Institute
of
Oncology
Research

COST ACTION CA 17140
NANO2CLINIC
CANCER NANOMEDICINE - FROM THE BENCH TO THE BEDSIDE

March 24-25, 2022

Preclinical Development of Cancer Nanomedicines: State of the Art and Future Perspectives

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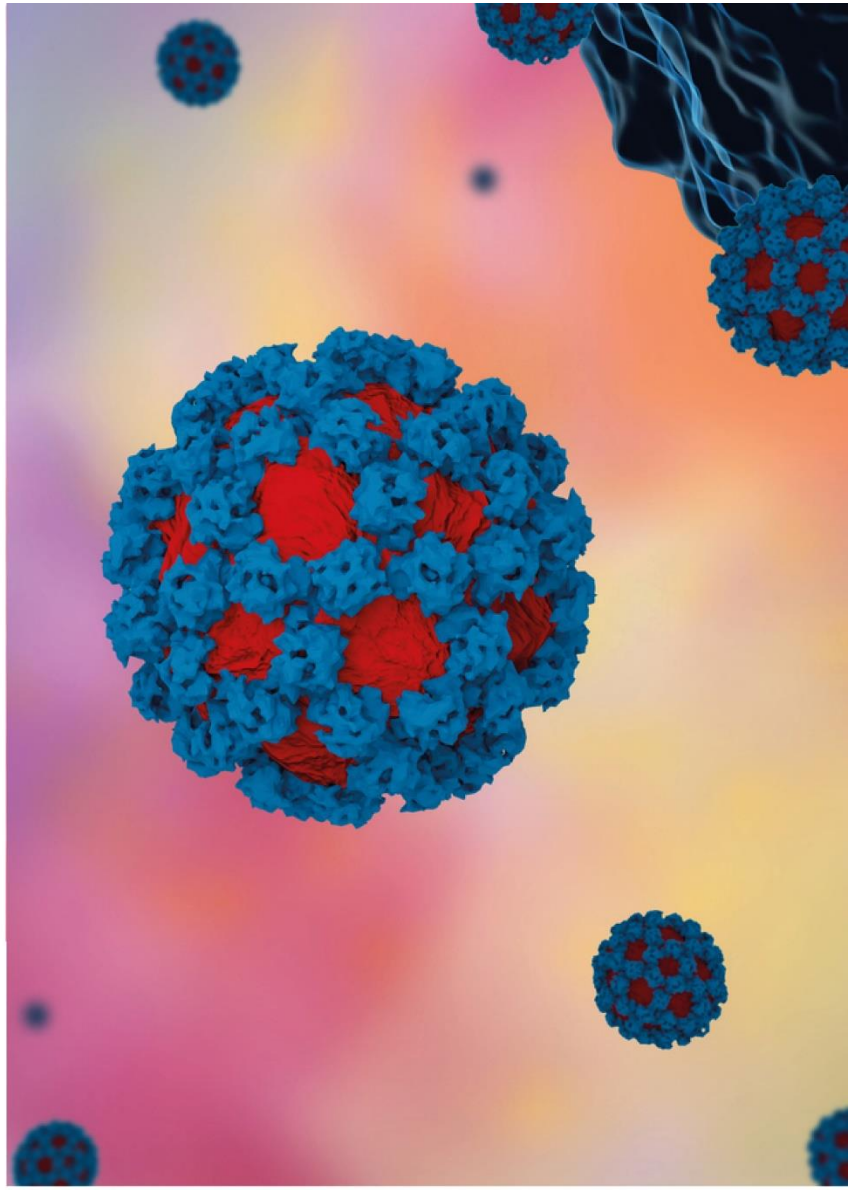

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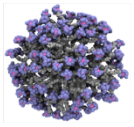
Welcome and Introduction

Carlo V. Catapano
Director, IOR, Bellinzona, CH



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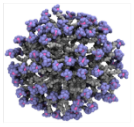
Power, Promise and Challenge



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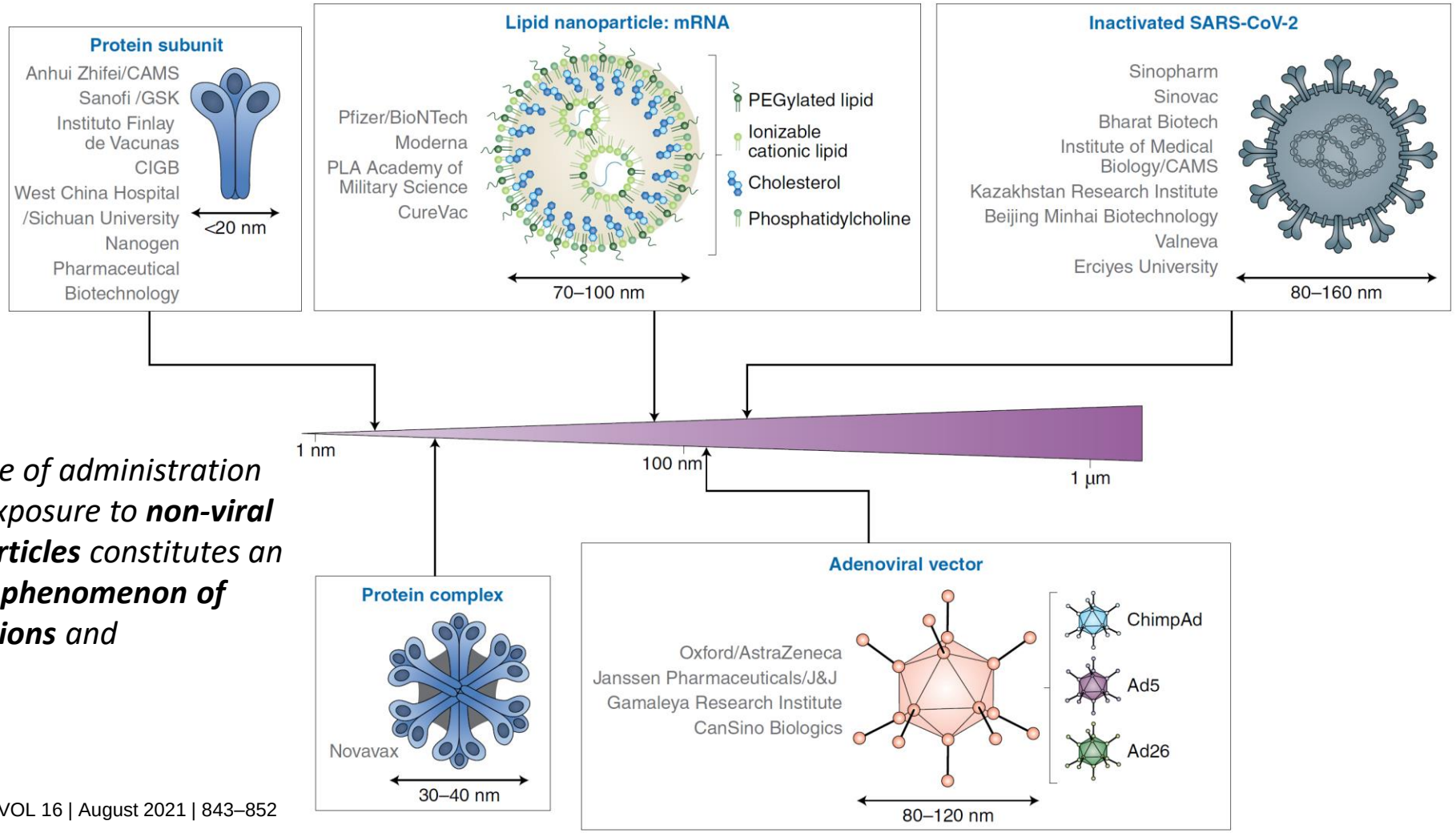
*The **power** of nanomedicine*

Nanoscale COVID-19 vaccines



*The current scale of administration and therefore exposure to **non-viral or viral nanoparticles** constitutes an **unprecedented phenomenon of historic proportions** and implications.*

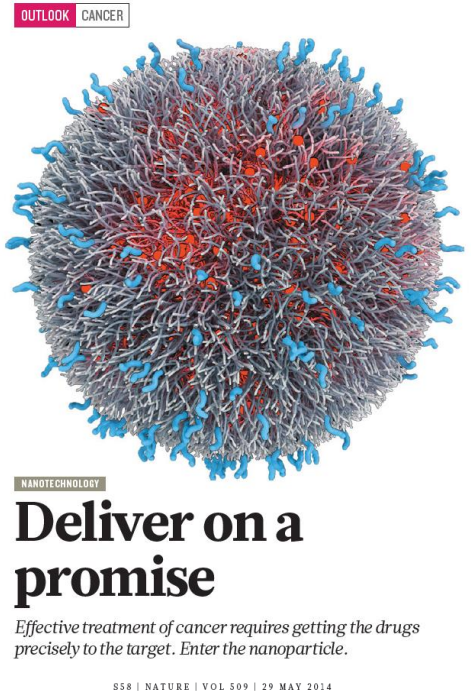
Nature Nanotechnology | VOL 16 | August 2021 | 843–852

*The **promise** of nanomedicine*

- Enhanced drug properties like stability, solubility, circulating half-life
- Enhanced accumulation in tumor tissues
- Improved therapeutic index increasing efficacy and reducing toxicities

- Enabling of controlled release of drugs
- Improving distribution of drugs across physiological barriers: blood-brain barrier, transcytosis
- Enabling in vivo imaging for monitoring drug delivery and efficacy

- Delivery of biologicals: siRNA, miRNA, mRNA, DNA, proteins
- Combined delivery of multiple drugs to improve efficacy and overcome resistance
- Targeted delivery in a tissue- or cell- specific manner



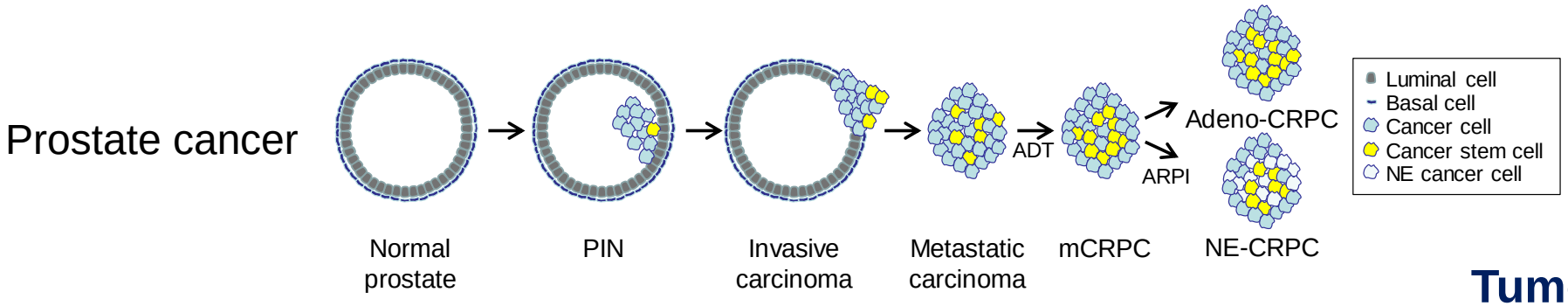
*The **challenge** of cancer biology*

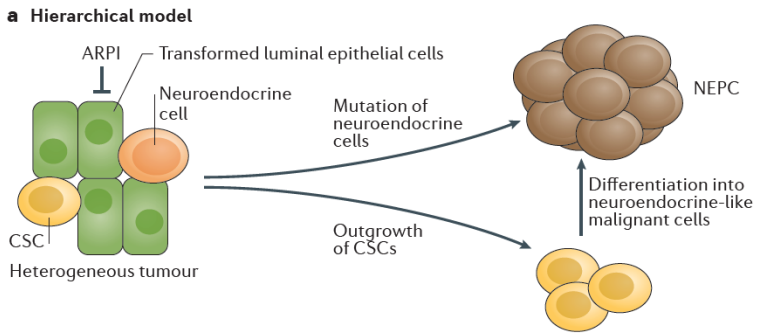
- **Cancer biology presents multiple barriers to a successful treatment**

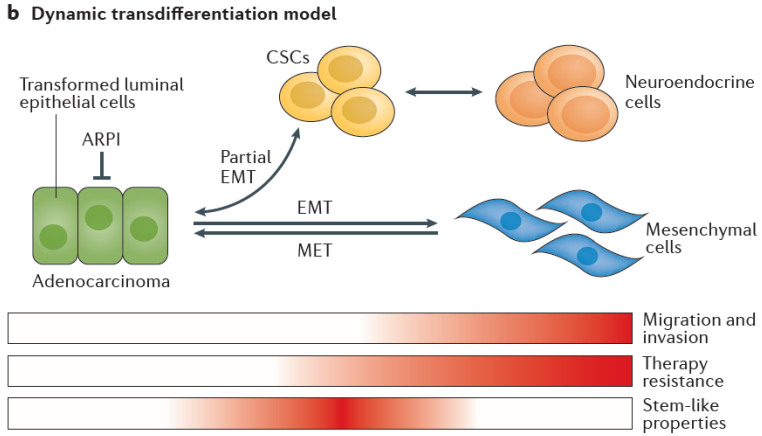
- **Cell intrinsic factors**
  - Intra-tumoral heterogeneity
  - Tumor evolution, phenotypic plasticity, tumor stemness
  - Metastasis, disease progression, therapy resistance

- **Cell extrinsic factors**
  - Tumor microenvironment
  - Heterotypic cell-cell interactions
  - Secreted factors
  - Extracellular vesicles

Cell intrinsic and extrinsic barriers







Tumor evolution

Tumor heterogeneity

Cell plasticity

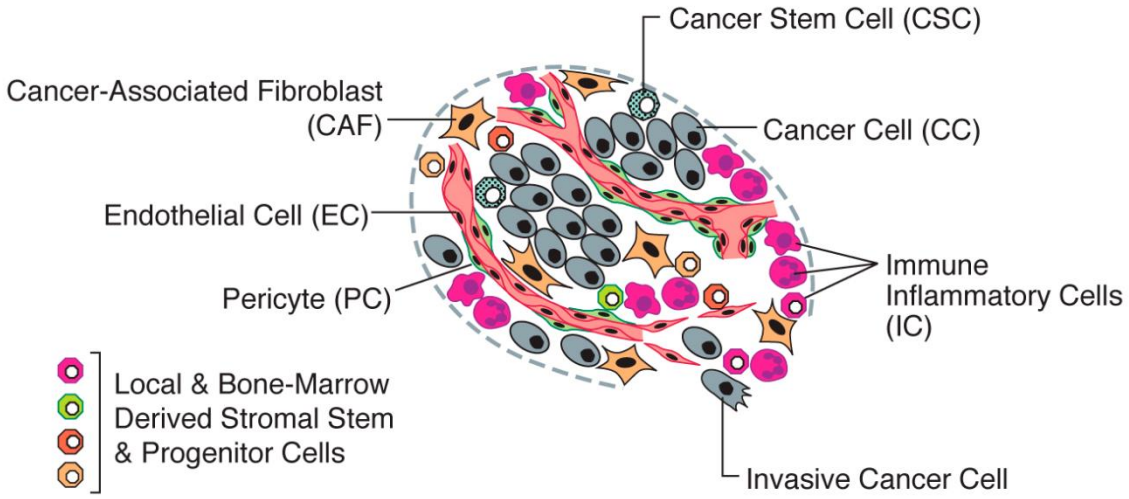
Tumor stemness

Disease progression

Treatment resistance

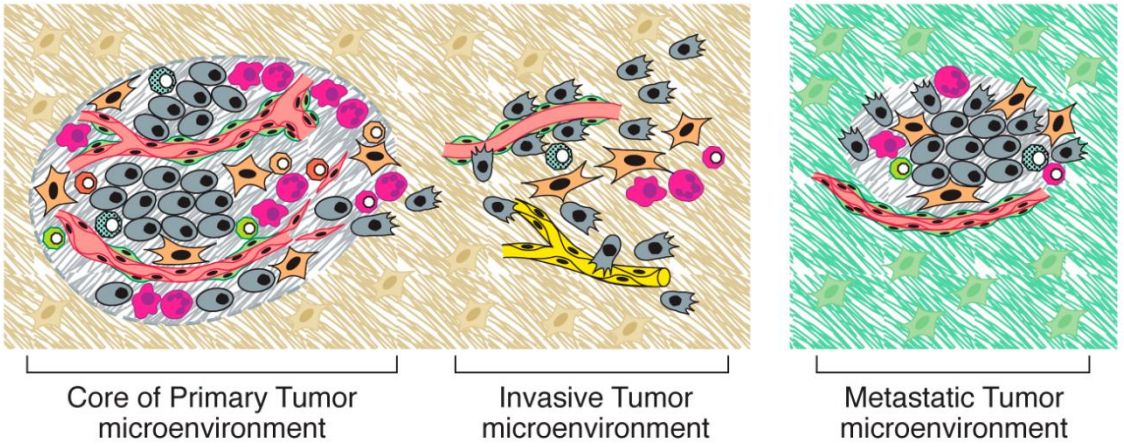
Cell intrinsic and extrinsic barriers

Intra-tumoral heterogeneity



Heterotypic cell-cell interactions

Tumor microenvironment



Disease state

Metastatic sites

Road to success in cancer nanomedicine

- Nanoparticle properties
  - Stability and physical chemical properties of nanoparticles
  - Distribution and uptake of nanoparticles in target and non-target tissues
  - Interactions of nanoparticle with biological systems
- Disease context
  - Tissue diversity
  - Tumor diversity and heterogeneity
  - Target expression and target essentiality
- Developmental strategy
  - Targeted therapeutics
  - Combination therapy
  - Treatment resistance
  - Precision cancer nanomedicine

Thank you!

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