

Research Engagement

Low Resource Solutions to High Impact Research

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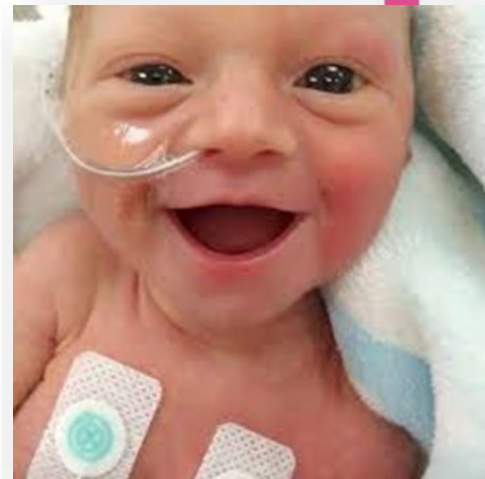
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Challenges to Research... Opportunities!

- Time
- Finances
- Research culture
- Facilities
- **My background – Research area**
- **What impact can we have?**
- **Example: Emma Wilson**

Sepsis, NEC, Probiotics & Preterms

- Preterm infants
- NEC: 21% infant deaths, preterm 20-40%
- Collaborators
 - RVI Newcastle and Newcastle University
 - Northumbria University and Teesside University
- Why *Bifidobacteria*?
 - Break down oligosaccharides and glycoproteins in breast milk
 - Immunoregulatory role



One step further... opportunities again

Developing students

Employability

Impact

Collaborate

Pilot studies

One step further... opportunities again

Developing students

- We ask our students to find a protocol
- Adapt it to the resources available... how?!
- Understand mechanisms and interactions... chemical and biological... and sometimes even physics

One step further... opportunities again

Developing students
Employability

- Problem Solving
- Critical analysis
- Confidence
- Deeper understanding
- Financial intelligence – budgetary constraints



One step further... opportunities again

Developing students

Employability

Impact

- Disseminate information and knowledge
- Funding and grant opportunities
- Outreach
- International implications...

One step further... opportunities again

Developing students

Employability

Impact

Collaborate

- Networks
- Training
- Facilities

One step further... opportunities again

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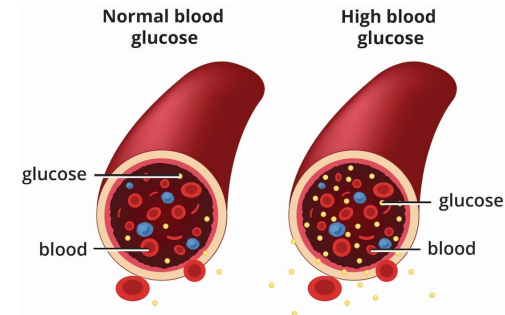
Collaborate

Pilot studies

- Proof of concept
- Here's one we prepared earlier...

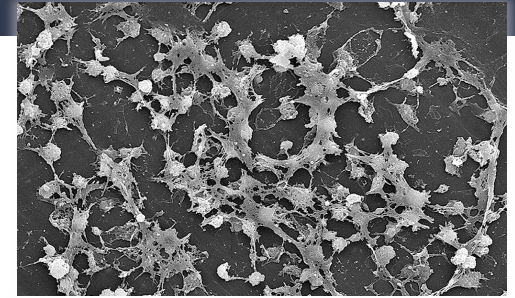
Diabetes

- Average cost of diabetic wound care can be up to £16,900 (Kerr et al. 2019).
- Around 25% of diabetic patients will have wound healing complications (Guest et al. 2020).
- NHS cost: approximately £10 billion per year (NHS.2022).

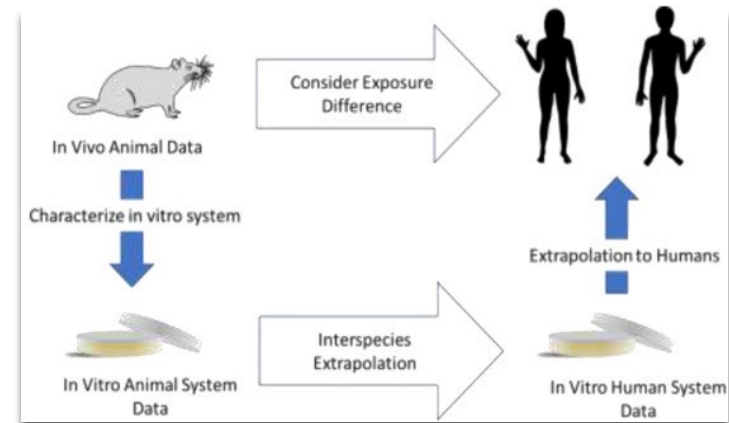


The Issues

- Biofilm formation
 - Increased bacterial growth can lead to biofilm formation.
 - Optimum healing conditions can never be achieved once a biofilm has formed (Zhou et al. 2020).
- Diabetes Research Using Rats and Mice
 - Replacement
 - Reduction
 - Refinement



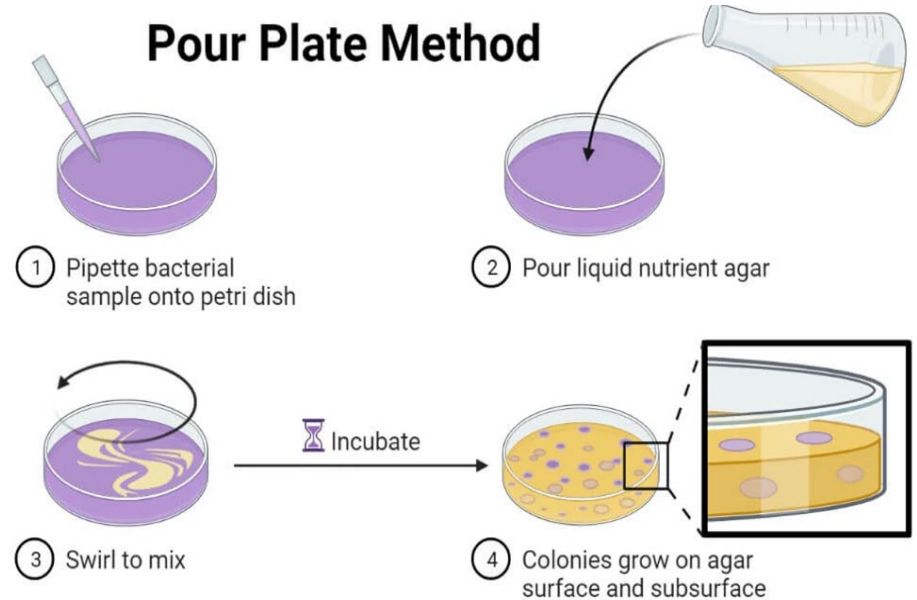
Staphylococcus aureus in biofilm (Picryl. 2005)



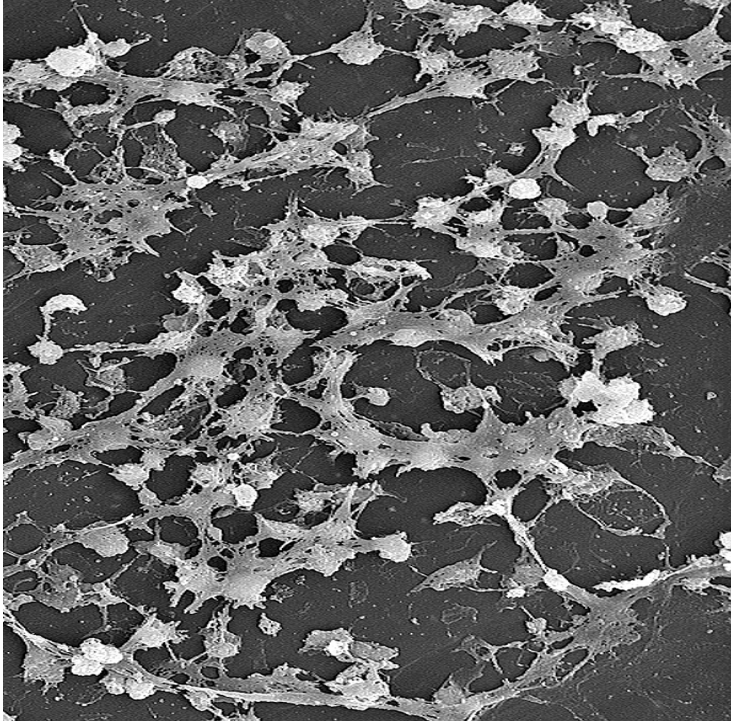
The General Scheme of Animal to Human Testing (Mattes. 2020)

Our Solution

- The diabetic conditions were created *in vitro*.
- Glucose was added to agar medium.
- This mimicked the conditions found in diabetic wounds.



Colonisation of *Bacillus Megaterium* in the Presence of Glucose - Comparison



Staphylococcus aureus



Bacillus Megaterium

Conclusion

- The project permitted an animal free solution for diabetic research.
- Potential money saving approach for NHS and other research institutes.
- Providing a low resource solution to high impact research!

Any Questions?



References

- Carbone, L. (2012). Estimating mouse and rat use in American laboratories by extrapolation from Animal Welfare Act-regulated species. *Sci Rep* (11). Available from: [Streptozotocin-induced type 1 and 2 diabetes in rodents: a model for studying diabetic cardiac autonomic neuropathy - PMC \(nih.gov\)](#). (Accessed 27th June 2023).
- Degrazia, D. Beauchamp, T.L. (2019). Beyond the 3 Rs to a more comprehensive framework of principles for animal research ethics. *J ILARJ*. 60(3). Pp 308-317. Available from: [ilz011.pdf \(silverchair.com\)](#). (Accessed 26th June 2023).
- Guest, J. F. Fuller, G. W. Vowden, P. (2020). Cohort study evaluating the burden of wounds to the UK's national health service in 2017/2018. *BMJ*. 10(12). Available from: [e045253.full.pdf \(bmj.com\)](#). (Accessed 25th June 2023)
- Kerr, M. Barron, E. Chadwick, P. Evans, T. Kong, W.M. Rayman, G. Sutton-Smith, M. Todd, G. Young, B. Jeffcoate, W.J. (2019). The cost of diabetic foot ulcers and amputations to the National Health Service in England. *Diabet Med*. 36(8). Available from: [The cost of diabetic foot ulcers and amputations to the National Health Service in England - PubMed \(nih.gov\)](#). (Accessed 25th June 2023).
- Kottaisamy, C.P.D., Raj, D.S., Prasanth Kumar, V. Sankaran, U. (2021) Experimental animal models for diabetes and its related complications—a review. *Lab Anim Res* (37). Available from: [Experimental animal models for diabetes and its related complications—a review | Laboratory Animal Research | Full Text \(biomedcentral.com\)](#). (Accessed 27th June 2023).
- NHS (2022). NHS prevention programme cuts chance of type 2 diabetes for thousands. Available from: [NHS England » NHS Prevention Programme cuts chances of Type 2 diabetes for thousands](#). (Accessed 25th June)
- Mattes, W. B. (2020). *In Vitro* to *In Vivo* Translation. *Curr Op Toxicol*. (24). Pp 114-118. Available from: [In vitro to in vivo translation - ScienceDirect](#). (Accessed 26th June 2023)
- Zhao, H. Huang, J. Li, Y. Lv, X. Zhou, H. Wang, H. Xu, Y. Wang, C. Liu, Z. (2020). Ros-scavenging hydrogel to promote wound healing of bacteria infected wounds. *Biomater*. 258. Available from: [ROS-scavenging hydrogel to promote healing of bacteria infected diabetic wounds - ScienceDirect](#). (Accessed 24th June 2023)