Early cancer detection using organic electrochemical transistor based on the conductive polymer

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Super-Sensing device

- C… bon p…
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DOI: 10.1557/adv.2016.543

Tailoring super-hydrophobic properties of electrochemical biosensor for early cancer detection

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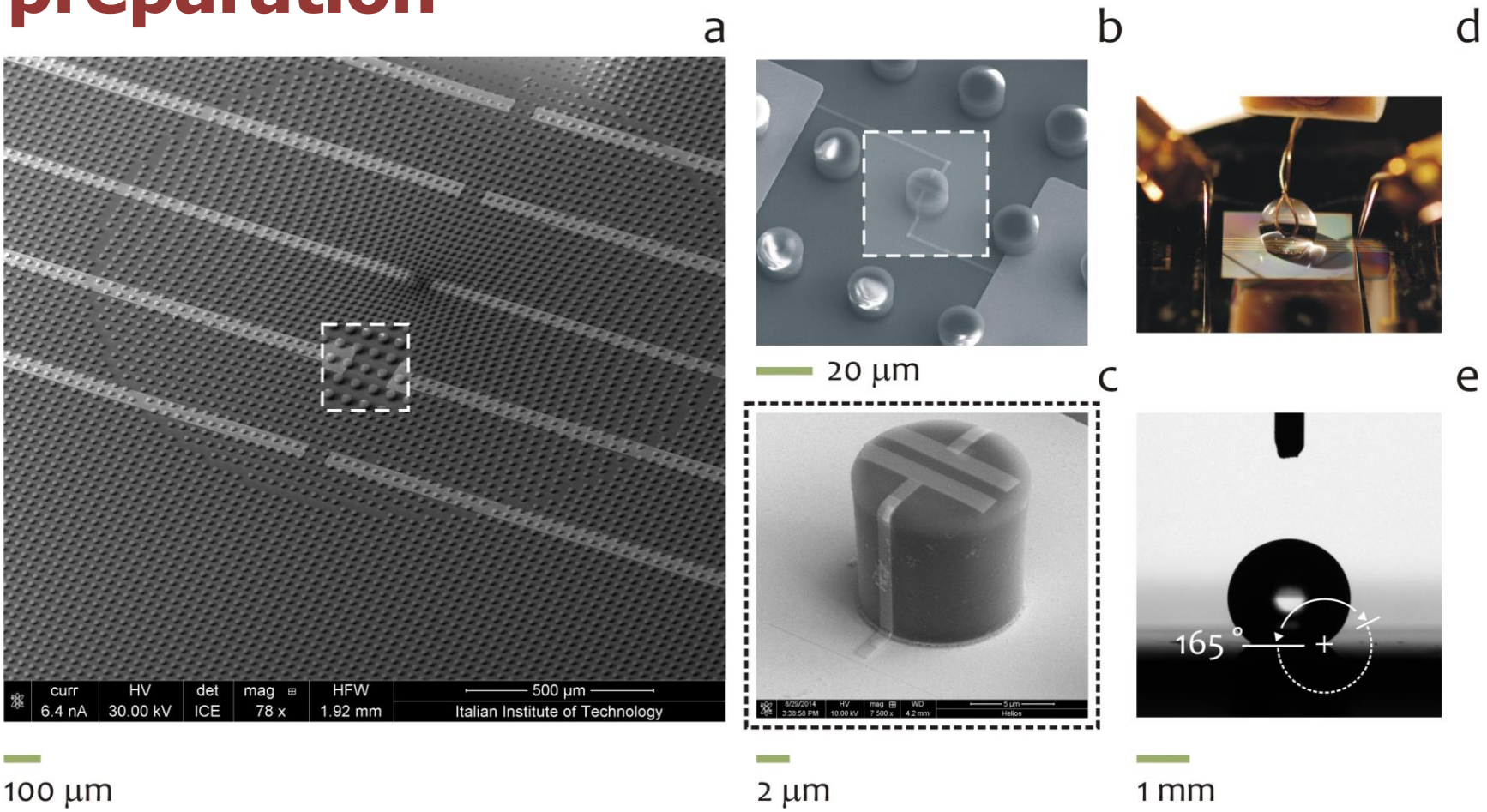
The working mechanism is a strategic combination with biomedical interfaces, low voltage operation regime-and sensing ability in aqueous environment.

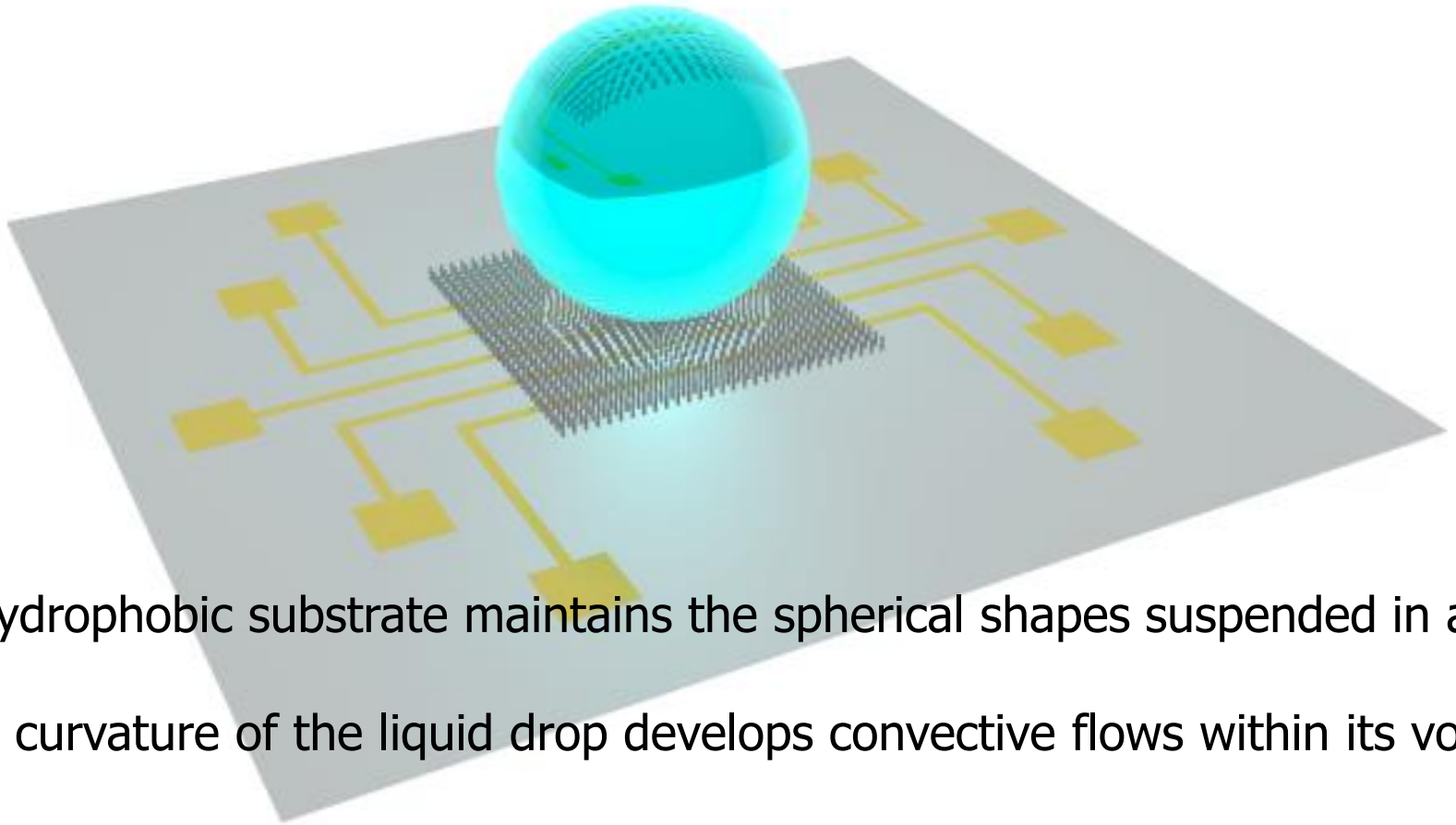
Super-hydrophobic sensing device preparation



- Optical lithography has been used to prepare SU8 pillars on the surface, following a regular scheme. In figure b and c the structure of the contacts and of the sensing device on top of the pillar. In figure c the spherical drops of solute and the contacts on the device, with the value of contact angle

Super-hydrophobic sensing device

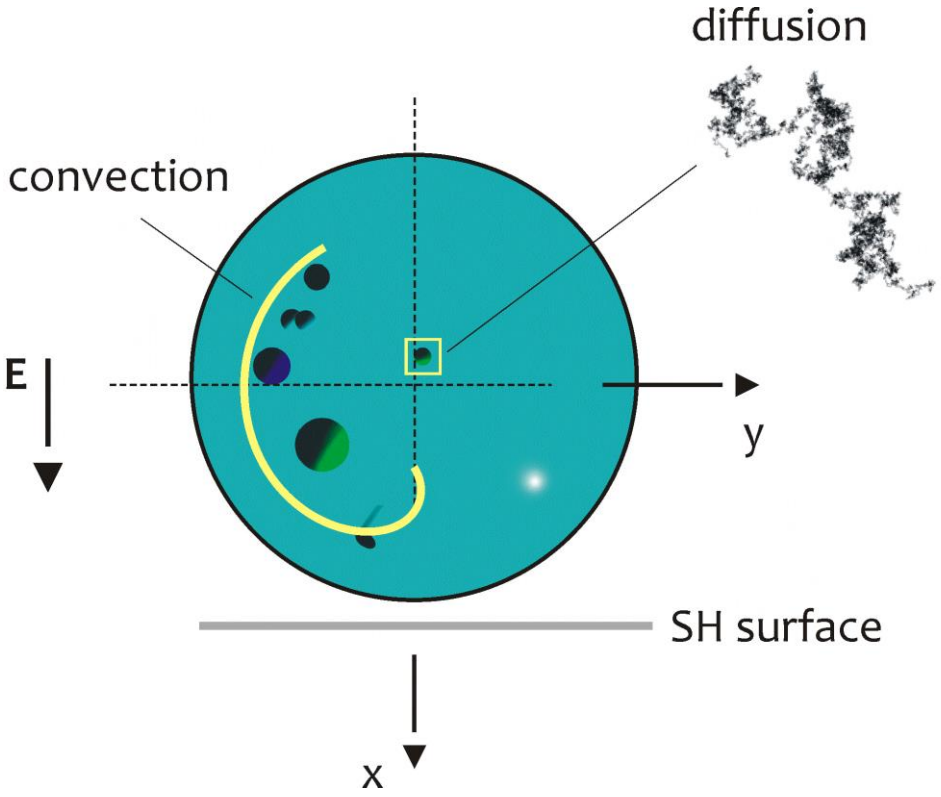
- Ion-polymer interaction is assure by the contact of conductive polymer with electrolyte, in which a gate electrode is immersed.
- Super-hydrophobic pillars positioned on the substrate to form a non-periodic square lattice represent multiple positions to record the signal variations
- Micro-scale geometry enables to measure the electric activity and to design trajectories of the species in the solution, as a function of time and space



Super-hydrophobic substrate maintains the spherical shapes suspended in air

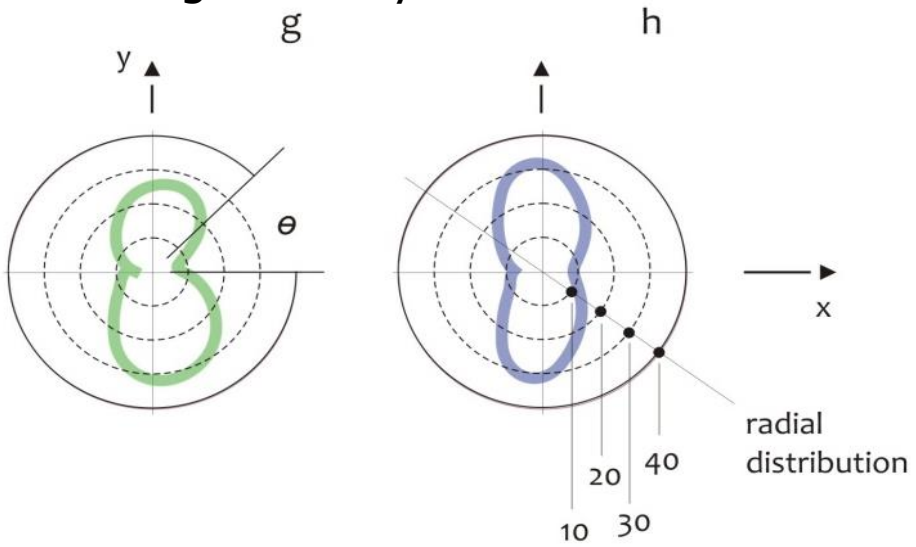
Intrinsic curvature of the liquid drop develops convective flows within its volume

Super-hydrophobic sensing



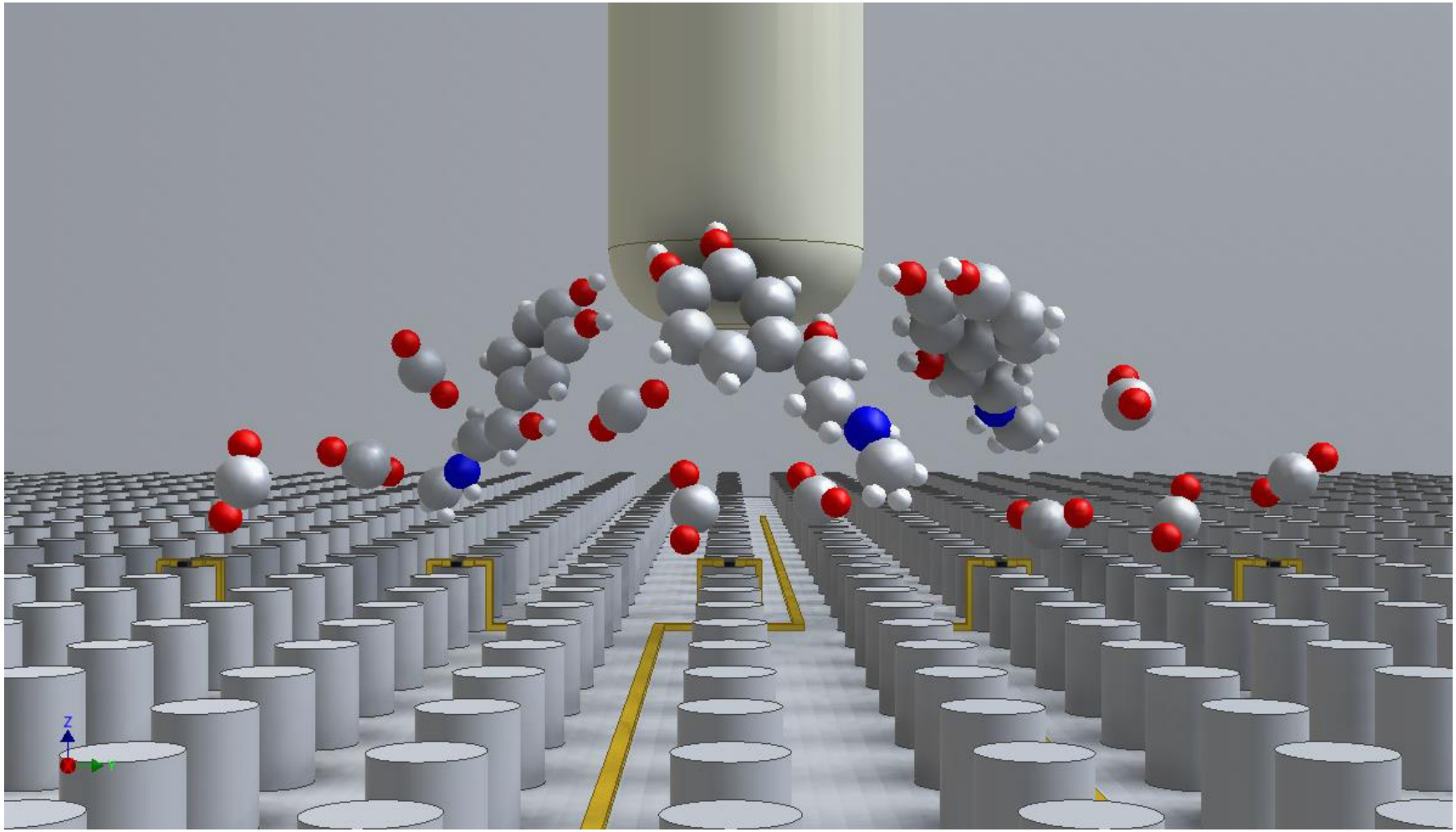
The transportation of active species in the drop from a initial position to the biosensor surface depends on size and charge of the molecules. The separation of the biological species placed in the solution is a result of a competition between convection and diffusion. The final trajectories of the molecules are registered by biosensor.

The sketch on the right explains the Marangoni effect applied to a drop on a super hydrophobic surface

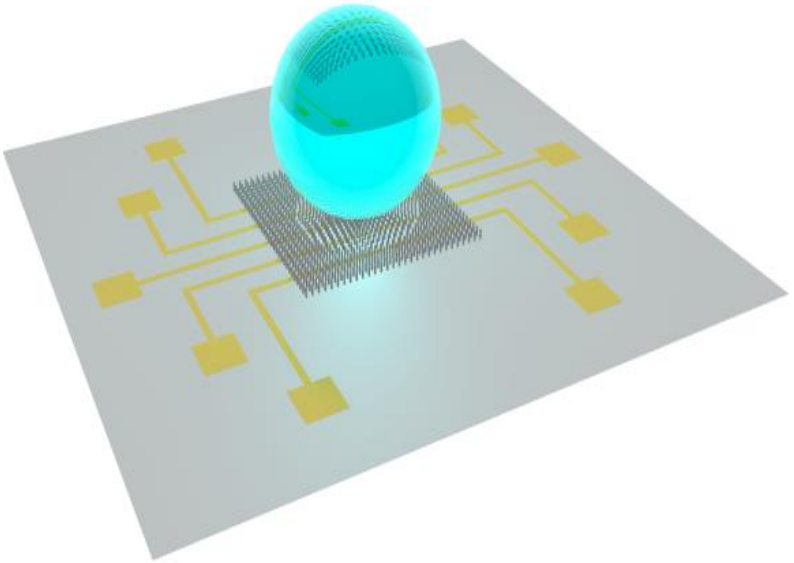


Super-hydrophobic sensing device:

Here surface chemistry and geometry combine to realize a device with an increased hydrophobicity and high electric sensitivity that create a complex environment in which the differences active species are exasperated

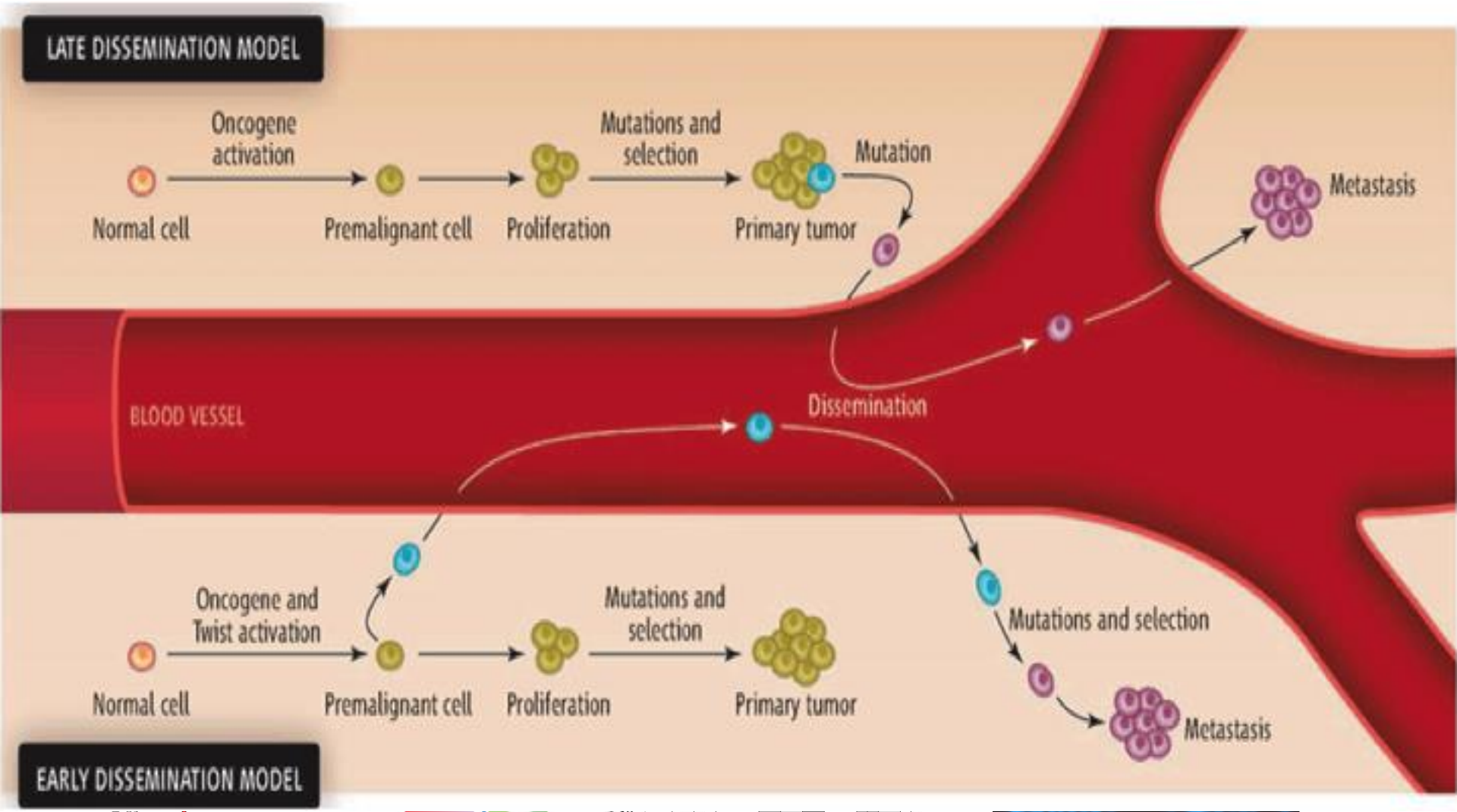


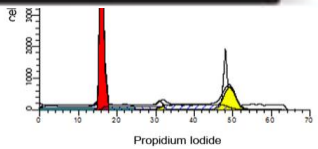
Device results on conditioned-medium of Circulating Tumor Cells

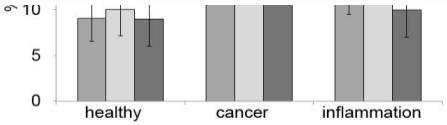


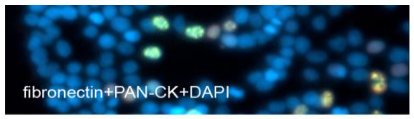
Biomolecules

Circulating Tumor Cell Culture Medium extraction

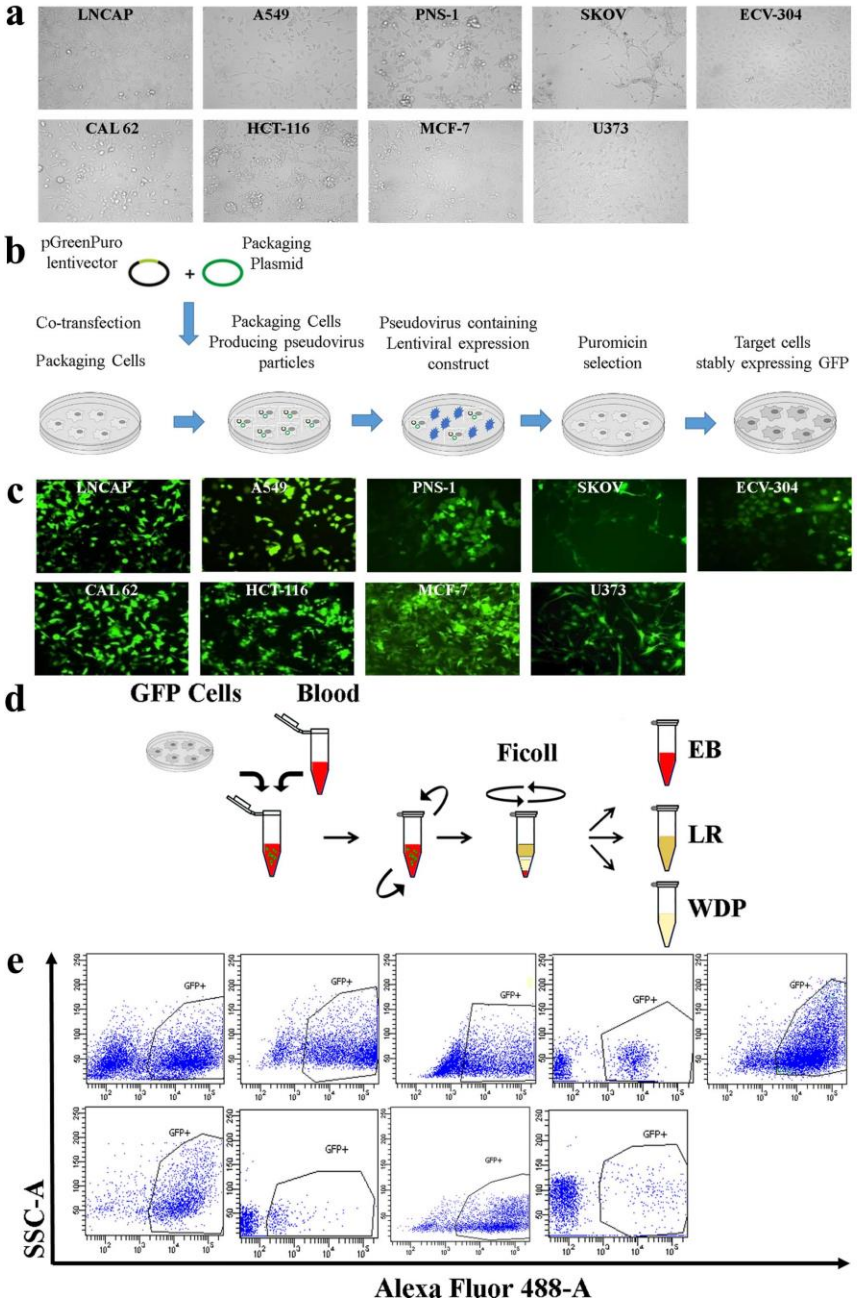


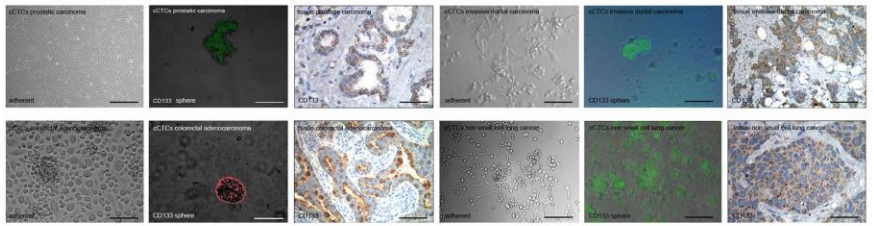


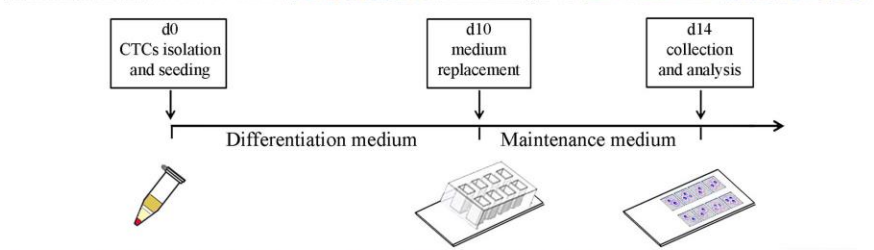


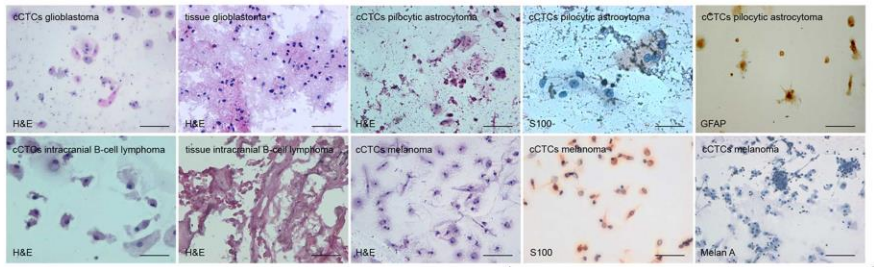


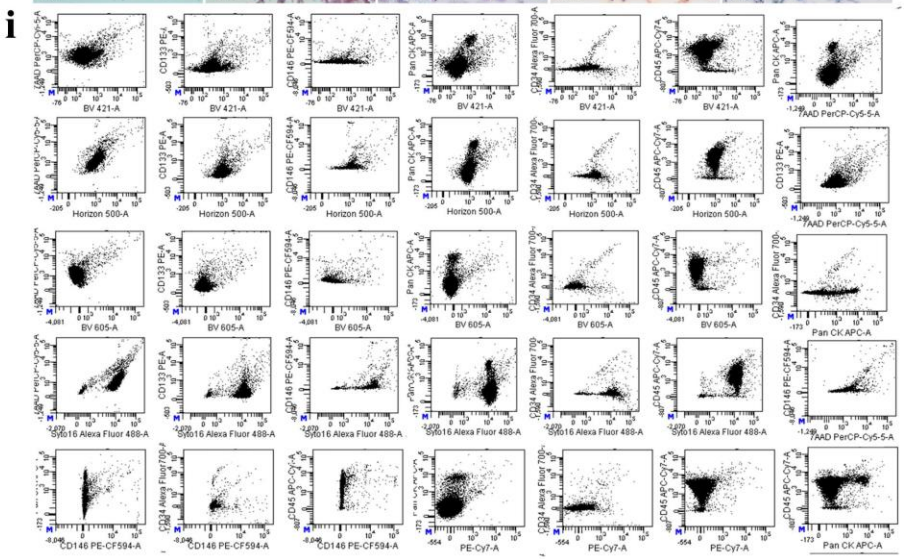
Biomolecules



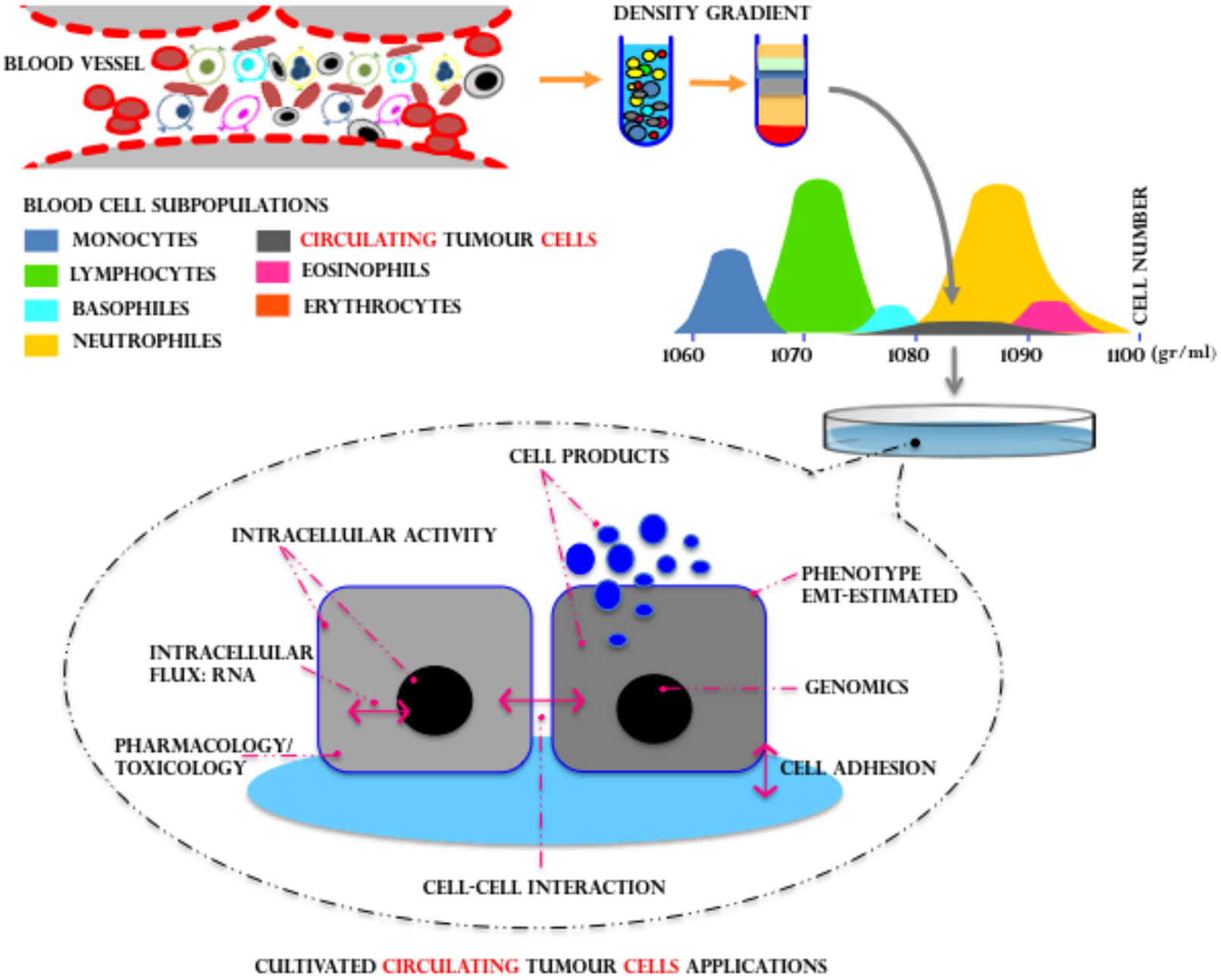




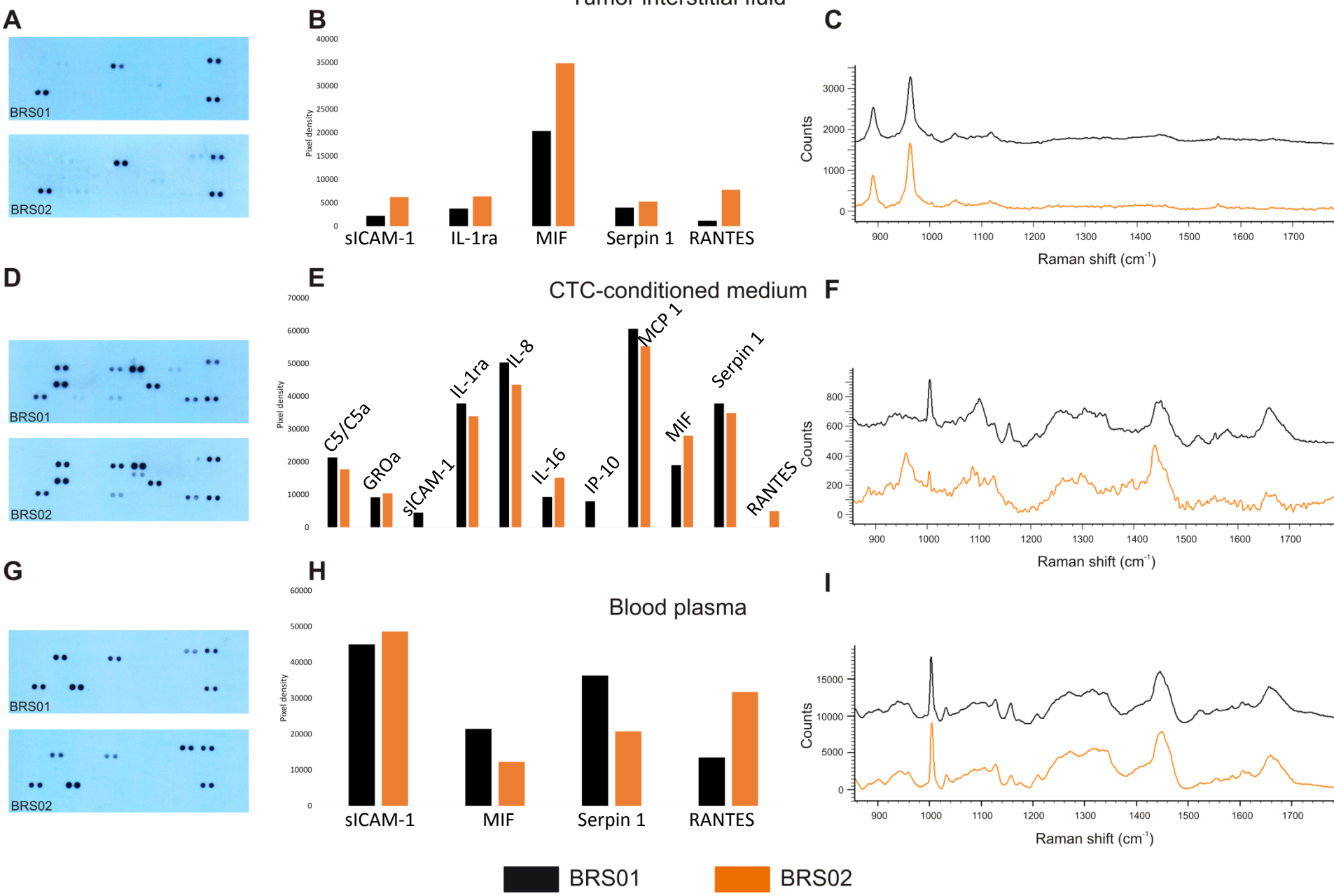




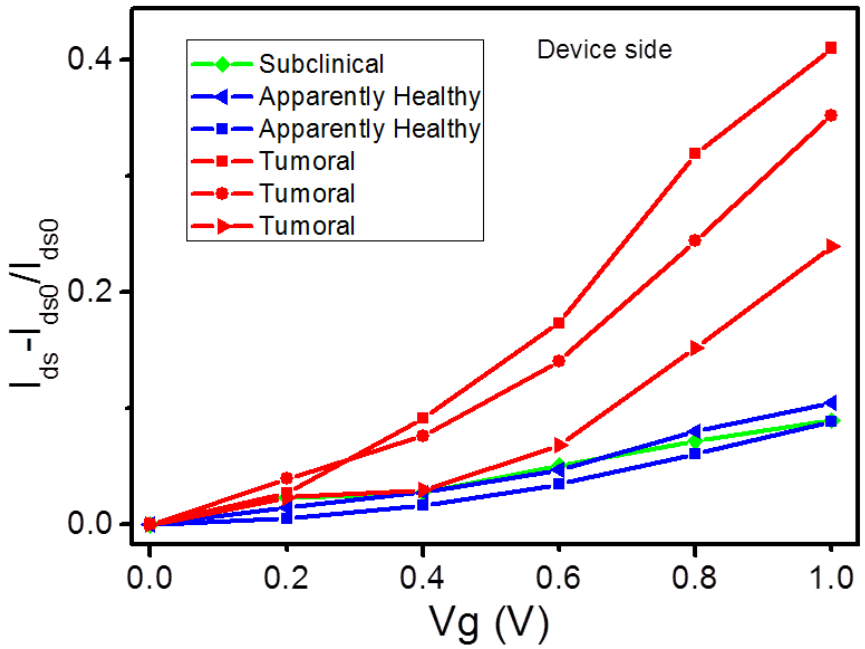
Biomolecules



Biomolecules

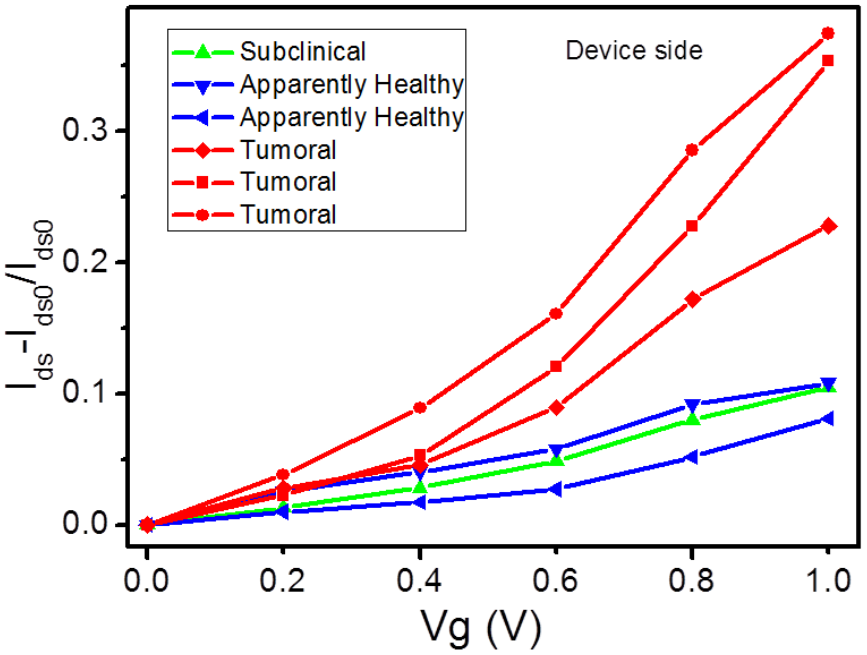


Device results on conditioned-medium of Circulating Tumor Cells



- Tumoral samples present higher modulation signal

- Apparently Healthy present lower modulation signal and also Subclinical sample



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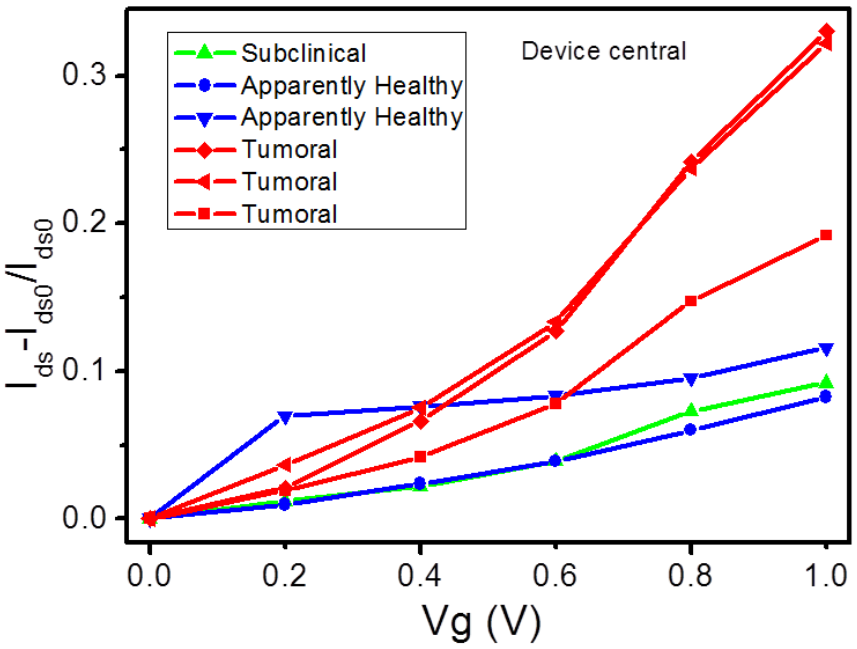
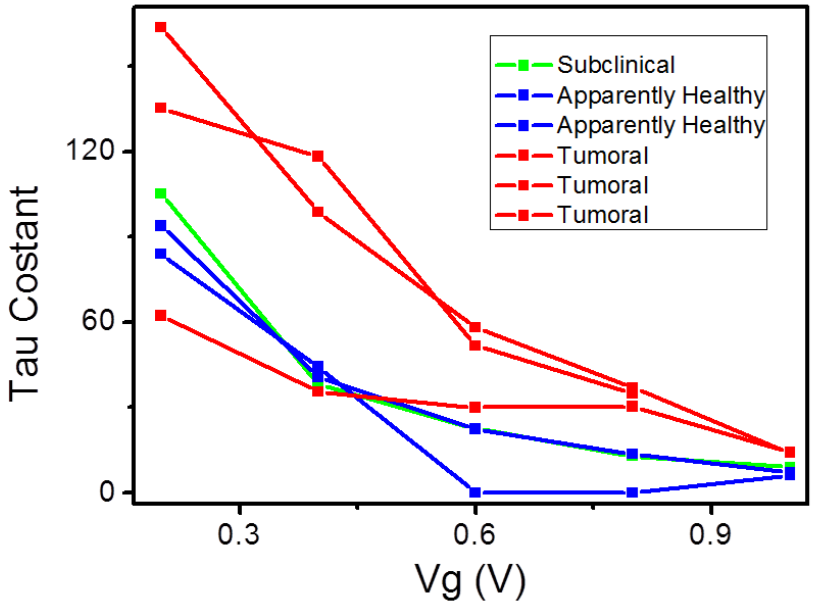


- By fitting the modulation curves with exponential, we obtain tau constants , representing the kinetic of the signal, a faster kinetic is present for tumour samples

- Central position device present a different dynamic in the modulation



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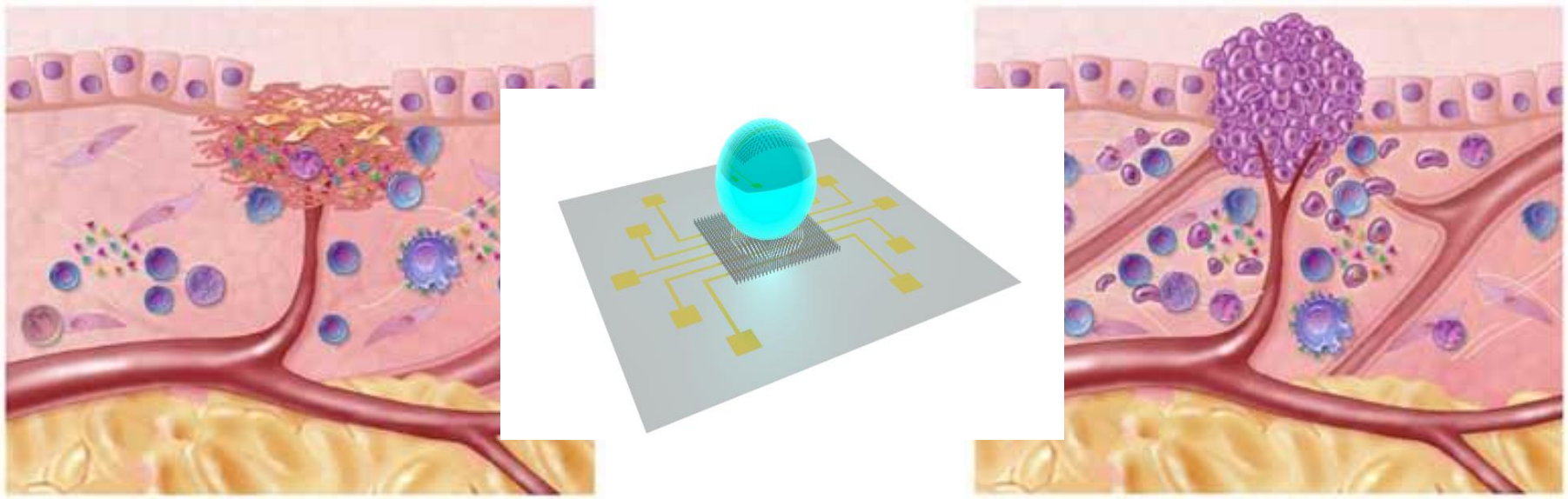

"THE EARLIER WE FIND CANCER, THE EASIER IT IS TO TREAT."

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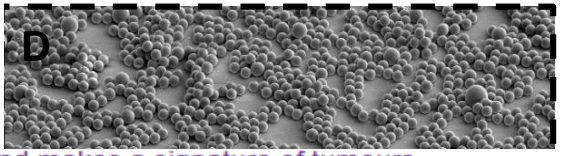

Full Paper

Protein–Carbohydrate Compl
Metastatic Cells in a Microflu

G. Simone ✉, N. Malara, V. Trunzo, G. Perozz
M. Renne, U. Prati, V. Mollace, A. Manz ✉, E.

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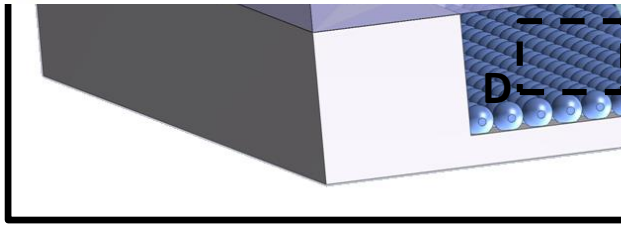

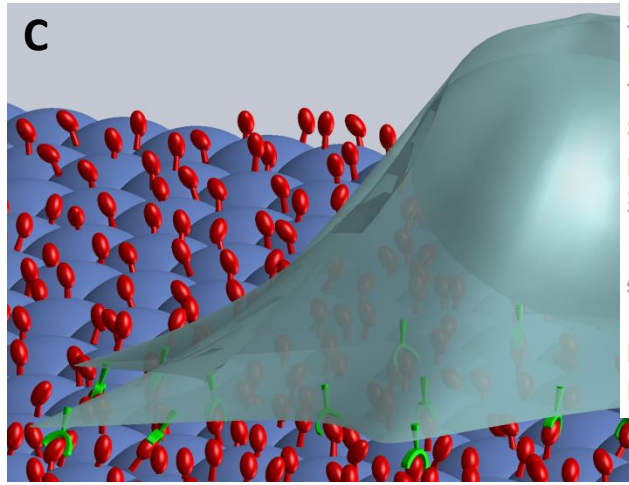

Galectin-3 coats the membrane of breast cells and makes a signature of tumours.
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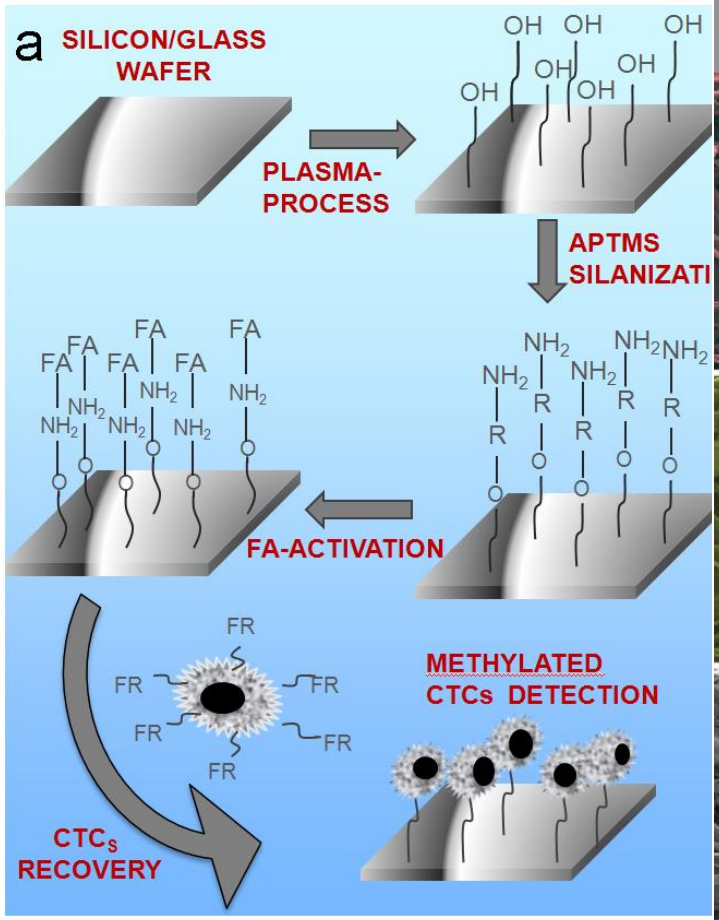

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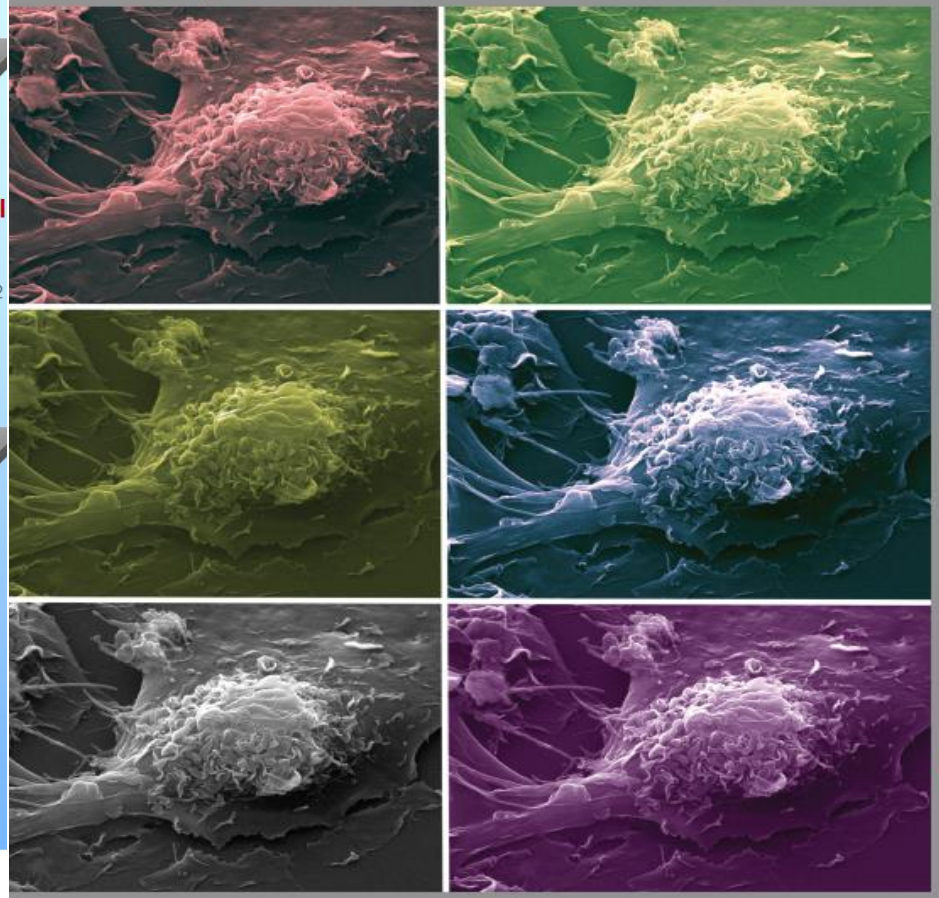

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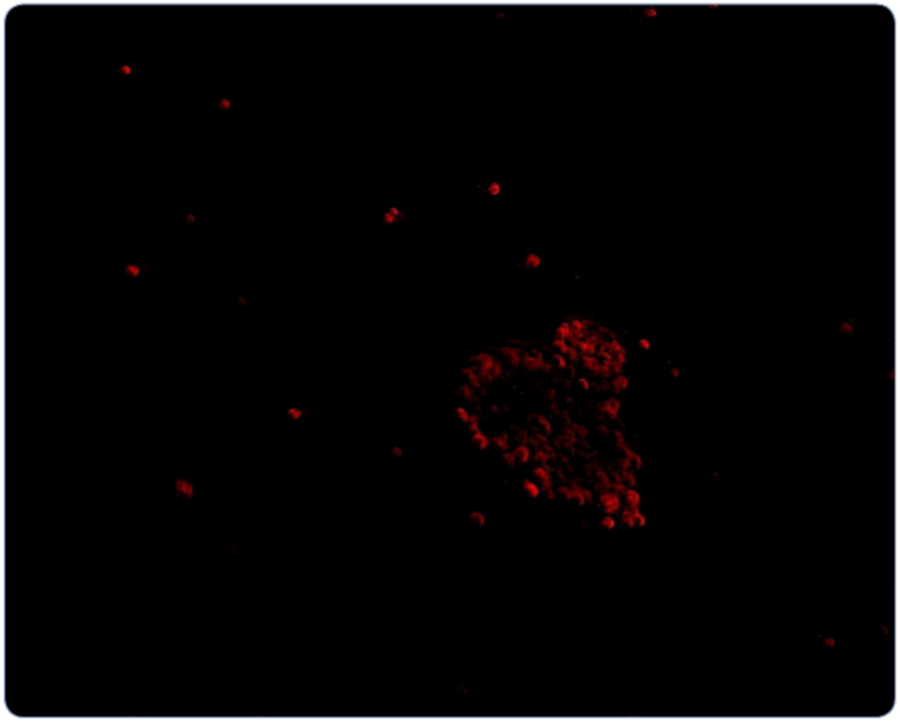

Ex-vivo characterization of circulating colon cancer cells distinguished in stem and differentiated subset provides useful biomarker for personalized metastatic risk assessment

Malara *et al.*

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