

monoguthealth

Optimal gut function in monogastric livestock

CapSa: Development of a protocol for administering a capsule to sample small intestine content

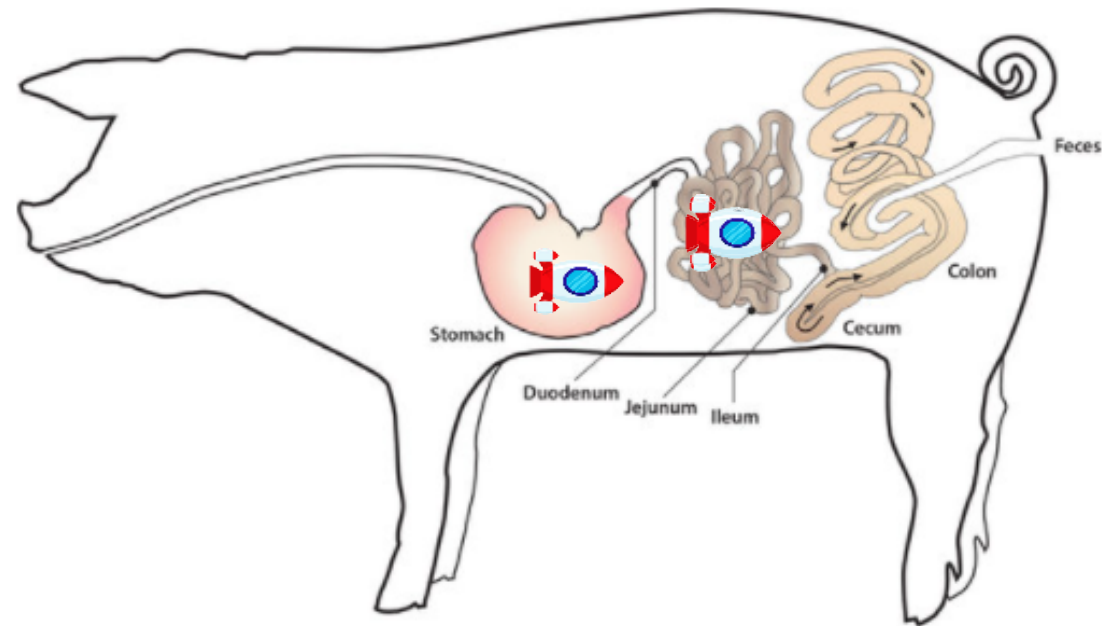
Inés Garcia-Viñado, Marco Tretola, Giuseppe Bee,
Paolo Trevisi and Catherine Ollagnier

EAAP, Lyon 2023



This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No 955374.

The elegant method: a capsule



From Devin Holman, 2017



Capsule: «CapSa»

⇒ A new sampling capsule to perform non-invasive collection of the intestinal microbiota.

- ✓ Sampling mechanism activated based on physicochemical properties of the environment

- ✓ Size 0 and can collect up to 400µL of liquid.

Tested in vitro:

last EAAP presentation from

Inés García Viñado



- ✓ 3D printed and biocompatible

- ✓ Retrieval in the feces

- ✓ Oral administration

In vivo: the challenges

- Capsule administration

-> pigs chew the capsule

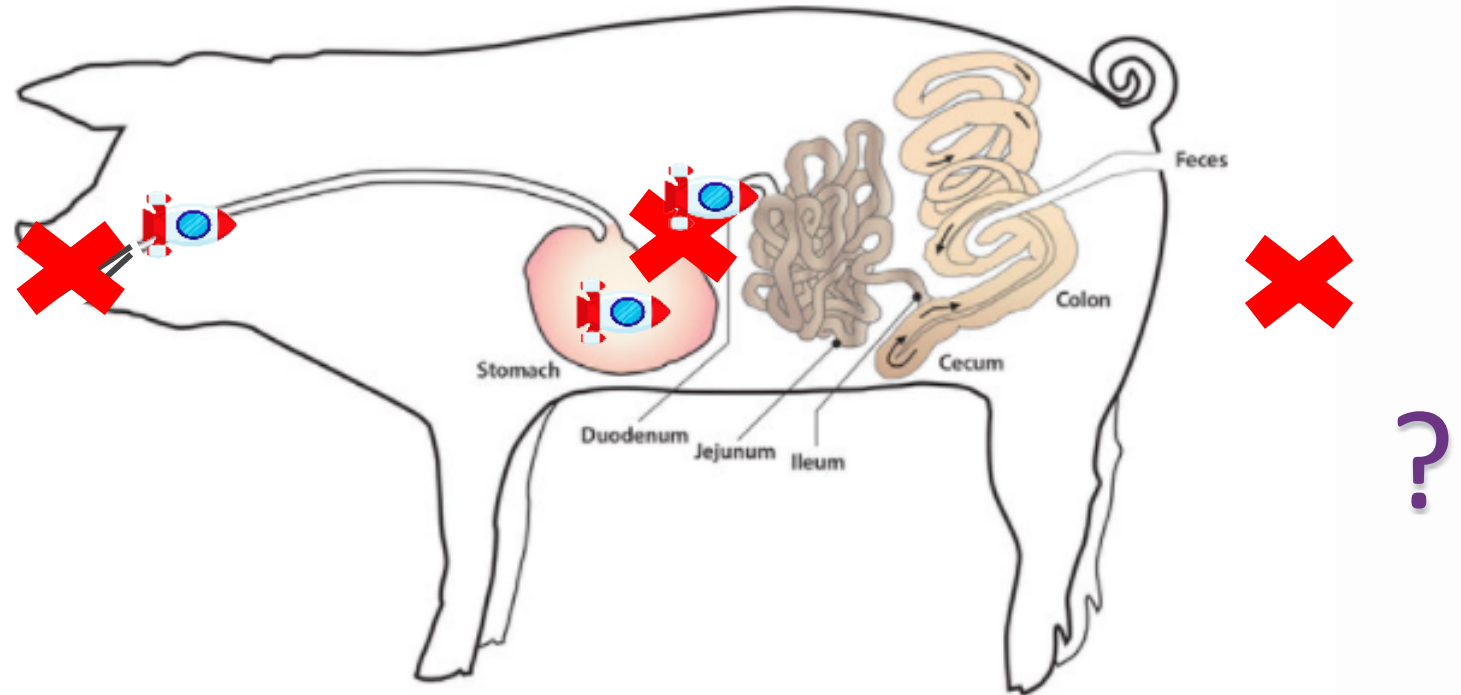
- Transpyloric passage

-> capsules get stuck in the stomach



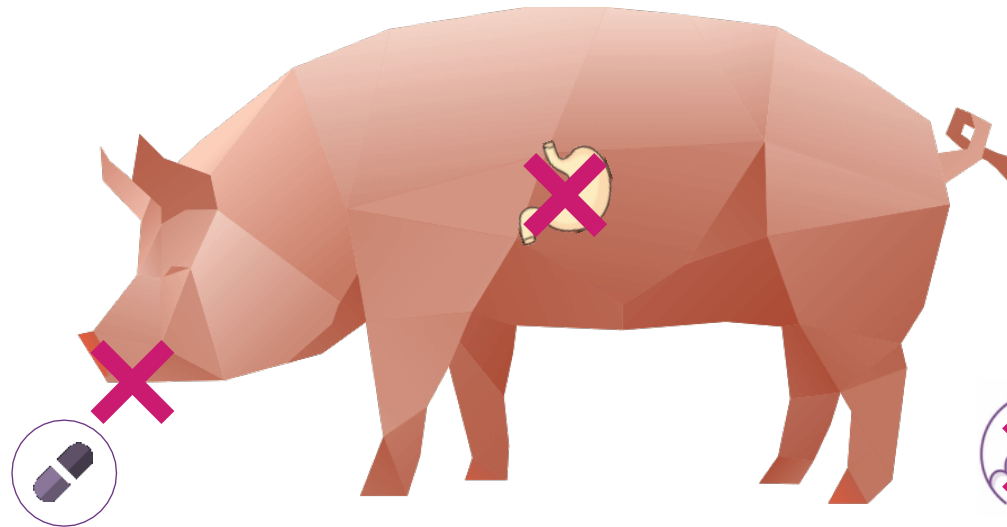
- Capsule retrieval

-> capsules get lost in the environment



Solutions to main challenges

Gastric passage



Oral administration



Retrieval in
feces

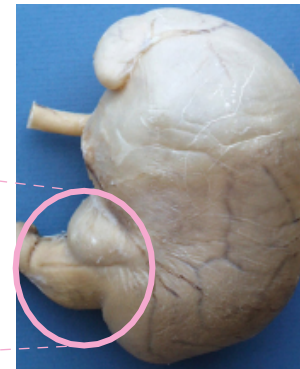
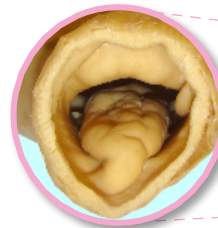


Adapted floors for capsule retrieval



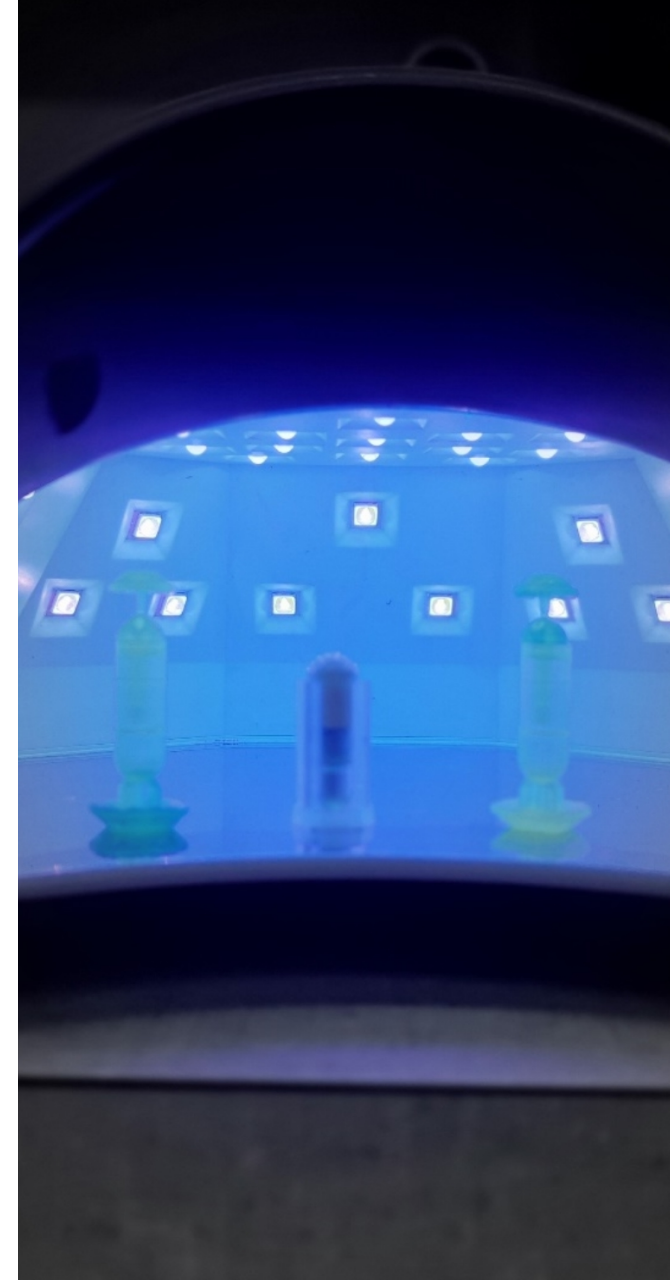
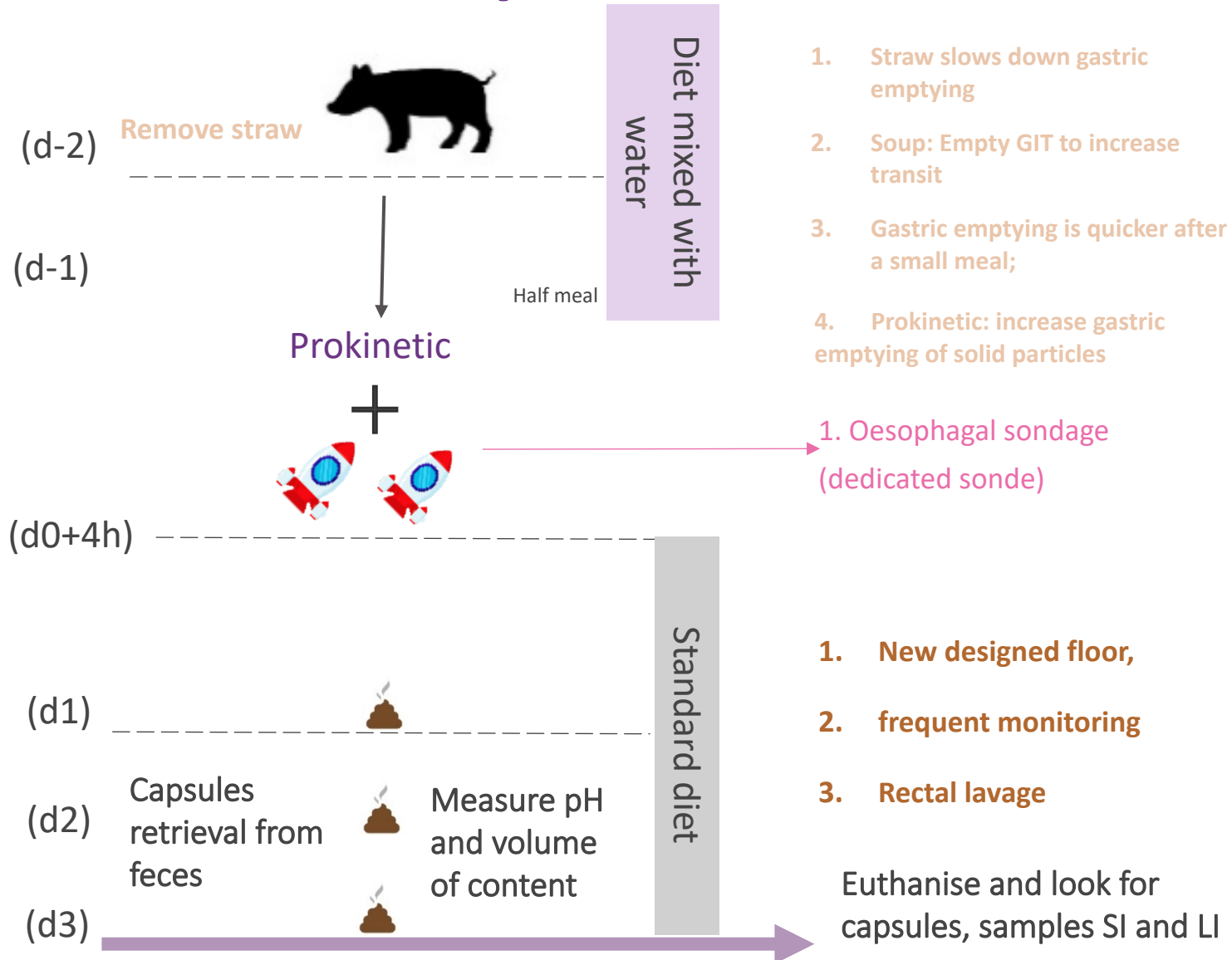
Esophageal sondage

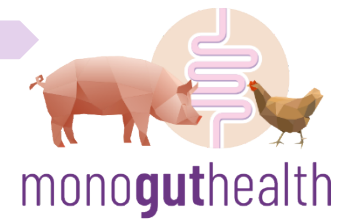
Prokinetics



Source: [Ungulate Img14-17 \(umn.edu\)](http://Ungulate Img14-17 (umn.edu))

Administration protocol: reasoning for optimization





Animals included in CapSa pilot studies

BW category	n=	BW \pm SD (kg)	% males	% females
Size XS (<12kg)	14	8.31 \pm 1.60	50	50
Size S (\geq 12 - 20kg)	21	14.06 \pm 1.40	66.7	33.3
Size M (\geq 20-40kg)	17	34.34 \pm 4.01	82.35	17.65
Size L (\geq 40-70kg)	32	55.85 \pm 8.00	53.1	46.9
TOTAL	84	33.12 \pm 20.51	69.1	38.1



Inés García Viñado,
PhD student

Nb of
capsules
retrieved

Time of
retrieval

pH and
volume



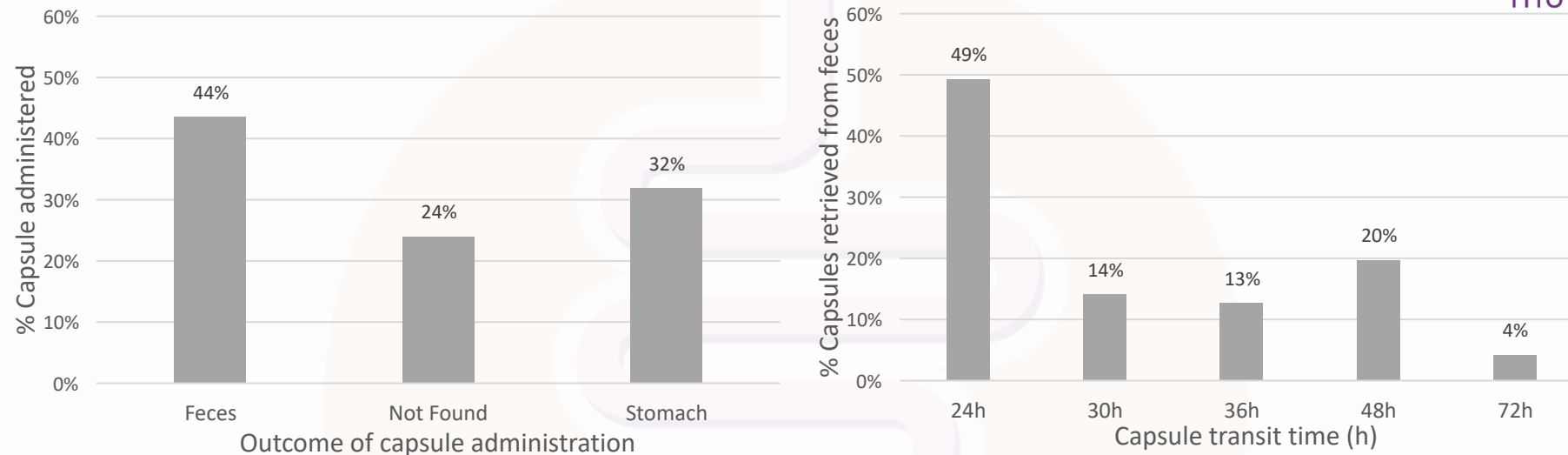
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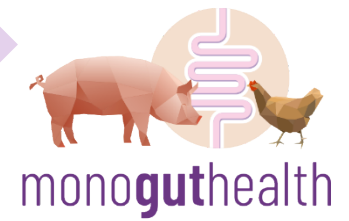
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Results: protocol's optimisation

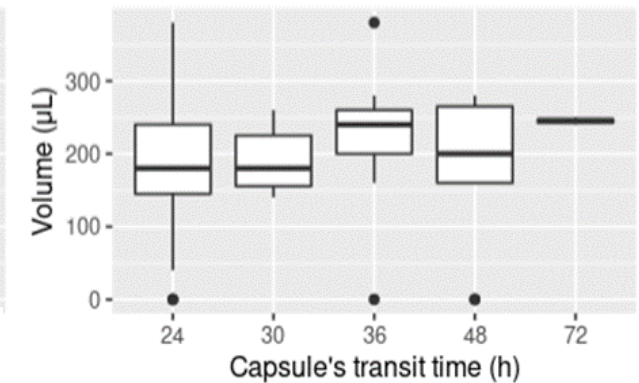
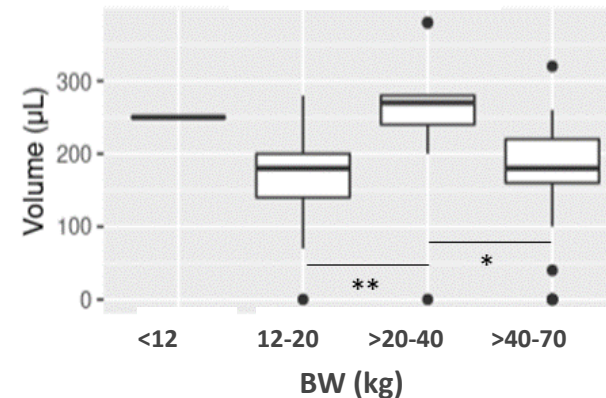
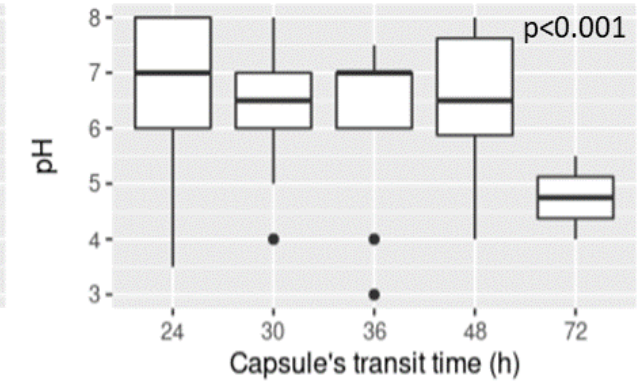
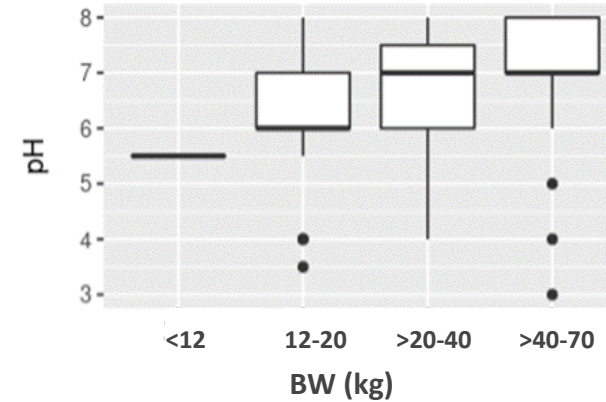


	BW category (kg)						Sex			
	<12	12-20	>20-40	>40-70	SEM	p	M	F	SEM	p
% Capsules retrieved from feces	2.08 ^a	59.67 ^b	62.17 ^b	44.62 ^{ab}	15.5	0.03	47.2	37.1	9.91	0.45
% Capsules retrieved from the stomach	91.65 ^a	21.05 ^b	8.13 ^b	14.45 ^b	9.96	< 0.05	34.1	33.5	6.36	0.94
% Capsules Not Found	0	19.4	29.9	36.8	13.1	0.19	15.4	27.6	8.33	0.29



Suitability of the retrieved capsules

- 72% capsules retrieved from feces had a pH>6
- pH of the samples becomes more acidic when the capsule transit time increase.
- The volume of the collected digesta samples was affected by the BW category.



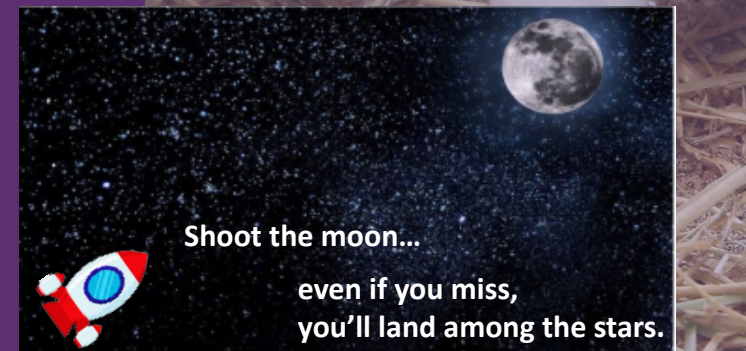
Take home message

- Innovative research is risky, but may sometimes be worth the journey: think out of the box!
- Be prepared for unexpected results: Failure constitute an opportunity to learn even more.
- 3R refinement takes energy (**a lot**), time and money



Success and Failure

There is a failure behind every success



THANK YOU

Do you have any questions?

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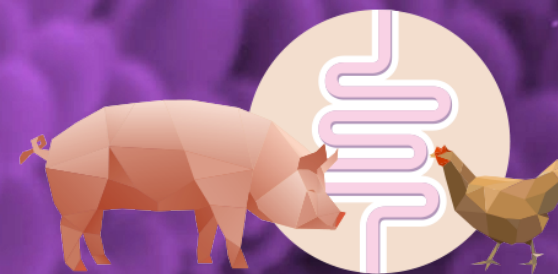
Paolo Trevisi (UniBo)



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UNIVERSITÀ DI BOLOGNA



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