EPSRC
Engineering and Physical Sciences Research Council

Safety evaluation of repeated microarray patch applications using a miniature pig model

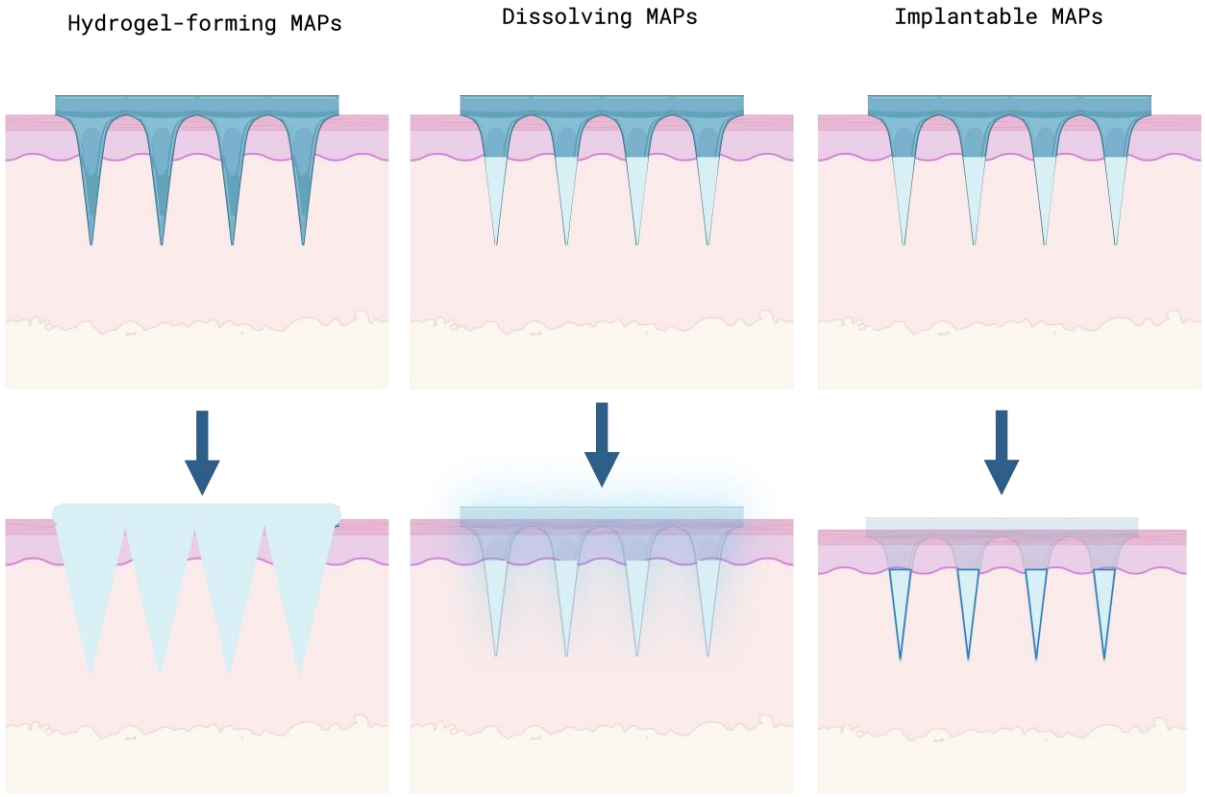
Qonita Kurnia Anjani[1], Aaron Hutton[2], Eneko Larrañeta[1], Ryan F. Donnelly[1]

[1]School of Pharmacy, Queen's University Belfast
[2]School of Pharmacy and Pharmaceutical Sciences, Ulster University

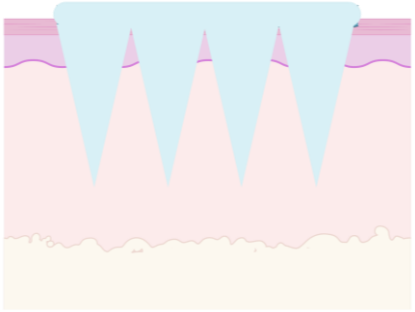
CRS 2025 ANNUAL MEETING & EXPOSITION
PHILADELPHIA, PA
JULY 13-18, 2025

QUEEN'S UNIVERSITY BELFAST

NEXT-GENERATION DELIVERY INNOVATIONS

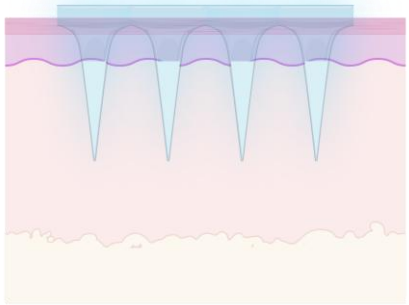

Hydrogel-forming MAPs
Dissolving MAPs
Implantable MAPs

Hydrogel-forming MAPs



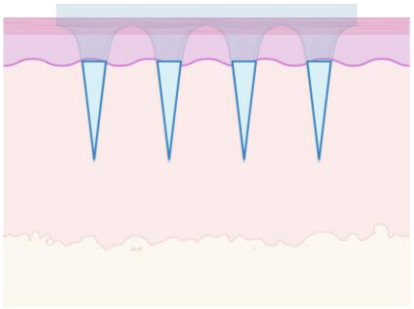
- **Designed for the delivery of both high-dose, low-potency drugs and macromolecules.**
- Enables controlled, sustained release from days to weeks.
- Demonstrated delivery of poorly soluble drugs, including **cabotegravir** in rats for up to 28 days and **atorvastatin** for up to 14 days.

Dissolving MAPs



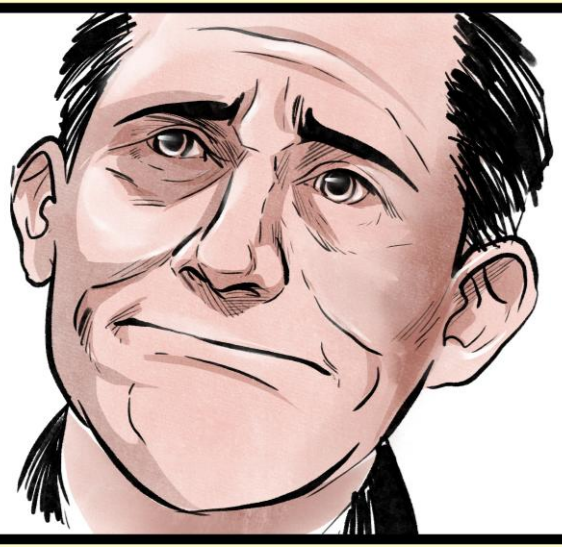
- **Designed for the delivery of low-dose, high-potency drugs**
- Fast-dissolving MAP made from biocompatible polymers
- Demonstrated sustained release of **islatravir**: up to 3 months in rats and 20 days in minipigs

Implantable MAPs

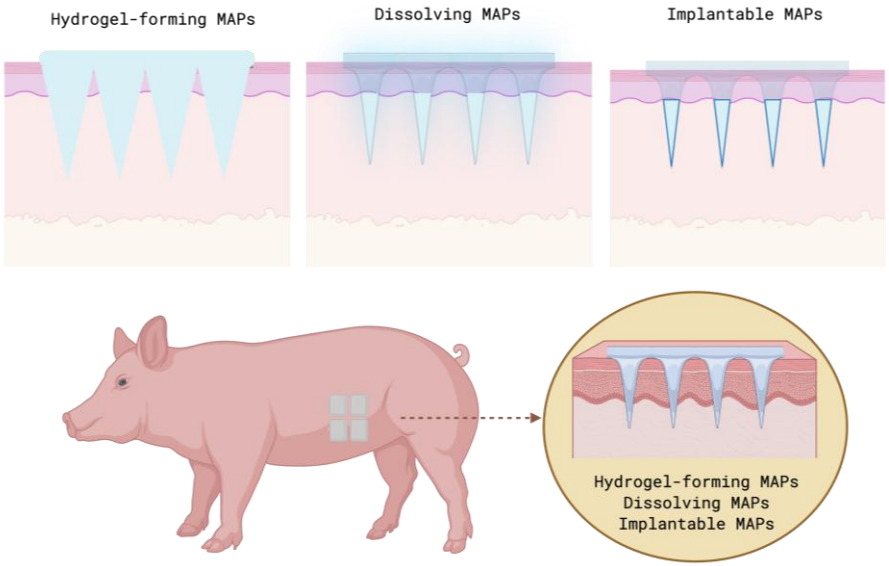


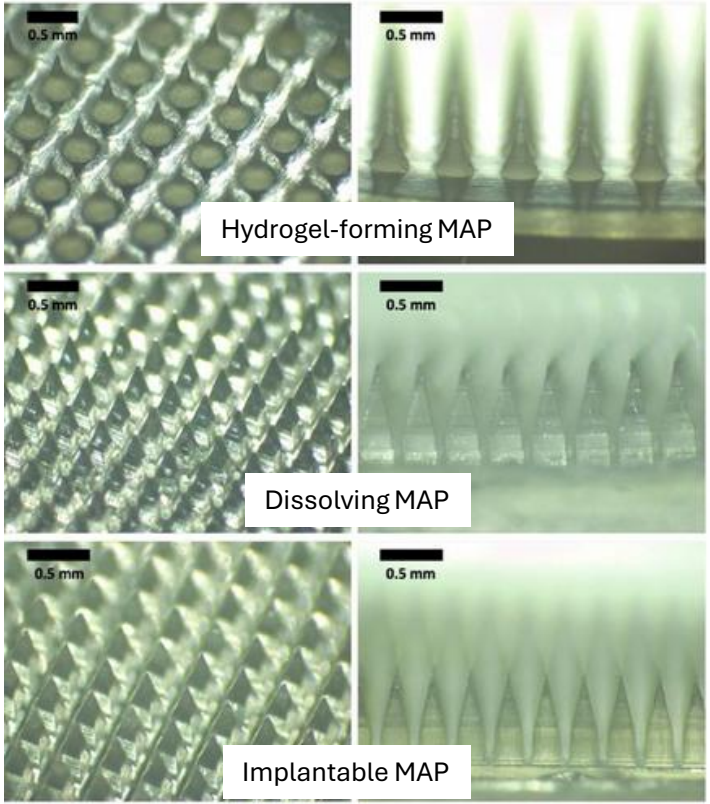
- **Biodegradable tip design** enables deep, sustained release from a skin depot
- Engineered for tip separation and retention in the skin upon baseplate removal
- Demonstrated **fluphenazine** release for up to 14 days in rats

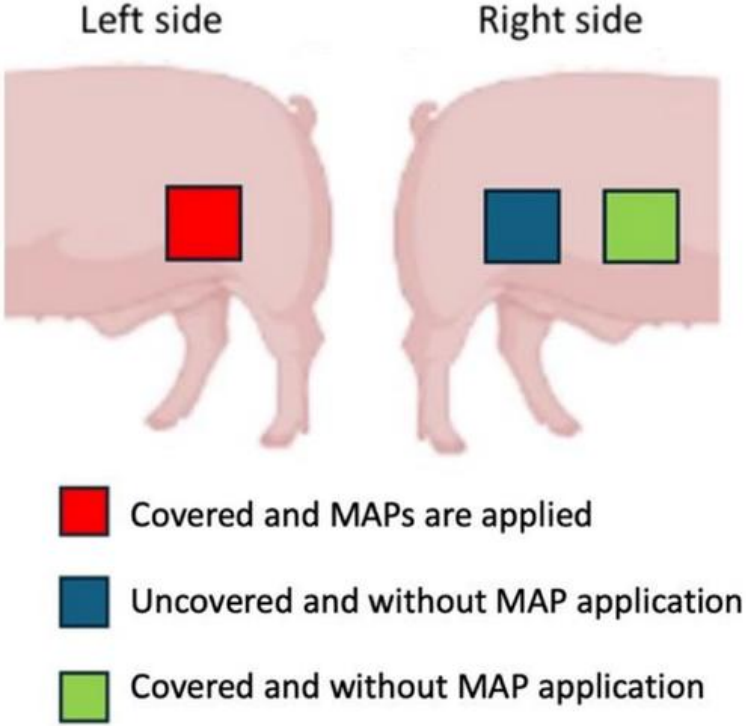
WITH ALL THE PROMISING POTENTIAL OF MAPS FOR LONG-ACTING DRUG DELIVERY,

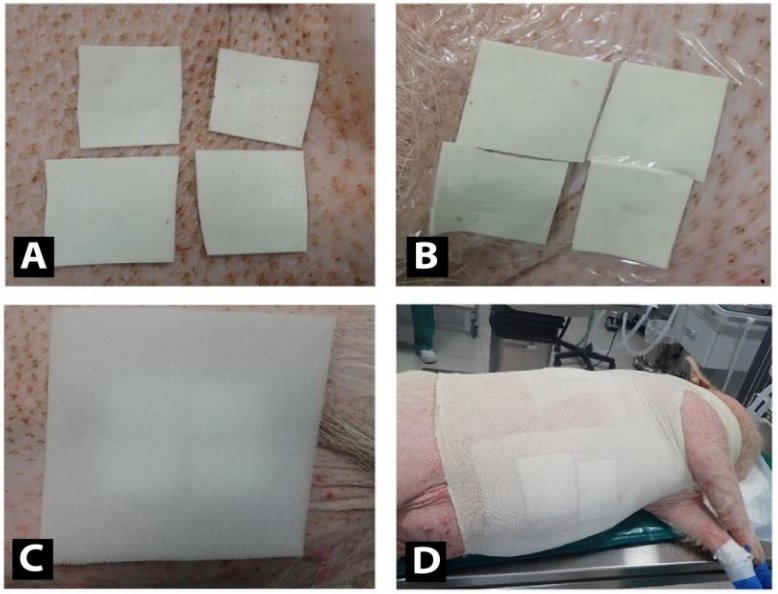


ARE THESE SYSTEMS TRULY SAFE FOR REPEATED APPLICATION IN THE LONG RUN?

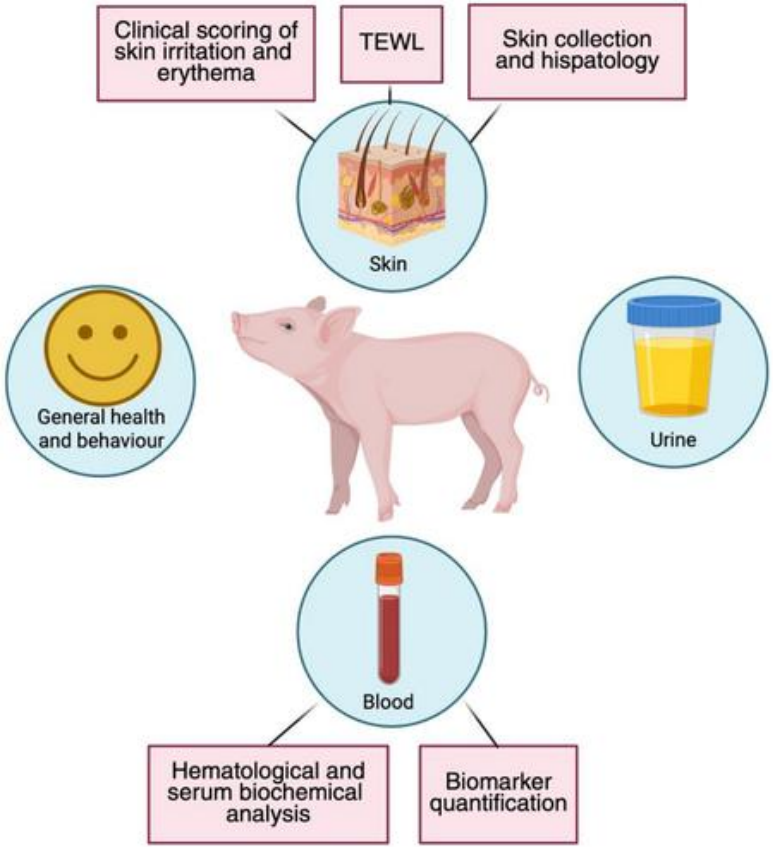

Hydrogel-forming MAPs
Dissolving MAPs
Implantable MAPs
Hydrogel-forming MAPs
Dissolving MAPs
Implantable MAPs


0.5 mm
0.5 mm
Hydrogel-forming MAP
0.5 mm
0.5 mm
Dissolving MAP
0.5 mm
0.5 mm
Implantable MAP


Left side
Right side
Covered and MAPs are applied
Uncovered and without MAP application
Covered and without MAP application


A
B
C
D

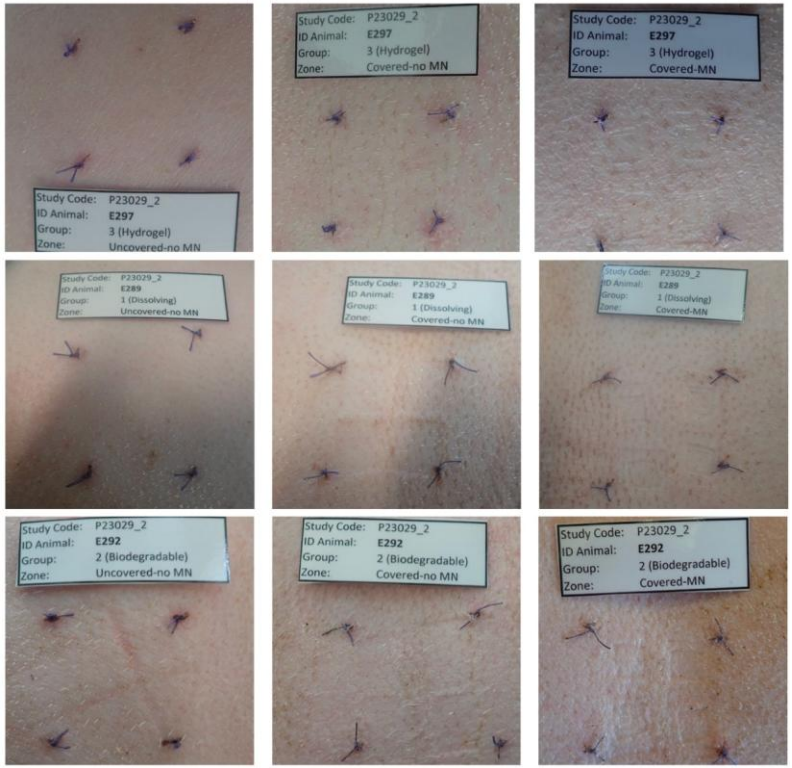
- **Hydrogel-forming MAPs:** Applied every 3 days (Days 0, 4, 7, 11, 14, 18, 21, 25)
- **Dissolving & Implantable MAPs:** Applied once weekly (Days 0, 7, 14, 21)



Clinical Scoring of Skin Irritation and Erythema

	D0	D2	D7	D9	D14	D16	D21	D23	D28
Hydrogel-forming MAPs	0	0	0	0	0	0	0	0	0

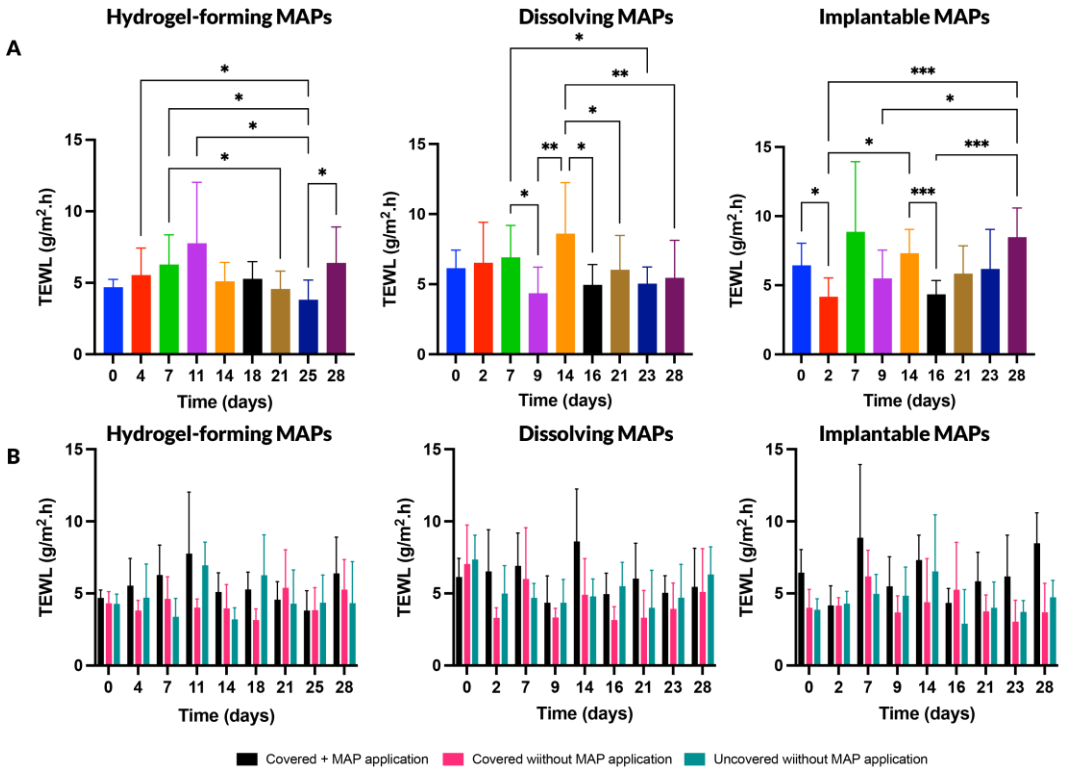
	D0	D2	D7	D9	D14	D16	D21	D23	D28
Dissolving MAPs	0	0	0	0	0	0	0	0	0
Implantable MAPs	0	0	0	0	0	0	0	0	0



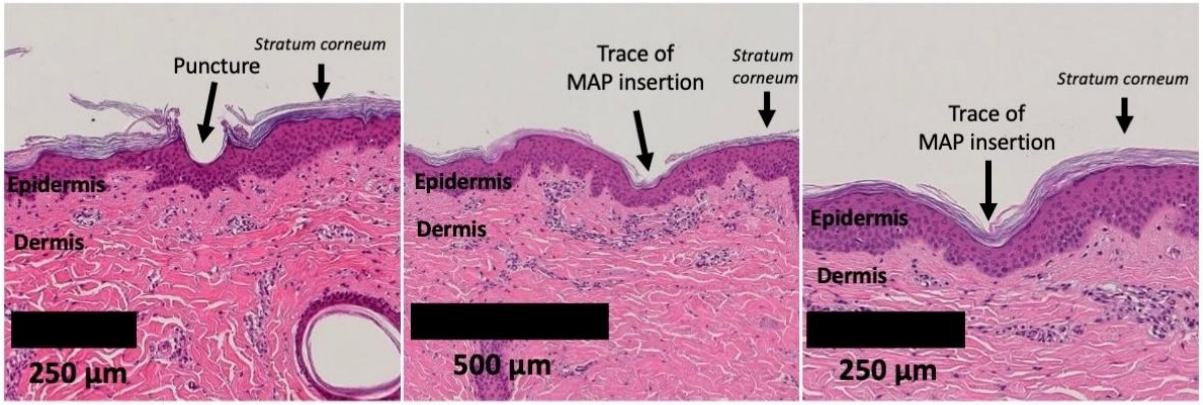
Measurement of Skin Integrity

Repeated MAP application **did not compromise** skin barrier function, as indicated by stable TEWL values that remained well below thresholds associated with skin damage, confirming rapid pore recovery and overall skin safety.

(A) TEWL at MAP application sites on miniature pig skin. (B) TEWL comparison across MAP-treated, covered (no MAP), and uncovered skin (means ± SD, n = 12).



Skin Collection and Histopathology

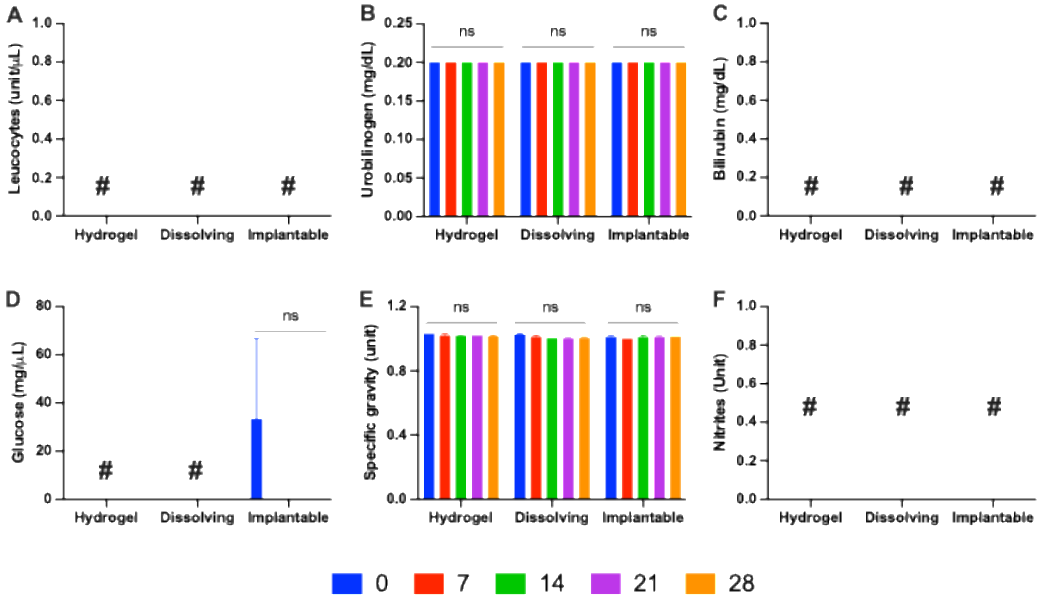


Hydrogel-forming MAPs | Dissolving MAPs | Implantable MAPs

Histological analysis confirmed that repeated MAP application over 28 days did not cause skin damage in miniature pigs, with rapid pore closure and no significant lesions observed across all MAP types.

Urine Collection and Analysis

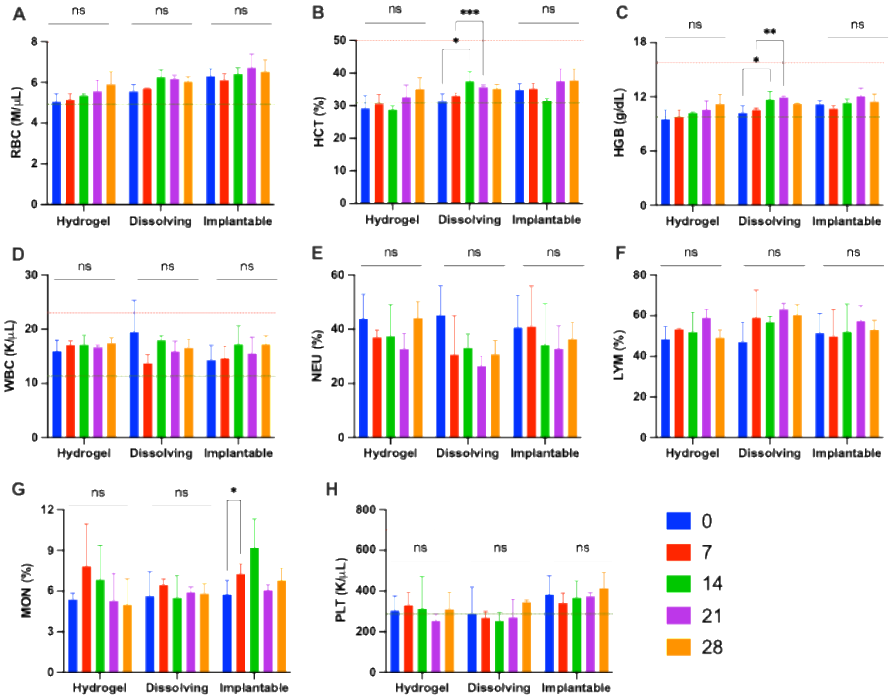
Urinalysis results demonstrated that repeated MAP application over one month caused **no significant renal or systemic toxicity** in miniature pigs, with all measured parameters remaining within **normal physiological ranges**.



(A) leukocytes, (B) urobilinogen, (C) bilirubin, (D) glucose, (E) specific gravity, (F) nitrites, (means + SD, n = 3).

Haematological Analysis

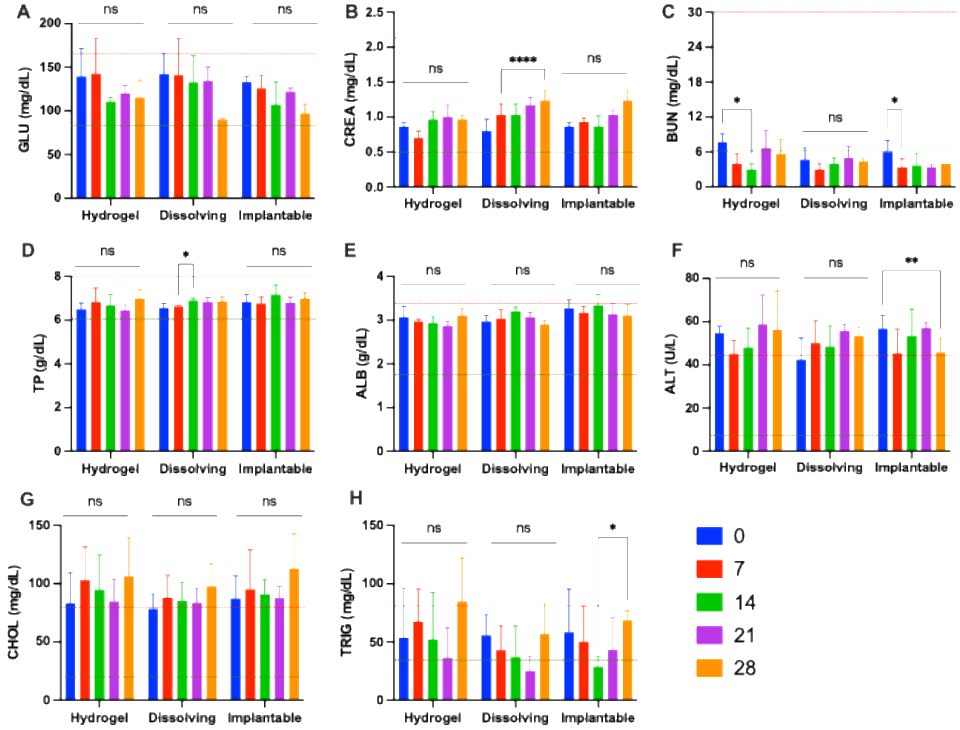
Repeated MAP application over 28 days **did not significantly alter haematological biomarkers**, indicating no systemic toxicity or inflammatory response in miniature pigs.



(A) Red blood cell count, (B) hematocrit, (C) hemoglobin, (D) white blood cell count, (E) neutrophils, (F) lymphocytes, (G) monocytes, and (H) platelets (means + SD, n = 3).

Serum Biochemical Analysis

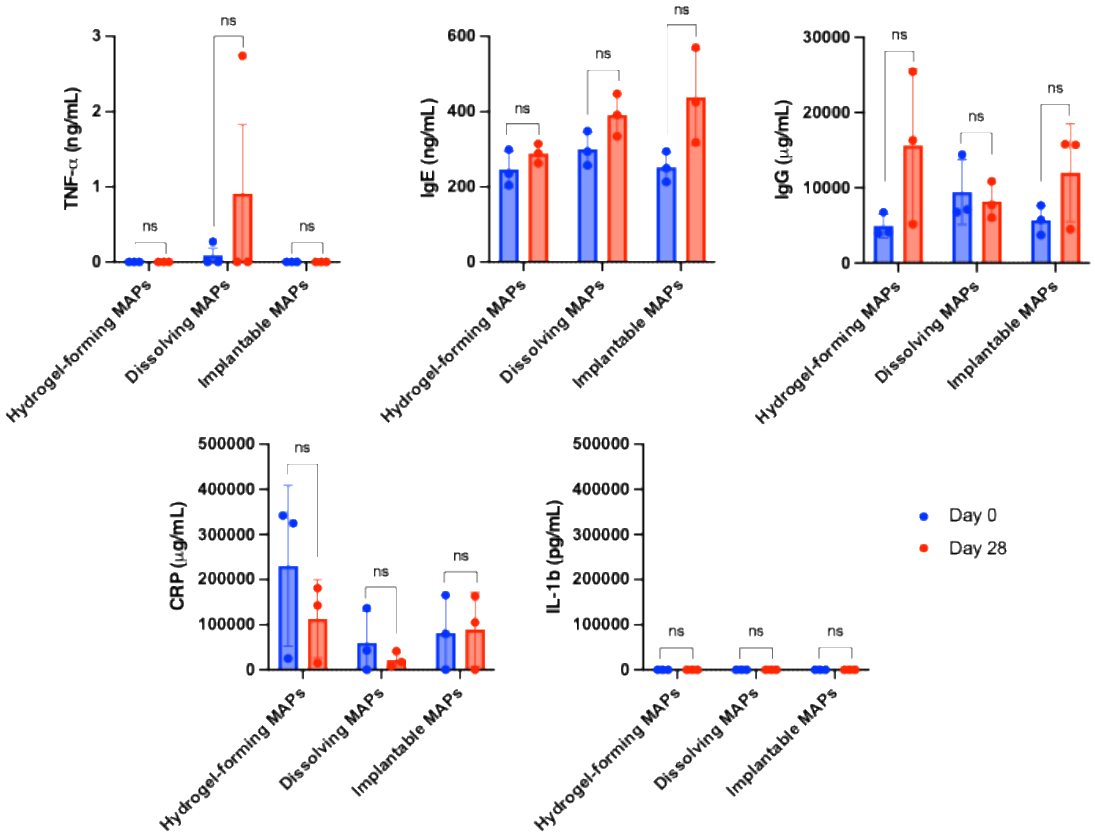
Repeated MAP application **did not cause any significant biochemical abnormalities**, confirming the systemic safety of the treatment in miniature pigs.



(A) Glucose (B) creatinine, (C) urea, (D) total protein, (E) albumin, (F) alanine aminotransferase, (G) cholesterol, (H) triglycerides (means + SD, n = 3).

Biomarker Quantification in Plasma Samples

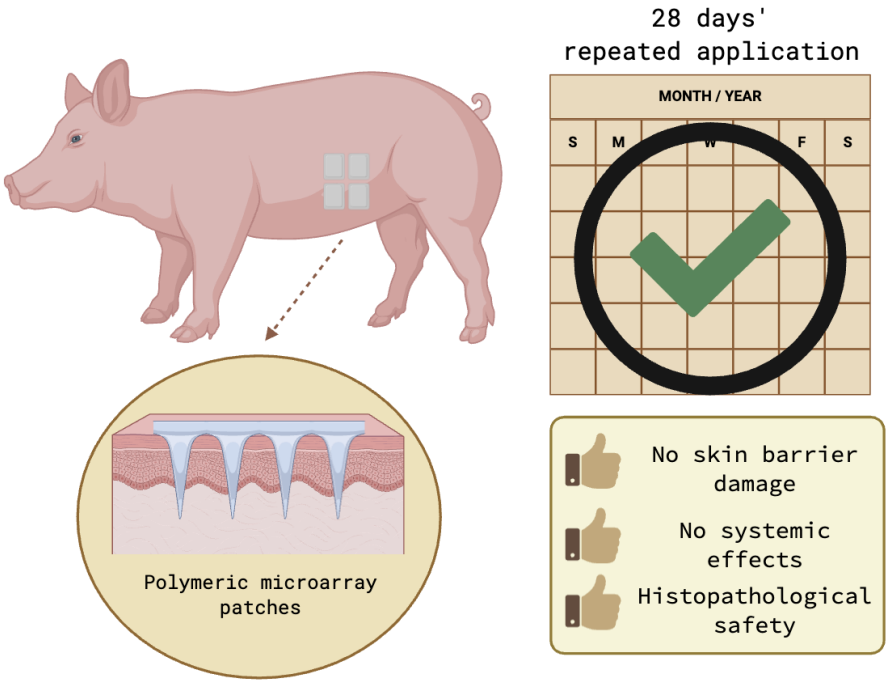
Repeated application of MAPs over one month **did not trigger any significant systemic immune or inflammatory responses** in miniature pigs, as shown by stable TNF-α, IgE, IgG, CRP, and IL-1β levels across all groups.



Conclusion

- These current work confirm the **safety of repeated applications** of hydrogel-forming, dissolving, and implantable MAPs, supporting their potential for safe and effective drug delivery.

- This study establishes preclinical safety benchmarks, advancing the translation of MAP technology to human clinical trials.



Acknowledgment

Aaron Hutton

Eneko Larrañeta

Ryan F. Donnelly

QUEEN'S UNIVERSITY BELFAST

EPSRC
Engineering and Physical Sciences Research Council

qonita.anjani@qub.ac.uk

CRS 2025
ANNUAL MEETING & EXPOSITION

PHILADELPHIA, PA
JULY 13-18, 2025

NEXT-GENERATION DELIVERY INNOVATIONS