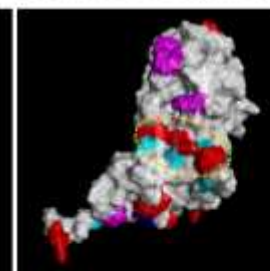
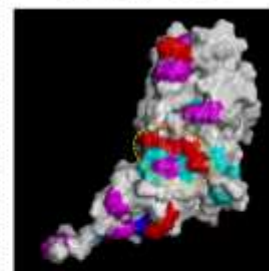
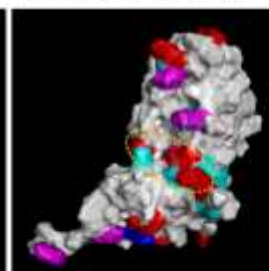
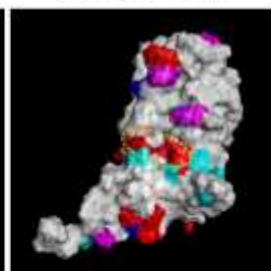
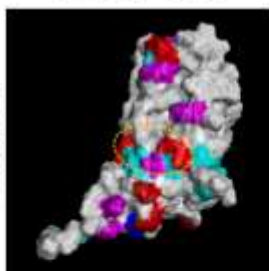
PCV2d-1 - 09V448

PCV2a - 1010

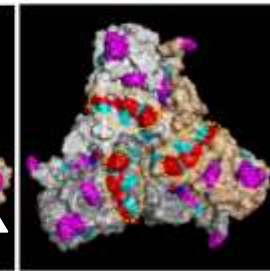
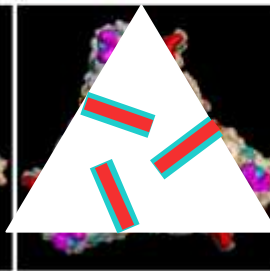
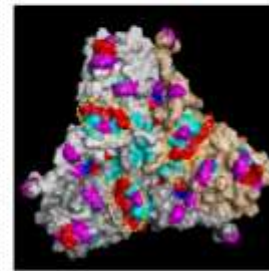
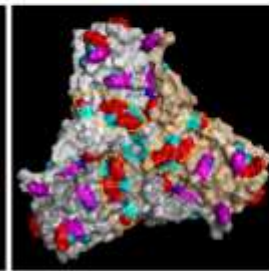
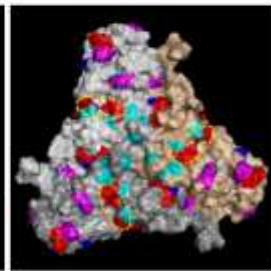
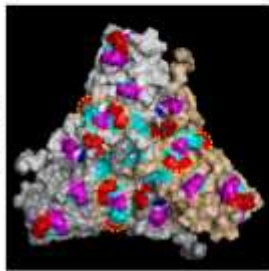
PCV2d-2 - DE222-13

PCV2d-2 - 19V245

Monomer



Trimer

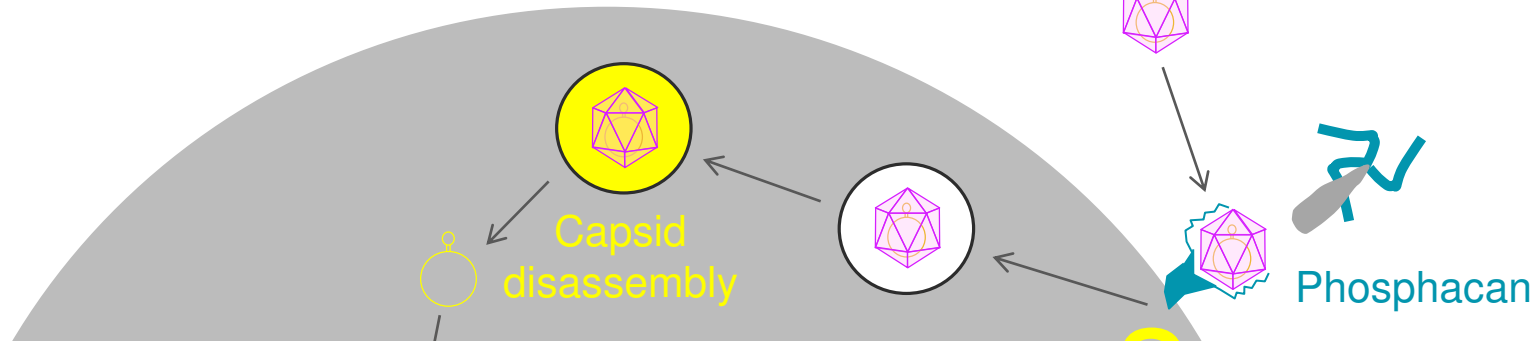


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Configuration 2

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PCV2



PCV2a - 1121

PCV2b - 1147

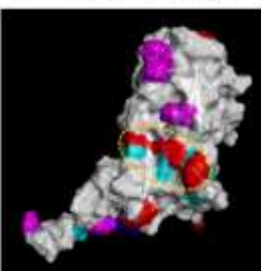
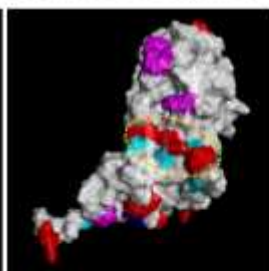
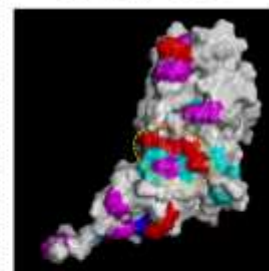
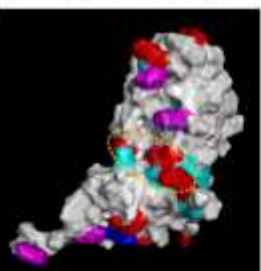
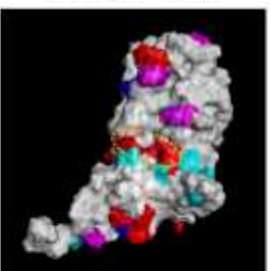
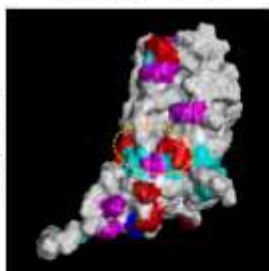
PCV2d-1 - 09V448

PCV2a - 1010

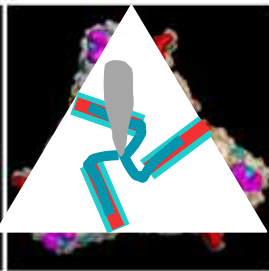
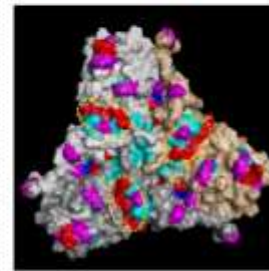
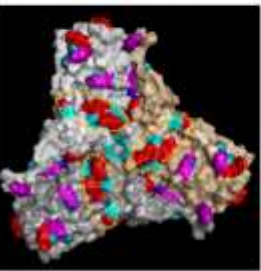
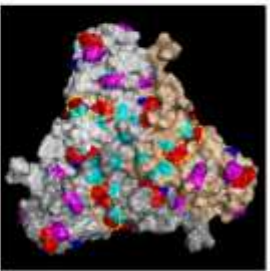
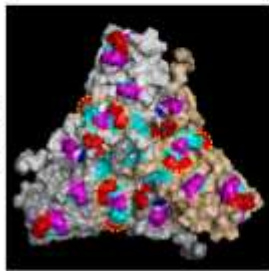
PCV2d-2 - DE222-13

PCV2d-2 - 19V245

Monomer



Trimer

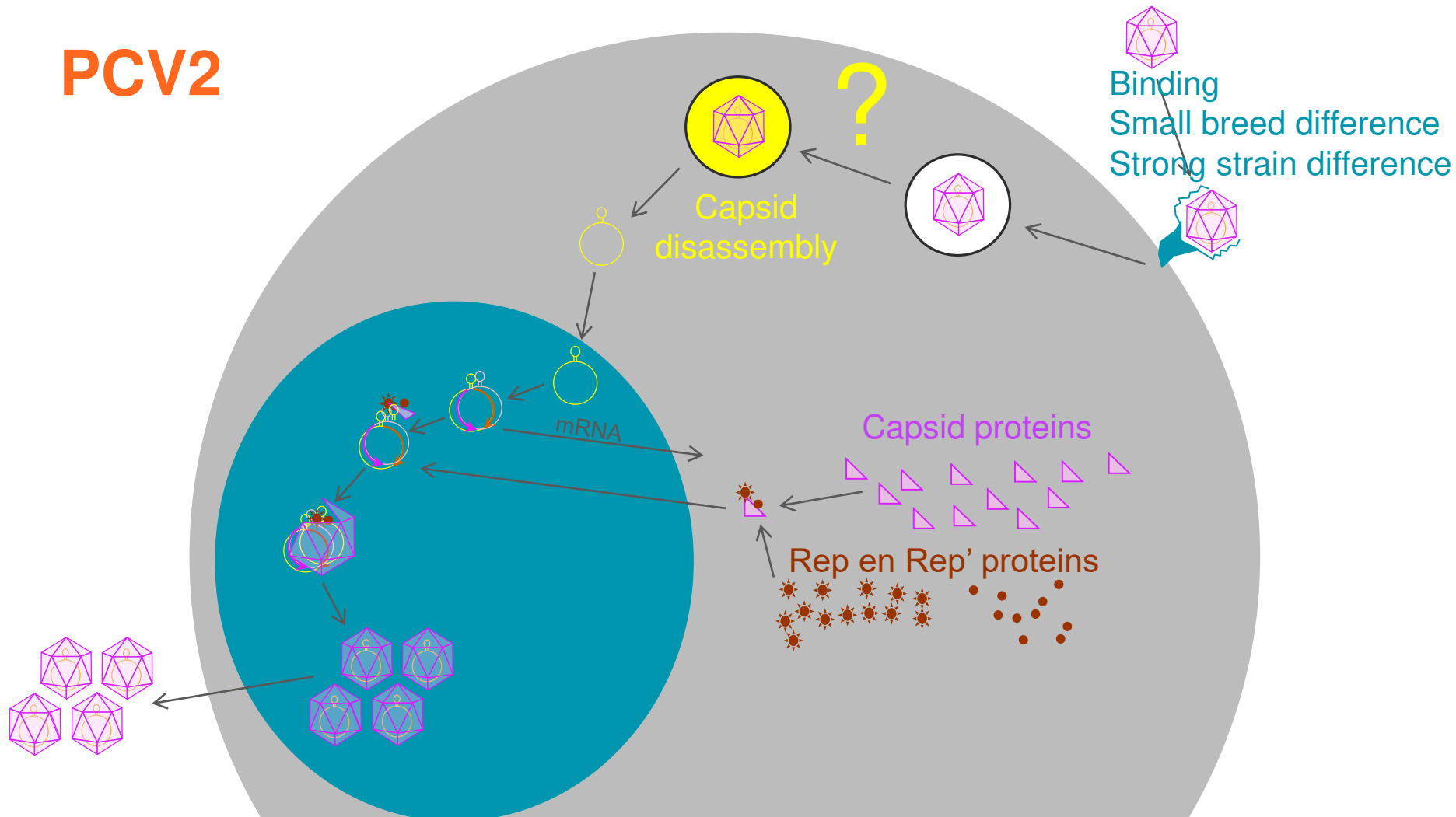


Configuration 1

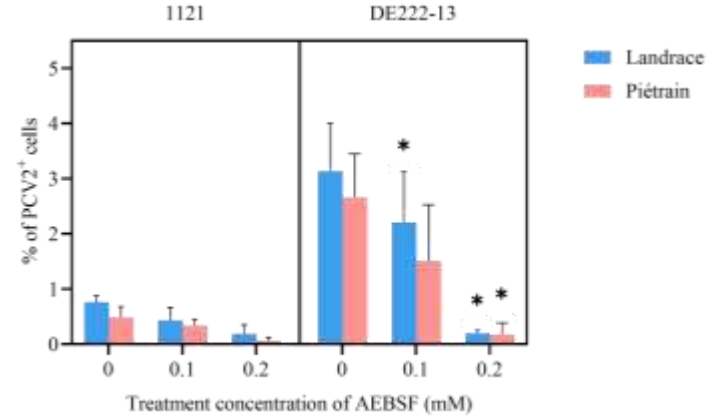
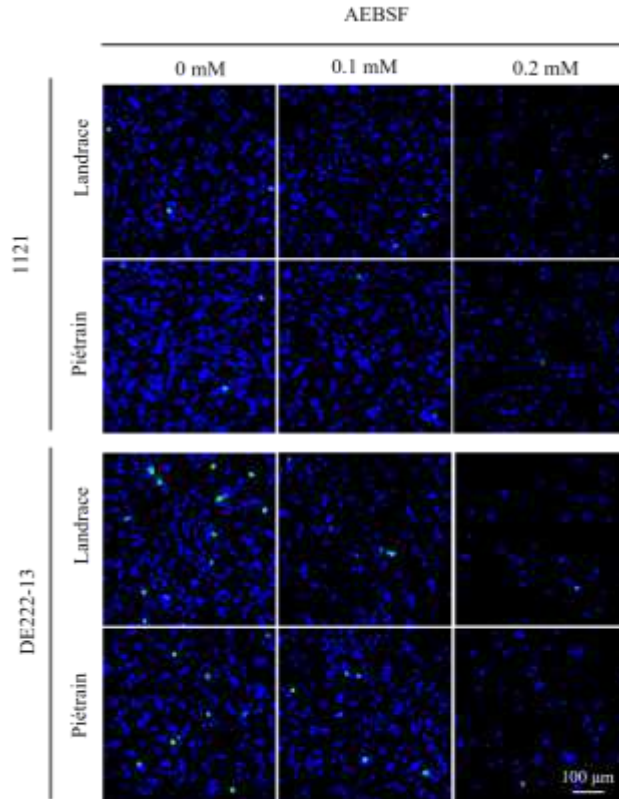
Configuration 2

- + arginin
- + lysine
- aspartic acid
- glutamic acid

PCV2

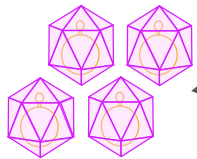


PCV2



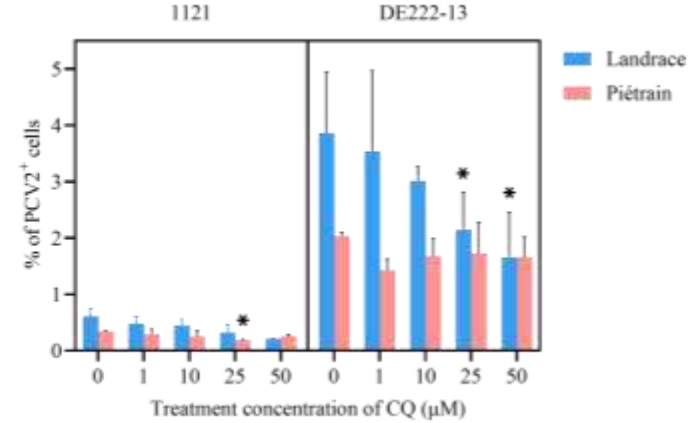
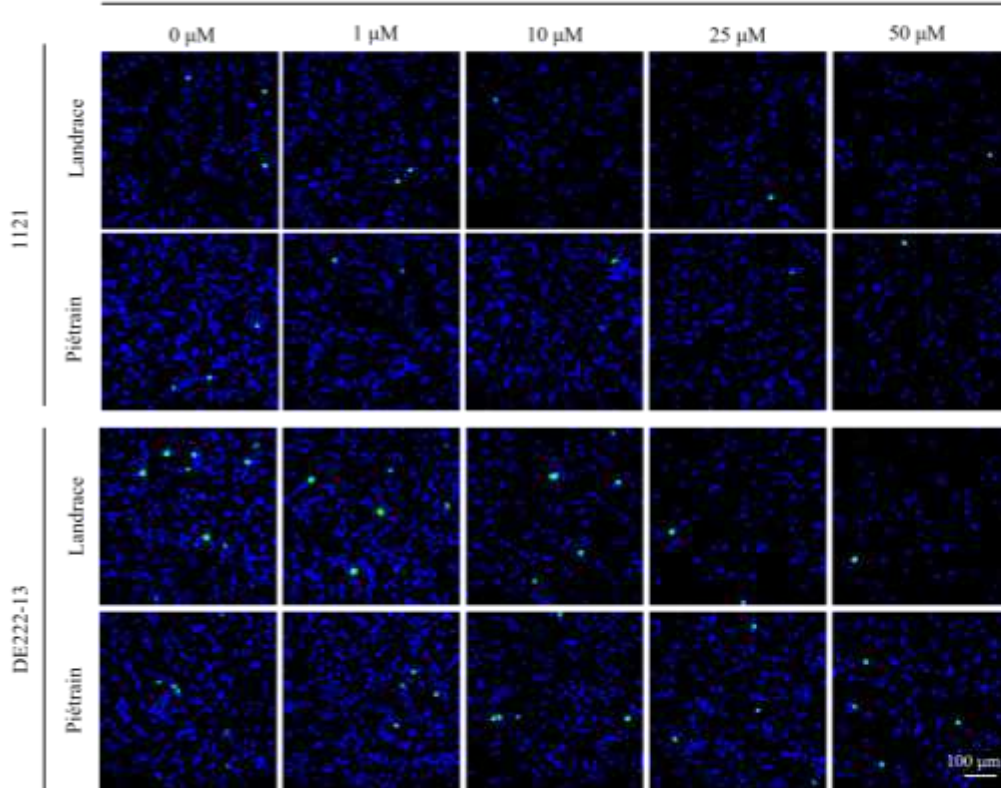
AEBSF=
serine protease inhibitor

ALL INVOLVED PROTEASES
ARE SERINE PROTEASES



PCV2

Chloroquine (CQ)

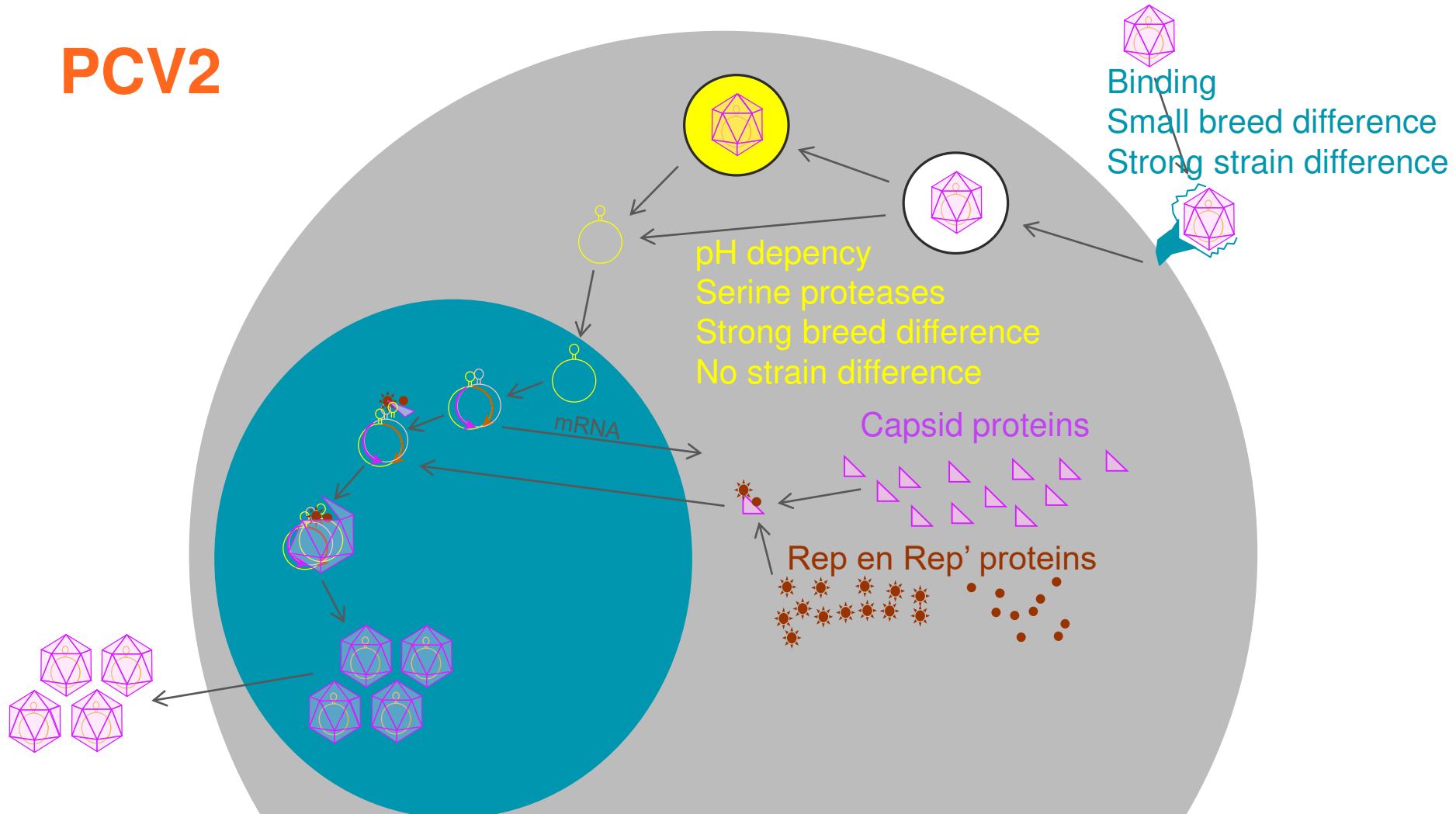


**Chloroquine =
blocker of pH drop**

**PIÉTRAIN:
PROTEASES ONLY AT pH=7
LANDRACE:
PROTEASES AT pH=7 & LOW pH**

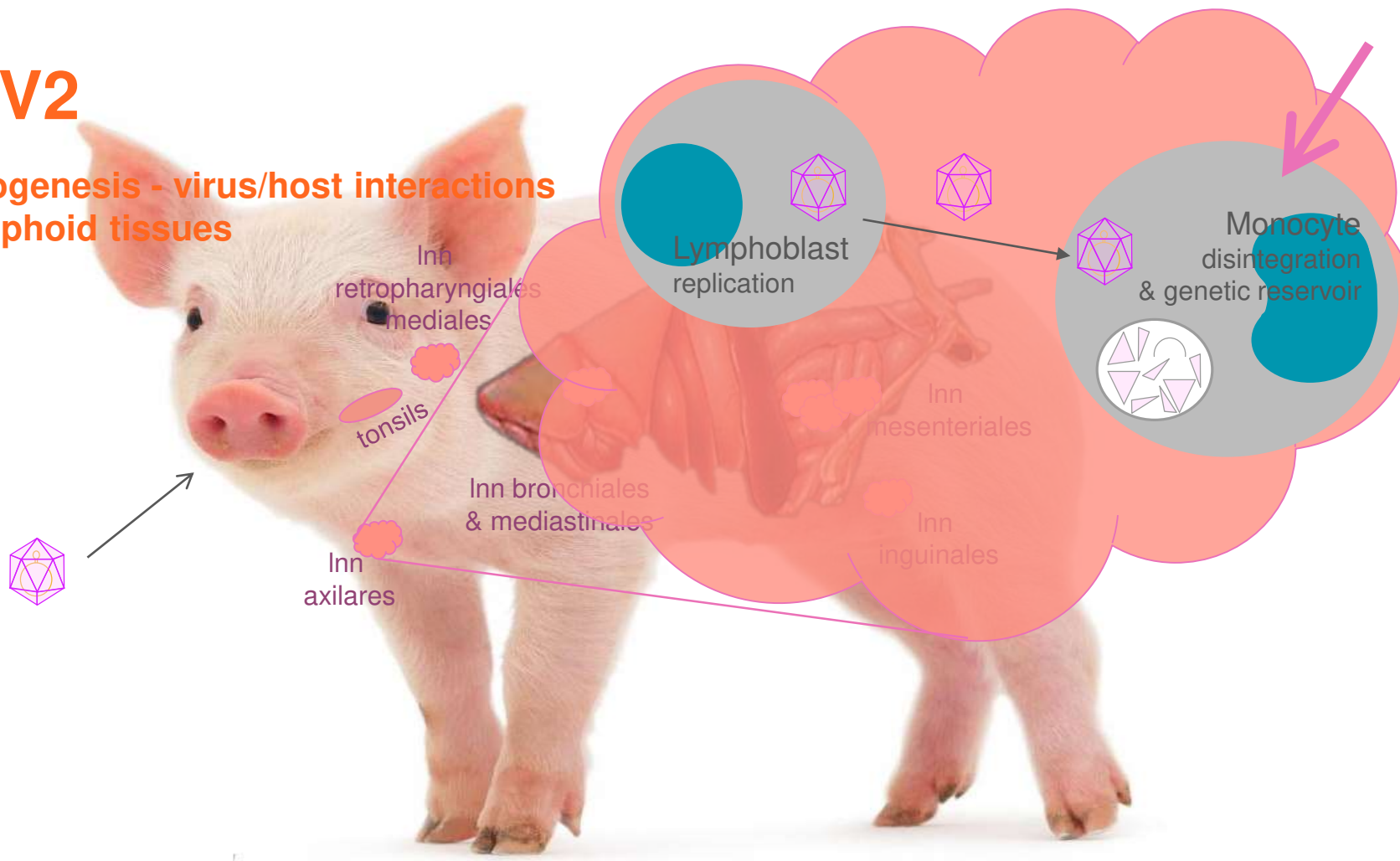


PCV2



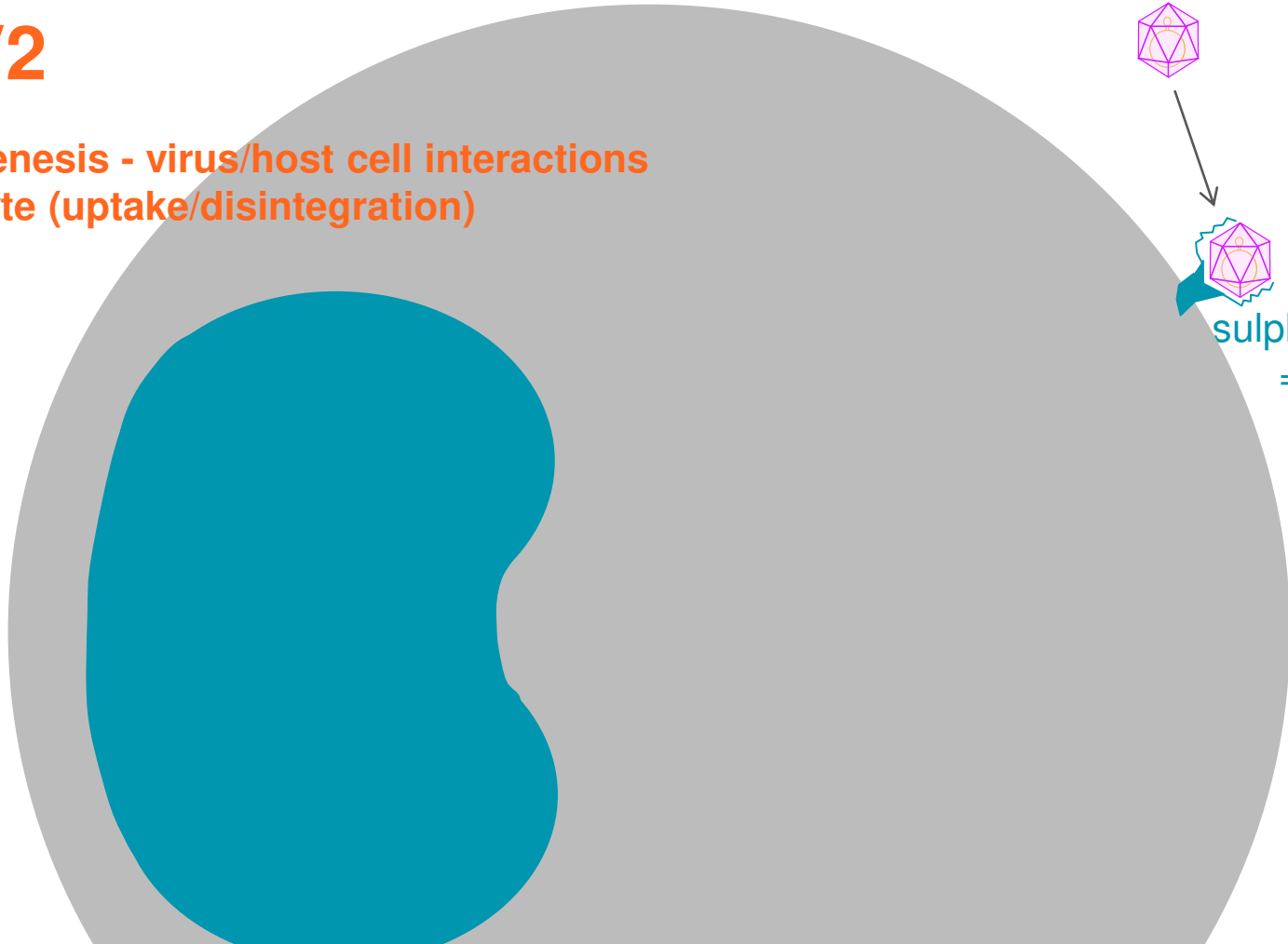
PCV2

Pathogenesis - virus/host interactions
~ lymphoid tissues



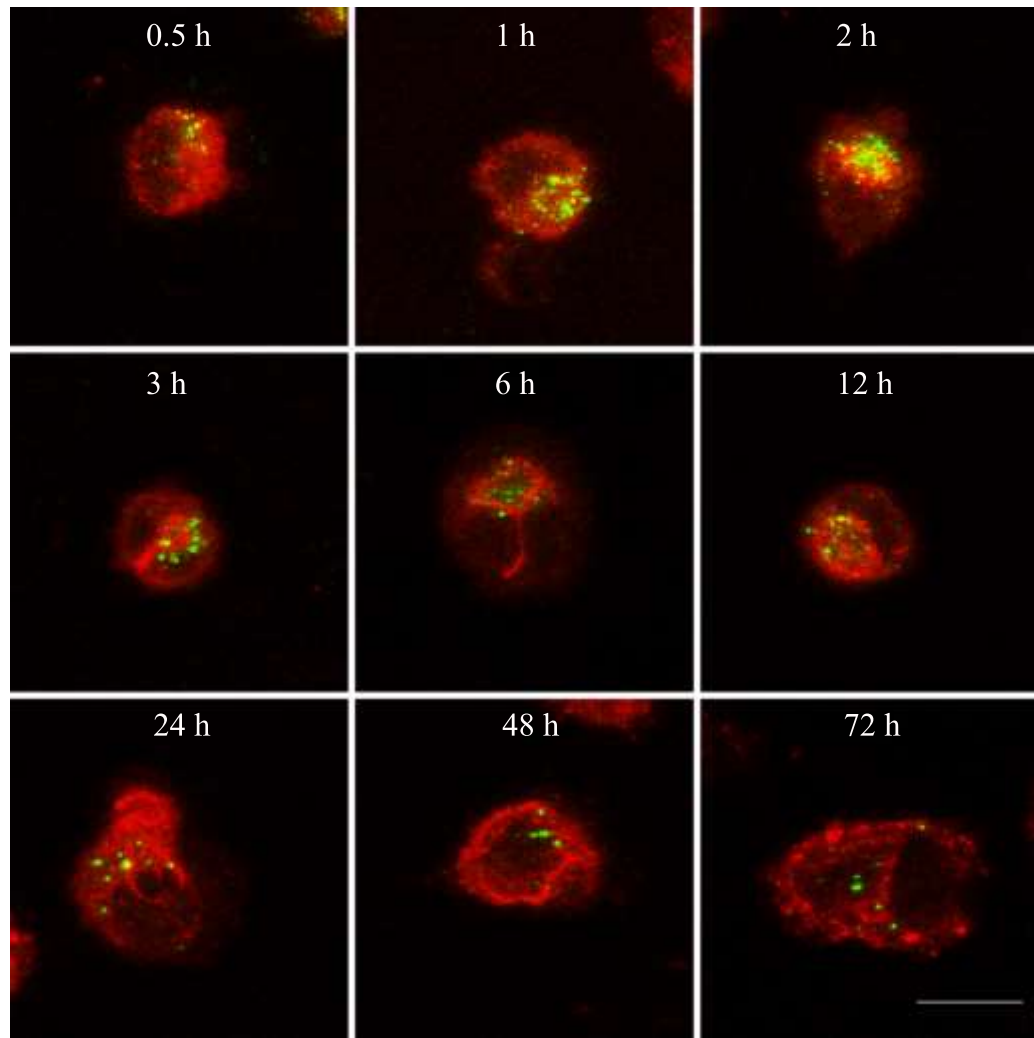
PCV2

Pathogenesis - virus/host cell interactions
Monocyte (uptake/disintegration)



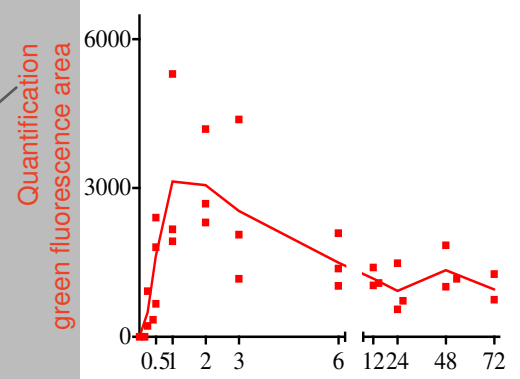
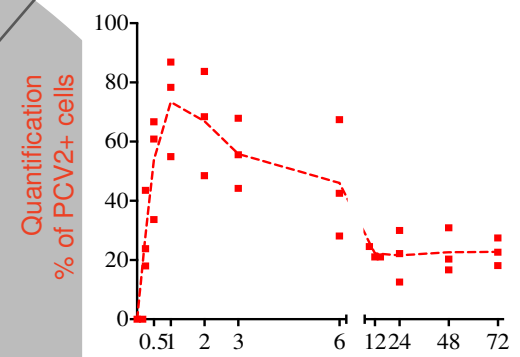
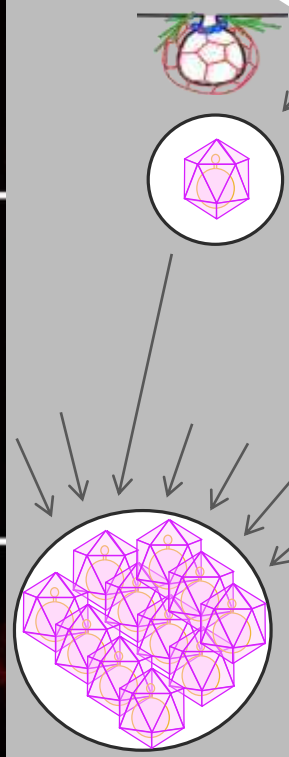
Binding

- chondroitin sulphate ($\pm 30\%$)
= phosphacan
- receptor X (70%)



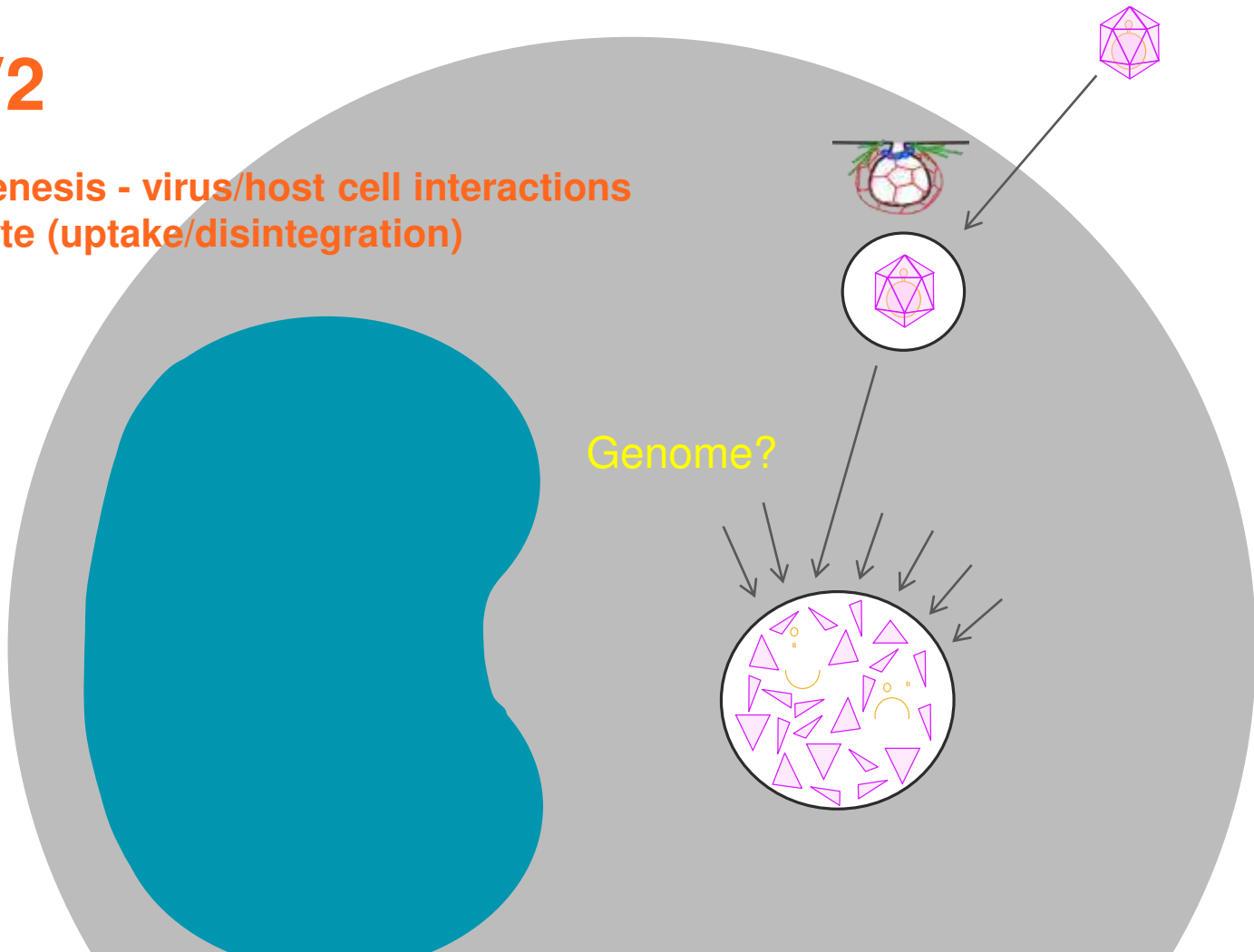
Piétrain x
Topigs 20

PCV2a
1121



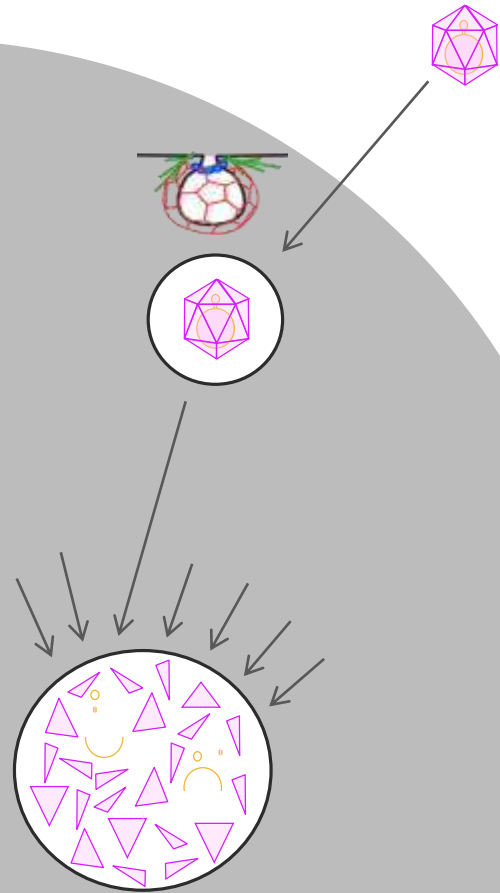
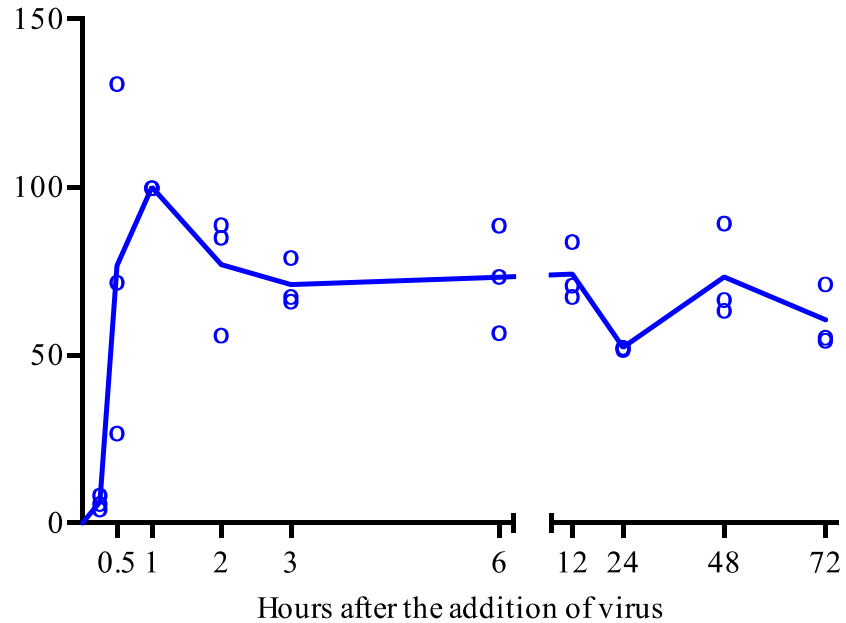
PCV2

Pathogenesis - virus/host cell interactions
Monocyte (uptake/disintegration)



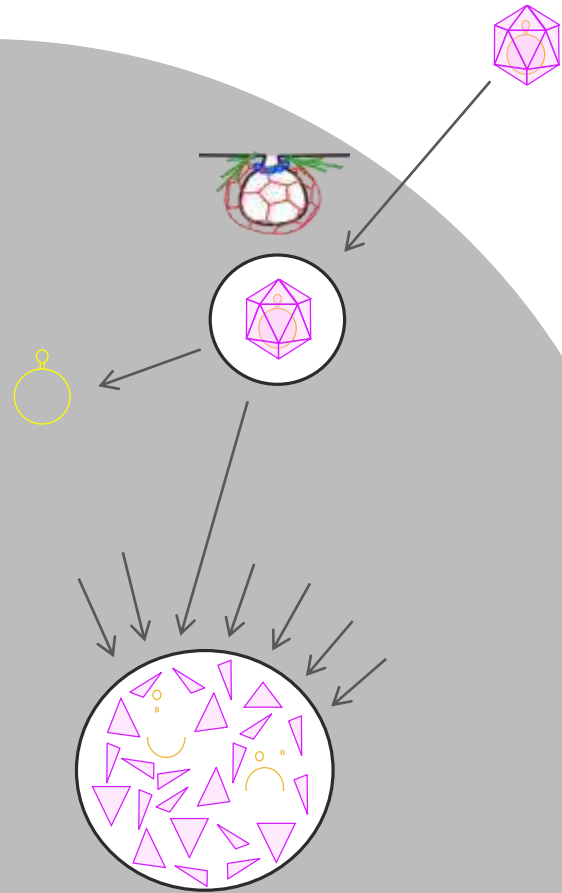
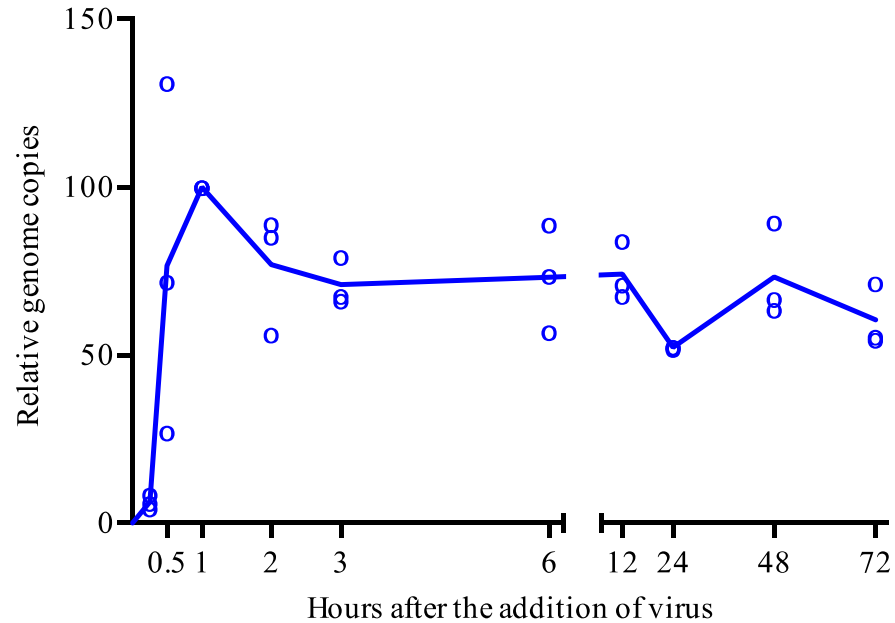
PCV2

Pathogenesis - virus/host cell interactions
Monocyte (uptake/disintegration)



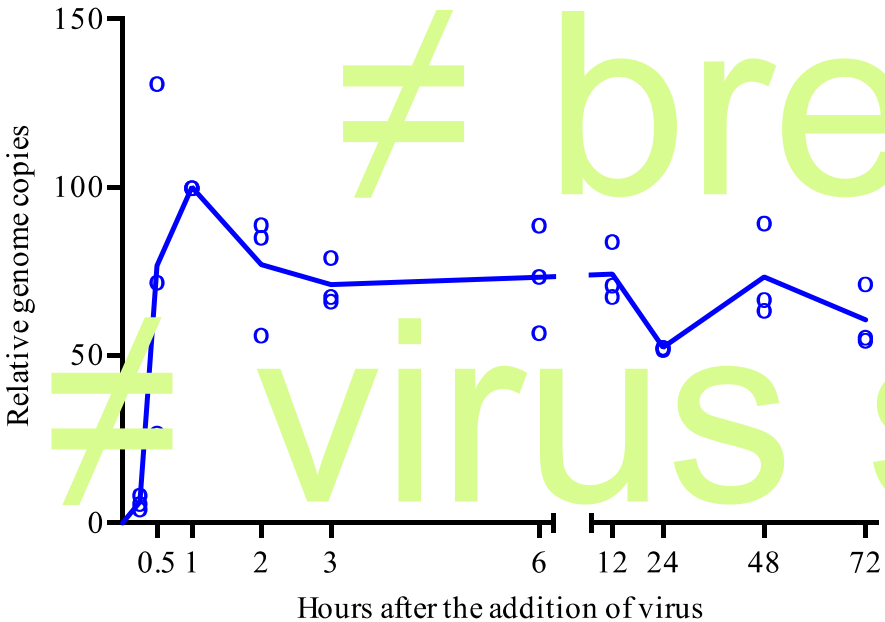
PCV2

Pathogenesis - virus/host cell interactions
Monocyte (uptake/disintegration)

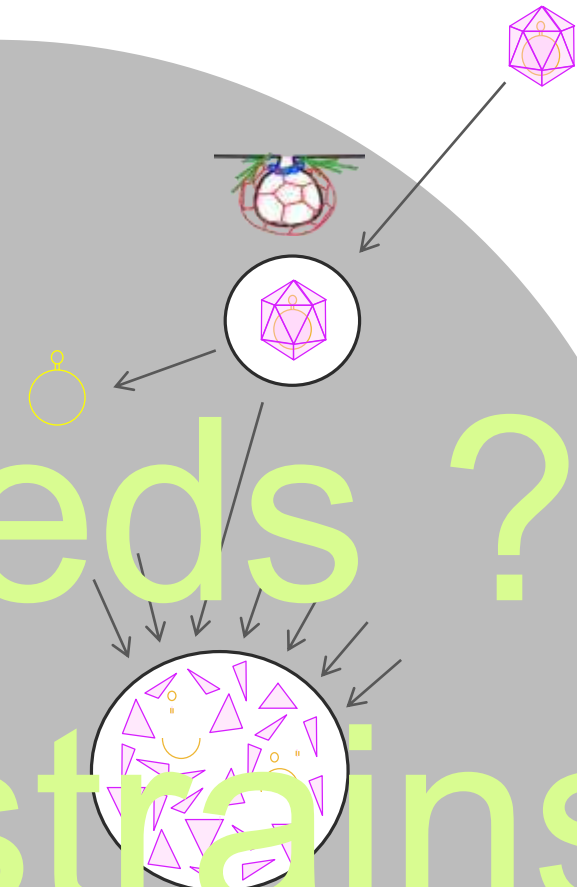


PCV2

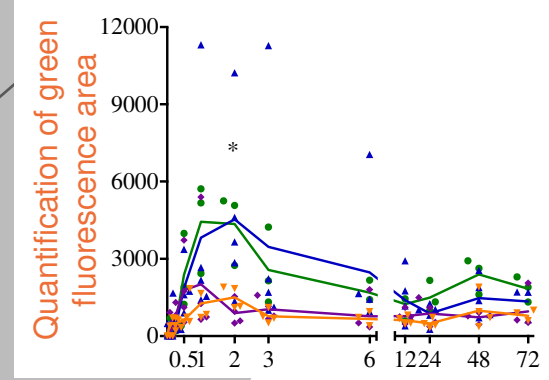
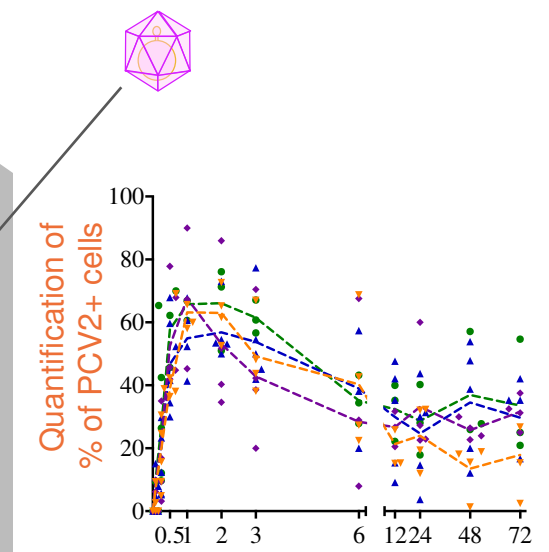
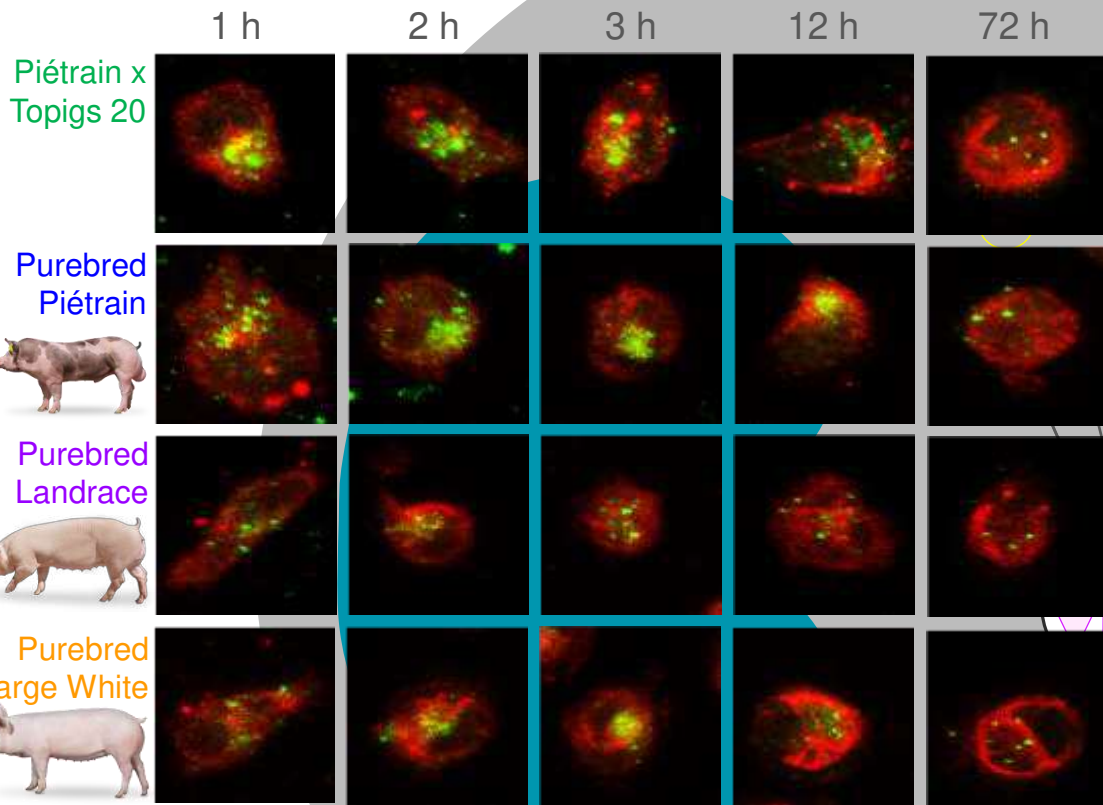
Pathogenesis - virus/host cell interactions
Monocyte (uptake/disintegration)



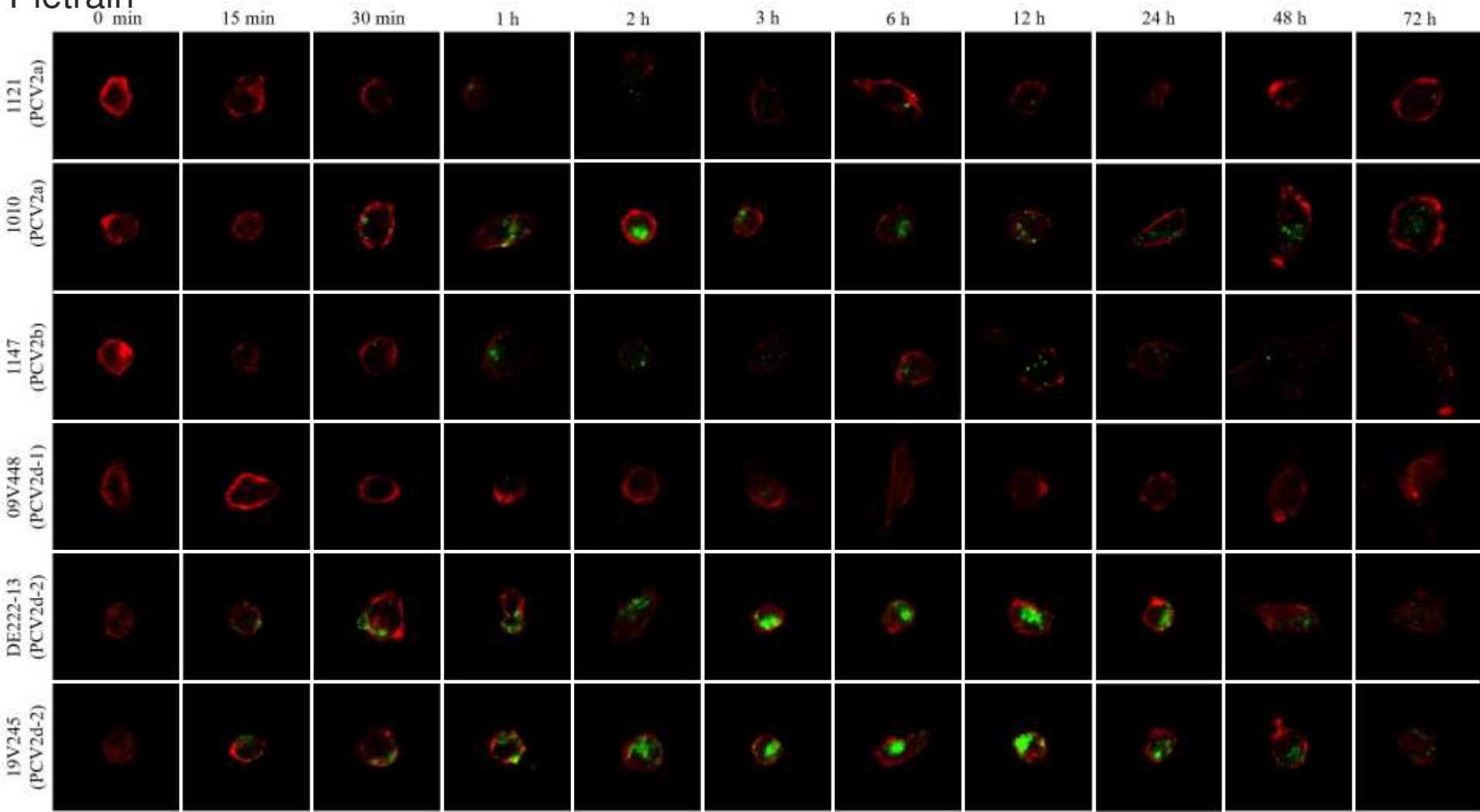
≠ breeds ?
≠ virus strains ?



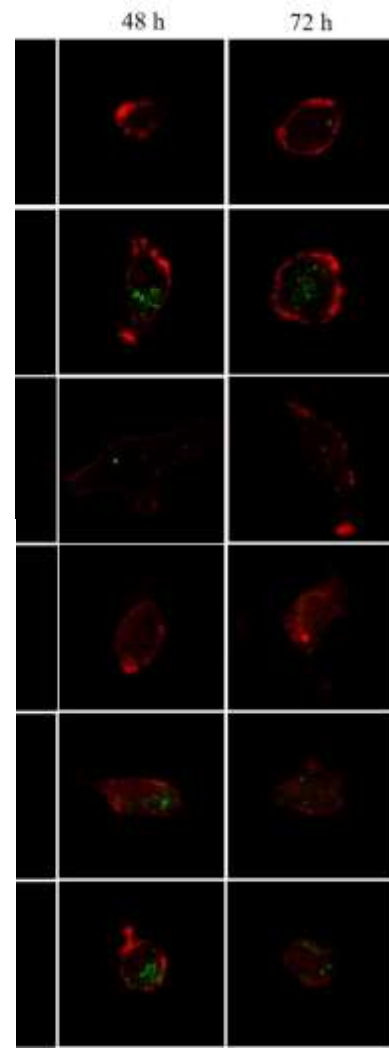
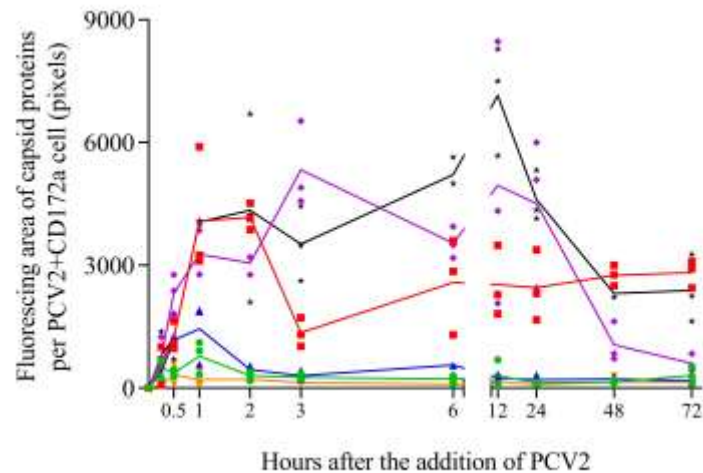
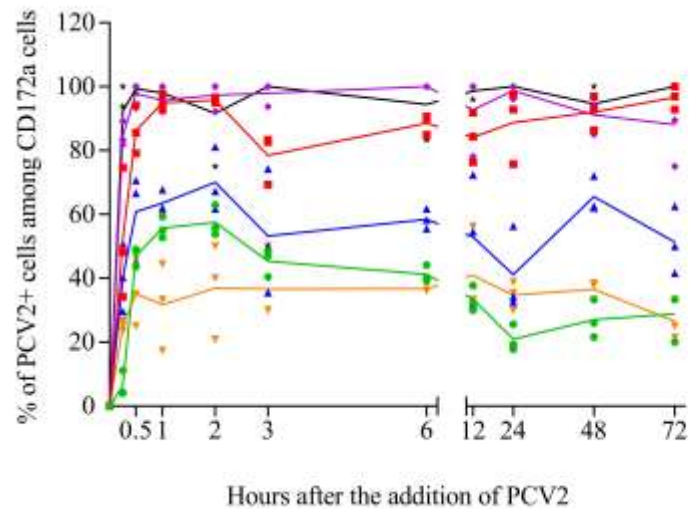
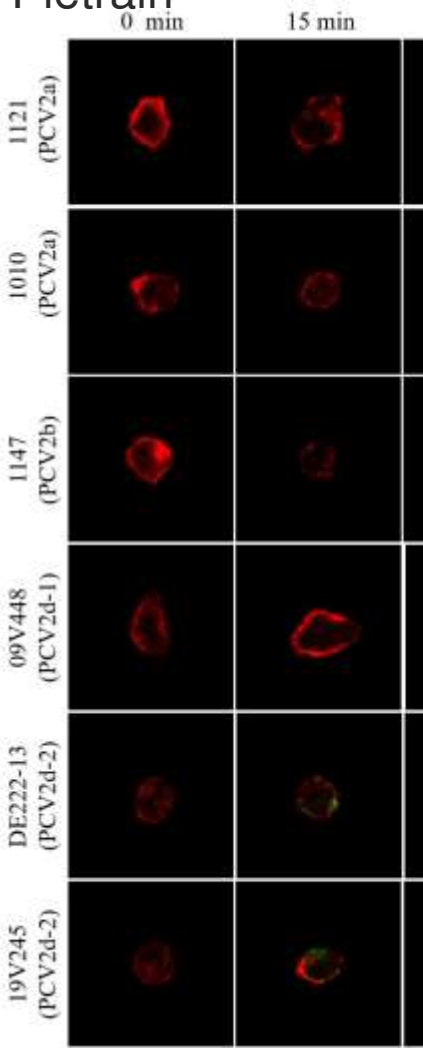
PCV2 1121



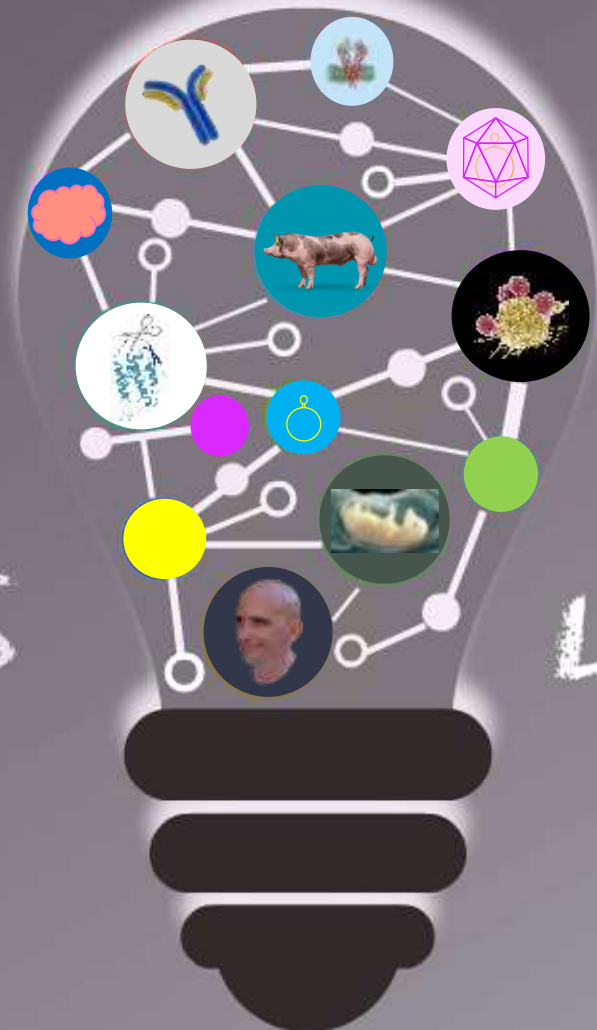
Pietrain



Pletrain



LESSONS

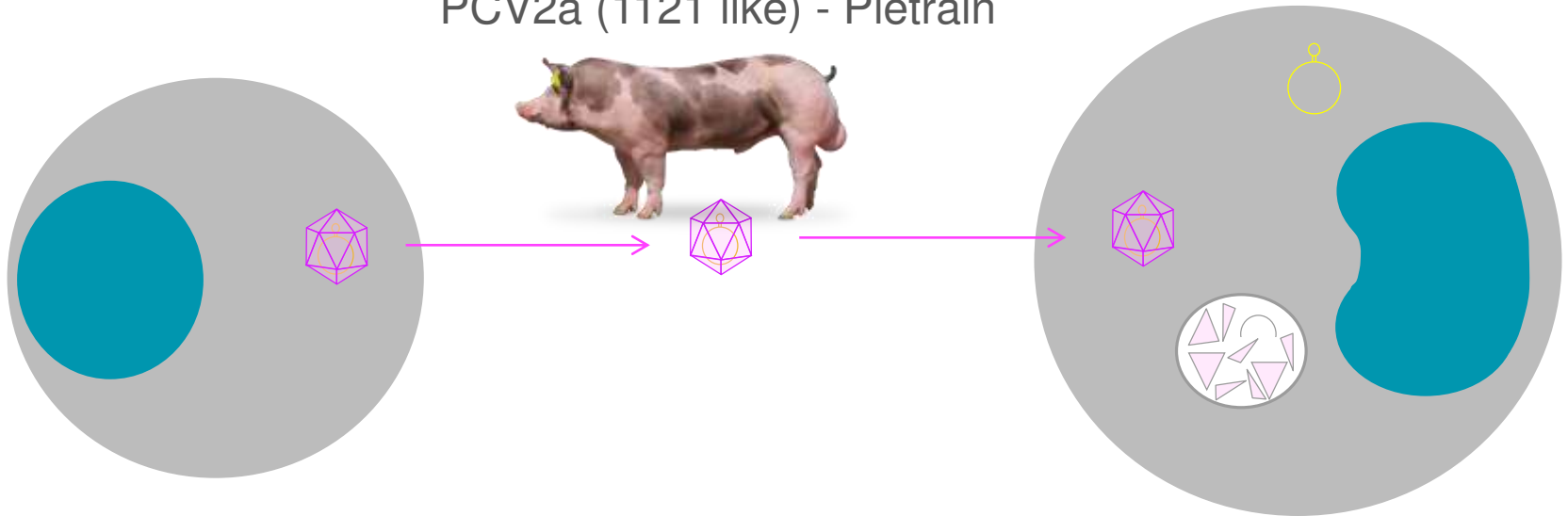


LEARNED

PCV2

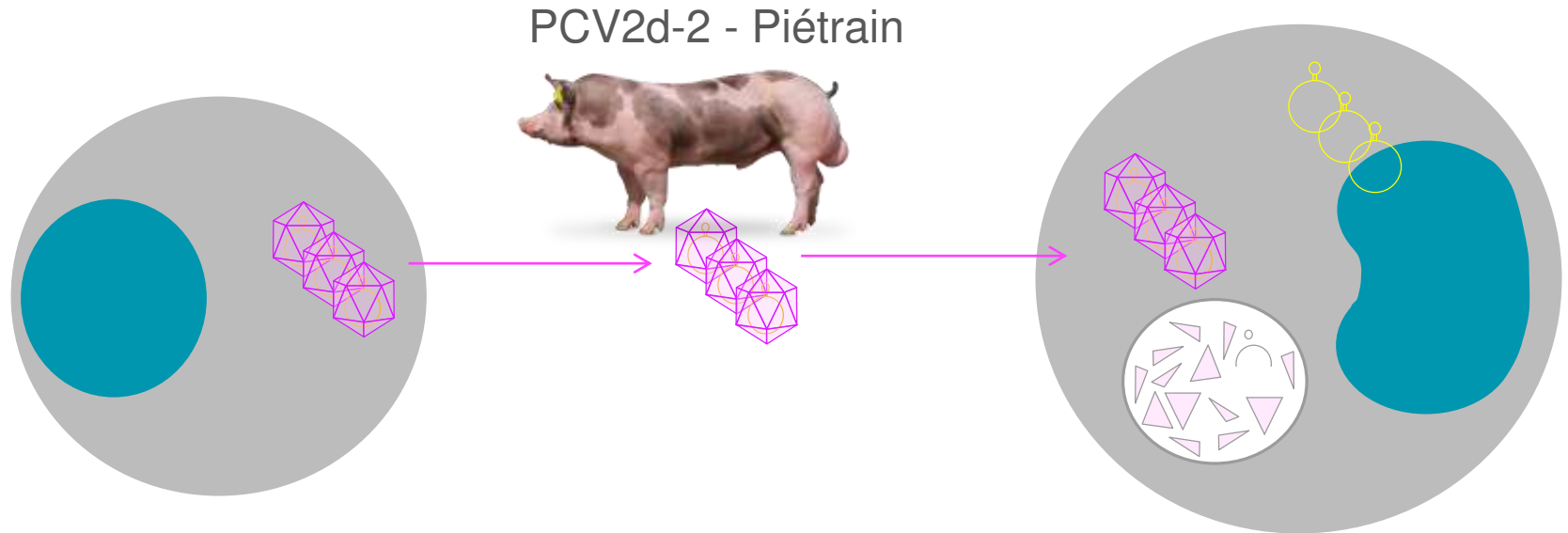
Pathogenesis - virus/host interactions
Combination lymphoblasts and monocytes

PCV2a (1121 like) - Piétrain



PCV2

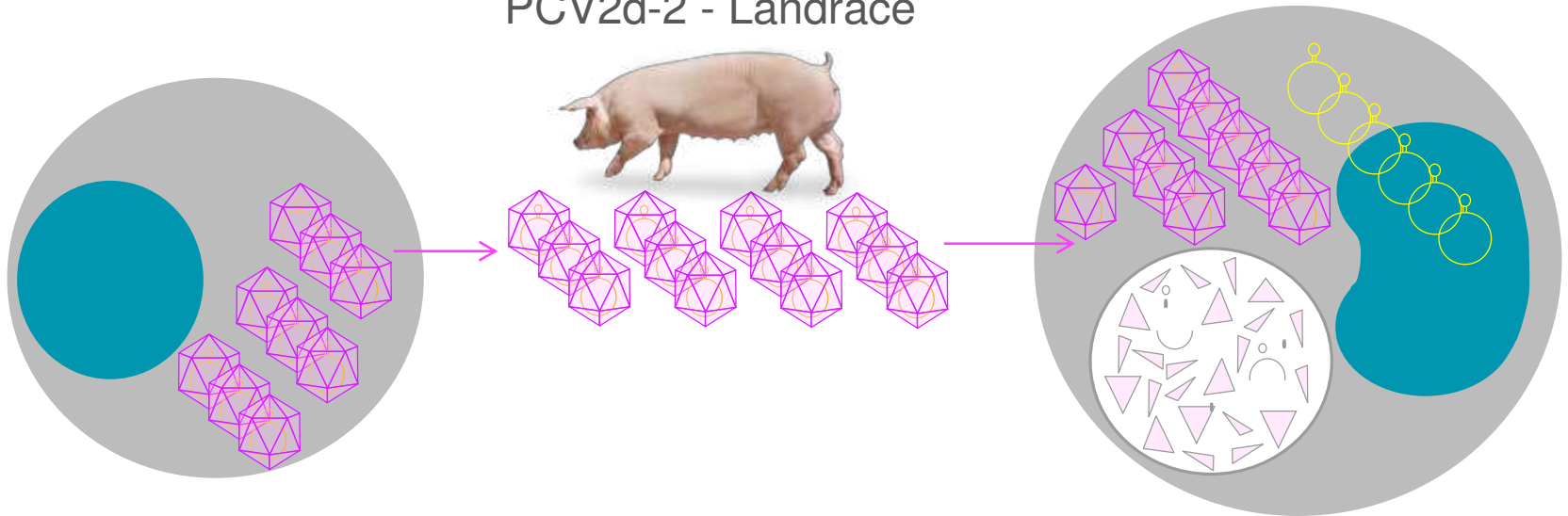
Pathogenesis - virus/host interactions
Combination lymphoblasts and monocytes



PCV2

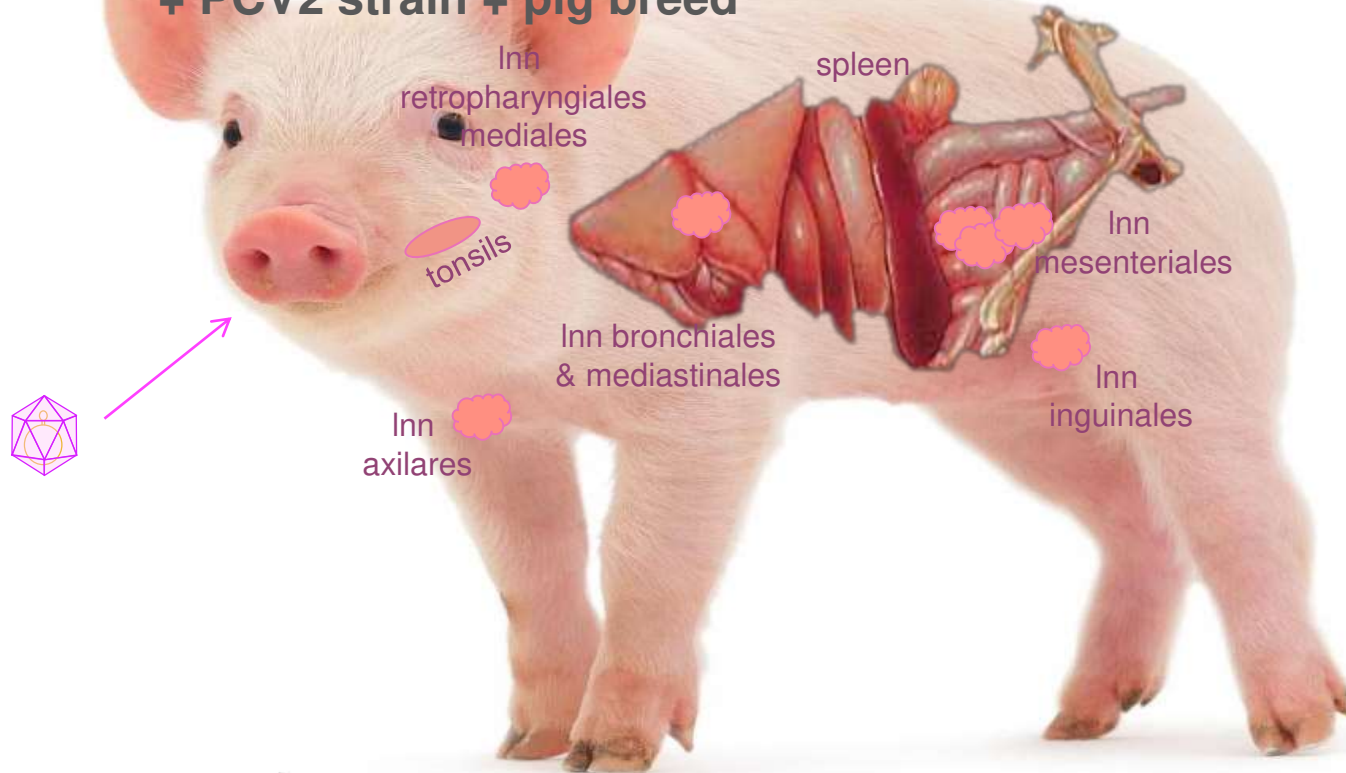
Pathogenesis - virus/host interactions
Combination lymphoblasts and monocytes

PCV2d-2 - Landrace



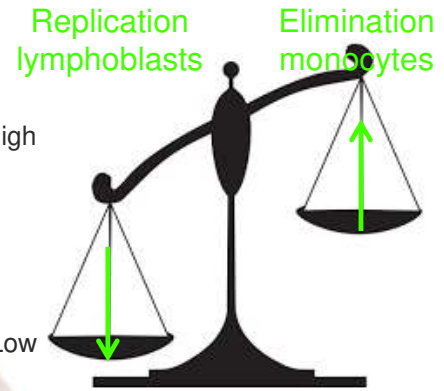
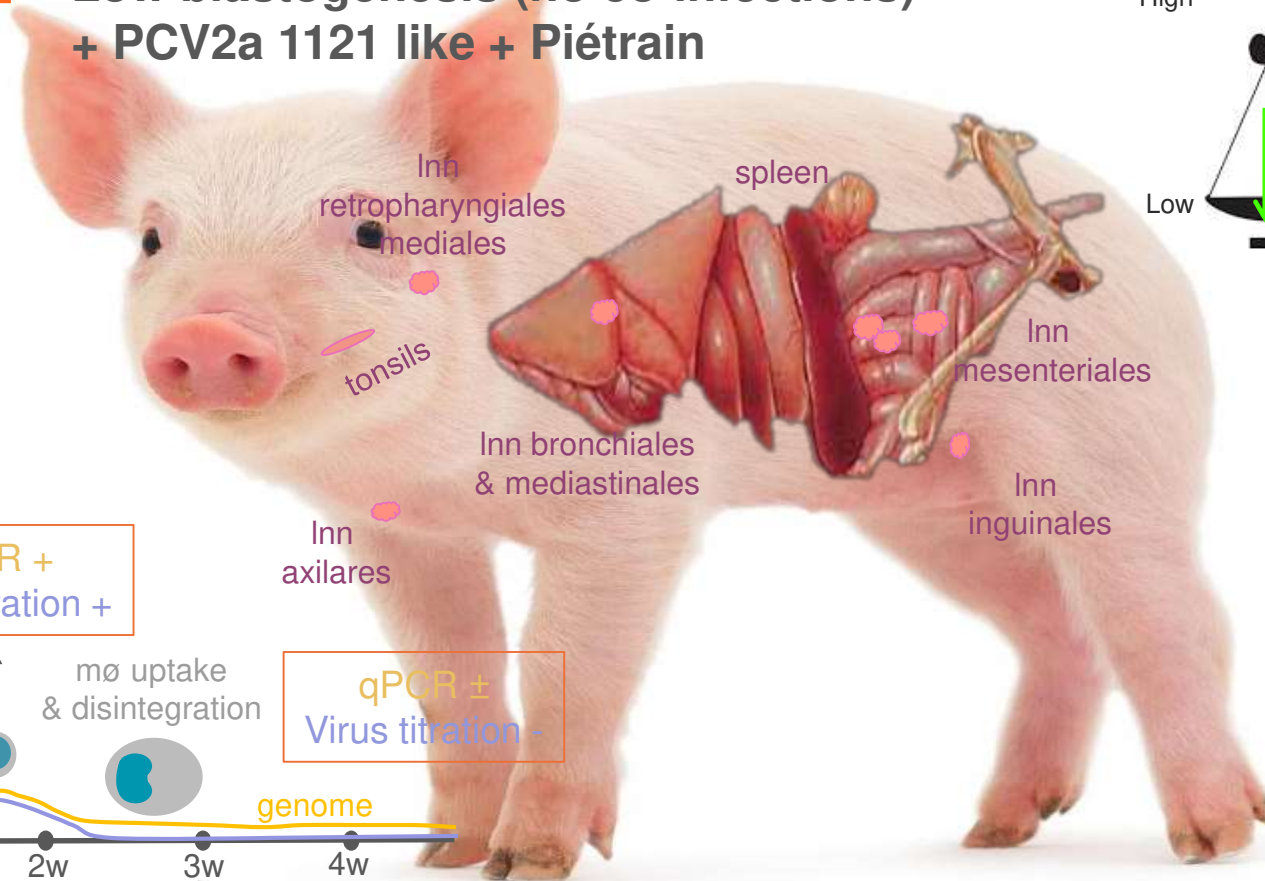
PCV2

Pathogenesis - virus/host interactions Role of status of lymphoid tissues + PCV2 strain + pig breed



PCV2

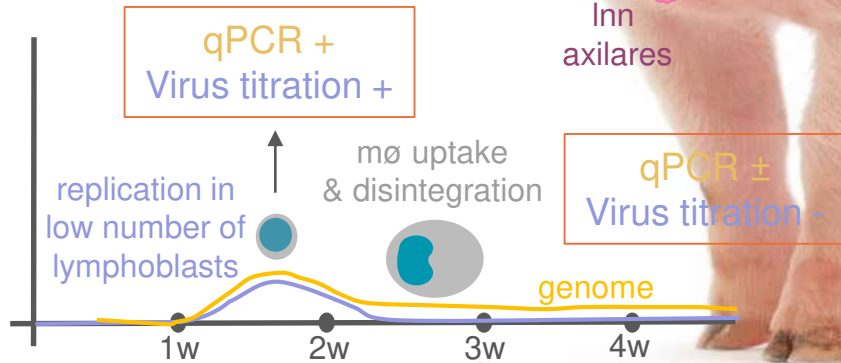
Low blastogenesis (no co-infections)
+ PCV2a 1121 like + Piétrain



Excellent

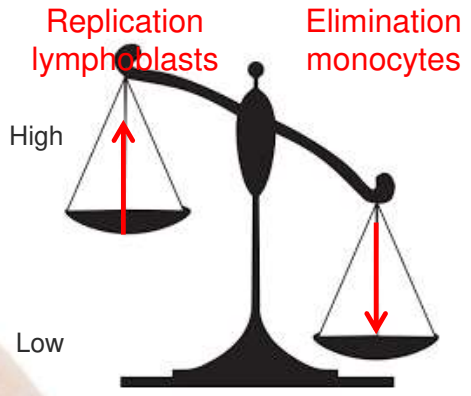


Best case scenario



PCV2

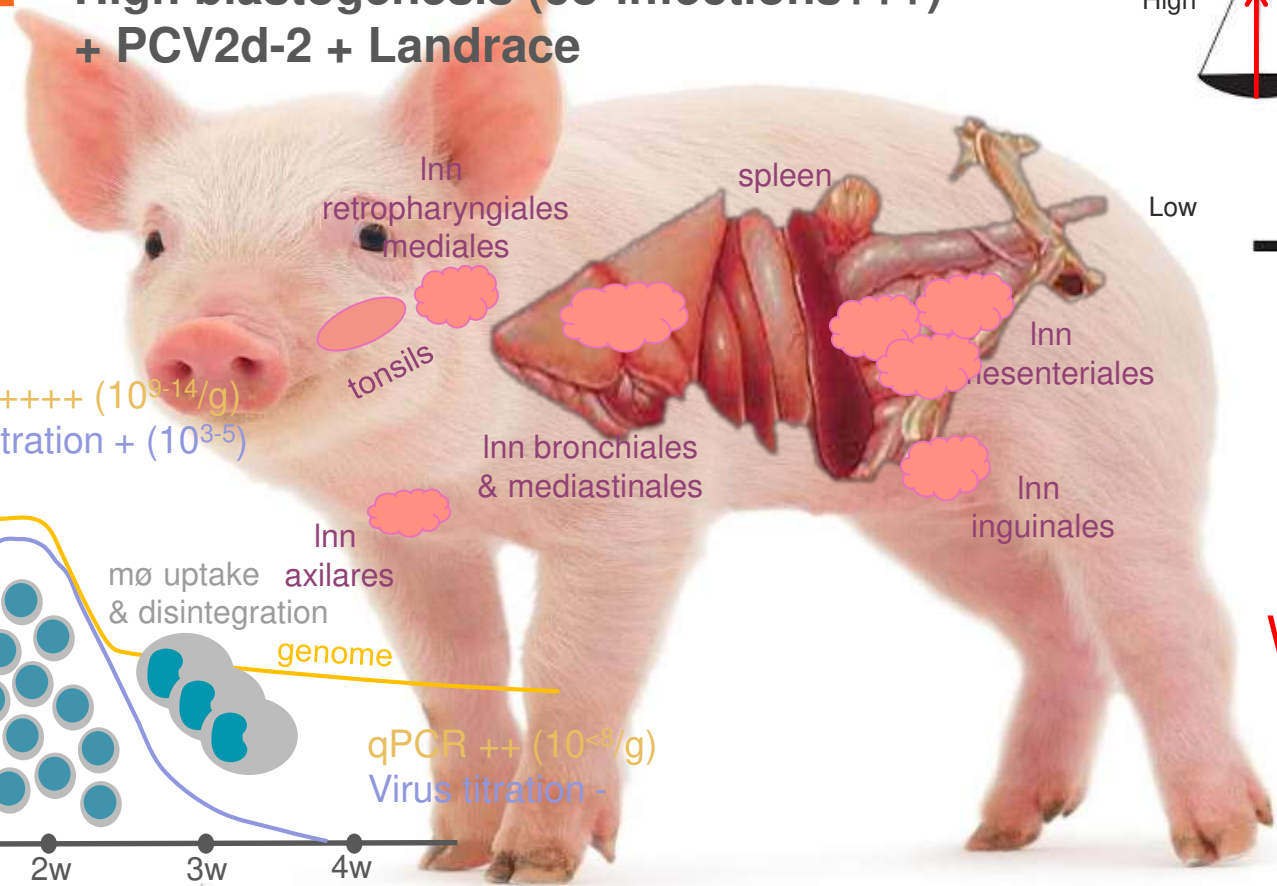
High blastogenesis (co-infections+++)
+ PCV2d-2 + Landrace



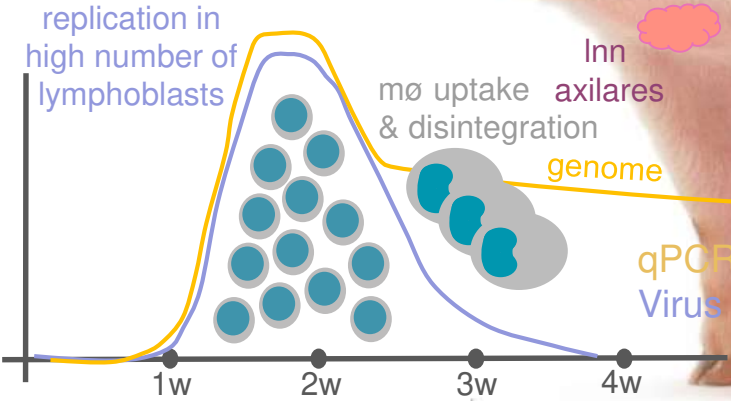
Bad



Worst case scenario



qPCR +++++ ($10^{9-14}/g$)
Virus titration + (10^{3-5})



Future?

