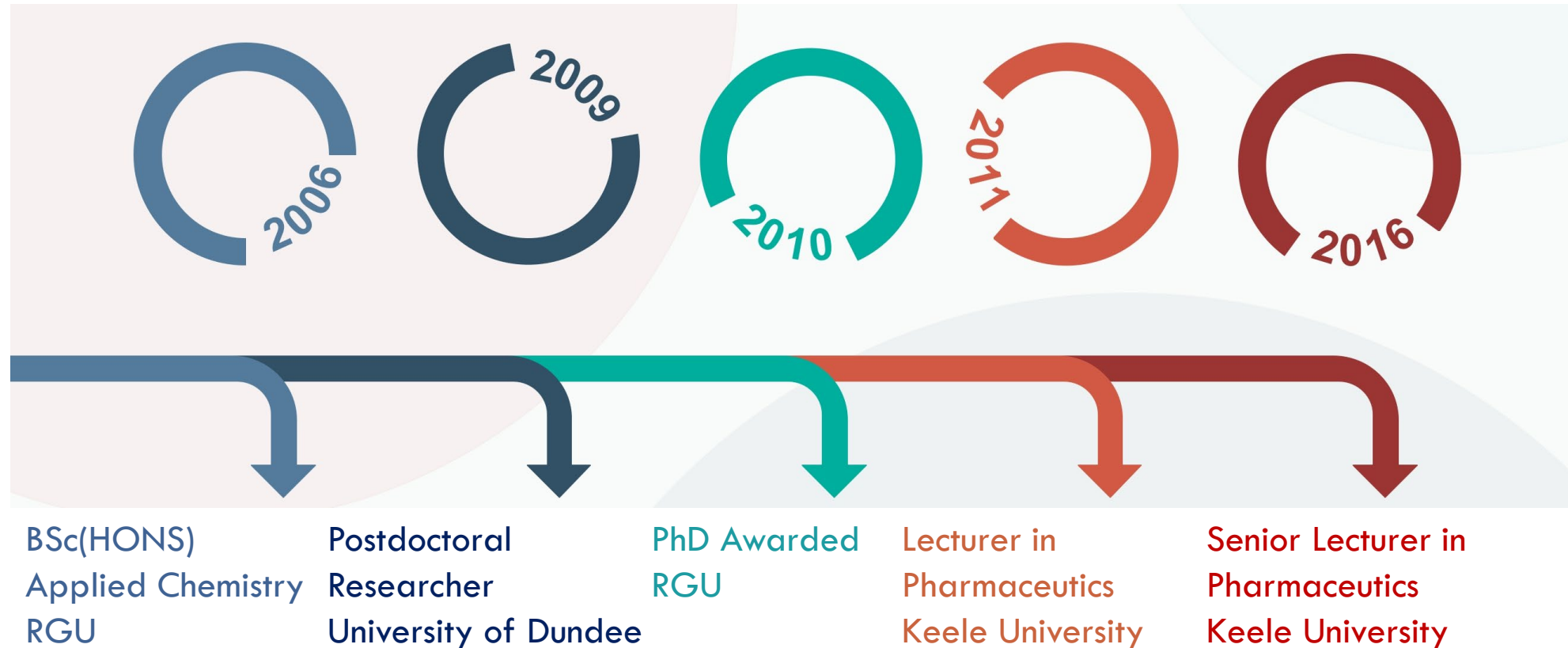




# **NANO-ASSASINS FOR PANCREATIC CANCER THERAPY**

Dr Clare Hoskins  
13/09/19  
@HoskinsLab

# CAREER PROFILE



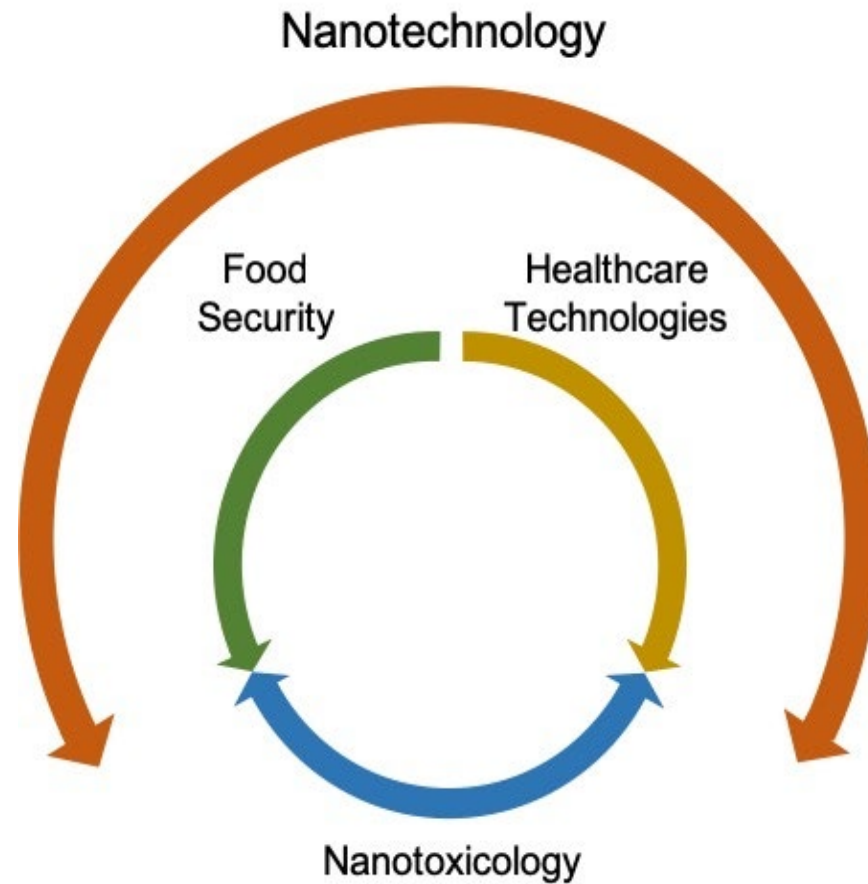
# KEELE UNIVERSITY



# NANOPHARMACEUTICS GROUP



# RESEARCH PORTFOLIO



# HEALTHCARE TECHNOLOGIES

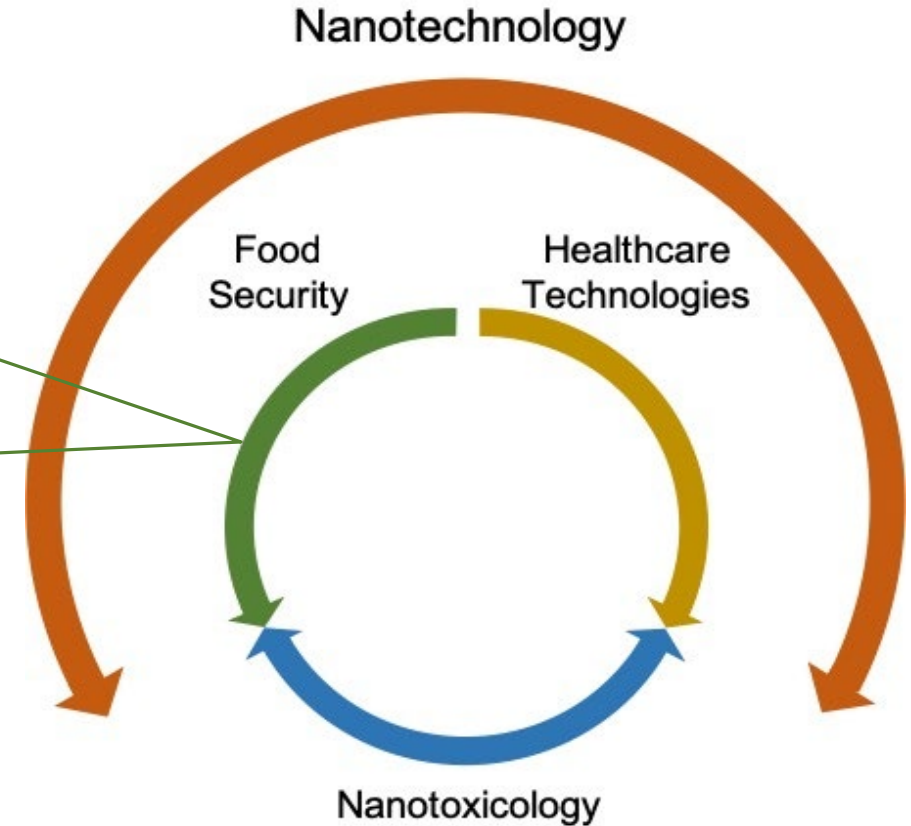


- Cancer Nanomedicine
- Theranostics
- Drug delivery
- Image Guidance
- Parasitology
- Reproductive Technology
- Antimicrobial Resistance
- Regenerative Medicine
- Cardiovascular Disease



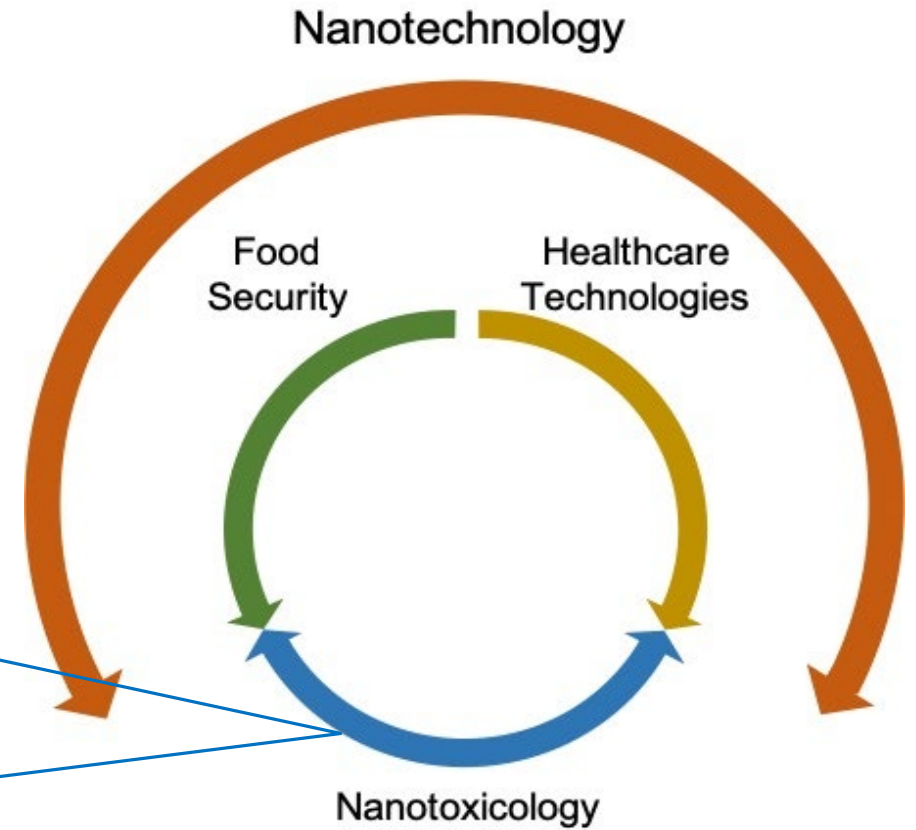
# FOOD SECURITY

- Formulation of biorationals
- Translated from medical technologies
- Multiple insect pests
  - Aphids
  - Thrips
  - Full army worm
  - White fly
- Varied administration routes
- Field trials



# NANOTOXICOLOGY

- Health
  - *In vitro* assays
    - Cytotoxicity
    - Immunotoxicity
    - Assay appropriateness
    - Absorption across membranes
  - *In vivo*
    - Pharmacokinetics
    - Pharmacodynamics
    - Fate
    - Clearance
    - Accumulation
- Environmental
  - Impact on insect life: Bees!!
  - Lasting impact on soils

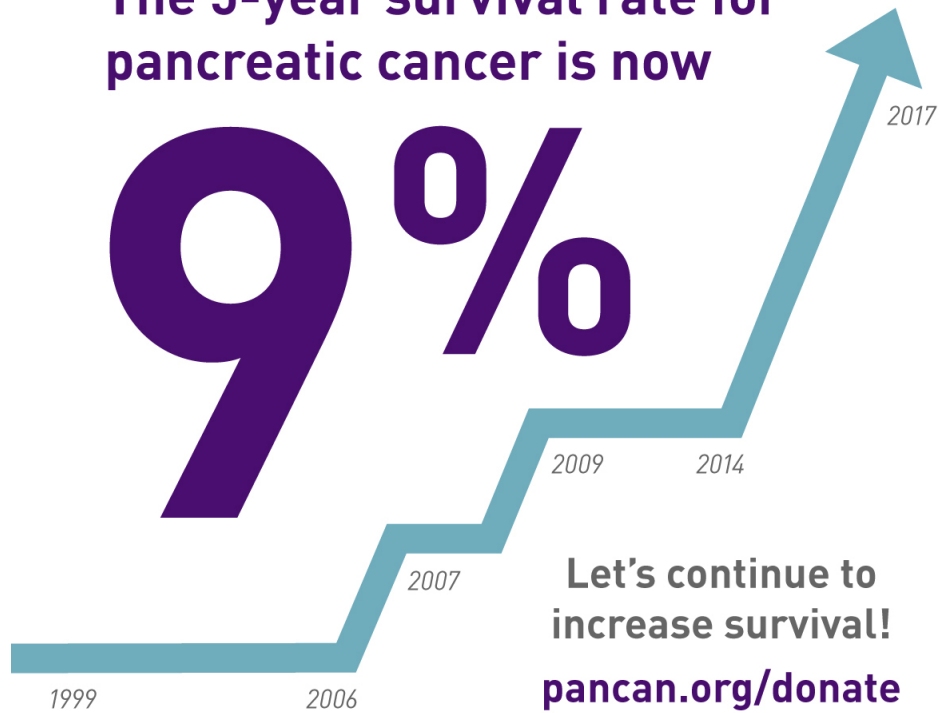




# CANCER NANOMEDICINE

The 5-year survival rate for pancreatic cancer is now

9%



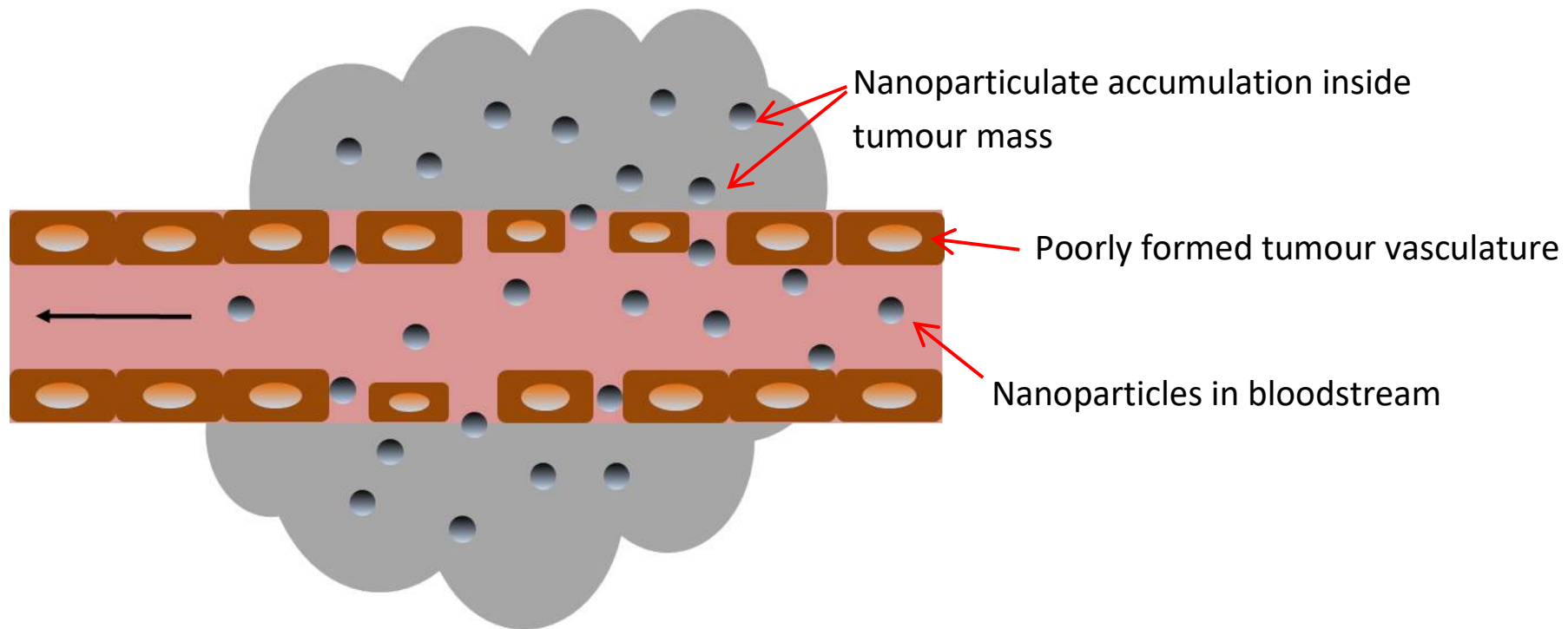
Let's continue to increase survival!  
[pancan.org/donate](http://pancan.org/donate)



American Cancer Society, Cancer Facts and Figures 1999-2017, SEER-9 database.



# NANOMEDICINES FOR CANCER THERAPY





# METALLIC NANOPARTICLES

- Detection at the cellular level
- Imaging using magnetic resonance imaging (MRI)
- Targeted drug delivery and gene therapy.



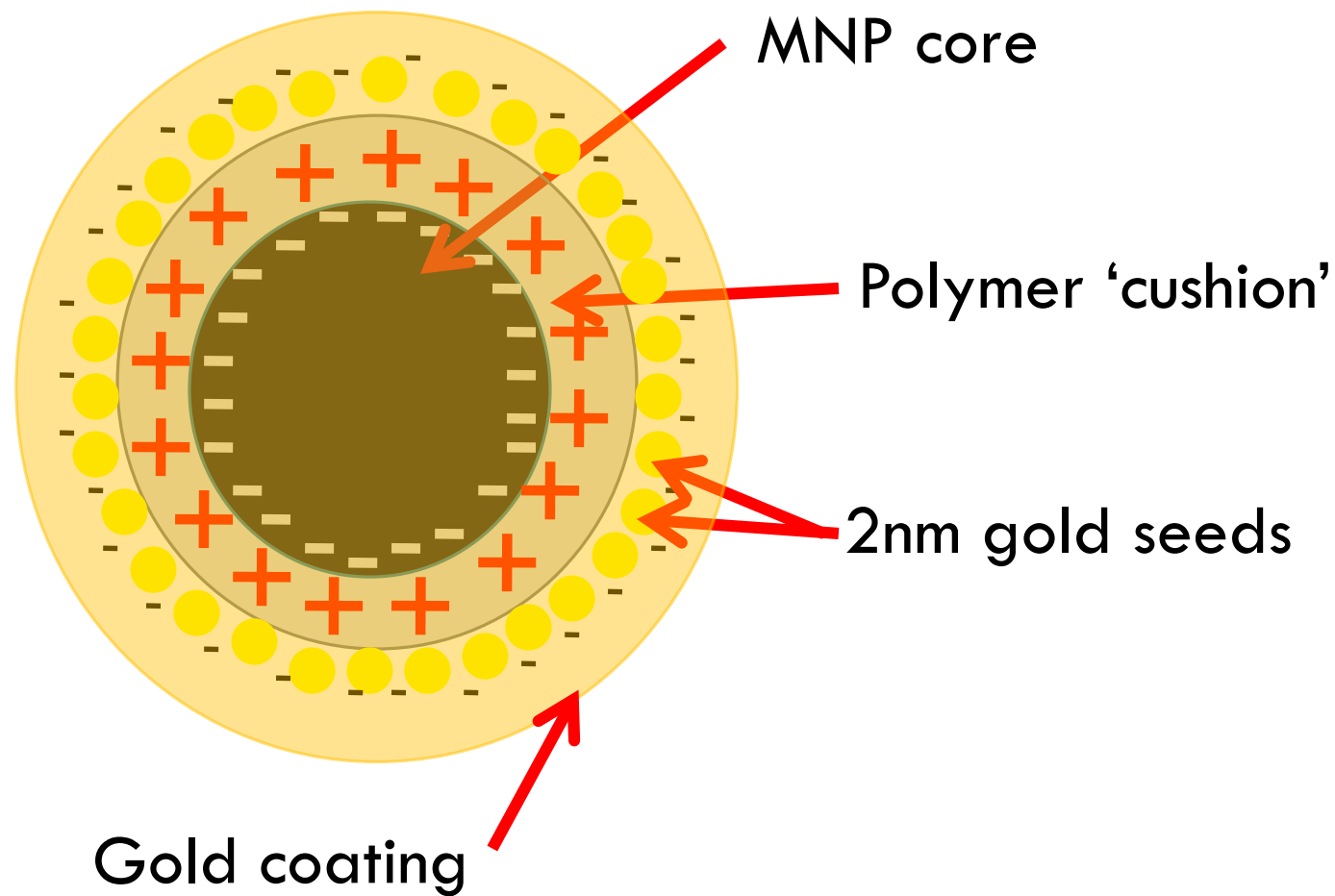
**Magnetic nanoparticles**

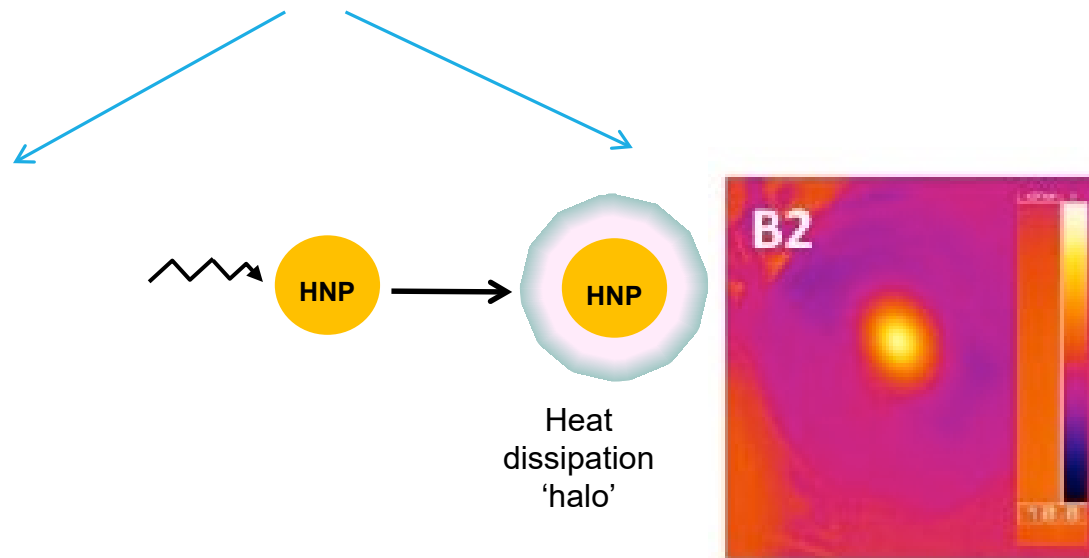
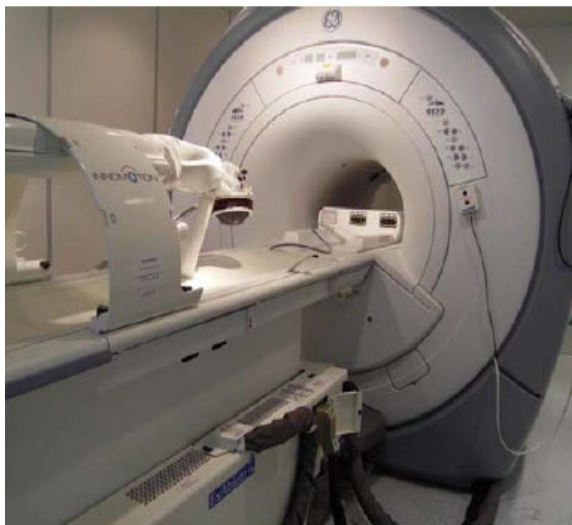
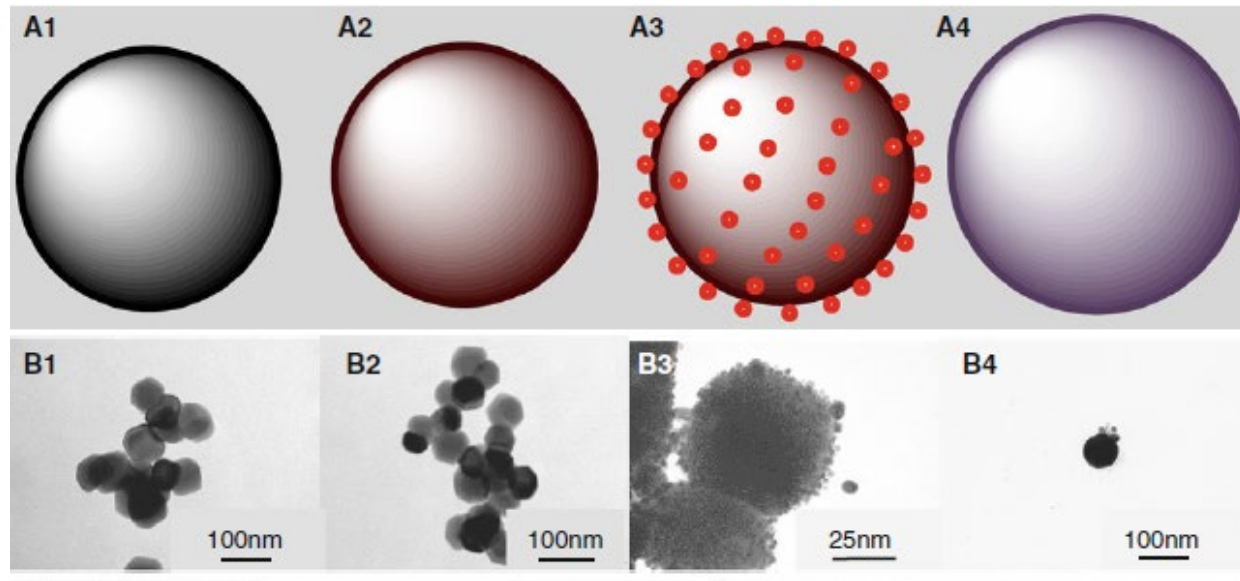


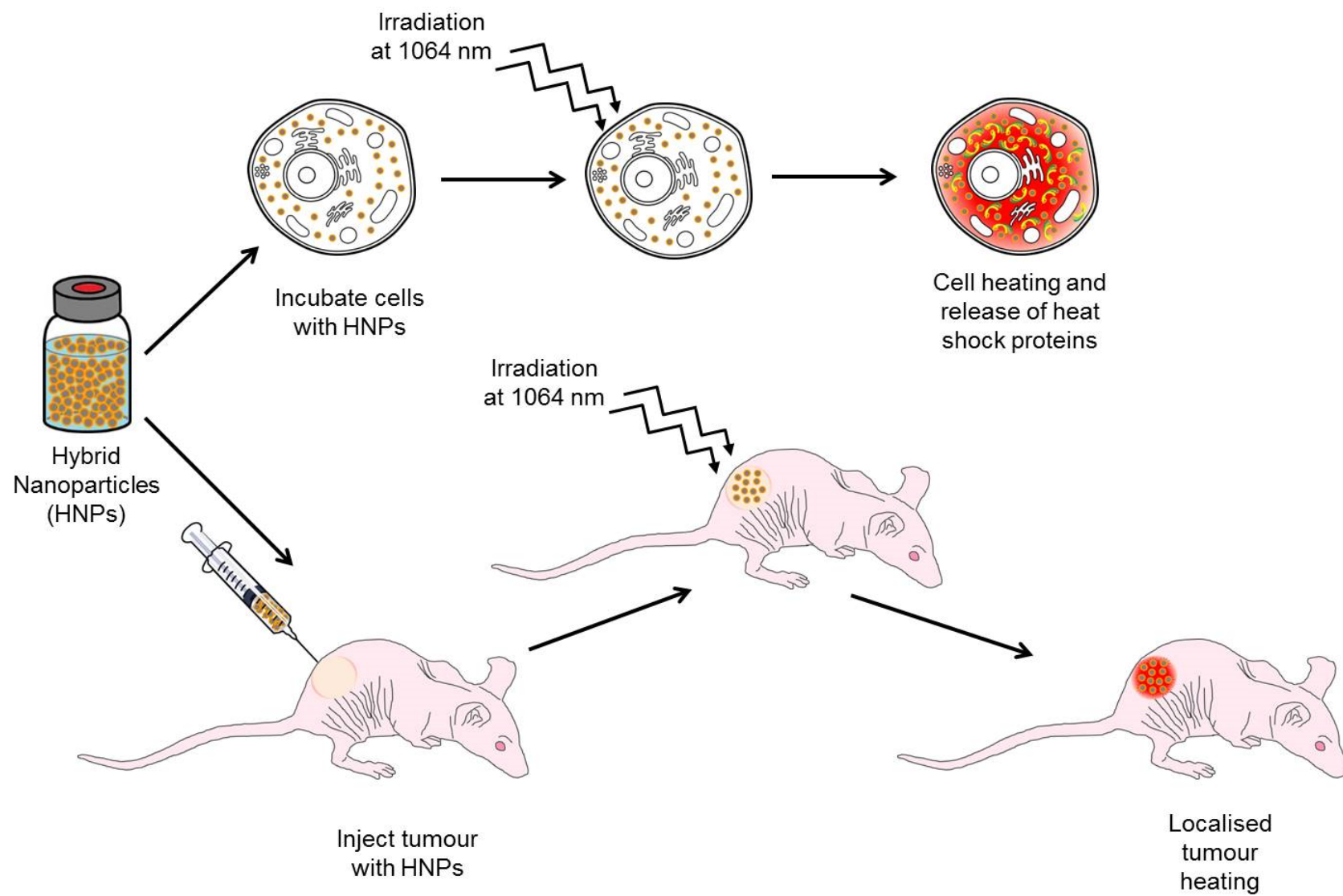
**Gold**

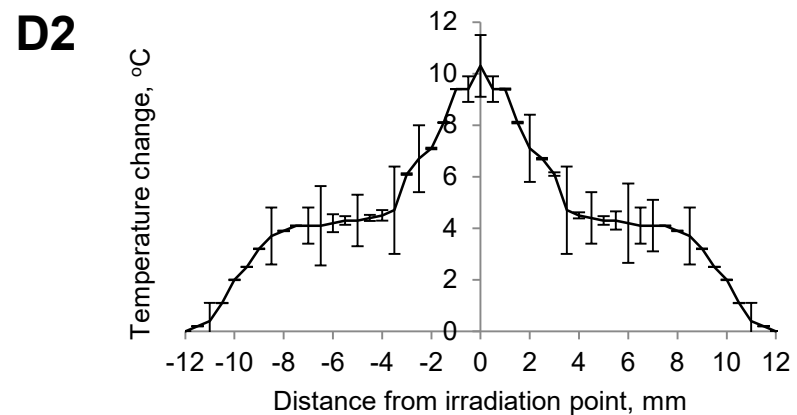
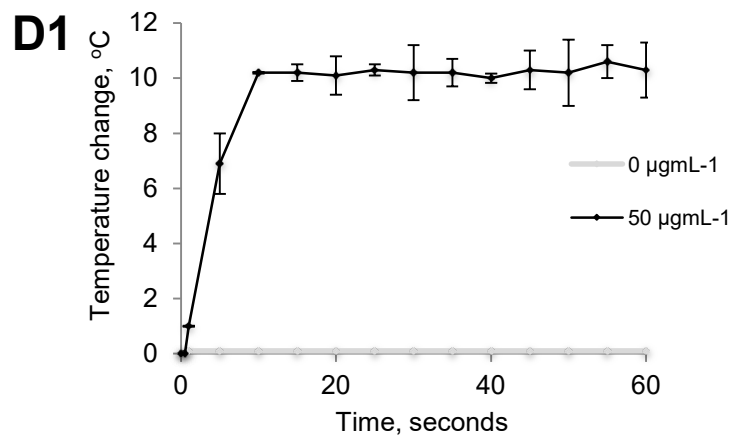
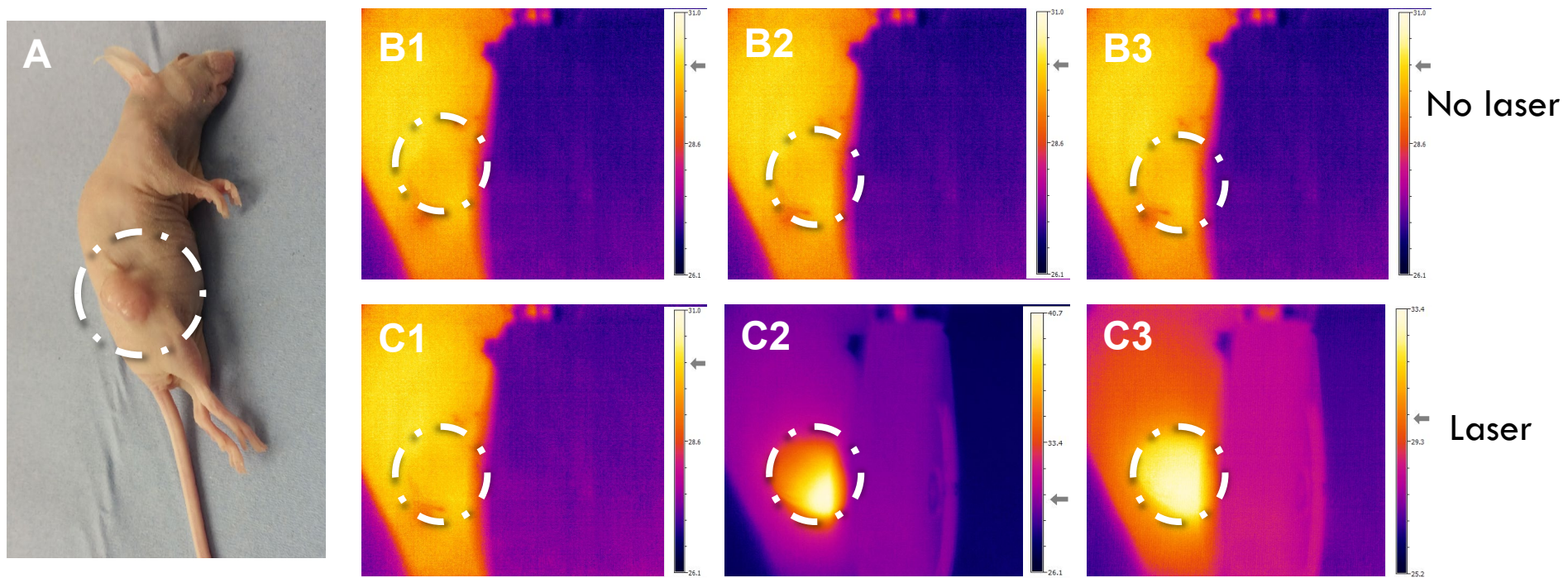
- Chemically stable
- Biocompatibility
- Surface plasmon resonance (SPR)  
SPR allowing strong absorption and scatter at visible and near infrared wavelengths upon irradiation resulting in heating effect.

# HYBRID NANOPARTICLES

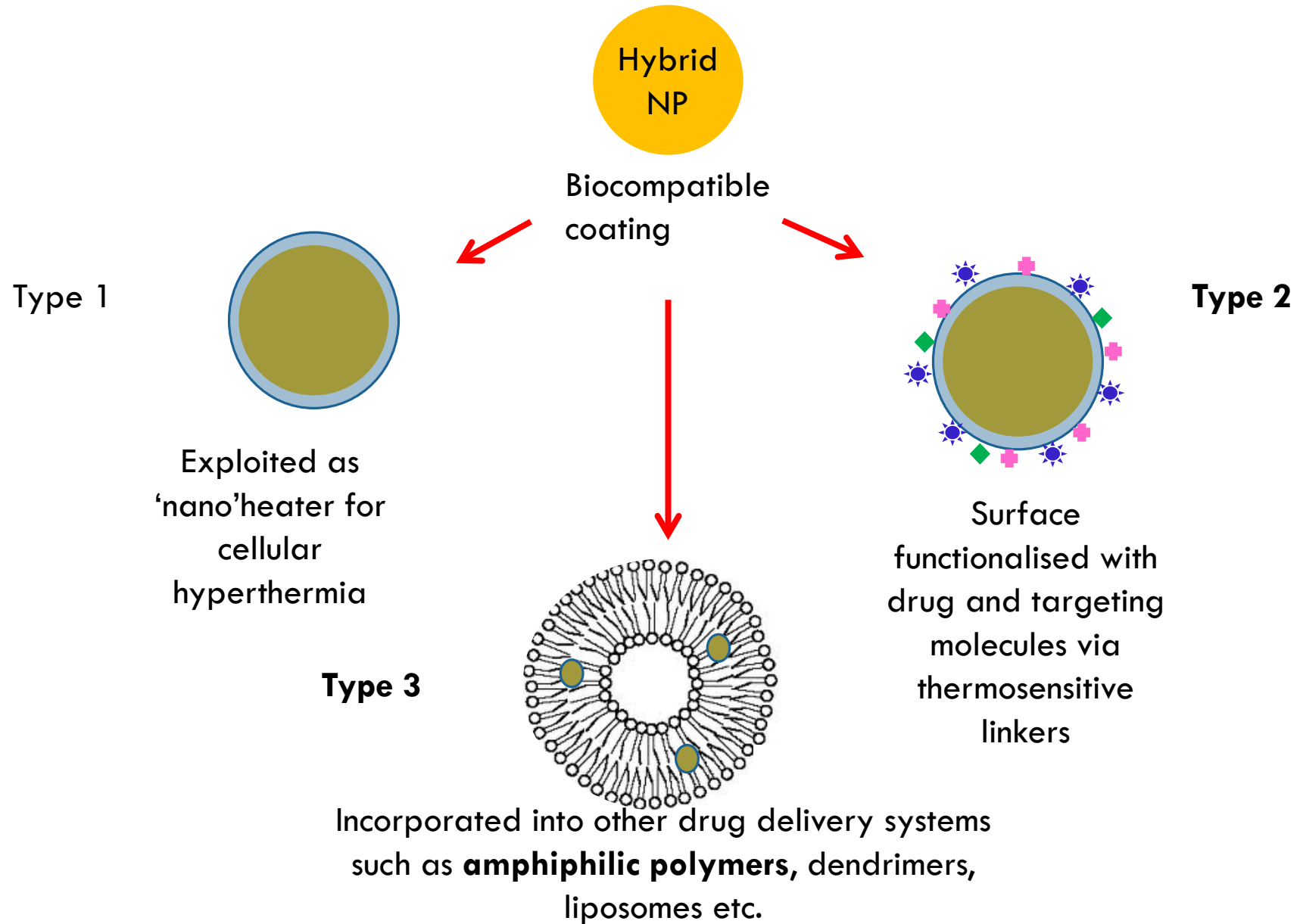




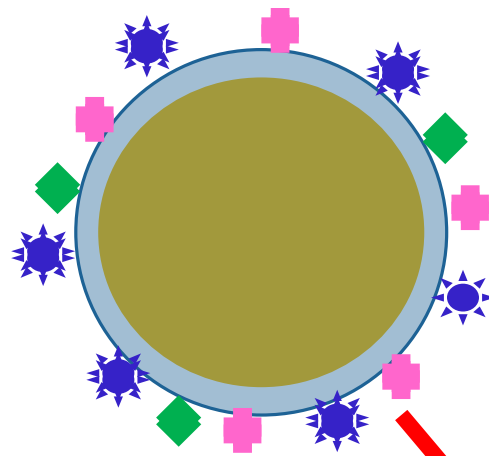








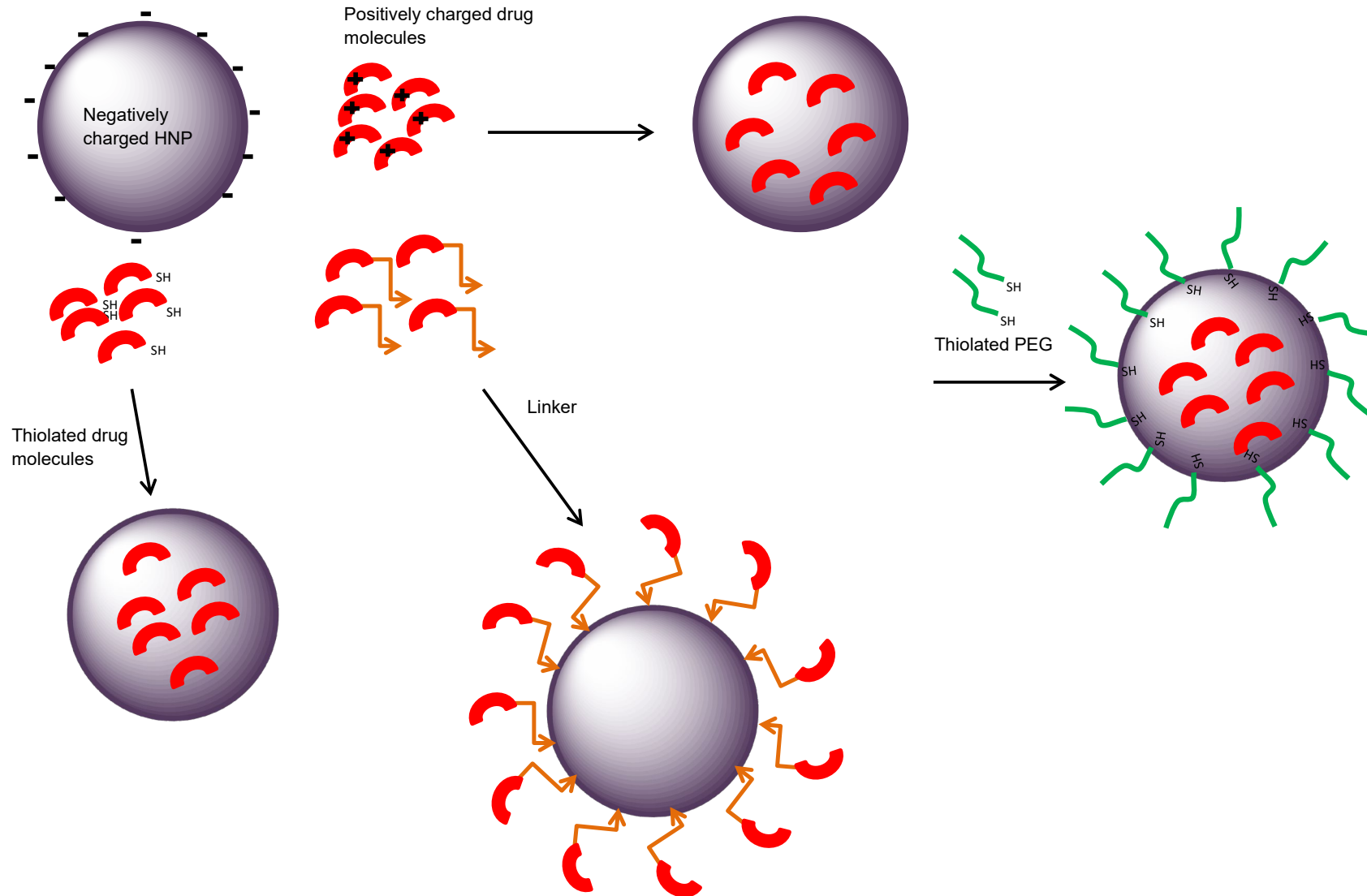
# TYPE 2



Upon heating  
thermosensitive  
bonds break and  
drug molecules  
released

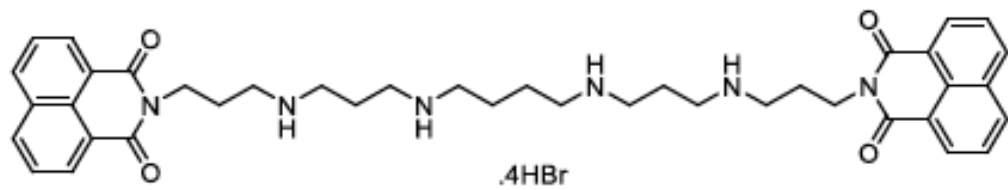
**Uses:**  
**Water soluble drugs**

# DRUG CONJUGATION MECHANISMS



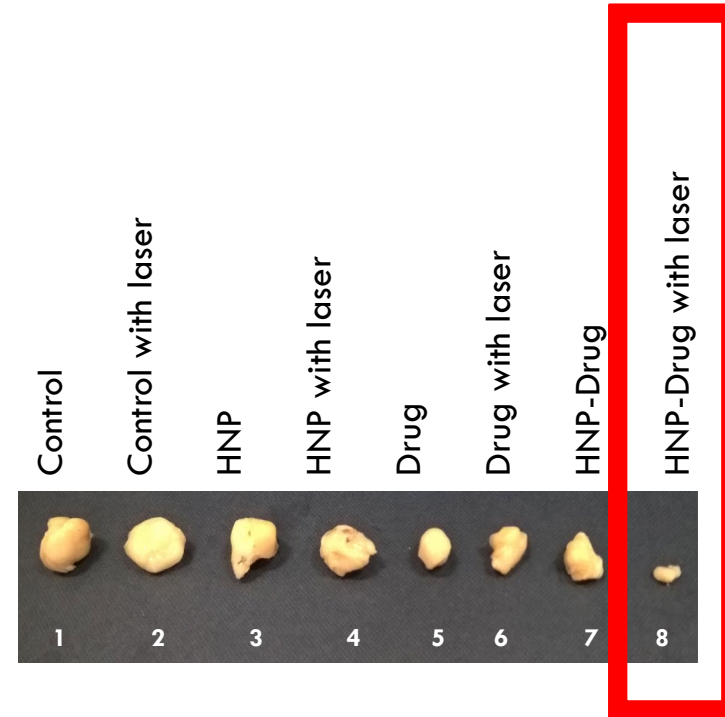
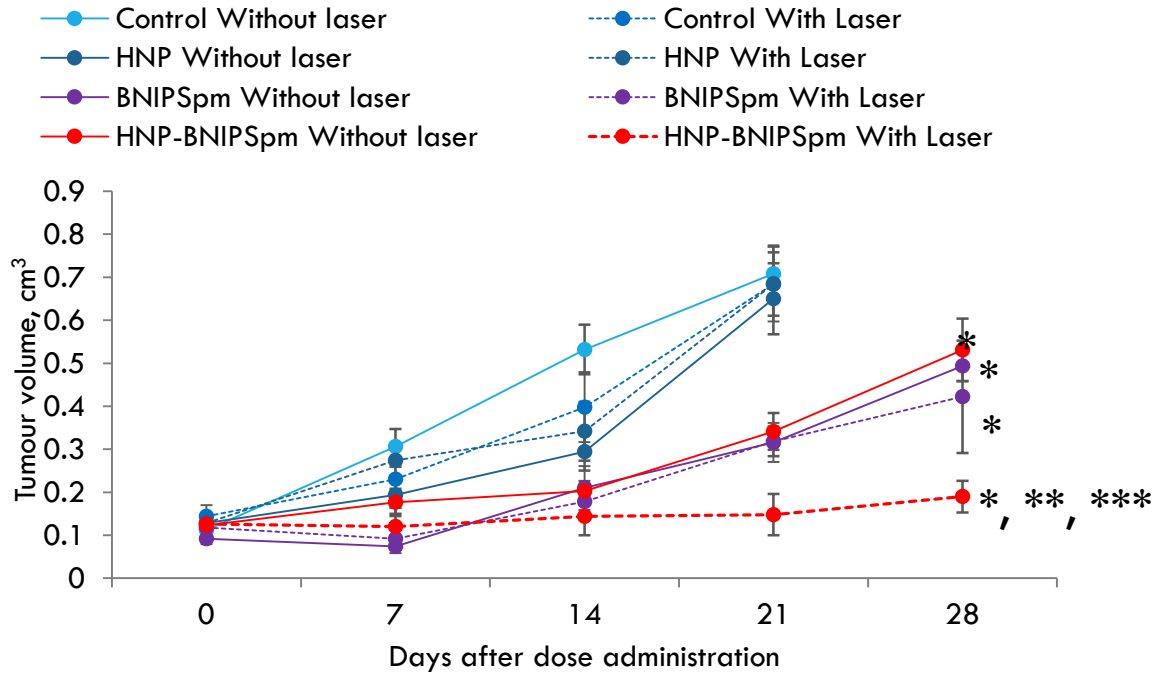


# ELECTROSTATIC NANO-NINJAS



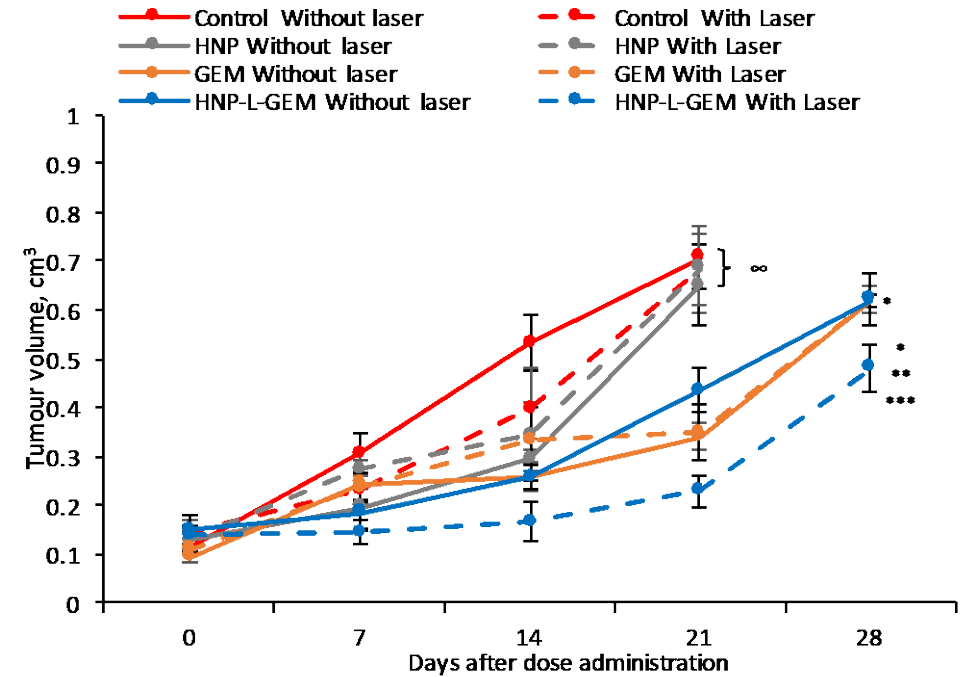
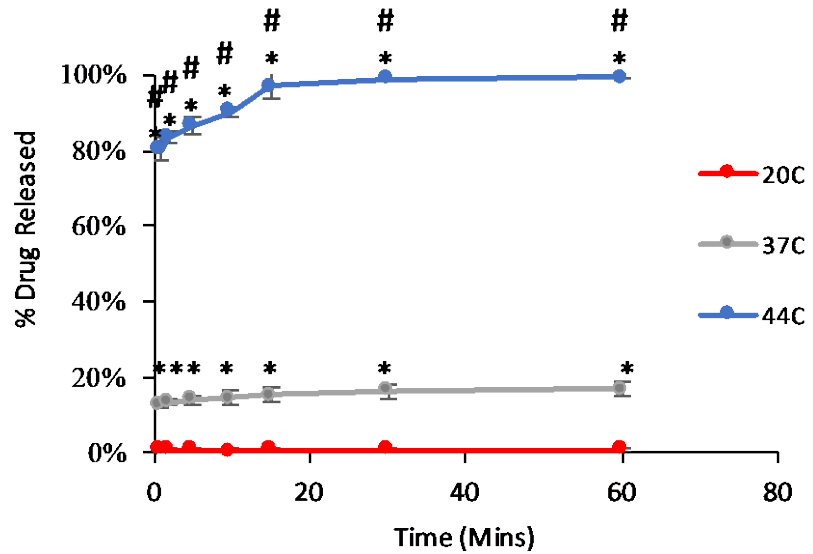
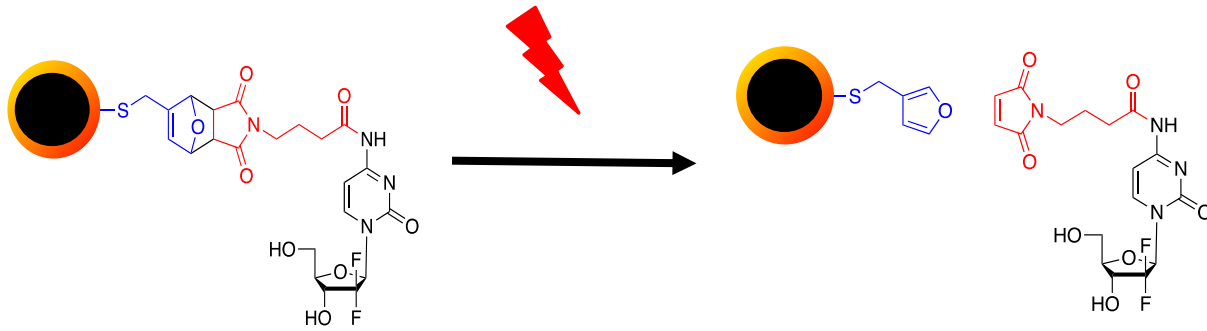


# IN VIVO TUMOUR VOLUME





# DIELS-ALDER MEDIATED NANO-NINJAS



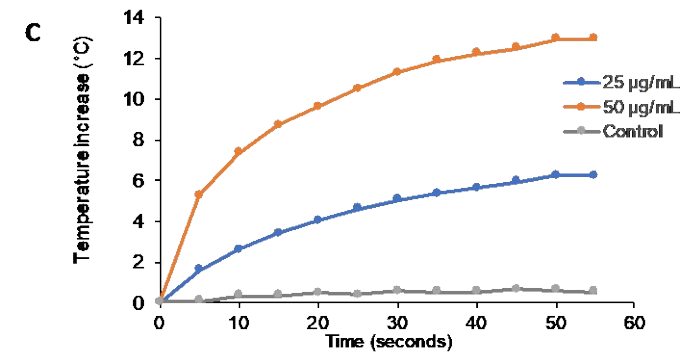
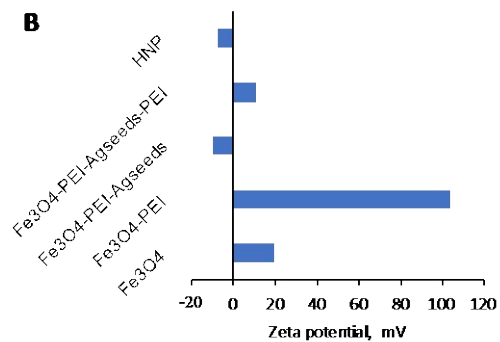
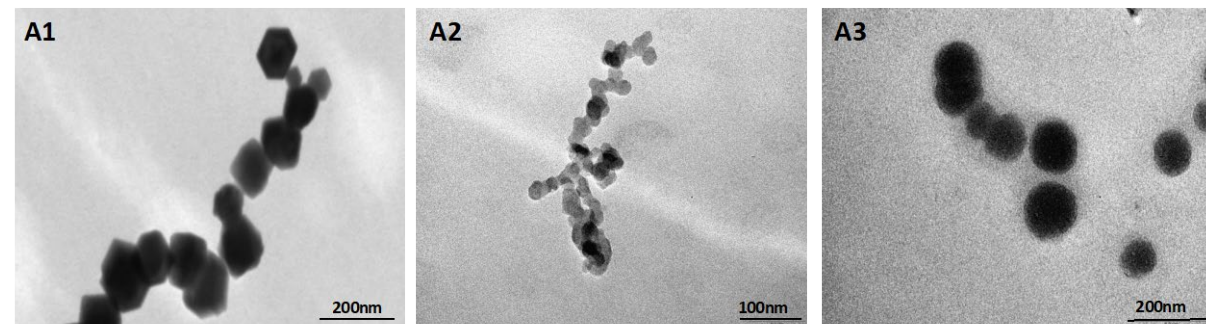
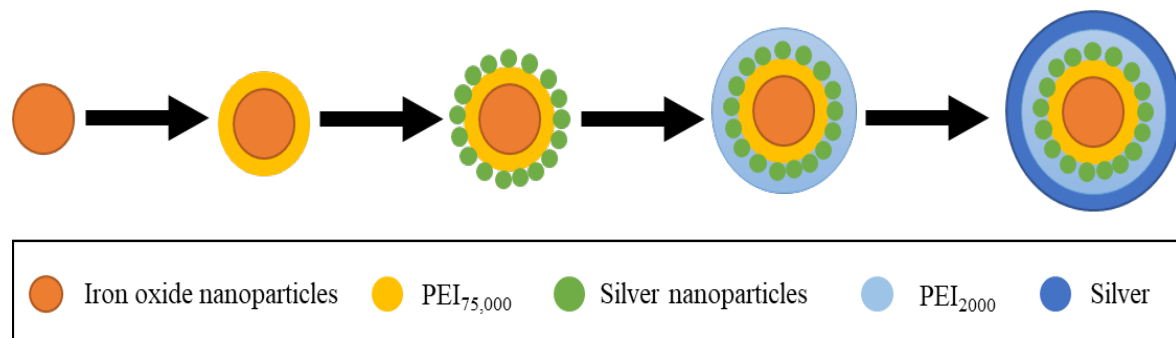
# EVOLUTION OF TECHNOLOGY

## Potential role of intratumor bacteria in mediating tumor resistance to the chemotherapeutic drug gemcitabine

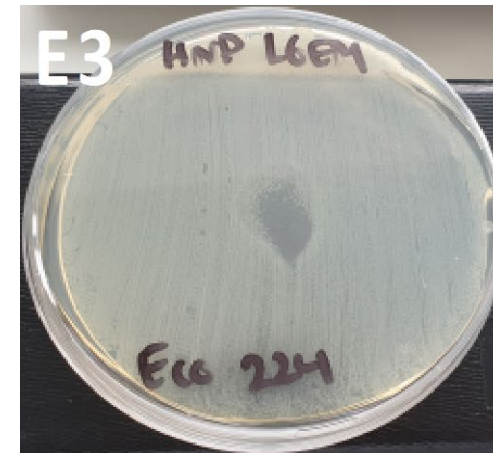
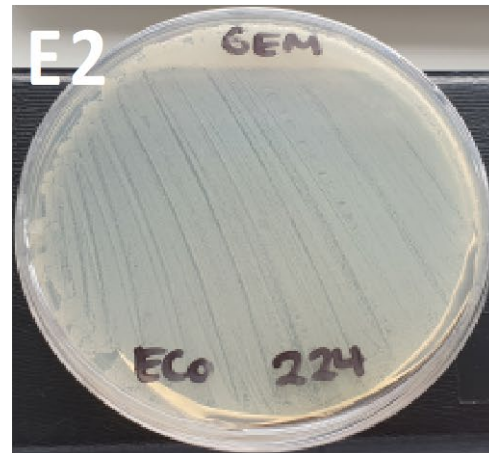
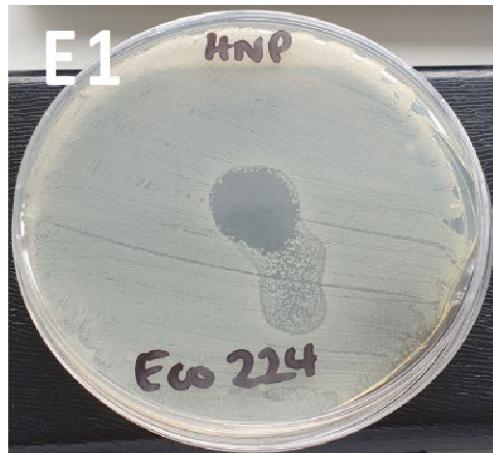
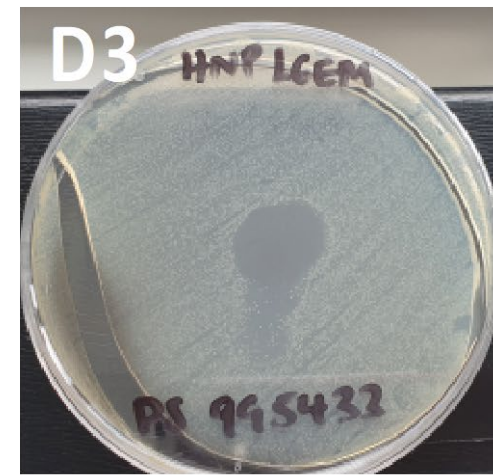
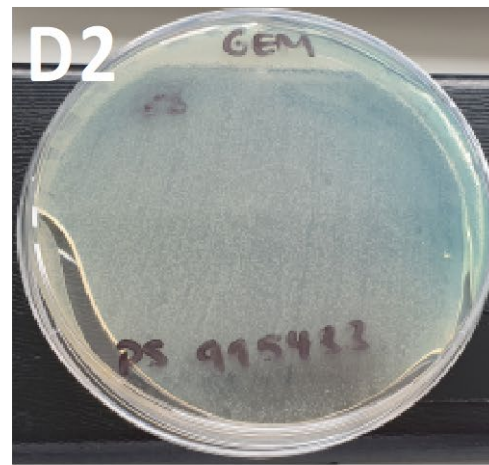
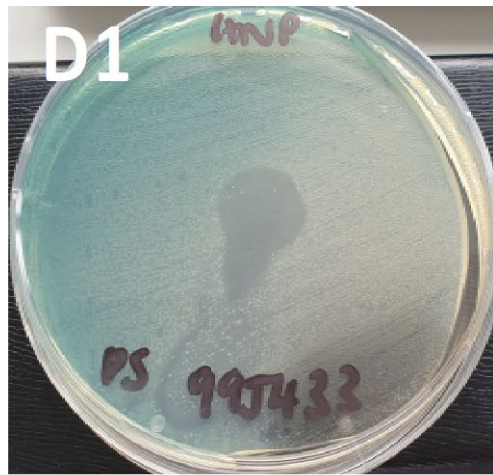
Leore T. Geller<sup>1,\*</sup>, Michal Barzily-Rokni<sup>2,\*</sup>, Tal Danino<sup>3,†</sup>, Oliver H. Jonas<sup>4,5</sup>, Noam Shental<sup>6</sup>, Deborah Nejman<sup>1</sup>, Nancy Gavert<sup>1</sup>, Yaara Zwang<sup>1</sup>, Zachary A. Cooper<sup>7,8,‡</sup>, Kevin Shee<sup>2</sup>, Christoph A. Thaiss<sup>9</sup>, Alexandre Reuben<sup>8</sup>, Jonathan Livny<sup>2</sup>, Roi Avraham<sup>10</sup>, Dennie T. Frederick<sup>11</sup>, Matteo Ligorio<sup>12</sup>, Kelly Chatman<sup>13</sup>, Stephen E. Johnston<sup>2</sup>, Carrie M. Mosher<sup>2</sup>, Alexander Brandis<sup>14</sup>, Garold Fuks<sup>15</sup>, Candice Gurbatri<sup>16</sup>, Vancheswaran Gopalakrishnan<sup>8</sup>, Michael Kim<sup>8</sup>, Mark W. Hurd<sup>17</sup>, Matthew Katz<sup>8</sup>, Jason Fleming<sup>8</sup>, Anirban Maitra<sup>18</sup>, David A. Smith<sup>2</sup>, Matt Skalak<sup>3</sup>, Jeffrey Bu<sup>3</sup>, Monia Michaud<sup>19</sup>, Sunia A. Trauger<sup>13</sup>, Iris Barshack<sup>20,21</sup>, Talia Golan<sup>21,22</sup>, Judith Sandbank<sup>21</sup>, Keith T. Flaherty<sup>12</sup>, Anna Mandinova<sup>2,23</sup>, Wendy S. Garrett<sup>2,19,24</sup>, Sarah P. Thayer<sup>25</sup>, Cristina R. Ferrone<sup>26</sup>, Curtis Huttenhower<sup>2,27</sup>, Sangeeta N. Bhatia<sup>2,28,29,30,31,32,33</sup>, Dirk Gevers<sup>2,Δ</sup>, Jennifer A. Wargo<sup>7,8</sup>, Todd R. Golub<sup>34,35,36,#</sup>, and Ravid Straussman<sup>1,#,¥</sup>



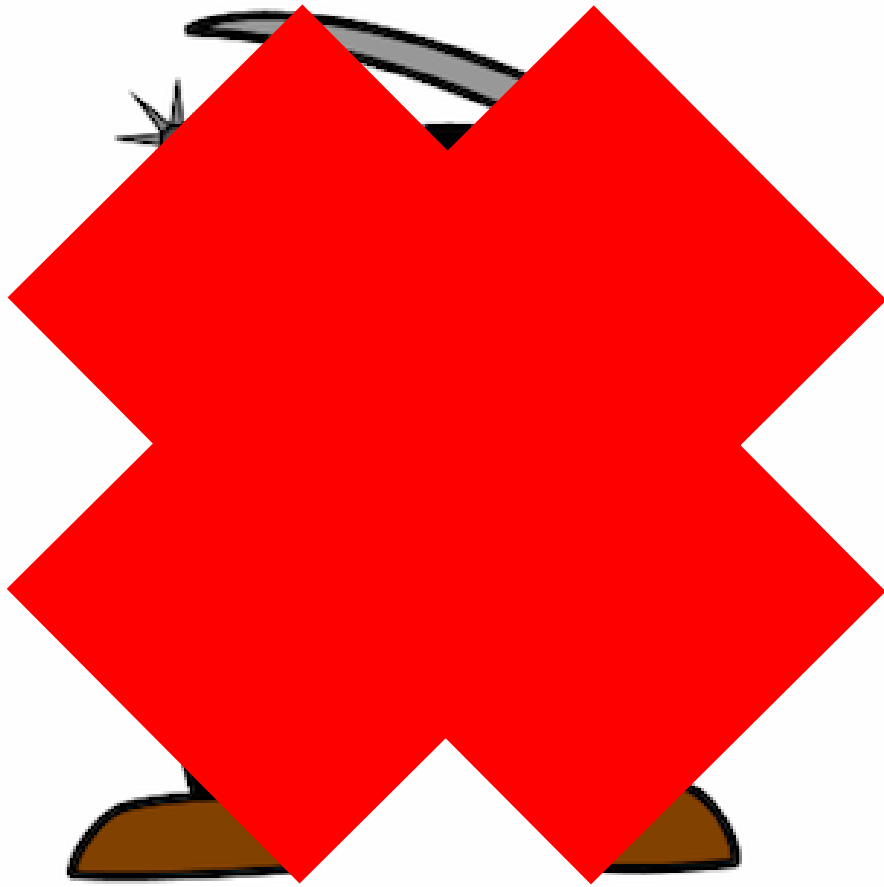
# SILVER – IRON OXIDE HYBRID NANOPARTICLES



# ANTIMICROBIAL ACTION



# LIMITATIONS



# ONGOING WORK

- Active targeting
- Surface optimisation
- Mechanistic studies of cellular interaction and fate
- Imaging
- Manufacture scale-up
- *In vivo* pharmacokinetics

# COLLABORATORS



# ACKNOWLEDGEMENTS

## **Nanopharmaceutics Group**

- Dr Tony Curtis
- Dr Maryam Malekigorji
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- Dr Mohanad Alfahad
- Dr Wejdan Al Shakarchi
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- Moa Ellingsen
- Ali Taha Alsuraifi
- Chris Barnett
- Malin Stenhoff
- Jenan Al Jemira
- Tahani Jihad
- May Albulraman
- Mohsen Ali Asgari
- Rachel Foulkes

## **Collaborators**

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- Dr Andrew Lamb, RGU
- Dr Martin Lees, University of Warwick
- Dr Mariana Gueorguieva, University of Dundee
- Dr Johannes Reynisson, Keele University
- Dr Gavin Miller, Keele University
- Professor Cameron Alexander, University of Nottingham
- Mr Chris Halloran, University of Liverpool

# FUNDING



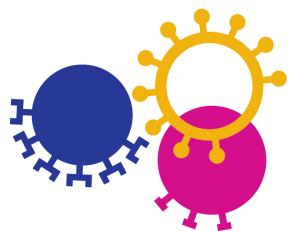
North Staffordshire  
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UNIVERSITY OF  
GOTHENBURG



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# EPSRC

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Research Council



INSTITUTE FOR  
SCIENCE AND  
TECHNOLOGY  
IN MEDICINE

# MENTORS





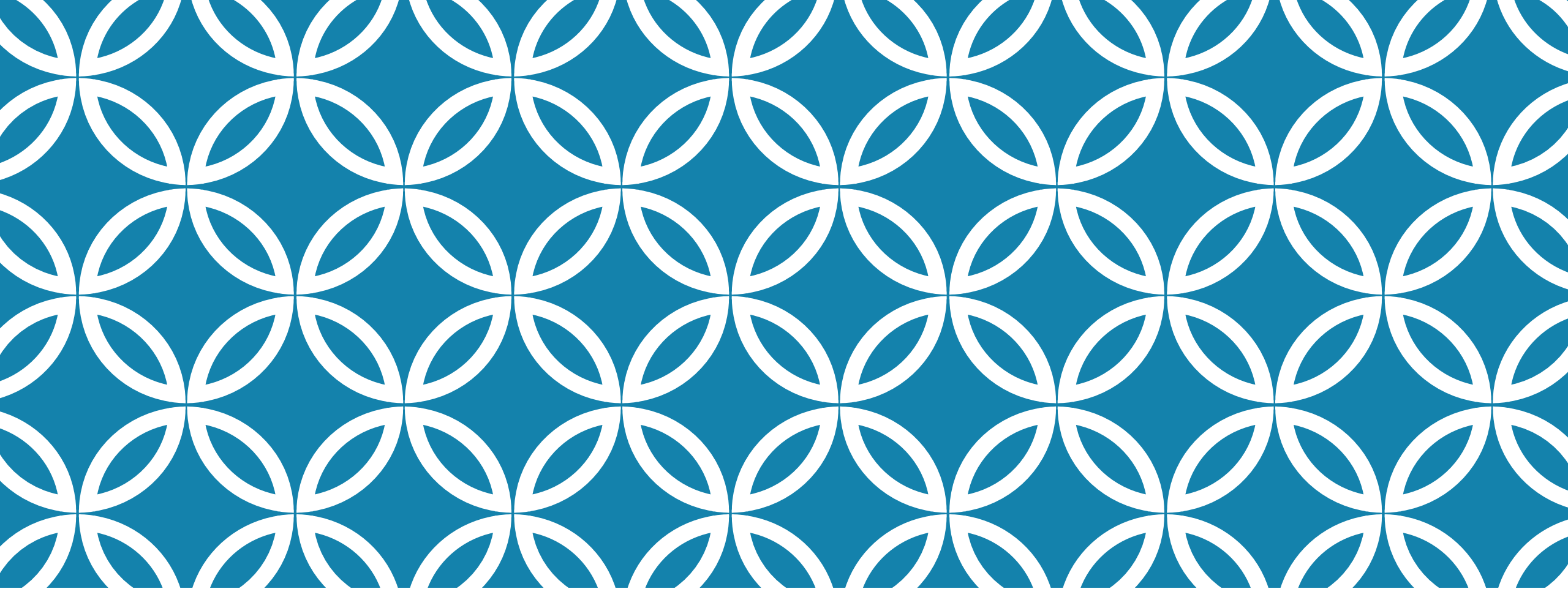


**MEN**  
←  
**TO THE LEFT  
BECAUSE  
WOMEN**  
→  
**ARE ALWAYS  
RIGHT!**



*‘The place of useful learning’*

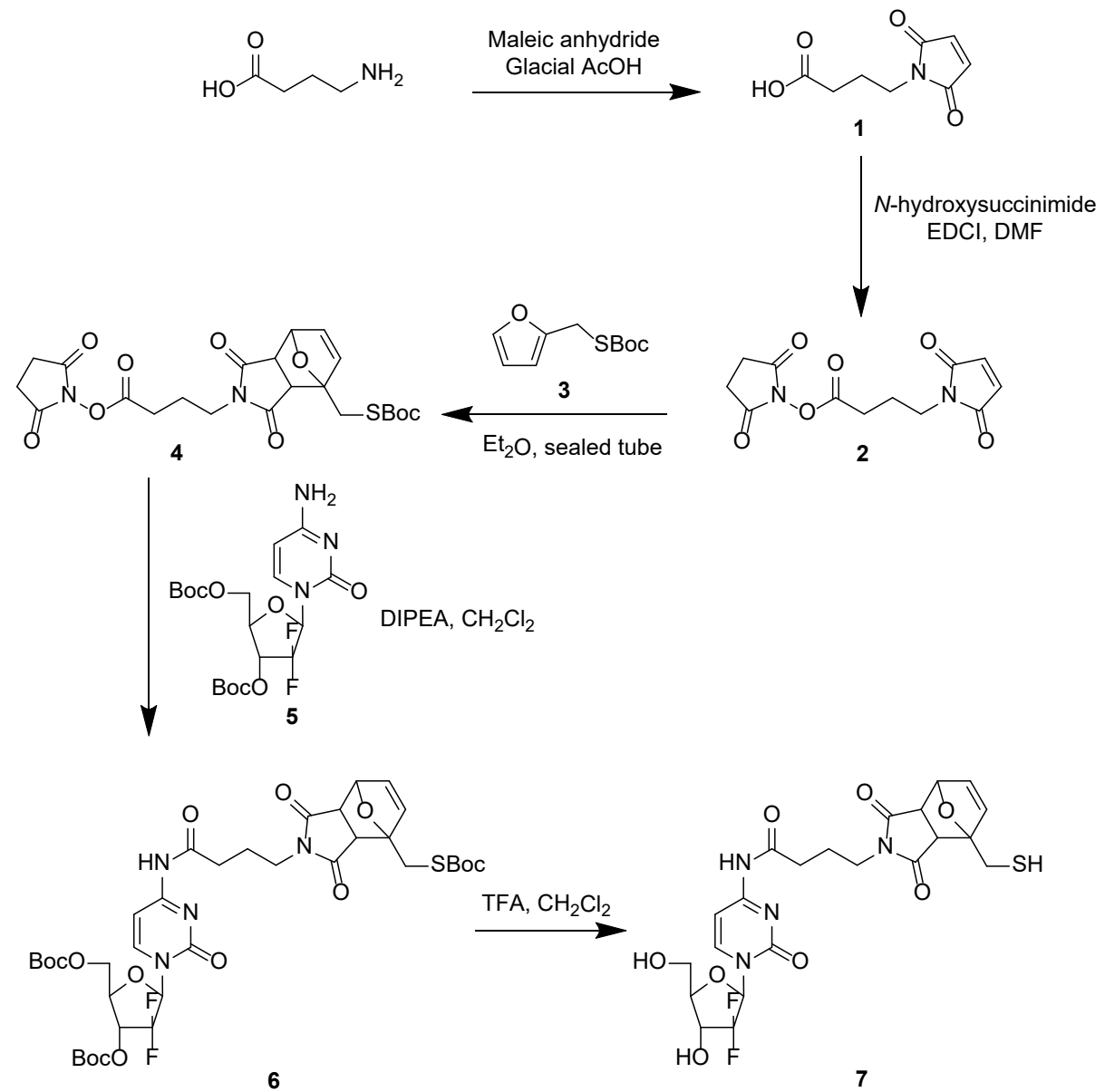




**THANK YOU FOR LISTENING**

ANY QUESTIONS?

@HoskinsLab





10<sup>th</sup> APS International

**PharmSci**

Conference

Greenwich 2019

# Closing address

*Professor Cameron Alexander*

*Dr Mark McAllister*

*Professor Martin Snowden*





Greenwich 2019

**Thank you for attending**  
Please make your way to the  
Undercroft for coffee, exhibition and  
posters