

Bridging the Valley of Death: Resources for Accelerated Clinical Translation of Nanomedicine for Cancer

Anil K. Patri

Dy. Director, NCL

patria@mail.nih.gov

http://ncl.cancer.gov

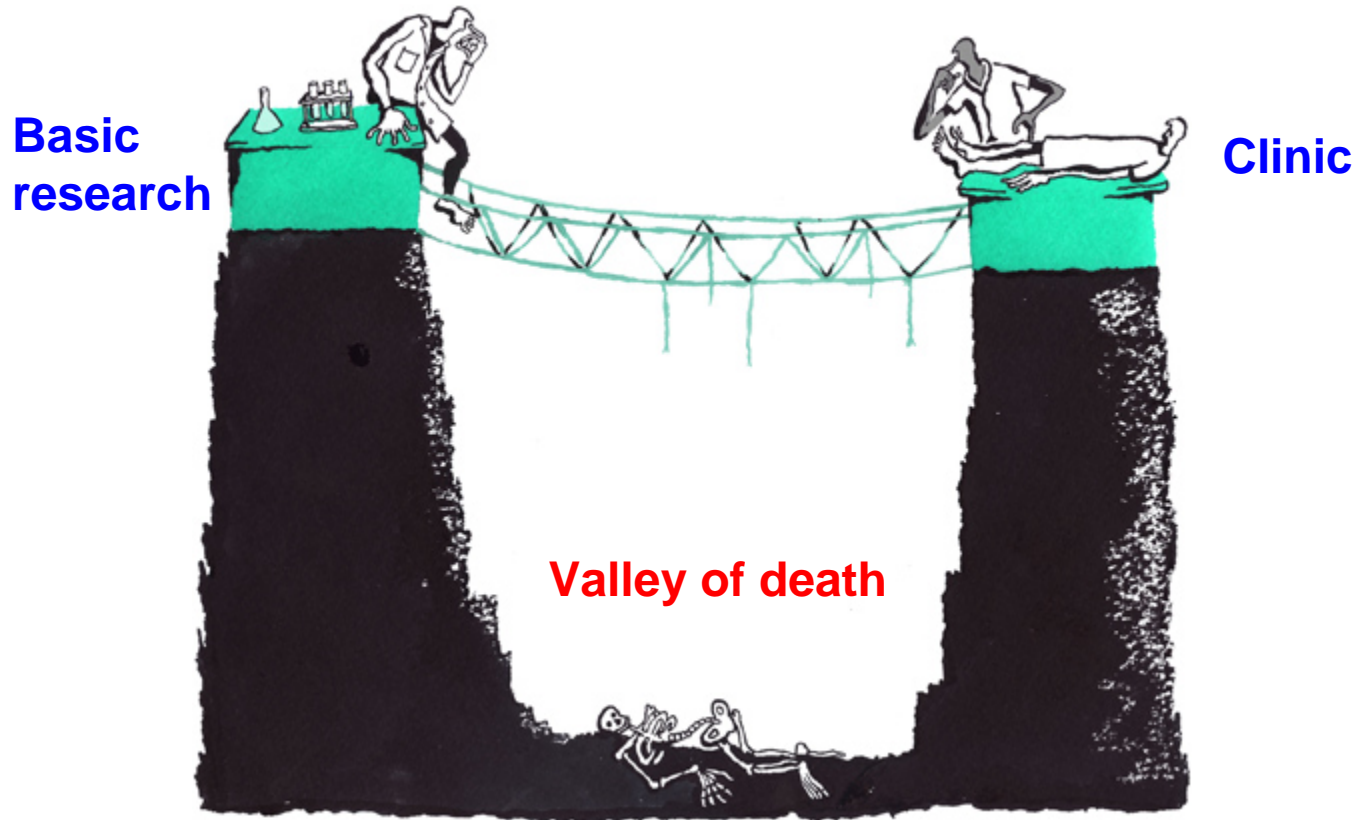


Advanced Technology Program

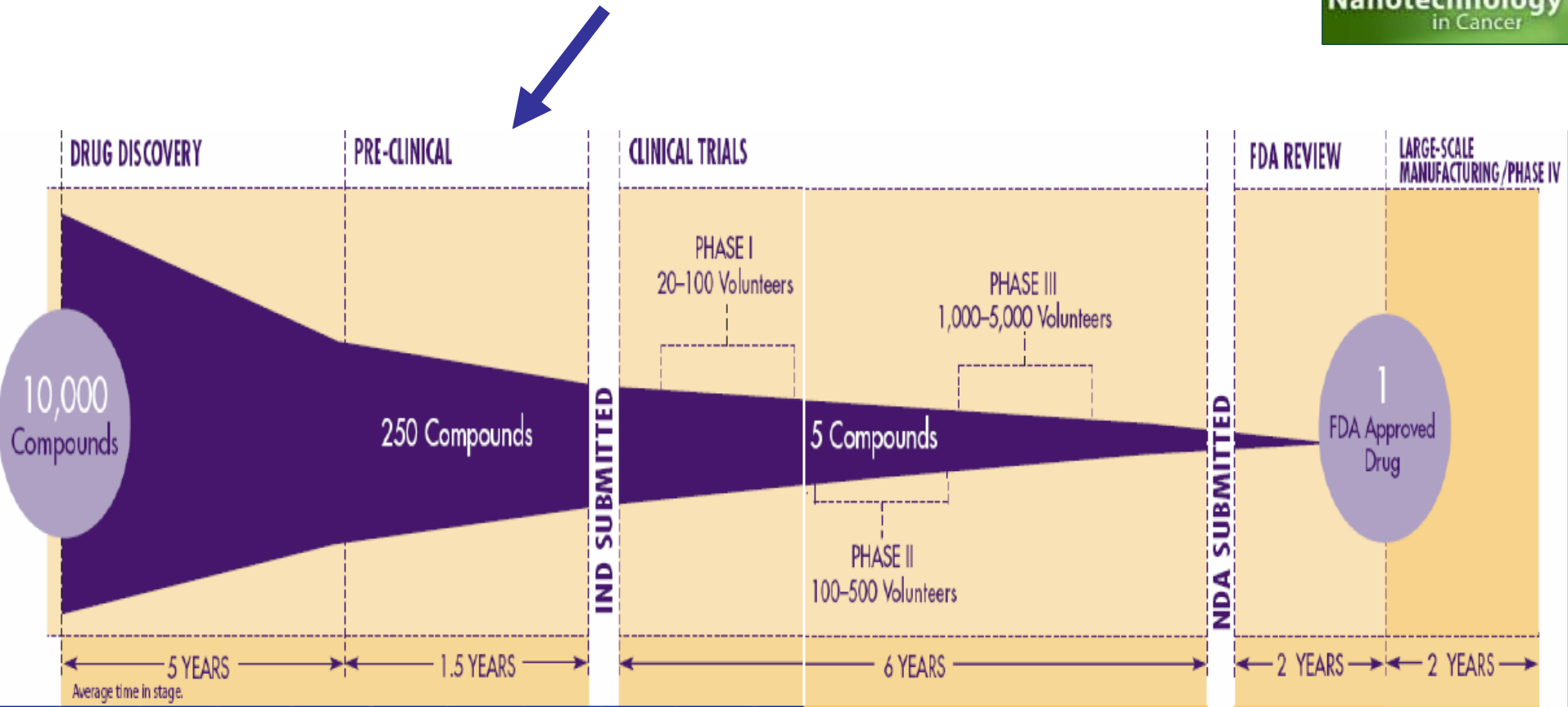
SAIC **SAIC-Frederick, Inc.**
From Science to Solutions A subsidiary of Science Applications
International Corporation

Contract N01-CO-12400 - Funded by the National Cancer Institute

The “Valley of Death”



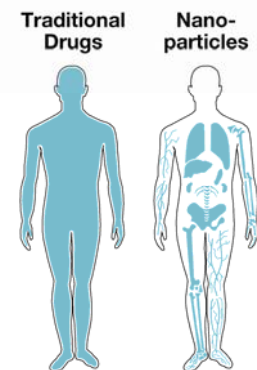
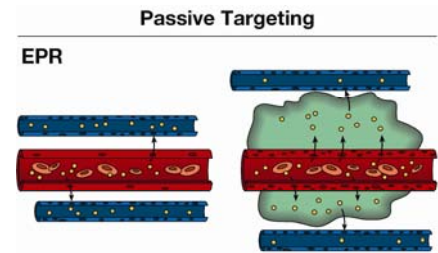
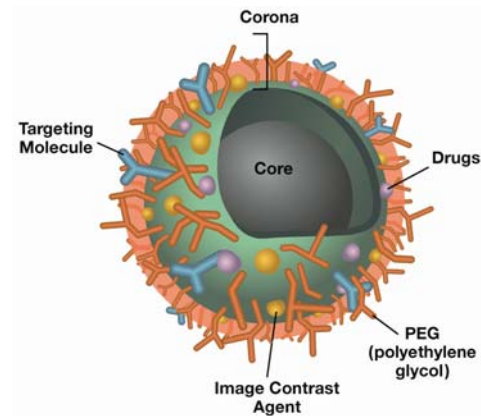
Accelerated Clinical Translation



IND or IDE submission with the US FDA

Advantages of Nanomedicine

- Early detection of disease
- Vehicle for therapeutics
 - Improved PK of Drug
- Multifunctional capability
- Active and passive targeting
- Improved efficacy
- Reduced systemic toxicity

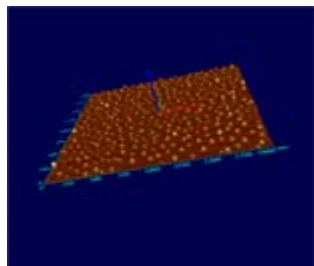


↑Solubility ↑Stability ↑Specificity = ↓Toxicity ↑Efficacy

NCL Objectives

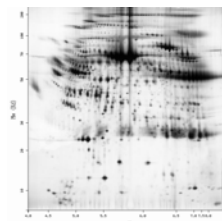
- **Preclinical characterization**
 - Physico-chemical
 - *In vitro*
 - *In vivo*
- **Collaborative standards development**
 - Nanoparticle RM standards with NIST
 - Protocol & Assay standards
 - Inter-lab studies (ASTM, IANH)
 - ASTM E56 & ISO TC 229
- **Collaborative research**
 - NCTR: Primate studies
 - FDA: Dermal penetration of TiO₂
 - FDA: Nanosilver sterilization stability
 - NIEHS: Characterization studies
- **SAR studies**
 - Biocompatibility
 - Toxic mechanisms specific to nanoparticles
 - Biological impact on size and surface characteristics
 - Sterility & endotoxin
- **Education and knowledge sharing**
 - Nanomedicine courses
 - Organize workshops and symposia
 - caNanolab web portal for data sharing

NCL Assay Cascade



Physicochemical:

- Size
- Shape
- Composition
- Molecular weight
- Surface chemistry
- Identity
- Purity
- Stability
- Solubility



In Vitro:

- Pharmacology
- Blood contact properties
- Immune cell function
- Cytotoxicity
- Mechanistic toxicology
- Sterility



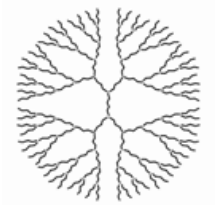
In Vivo:

- ADME
- Safety
- Efficacy

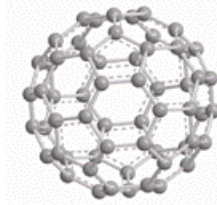
http://ncl.cancer.gov/assay_cascade.asp

Portfolio of Nanomaterial Platforms

- NCL has over 65 Materials Transfer Agreements (MTAs) with collaborators from industry and academia
- Over 200 different nanomaterial samples were characterized



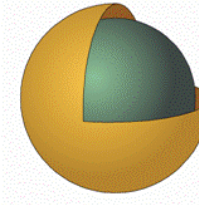
Dendrimers



Fullerenes



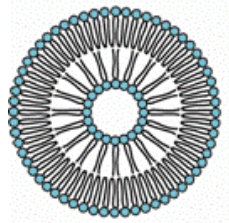
Gold nanoparticles



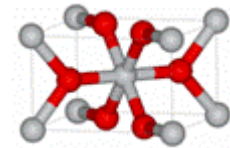
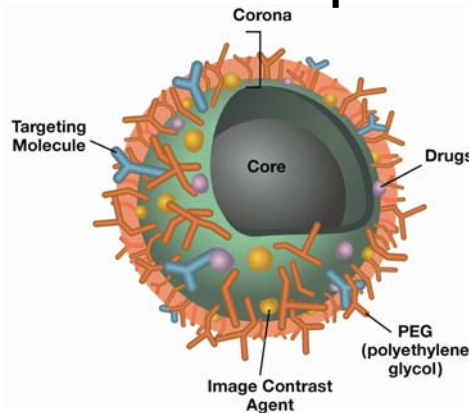
Gold nanoshells



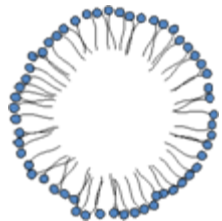
Iron Oxide



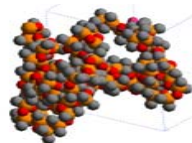
Liposomes



TiO₂



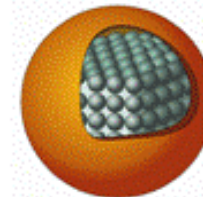
Nanoemulsions



Polymers



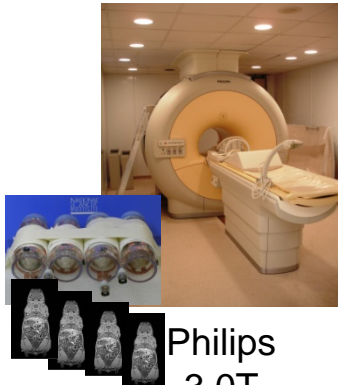
Nanorods



Quantum Dots

In Vivo Imaging

MRI



Philips
3.0T

PET/CT



Siemens
Inveon µPET
CT upgrade (6/08)

Optical



Xenogen
Spectrum

CRI
Maestro
GNIR-Flex

Ultrasound



Visual Sonics
Vevo 770

SPECT/CT



Bioscan
NanoSPECT/CT

γ -Well Counter



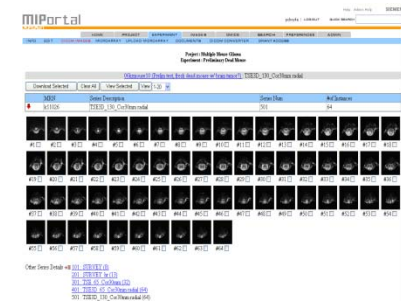
PerkinElmer
1480 Wizard

High Resolution



Fuji
FLA-5100

Archival System



Siemens
MIportal

Mechanisms for Collaboration



NCI Alliance for
Nanotechnology
in Cancer

- Brief application process
 - White papers, Full proposal
- Material transfer agreement (MTA)
- CRADA
- All projects are funded by the NCI
 - No cost to the collaborator

NCL Extramural Collaborators



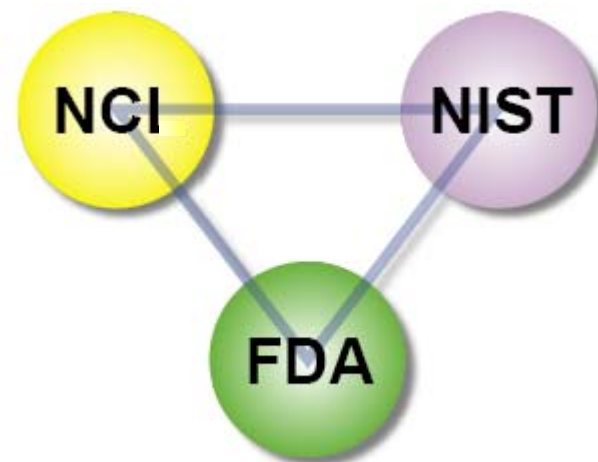
Acknowledgements



NCLTeam

Scott E. McNeil, Ph.D.
Martin Fritts, Ph.D.
Stephan T. Stern, Ph.D.
Jeffrey D. Clogston, Ph.D.
Jennifer B. Hall, Ph.D.
Sarah Skoczen, M.S.
Matthew Hansen, M.S.
Tim M. Potter, B.S.
Jamie Rodriguez, B.S.
Ruyin Shi, M.S.

Anil K. Patri, Ph.D.
Marina A. Dobrovolskaia, Ph.D.
Pavan Adisheshaiah, Ph.D.
Jiwen Zheng, Ph.D.
Rachael M. Crist, Ph.D.
Chris B. McLeland, B.S.,M.B.A
Sonny Man, M.S.
Barry W. Neun, B.S.
David Parmiter, B.A.



Further Info: ncl@mail.nih.gov

Ph: 301-846-6939

<http://ncl.cancer.gov>



Advanced Technology Program



Contract HHSN26120080001E – Funded by the National Cancer Institute