Introduction
Center for Future Technologies in Cancer Care

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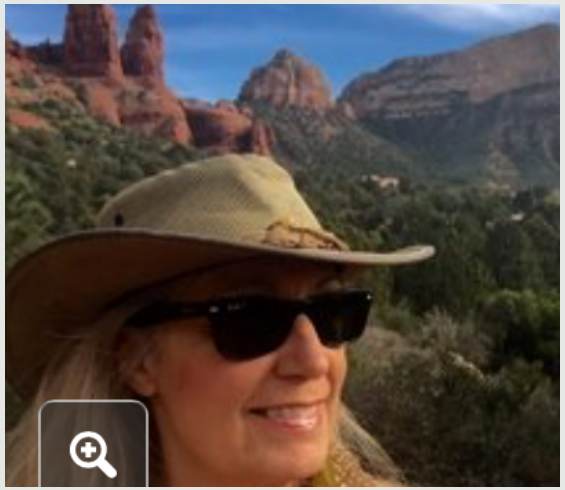
Boston University

9 June 2016

How New Cancer Treatments Are Shaping Lives

By THE NEW YORK TIMES MAGAZINE MAY 15, 2016



Linda McCulloch

Immunotherapy,
Brain Cancer
Remission

William Burhans

Targeted Therapy,
Remission from
BRCA-positive
prostate cancer

Andrew Levy

Immunotherapy,
Leukemia Remission

Precision Medicine

> ***"Precision medicine is not the future of cancer care, it is the present.*** *This study reinforces that the more we personalize treatment to the patient and the tumor, the better the outcomes – even in the earliest phases of research," said Don S. Dizon, MD, FACP.*

- Who will benefit most from these new therapies?
- How can we improve healthcare delivery to impact the most patients?
- Will these new therapies and their cost worsen health disparities?

Point of Care and the New Cancer Care

- In order to reduce costs, it will be necessary to have the following information accessible to clinicians and their patients
  - Inexpensive sequencing data of primary and metastatic tumors.
  - Tumors monitored molecularly throughout the course of treatment.
  - Assessment of therapy earlier in treatment. Early detection of new acquired mutations that might enable resistance.
  - Management of these tests throughout the course of care.
  - High touch patient management with fewer office visits.
  - Putting quality of life issues front and center.

Disparities in Cancer Care

Documented cancer health disparities include:

- a higher incidence of a particularly aggressive form of breast cancer (the triple-negative subtype) among African American women than women of other racial/ethnic groups
- substantially higher rates of prostate cancer incidence and death among African American men than men of other racial/ethnic groups
- higher rates of kidney cancer among American Indian and Alaska Natives than other racial/ethnic groups
- higher rates of liver cancer among Asian and Pacific Islanders than other racial/ethnic groups
- higher rates of cervical cancer incidence and death among Hispanic and African American women than women of other racial/ethnic groups

Global Disparities in Cancer Care

Areas to address global health disparities in cancer care include:

- Tobacco Control
- Obesity, Diet and Exercise
- Vaccines
- Prevention, Early Detection, Treatment
- Palliative Care

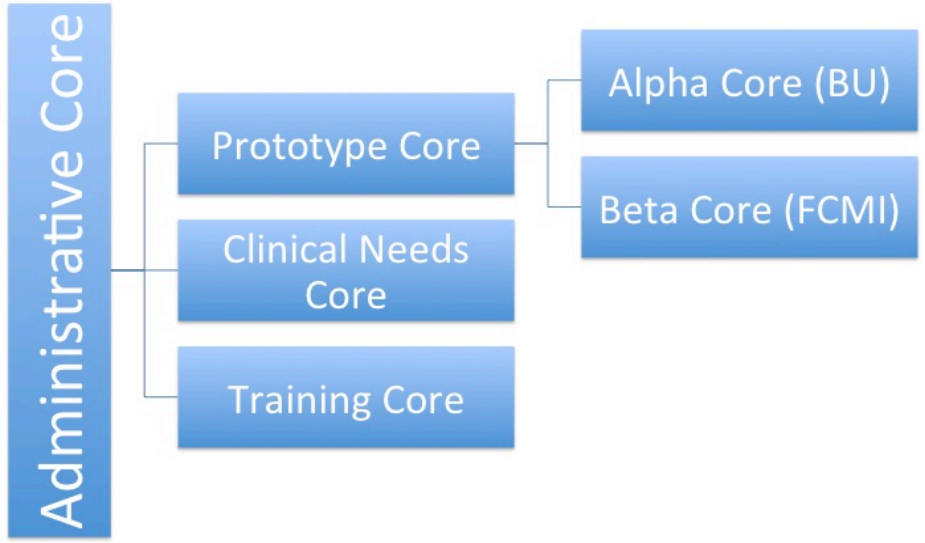
Means to address these disparities:

- Mobile Health Applications
- EMRs
- Point of Care Diagnosis and Risk Stratification
- Treatment Monitoring
- Quality of Life Technologies

doi: 10.1200/JCO.2015.62.2860, *JCO* ***January 2016*** *vol. 34 no. 1* ***6-13***

CFTCC | CENTER FOR FUTURE TECHNOLOGIES IN CANCER CARE

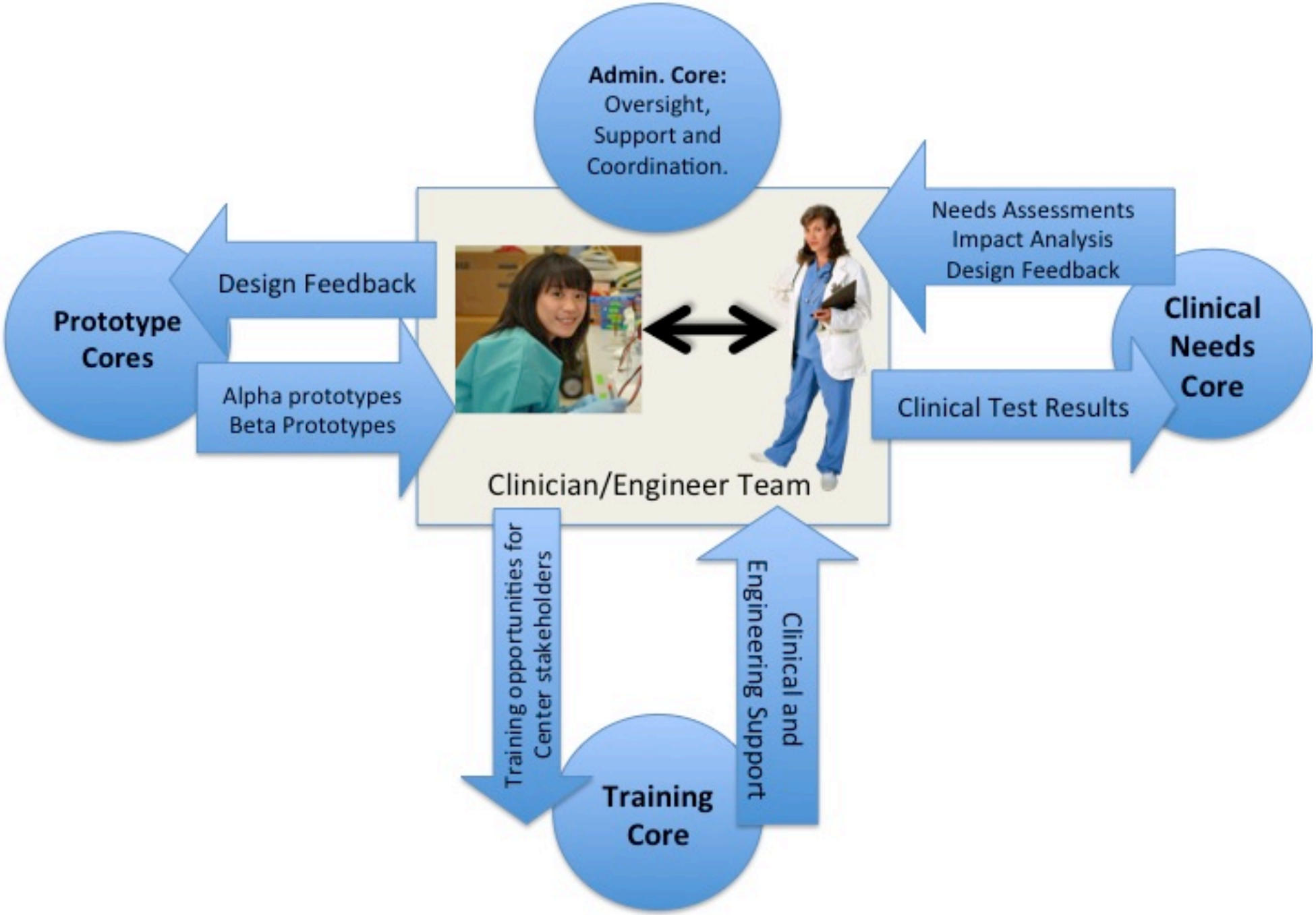
Cancer detection and treatment is evolving rapidly, and the CFTCC strives to keep test developers on top of the change.



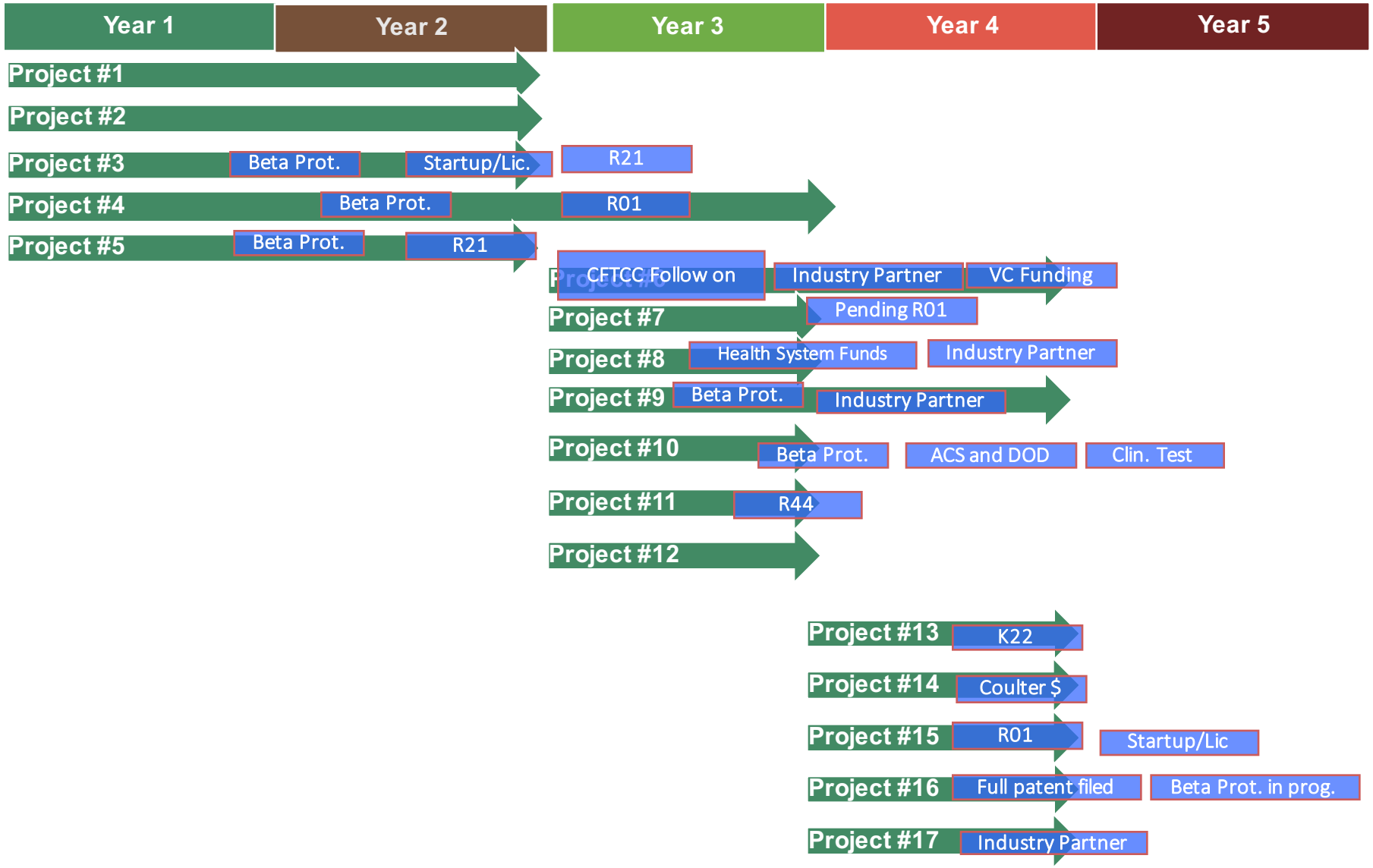
CFTCC is focused on the **identification, prototyping and early clinical assessment of innovative point of care technologies for the treatment, screening, diagnosis and monitoring of cancers.**

We aid investigators in the **assessment of early stage technologies in terms of clinical needs, market demands and setting appropriateness.**

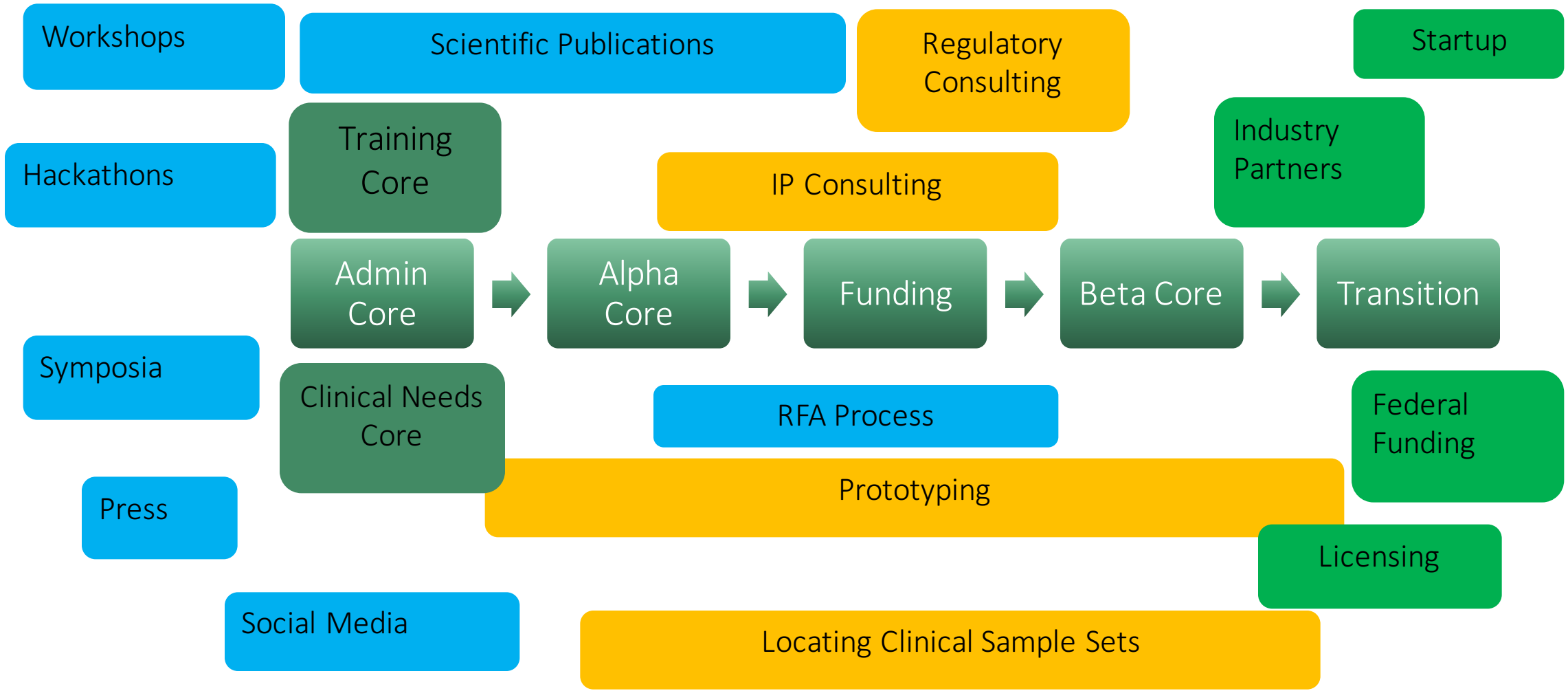
The Center has as strong emphasis on prototyping activities.


Admin. Core:
Oversight,
Support and
Coordination.
Prototype
Cores
Design Feedback
Alpha prototypes
Beta Prototypes
Needs Assessments
Impact Analysis
Design Feedback
Clinical
Needs
Core
Clinical Test Results
Clinician/Engineer Team
Training opportunities for
Center stakeholders
Clinical and
Engineering Support
Training
Core

Summary of Prototype Projects to Date



Progress of Projects Through the Center



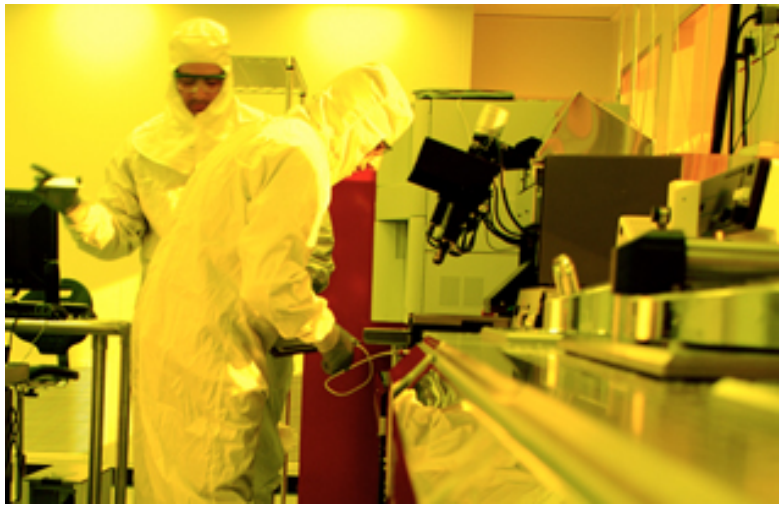
Alpha Prototyping Core

Equipment

- Microarray
- Laser Cutter
- Wax printer
- Cutter Plotter
- Real-Time PCR System
- 3-D Printer
- Desktop mill
- Laminator
- Stereomicroscope

Stratasys uPrint SE

Nikon SMZ18



Other facilities

- Class 1000 cleanroom
- Precision Measurement Laboratory
- EPIC machine shop
- BSL 2 Lab Access

A New Wearable Optical Probe for Chemotherapy Monitoring.

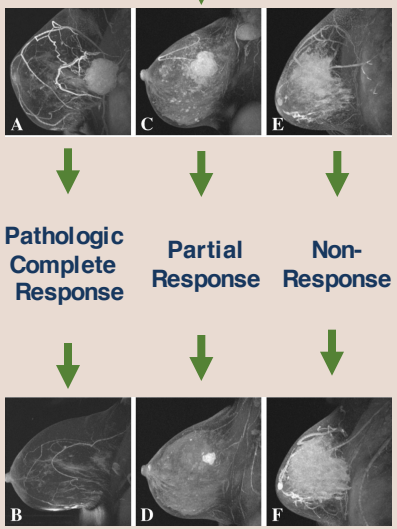
PI: Darren Roblyer, Boston University, Biomedical Engineering
Co-PI: Alexis Sauer-Budge, Fraunhofer CFI

Motivation

Standard of Care

Diagnosis
Stage II/III
Locally Advanced

Neoadjuvant Systemic Therapy



Months

Pathologic Complete Response | **Partial Response** | **Non-Response**

Adapted from Zakhireh et al., 2008

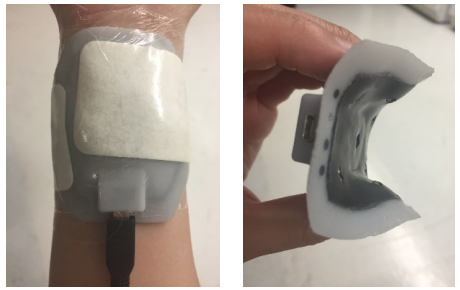
Improved 5-year survival

Little or no benefit toxic side-effects broad chemoresistance

Problem:
It can take months to determine chemosensitivity with current methods

Barrier:
Adaptive Therapy Requires Better Feedback

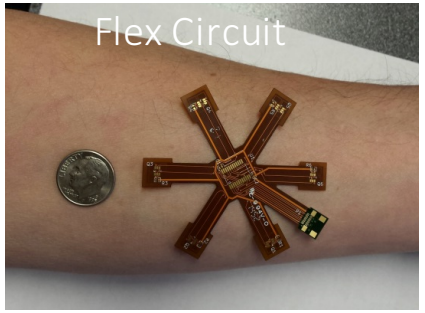
Our Solution:
Wearable Diffuse Optical Imaging

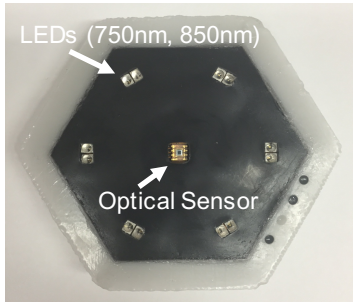


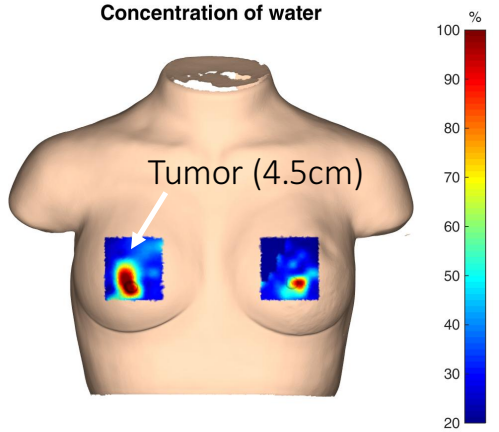
The Wearable probe will be placed on the skin of a breast cancer patient over a known tumor location. Continuous measurements will be taken during chemotherapy infusions.

The Wearable probe is designed to conform to breast tissue.

It measures tumor metabolism during chemotherapy for early response prediction.

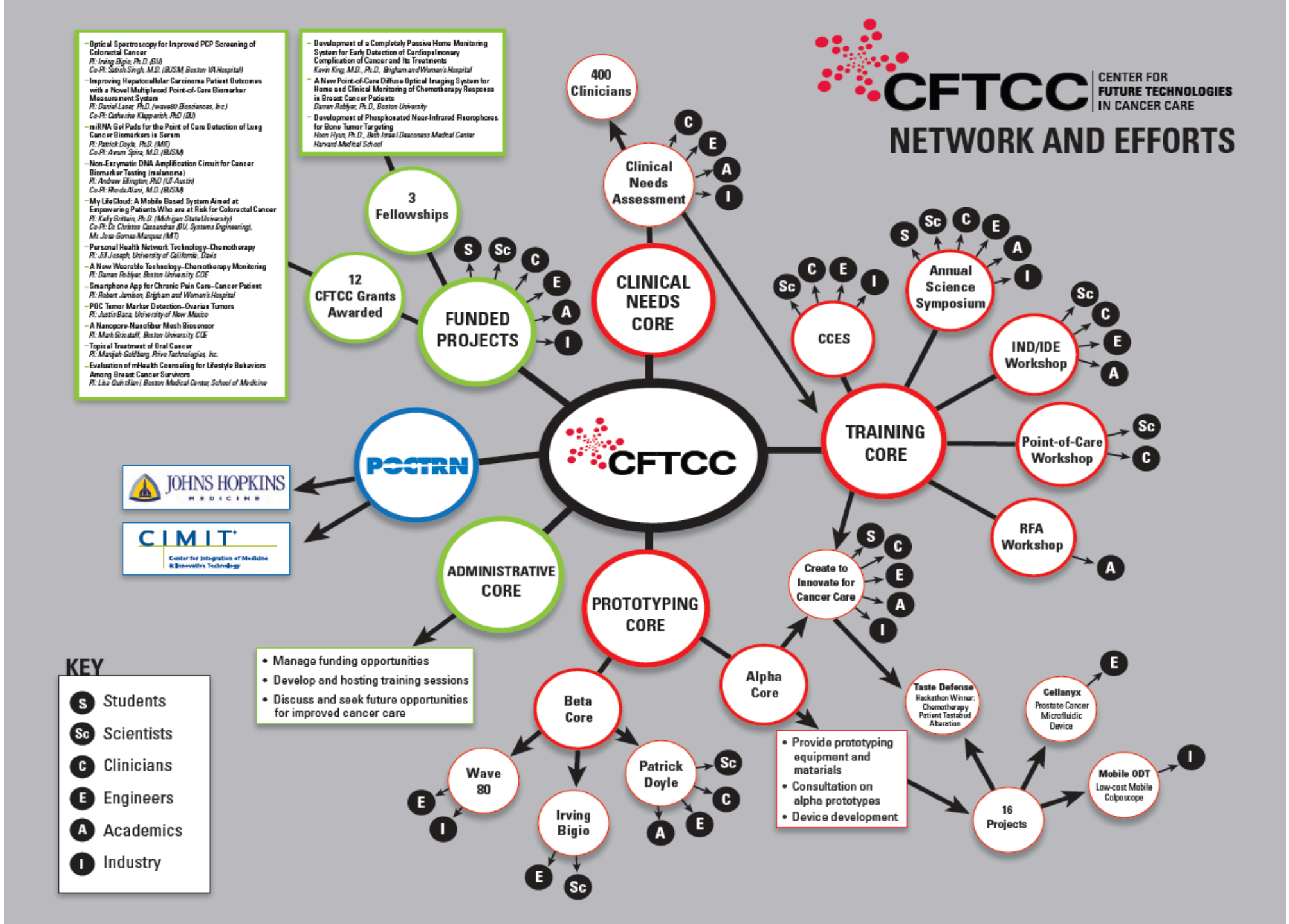






BOTLAB

Boston University College of Engineering
Biomedical Optical Technologies Lab


CFTCC
CENTER FOR FUTURE TECHNOLOGIES IN CANCER CARE
NETWORK AND EFFORTS
CFTCC
CLINICAL NEEDS CORE
Clinical Needs Assessment
400 Clinicians
FUNDED PROJECTS
12 CFTCC Grants Awarded
3 Fellowships
Optical Spectroscopy for Improved PCP Screening of Colorectal Cancer
PI: Irving Bigio, Ph.D. (BU)
Co-PI: Satish Singh, M.D. (BUSM, Boston VA Hospital)
Improving Hepatocellular Carcinoma Patient Outcomes with a Novel Multiplexed Point-of-Care Biomarker Measurement System
PI: Daniel Lasar, Ph.D. (nwave80 Biosciences, Inc.)
Co-PI: Catherine Klapperich, PhD (BU)
miRNA Gel Pads for the Point of Care Detection of Lung Cancer Biomarkers in Serum
PI: Patrick Doyle, Ph.D. (MIT)
Co-PI: Avrum Spira, M.D. (BUSM)
Non-Enzymatic DNA Amplification Circuit for Cancer Biomarker Testing (melanoma)
PI: Andrew Ellington, PhD (UT-Austin)
Co-PI: Rheda Alani, M.D. (BUSM)
My LifeCloud: A Mobile Based System Aimed at Empowering Patients Who are at Risk for Colorectal Cancer
PI: Kelly Brittain, Ph.D. (Michigan State University)
Co-PI: Dr. Christos Cassandras (BU, Systems Engineering), Mr. Jose Gomez-Marquez (MIT)
Personal Health Network Technology–Chemotherapy
PI: Jill Joseph, University of California, Davis
A New Wearable Technology–Chemotherapy Monitoring
PI: Daman Rabiyar, Boston University COE
Smartphone App for Chronic Pain Care–Cancer Patient
PI: Robert Jamison, Brigham and Women's Hospital
POC Tumor Marker Detection–Ovarian Tumors
PI: Justin Baca, University of New Mexico
A Nanopore-Nanofiber Mesh Biosensor
PI: Mark Grinstaff, Boston University COE
Topical Treatment of Oral Cancer
PI: Manjiah Goldberg, Privo Technologies, Inc.
Evaluation of mHealth Counseling for Lifestyle Behaviors Among Breast Cancer Survivors
PI: Lisa Quintiliani, Boston Medical Center, School of Medicine
Development of a Completely Passive Home Monitoring System for Early Detection of Cardiopulmonary Complication of Cancer and Its Treatments
Kevin King, M.D., Ph.D., Brigham and Women's Hospital
A New Point-of-Care Diffuse Optical Imaging System for Home and Clinical Monitoring of Chemotherapy Response in Breast Cancer Patients
Daman Rabiyar, Ph.D., Boston University
Development of Phosphonated Near-Infrared Fluorophores for Bone Tumor Targeting
Hoon Hyun, Ph.D., Beth Israel Deaconess Medical Center
Harvard Medical School
TRAINING CORE
CCES
Annual Science Symposium
IND/IDE Workshop
Point-of-Care Workshop
RFA Workshop
POCTRN
JOHNS HOPKINS MEDICINE
CIMIT Center for Integration of Medicine & Innovative Technology
ADMINISTRATIVE CORE
• Manage funding opportunities
• Develop and hosting training sessions
• Discuss and seek future opportunities for improved cancer care
PROTOTYPING CORE
Create to Innovate for Cancer Care
Alpha Core
Beta Core
Wave 80
Irving Bigio
Patrick Doyle
• Provide prototyping equipment and materials
• Consultation on alpha prototypes
• Device development
Taste Defense
Hackathon Winner: Chemotherapy Patient Tastebud Alteration
Cellanyx
Prostate Cancer Microfluidic Device
Mobile ODT
Low-cost Mobile Colposcope
16 Projects
KEY
S Students
Sc Scientists
C Clinicians
E Engineers
A Academics
I Industry

Center Outreach

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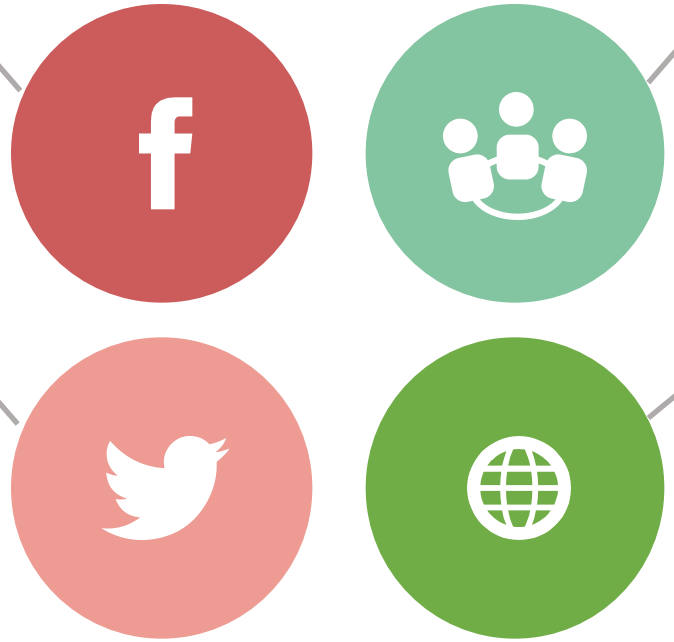

Workshops and Training
Photonics Center, Boston
Fraunhofer CMI
Alpha Prototyping Core

Web Based Resources and Archives
www.bu.edu/CFTCC
www.POCTRN.org