THERACAT Update: IBEC + TU/e

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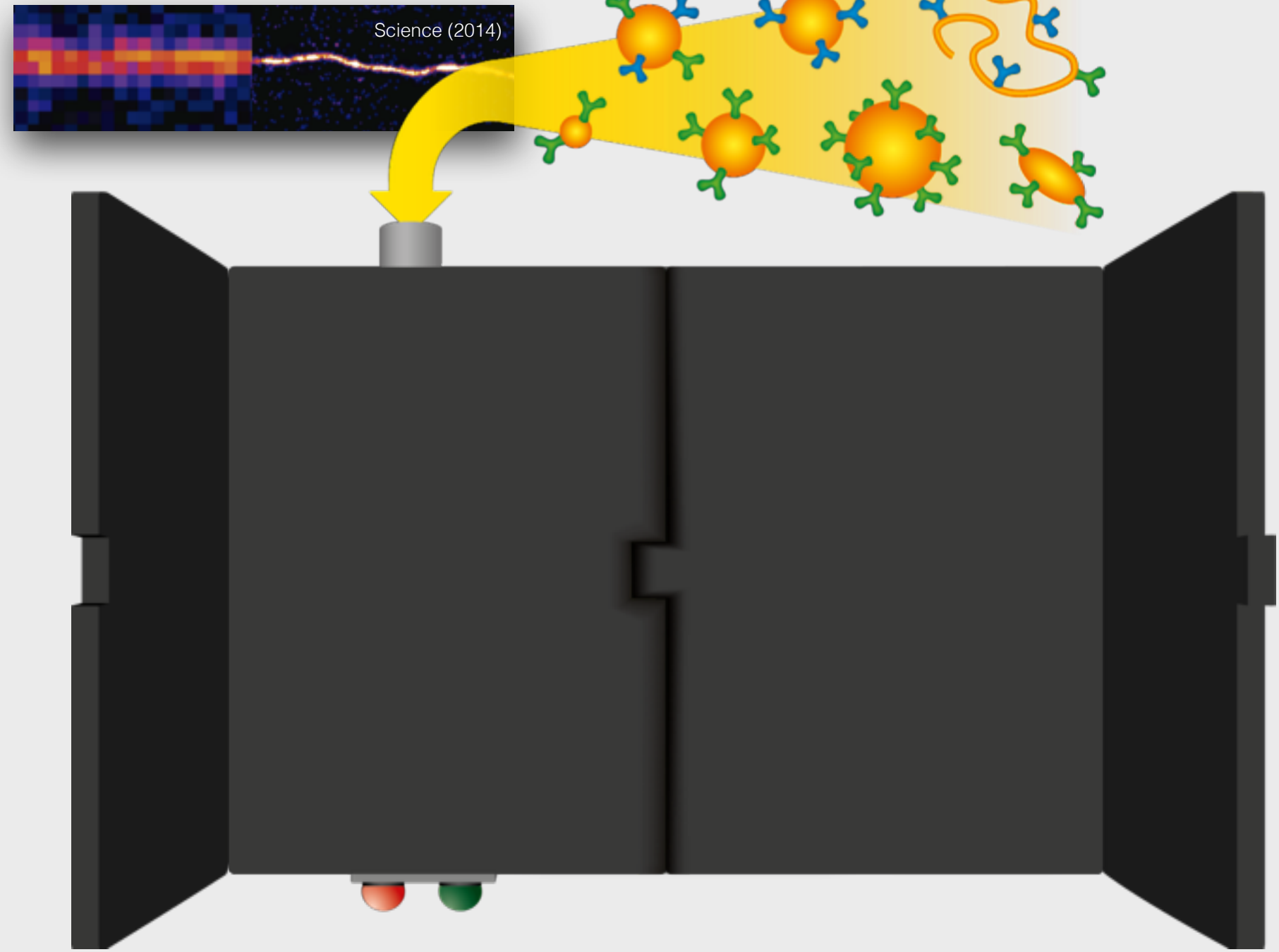
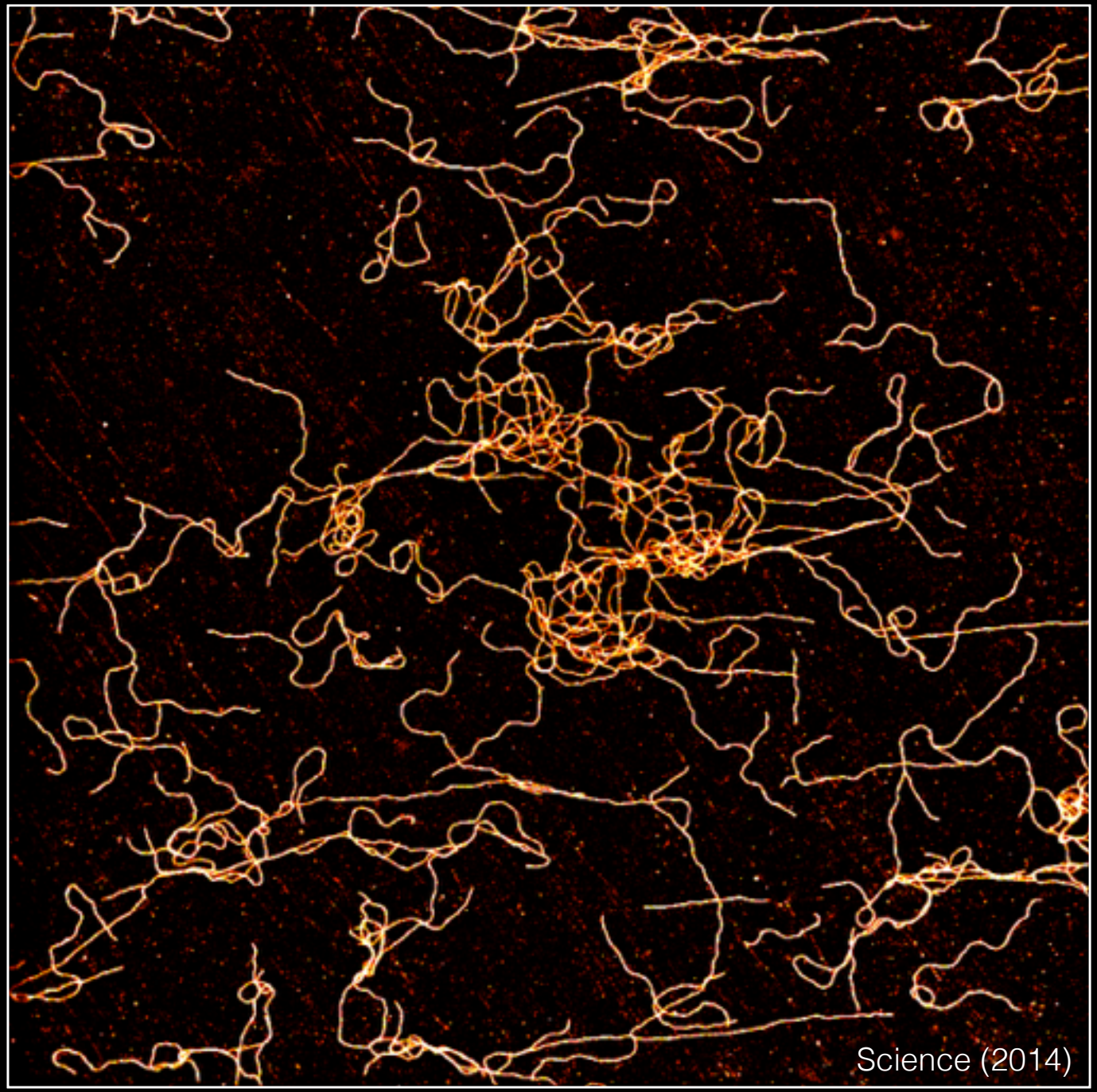
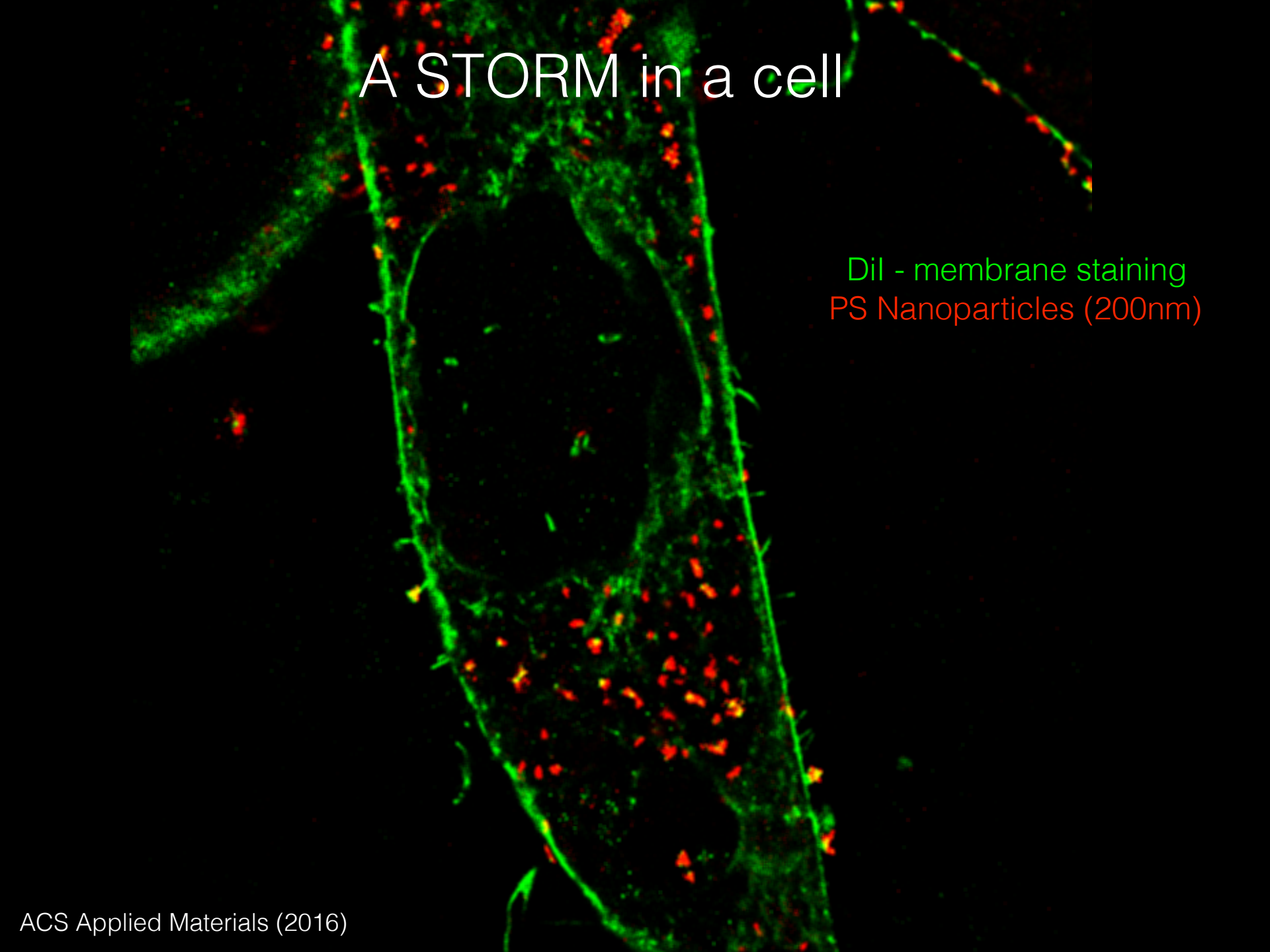
TU/e
PHILIPS


Science (2014)

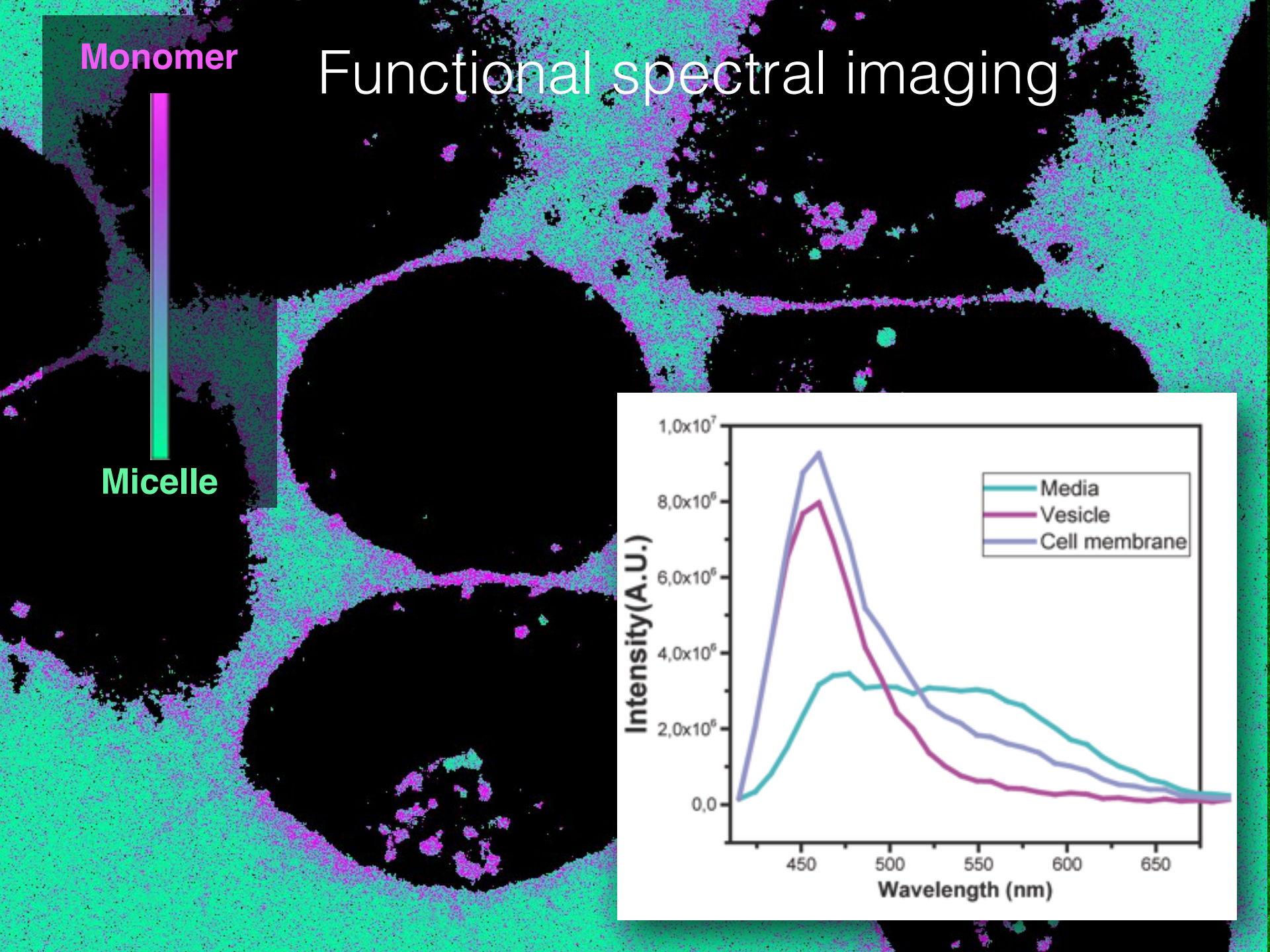

Science (2014)

A STORM in a cell

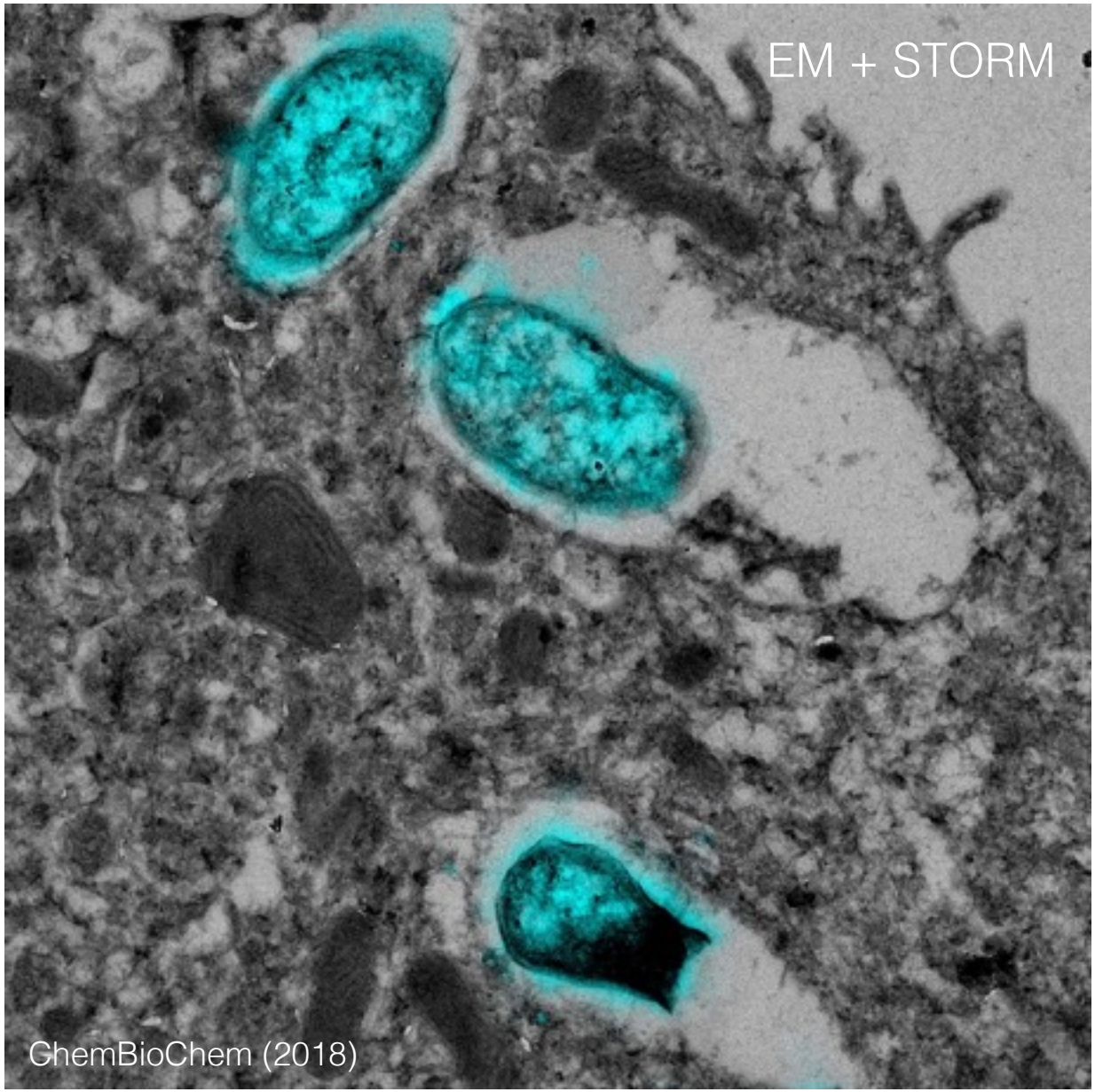


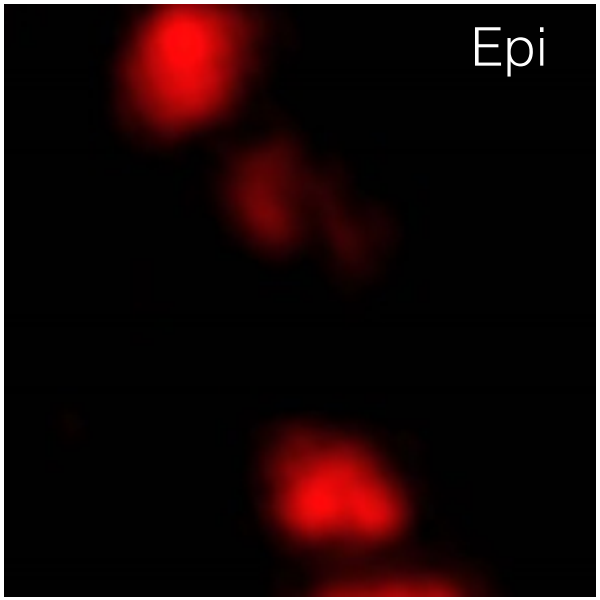
ACS Applied Materials (2016)

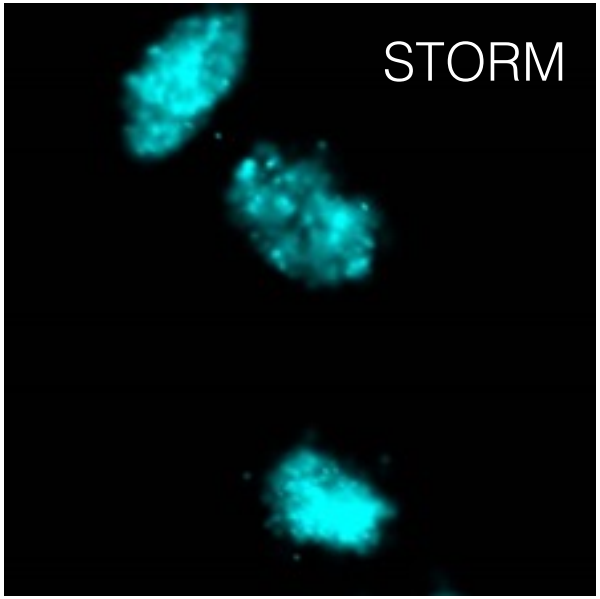
Functional spectral imaging



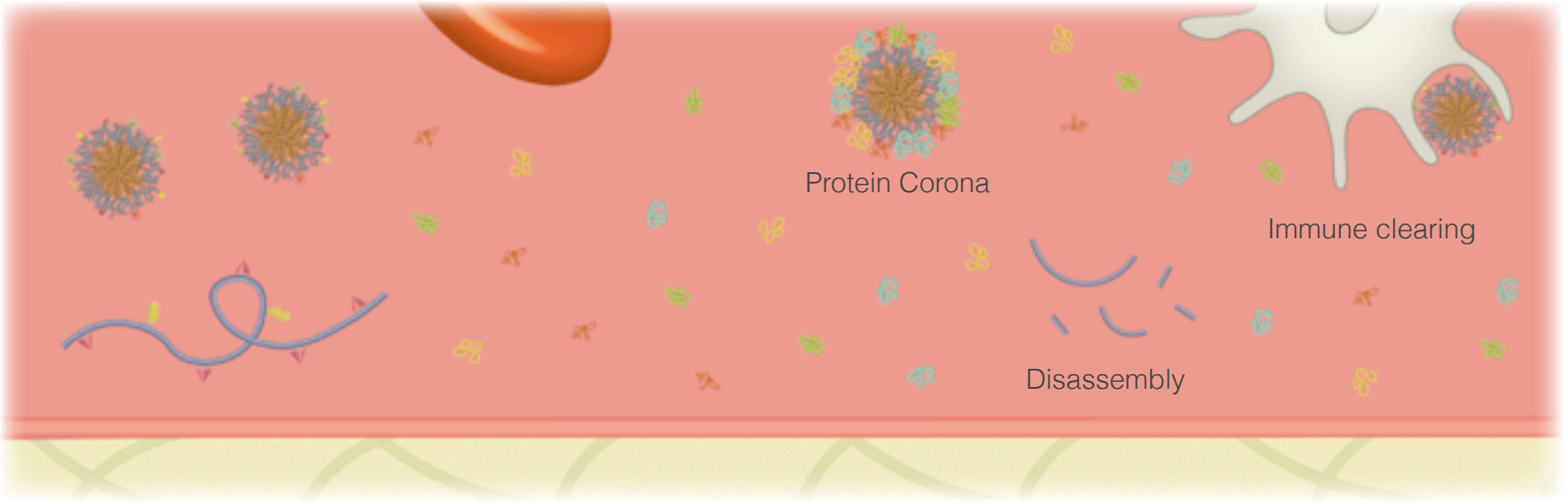
Correlative imaging: the best of both worlds

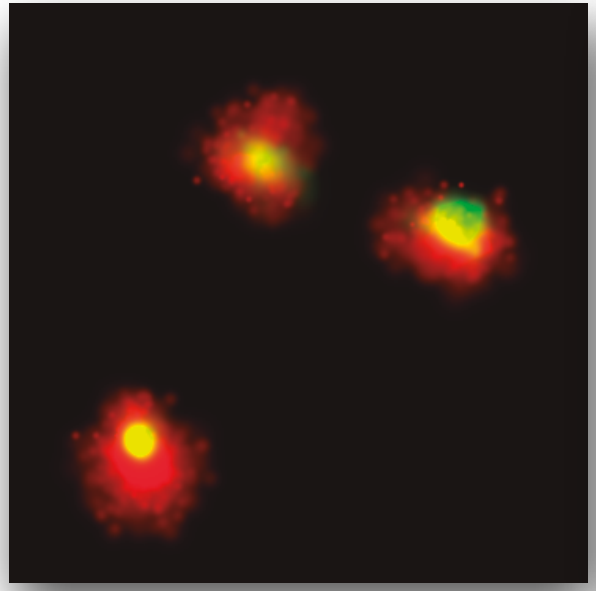


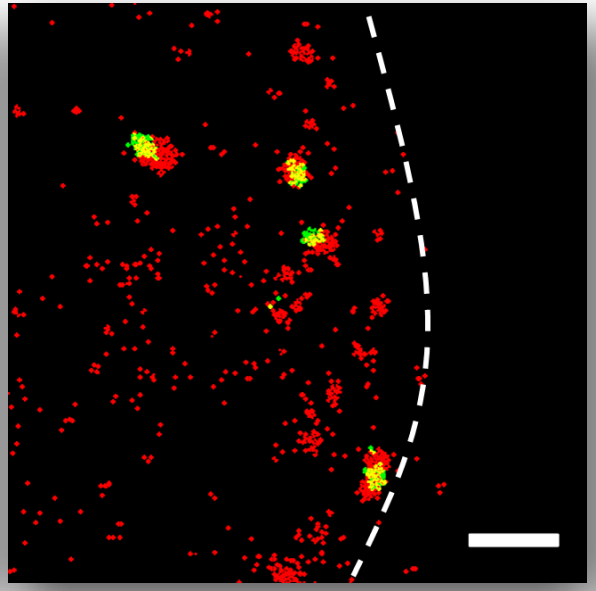


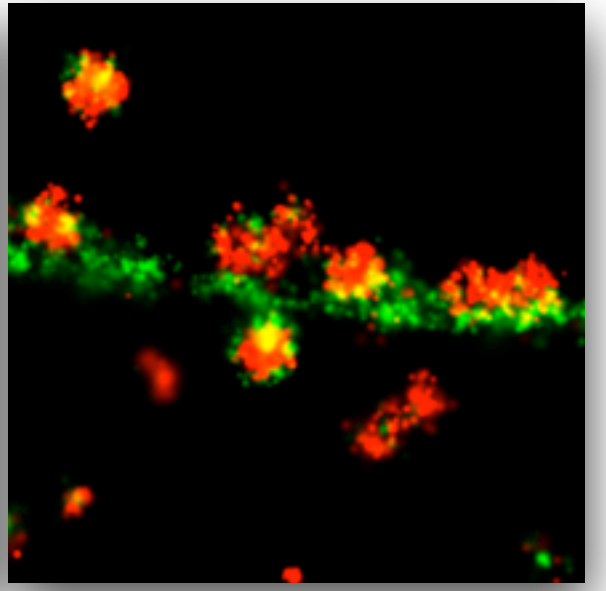


Can we make materials invisible to the body?

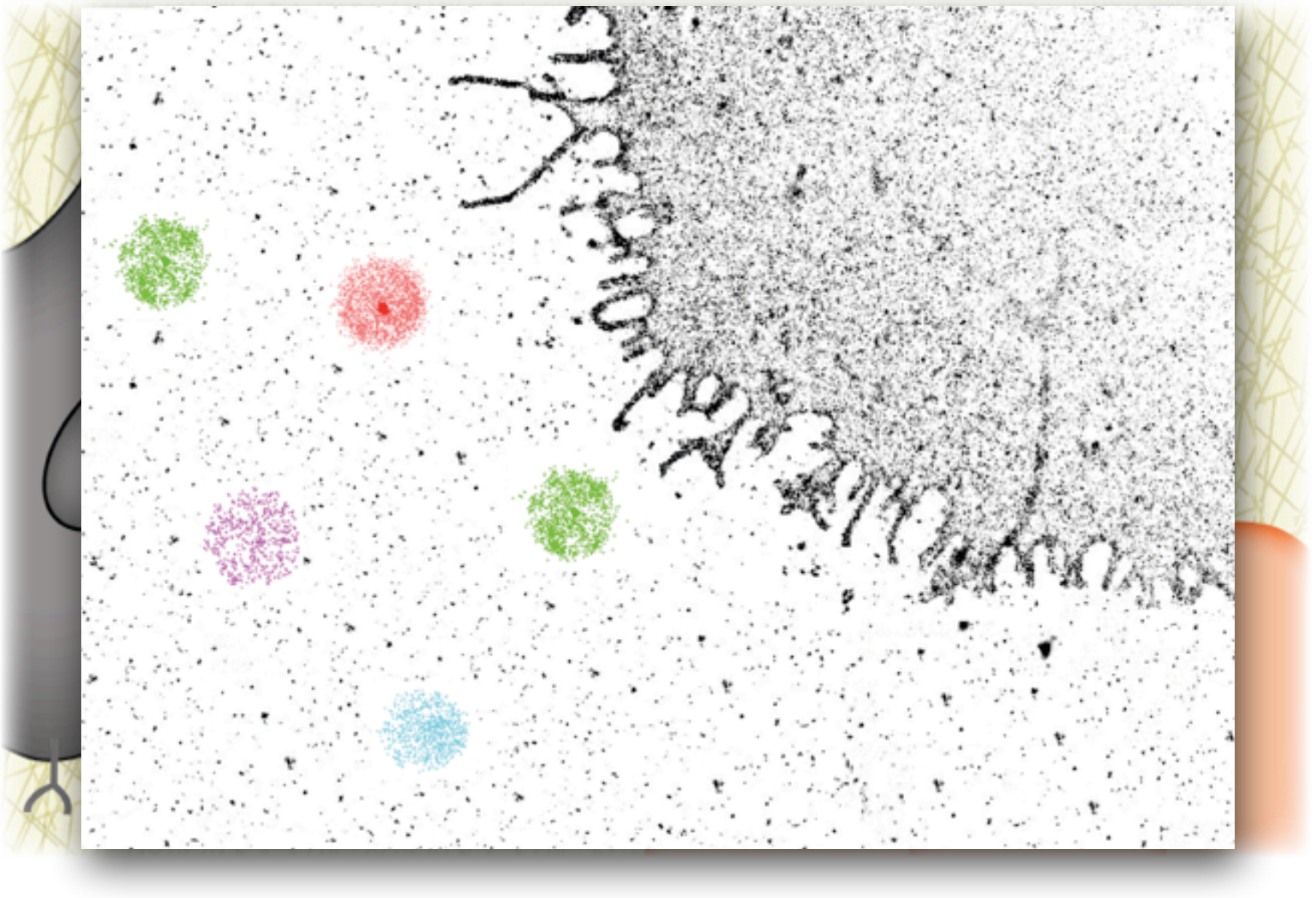








Targeting: the magic bullet



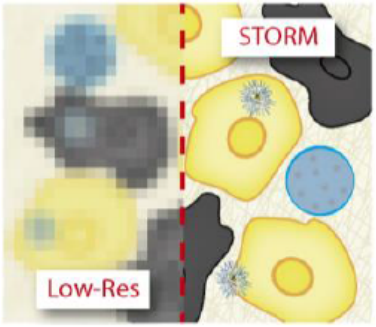
Update recruiting

ESR7: Super resolution imaging of catalytic nanoparticles delivery

ESR 7 - IBEC	Super resolution imaging of catalytic nanoparticles delivery	PhD: Yes	Deliv.: 3.2, 3.3	Start date: M9	Duration 36	WP3

Objectives: **1.** Develop a method for STORM nanocatalyst imaging; **2.** Imaging the localization and amount of nanocatalyst in different models; **3.** STORM imaging of prodye activation in different models.

Description: ESR7 will use super resolution imaging to track the delivery and the activity of nanocatalysts in different biological models. Super resolution microscopy allows for multicolour imaging in cells and tissues with 20 nm resolution and is therefore an ideal tool to study the interactions of nanostructured materials with living matter. Different nanostructures (e.g. ESR1-4) will be labelled with Cyanine dyes suitable for Stochastic Optical Reconstruction Microscopy (STORM) and administered to i) culture of cancer cells; ii) 3D models of tissue environment (ESR9). At the desired time point the sample will be fixed and imaged with STORM revealing with high accuracy the localization and amount of catalyst that reach the target. With an analogous procedure, we will be able to localize and quantify the amount of activated prodye in different biological model simply using a STORM-compatible prodyes.



Planned secondments: BGX – imaging of gel models (M21, 3 months); **TAU** – in vivo and ex vivo imaging of catalysis (M30, 4 months).	**Expected results (deliverables)**: Protocol for nanocatalyst STORM imaging (D3.2); Data on nanocatalyst localization in cell and 3D cultures (D3.2); Map of catalytic activity in cells and tissues (D3.3)

Name of selected researcher: **Alis Olea**

Contract start date: 16/10/2018

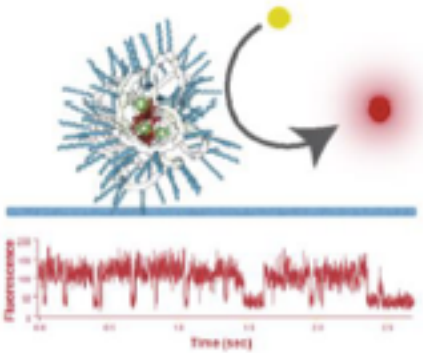
Recruitment completed

Update recruiting

ESR6: Single molecule imaging of prodyes activation

ESR 6 - IBEC	Single molecule imaging of prodyes activation	PhD: Yes	Deliv.: 2.2, 2.3	Start date: M6	Duration 36	WP2

Objectives: **1.** Synthesis of prodyes; **2.** Develop a method for single catalytic events imaging and measure of the turnover rate and stability of nanocatalyst; **3.** Measure and compare different families of natural and synthetic catalysts.



Description: ESR6 will develop a super resolution method to test at the single molecule level the catalytic efficiency of the nanomaterials proposed in THERACAT. Catalytically-activable prodyes (e.g. rhodamines and cyanines) will be synthesize to probe the efficiency of the catalyst developed in WP1. We anticipate that measuring catalytic activity and the single molecule level is crucial for synthetic structures due to the heterogeneity induced by the polydispersity in the synthesis. Individual catalyst will be anchored on a glass surface and a prodye substrate added to the solution. Single fluorescence events will be observed at any catalytic conversion using a TIRF microscope. The time profile of such events will provide information of the catalytic efficiency, turnover and stability of the catalyst and the distribution of such properties among a large population of nanostructures. A variety of structures created in WP1 (ESR1-4) will be tested and compared with natural enzymes.

Name of selected researcher: **Manos Arxontakis**

Contract start date: 01/03/2019

Recruitment completed

Update research activities

WP4: Prodrugs design and synthesis

Task 4.2. Synthesis of fluorescent dyes such (rhodamines, cyanines) protected with propargyl/allyl groups (IBEC-ESR7). **Started**

Task 4.3. Spectroscopic (bulk) and microscopic evaluation (single molecule) study of catalysis (EDI, IBEC-ESR7).

D4.2. Set of 2-3 fluorescent prodyes. Delivery Month 28

WP5: In vitro delivery and imaging

Task 5.2. Fluorescence and super resolution optical imaging of carriers' interactions with cancer cells (IBEC-ESR7, TUE).

Task 5.3. Test the efficiency of prodrug conversion in 2D and 3D cancer models (BGX, TUE, BAS, IBEC-ESR7).

D5.2. Description of the structure-activity relations of the material-cell interactions. Delivery Month 30

WP6: In vivo evaluation

Task 6.3. Use intravital optical and PET imaging to study catalyst localization and efficacy (BGX, TUE, BAS, IBEC-ESR7).

Update on training activities

Training Courses:

1 – Introducing the THERACAT Network & How to plan and start a PhD. Month 12
- General introduction & introduction of the training programme
- Skills to start a successful PhD
- Scientific communication

2 – Chemical synthesis & catalysis. Month 18
- Entrepreneurship and translation: IP and commercial exploitation

3 – Drug delivery & microscopy. Month 24
- The power of microscopy techniques in biomedical research: principles and challenges

5 – Getting ready for the next career step. Month 36
- Searching for post-doc and setting the path for academic careers

Secondments at IBEC:

ESR3-TEVA. Month 18 – 21 (4 months)
ESR8-TUE. Month 21 – 24 (4 months)
ESR9-BGX. Month 36 – 39 (4 months)
ESR13-TAU (Satchi-Fainaro). Month 21 – 24 (4 months)

Organisation of Network Meetings & Conference:

Kick-off Meeting. Month 1. Barcelona. May 2018.
Meeting 3. Month 36. Barcelona. February 2021.
THERACAT conference. Month 42. Barcelona. August 2021.
Final Meeting. Month 48. Barcelona. February 2022.

Update on management activities

Project Coordinator: Dr. Lorenzo Albertazzi

Project Manager: Dr. Rosa Miralles

Deliverables

WP1: Ethics Requirements

D1.1. A-Requirement No. 1. Delivery Month 12
D1.2. NEC-Requirement No. 2. Delivery Month 12
D1.3. HCT-Requirement No. 3. Delivery Month 12

WP2: Management and coordination

D2.1. Network meeting minutes (kick-off). Delivery Month 1
D2.2. Consortium Agreement. Delivery Month 2
D2.3. Supervisory Board of the Network. Delivery Month 2
D2.4. Network meeting minutes (Meeting 1). Delivery Month 12
D2.6. Progress Report. Delivery Month 13
D2.7. Network meeting minutes (Meeting 2). Delivery Month 24
D2.8. Network meeting minutes (Meeting 3). Delivery Month 36
D2.9. Network meeting minutes (Meeting 4). Delivery Month 48
D2.10. Final management, economic and scientific reports. Delivery Month 48

Update on management activities

WP7: Training

D7.1. Personal Career Development Plans. Delivery Month 10
D7.3., 5, 7, 10, 13. ESRs periodic short reports and AC recommendations. Delivery Month 12, 18, 24, 30, 36
D7.8., 12. Updated Personal Career Development Plans. Delivery Month 24, 36
D7.14. Personal Employment Plans. Delivery Month 40

WP8: Dissemination and outreach

D8.4. THERACAT video. Delivery Month 24
D8.5., 9. General press articles submitted to EU magazines. Delivery Month 30, 48
D8.7. THERACAT conference. Delivery Month 42

Milestones

MS1. Guidelines for recruitment and assessment of ESRs, PCDPs, strategy for dealing with scientific misconduct. Month 4
MS2. Assessment Commissions. Month 6
MS4. ESRs Recruitment and PCDPs. Month 12
MS5. ESR local doctoral studies. Month 12
MS6. Project Check. Month 14
MS7. Synthesis of the first prodye. Month 18
MS10. Establishments of the protocol for super resolution imaging in cells. Month 18
MS14. Midterm project assessment. Month 24