



Improving Education and Training for Radiologists who Interpret Information for Cancer Patients in Academic and Community Settings of Care

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Disclosures

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Consultant: Virtualscopics

Presentation Outline

- Mission of the Imaging Dept., Dana-Farber Cancer Institute
- Cancer Imaging Program (CIP) fellowship training
- Peer learning for CIP fellows
- Challenges for the community radiologists
- Quality improvement approaches- how can we improve as cancer imaging specialists?

The mission of the Department of Imaging at Dana-Farber Cancer Institute (DFCI)

- To inform individual management decisions
- To promote successful and timely translation of cancer discovery into clinical practice
- **To train the future generation of cancer imagers**

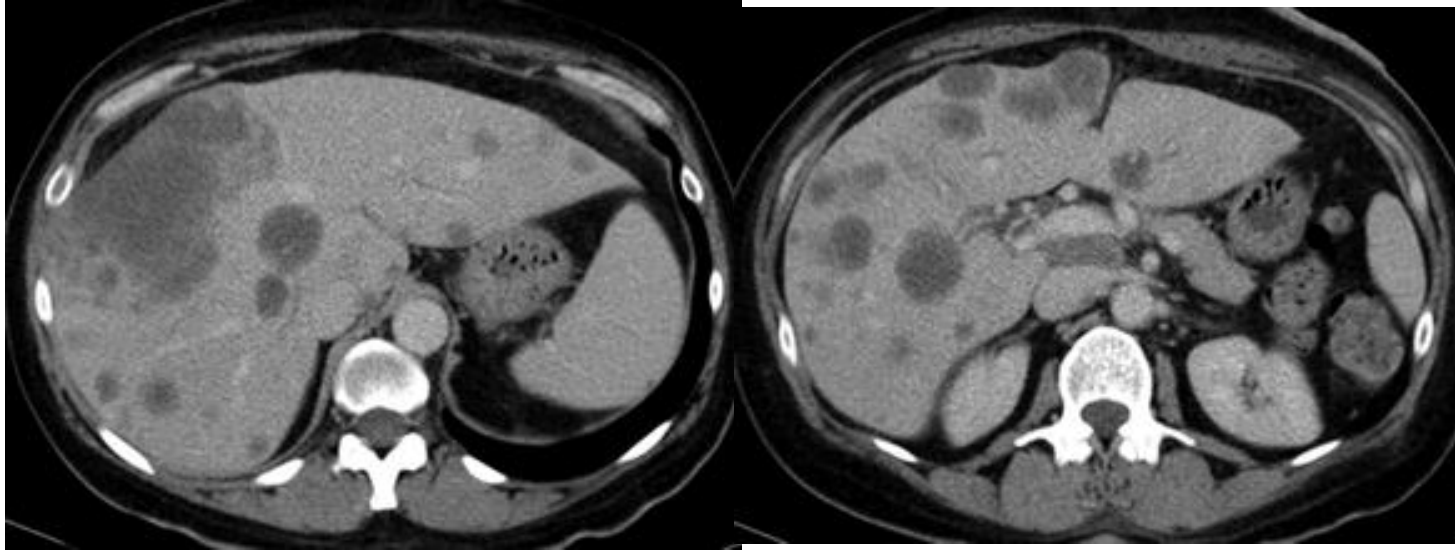


Why is there a need for a Cancer Imaging subspecialty training?

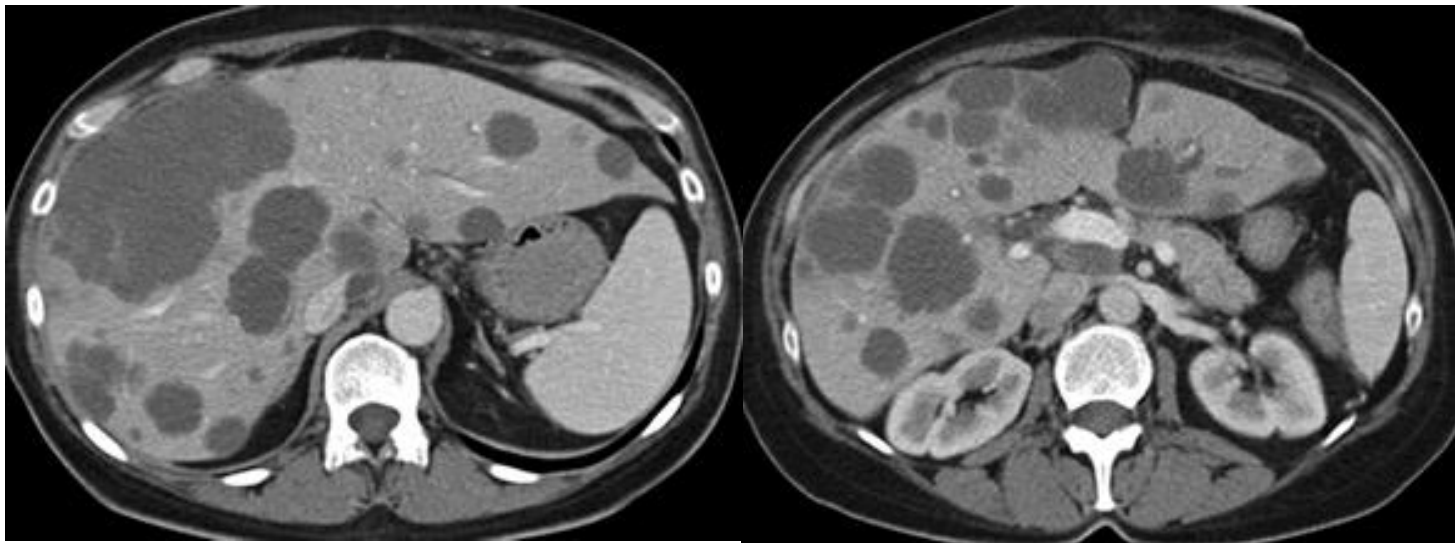
- Multidisciplinary precision medicine requires radiologists to consider the **systemic nature and genomic basis of cancer**, and to use **common language with oncology/pathology colleagues**
- Complexity of interpretation has increased:
 - Characterization of **tumor aggressiveness**
 - Knowledge of tumor **response assessment criteria**
 - RECIST 1.1, irRECIST, CHOI etc.
 - Knowledge of **adverse events to molecular targeted therapies**
- Rapid evolution in cancer biology and availability of therapies

Atypical molecular targeted therapy response

PRE-TX



3 months
POST-TX



Apparent “new”
lesions: 57-year-old
woman with met colorectal
cancer treated with 5-
fluorouracil, leucovorin,
oxaliplatin, and bevacizumab

Subspecialty Cancer Imaging Training Model

Traditional organ (*e.g. chest, abdomen, bone*)
or modality (*e.g. MR, US*)-based design



Disease-centric model
“Cancer Imaging Specialist”

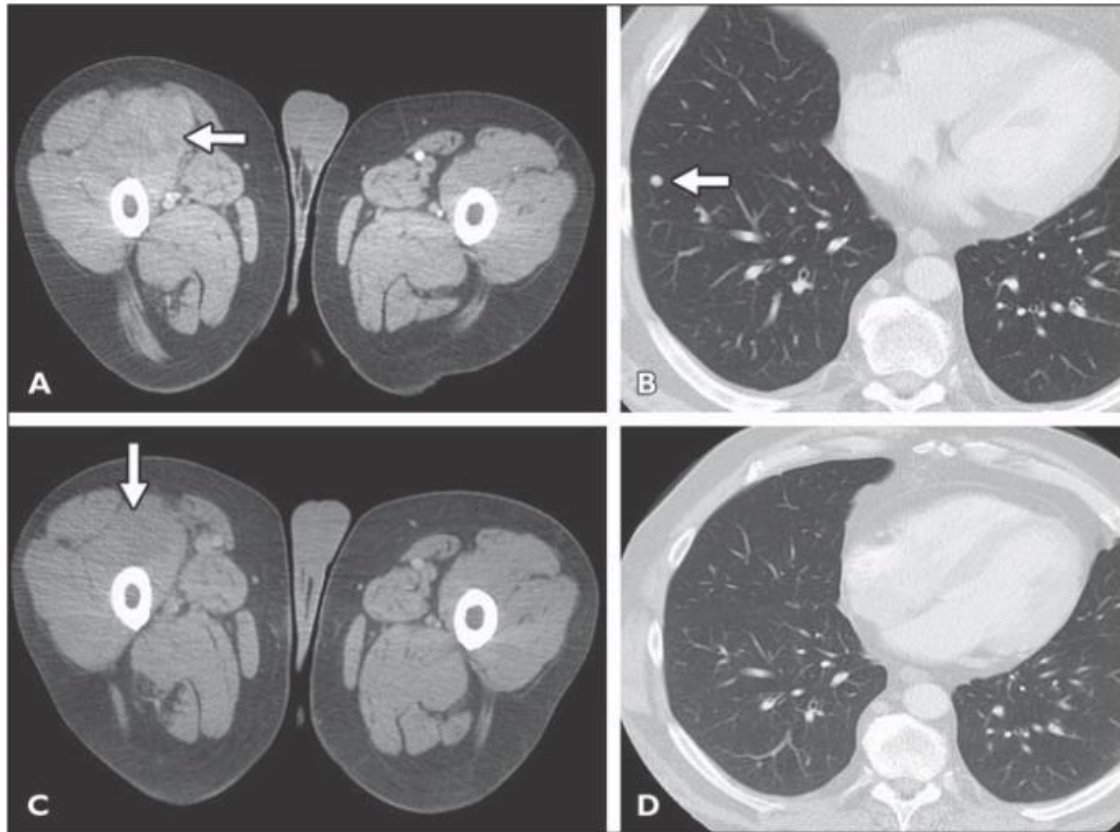
DFCI Cancer Imaging Program: 8 fellows/year

- 4 whole body CT/MR/US
- 2 PET-CT
- 1 Women's oncology (50% breast, 50% CT/MR/US)- SBI match
- 1 Translational (33%PET-CT, 33% CT/MR/US, 33% Research)

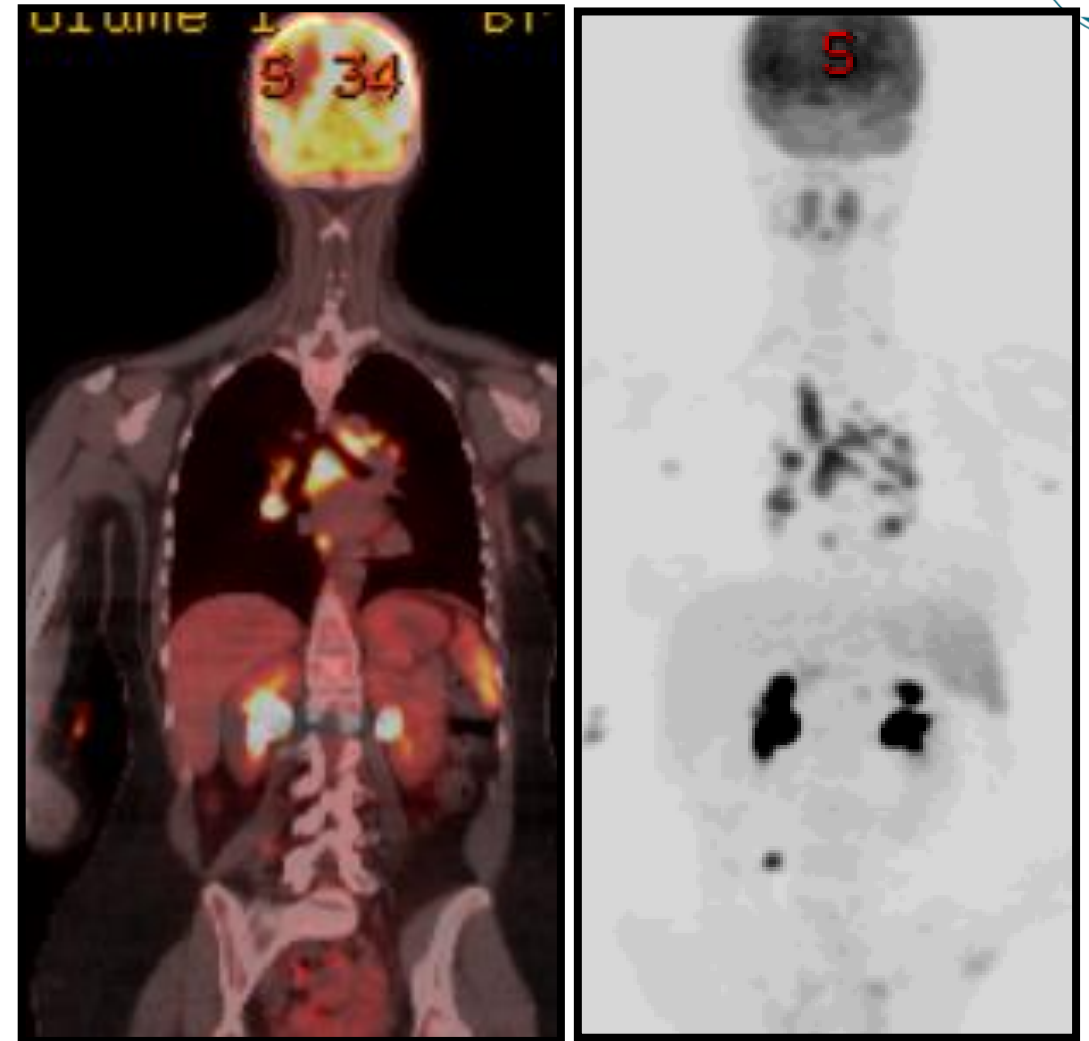
Learning objectives of Subspecialty Cancer Imaging Training

- Familiar with **genomic classification** of tumor types
- Familiar with **standard chemotherapy and molecular targeted/immune therapies**
- Familiar with **types of tumor response criteria** (anatomical/functional)
- Familiar with drug **toxicity** /oncologic emergencies
- Familiar with **template reports**
- Understand **role of radiologist in early phase clinical trials**
- Learn how impactful imaging is on **patient management**

Immune modulators- Ipilimumab



CASE 1: 55-yr old male, met melanoma to thigh and lung
A, B: baseline:
C, D: 3mths of ipi



CASE 2: 42-year-old woman with melanoma treated with ipilimumab showing sarcoidosis like reaction

Subspecialty Cancer Imaging Training weekly educational program

- Comprehensive disease-focused curriculum
- Meets trainees learning objectives (and keeps faculty up to date!)

July

Introductory lecture series

(modality based, clinical overview)

Department of Imaging Conference
July 27, 2016

Introduction to Cancer Drug Development and Targeted Therapies

Geoffrey Shapiro, M.D., Ph.D.
Director, Early Drug Development Center
Dana-Farber Cancer Institute

Principles of Targeted Therapies

Goal is to exploit cancer biology by:

- (1) **Targeting receptors or intracellular kinases that drive tumor cell proliferation or survival** that are altered by genetic mutation, amplification or translocation (BCR-ABL, EGFR, hormone receptors)
- (2) **inducing a synthetic lethal phenotype** where target inhibition paired with another non-lethal mutation causes tumor cell death or senescence (PARP inhibition in a BRCA-deficient tumor cell)
- (3) **targeting factors expressed in tumor or surrounding tissue** required for different stages of tumor formation and maintenance (VEGFR; reversal of immune suppression)

Subspecialty Cancer Imaging Training weekly educational program

- Comprehensive disease-focused curriculum
- Meets trainees learning objectives (and keeps faculty up to date!)

July

Introductory lecture series

(modality based, clinical overview)

August- June

Disease-centric blocks

*(lung, GI, GU, heme,
melanoma, sarcoma)*



←

💬

RE: CIP Program

Cancer Imaging Program week of 2/5 educational activities and Wednesday morning confere...

Foley, Erin M.

Sent: Tuesday, January 30, 2018 at 12:25 PM

To: Fennessy, Fiona Mary, et al.

Please make note of the following:

Monday	Tuesday	Wednesday	Thursday	Friday
Morning teaching: Dr. DiPiro, 8:30 am, L1 reading room	Morning teaching: Dr. Braschi 8:30 am L1 reading room	Cancer Imaging Program weekly seminar. **See details below**	Drug Conference: Dr. Thomas, 10:45-11 am L1 reading room	Morning teaching: Dr. Rosenthal, 8:30 am L1 reading room

On Wednesday morning we hope you can join us from 8:00-9:00 am in ML101 for the weekly Cancer Imaging Program seminar. Please see the details to follow.

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Dana-Farber
Cancer Institute

Cancer Imaging Program Fellowship Conference

ML101 Training Room

Wednesday February 7, 2018

8:00 - 9:00 AM

“Genomic Complexity in Gastroesophageal Cancer: Challenges to Tumor Profiling and Therapy”

Adam Bass, MD

Medical Oncologist, Dana-Farber Cancer Institute
Associate Professor of Medicine, Harvard Medical School





Cancer Imaging at the Crossroads of Precision Medicine: Perspective From an Academic Imaging Department in a Comprehensive Cancer Center

Annick D. Van den Abbeele, MD^{a,b,c,d}, Katherine M. Krajewski, MD^{a,b}, Sree Harsha Tirumani, MD^a, Fiona M. Fennessy, MD, PhD^{a,b}, Pamela J. DiPiro, MD^{a,b}, Quang-Dé Nguyen, PhD^{a,c}, Gordon J. Harris, PhD^{d,e}, Heather A. Jacene, MD^{a,b}, Greg Lefever, RT(R)(N), CNMT^a, Nikhil H. Ramaiya, MD^{a,b}

Abstract

The authors propose one possible vision for the transformative role that cancer imaging in an academic setting can play in the current era of personalized and precision medicine by sharing a conceptual model that is based on experience and lessons learned designing a multidisciplinary, integrated clinical and research practice at their institution. The authors' practice and focus are disease-centric rather than imaging-centric. A "wall-less" infrastructure has been developed, with bidirectional integration of preclinical and clinical cancer imaging research platforms, enabling rapid translation of novel cancer drugs from discovery to clinical trial evaluation. The talents and expertise of medical professionals, scientists, and staff members have been coordinated in a horizontal and vertical fashion through the creation of Cancer Imaging Consultation Services and the "Adopt-a-Radiologist" campaign. Subspecialized imaging consultation services at the hub of an outpatient cancer center facilitate patient decision support and management at the point of care. The Adopt-a-Radiologist campaign has led to the creation of a novel generation of imaging clinician-scientists, fostered new collaborations, increased clinical and academic productivity, and improved employee satisfaction. Translational cancer research is supported, with a focus on early in vivo testing of novel cancer drugs, co-clinical trials, and longitudinal tumor imaging metrics through the imaging research core laboratory. Finally, a dedicated cancer imaging fellowship has been developed, promoting the future generation of cancer imaging specialists as multidisciplinary, multitasked professionals who are trained to effectively communicate with clinical colleagues and positively influence patient care.

Key Words: Cancer imaging, precision medicine, disease-centric, multidisciplinary, training

J Am Coll Radiol 2016;13:365-371. Copyright © 2016 American College of Radiology

Van den Abbeele et al,
J Am Coll Radiol 2016



Cancer Imaging Fellowship Training: Utility and Added Value in the Modern Era

Katherine M. Krajewski, MD, Stephanie A. Howard, MD, Atul B. Shinagare, MD, Annick D. Van den Abbeele, MD, Fiona M. Fennessy, MD, PhD

RATIONALE

The practice of oncology has evolved dramatically in the past 10 years [1]. There has been a paradigm shift in the classification of cancer to an approach based on genomics rather than histology. Driver genetic alterations and gene products now serve as targets for novel cancer treatment. In this era, imaging has become an increasingly integral component of cancer care, extending beyond diagnosis and staging, influencing treatment selection and change decisions via characterization

approach, often based on traditional histology and patterns of spread, with more than 10 areas of fellowship subspecialization available to resident graduates [2]. However, multidisciplinary precision medicine will require radiologists to consider the genomic basis and systemic nature of cancer, using a common language with colleagues in oncology and pathology. Integrated, collaborative practice is beginning to highlight the utility and value of a cancer imaging specialist on the team and introduces an

[10-12]. In the context of "service line" organization of imaging departments and training, it makes sense for radiologists to organize the services we provide and fellowship training programs accordingly, to better contribute to patient management and outcomes. In oncology care, cancer imaging fellowship training promotes multimodality, multi-organ system or body part subspecialty expertise and integration of radiologists into multidisciplinary clinical and research practice.

Krajewski et al,
J Am Coll Radiol 2017



Where have all the fellows gone?????

- From the past 3 years (24 graduates) of the program
 - 50% faculty appointments,
 - 50% private practice/community setting



Mindful of the effort needed to keep abreast of constantly evolving knowledge in cancer biology!!!

Quality assurance and peer learning

Practical Suggestions on How to Move From Peer Review to Peer Learning

Donnelly et al,
AJR, March 2018

Lane F. Donnelly^{1,2}
David B. Larson²
Richard E. Heller III³
Jonathan B. Kruskal⁴

OBJECTIVE. The purpose of this article is to outline practical steps that a department can take to transition to a peer learning model.

CONCLUSION. The 2015 Institute of Medicine report on improving diagnosis emphasized that organizations and industries that embrace error as an opportunity to learn tend to outperform those that do not. To meet this charge, radiology must transition from a peer review to a peer learning approach.

Radiology

Larson et al,
Radiology, April 2017

David B. Larson, MD, MBA
Lane F. Donnelly, MD
Daniel J. Podberesky, MD
Arnold C. Merrow, MD
Richard E. Sharpe, Jr, MD, MBA
Jonathan B. Kruskal, MD, PhD

Peer Feedback, Learning, and Improvement: Answering the Call of the Institute of Medicine Report on Diagnostic Error¹

In September 2015, the Institute of Medicine (IOM) published a report titled "Improving Diagnosis in Health Care," in which it was recommended that "health care organizations should adopt policies and practices that promote a nonpunitive culture that values open discussion and feedback on diagnostic performance." It may seem counterintuitive that a report addressing a highly tech-

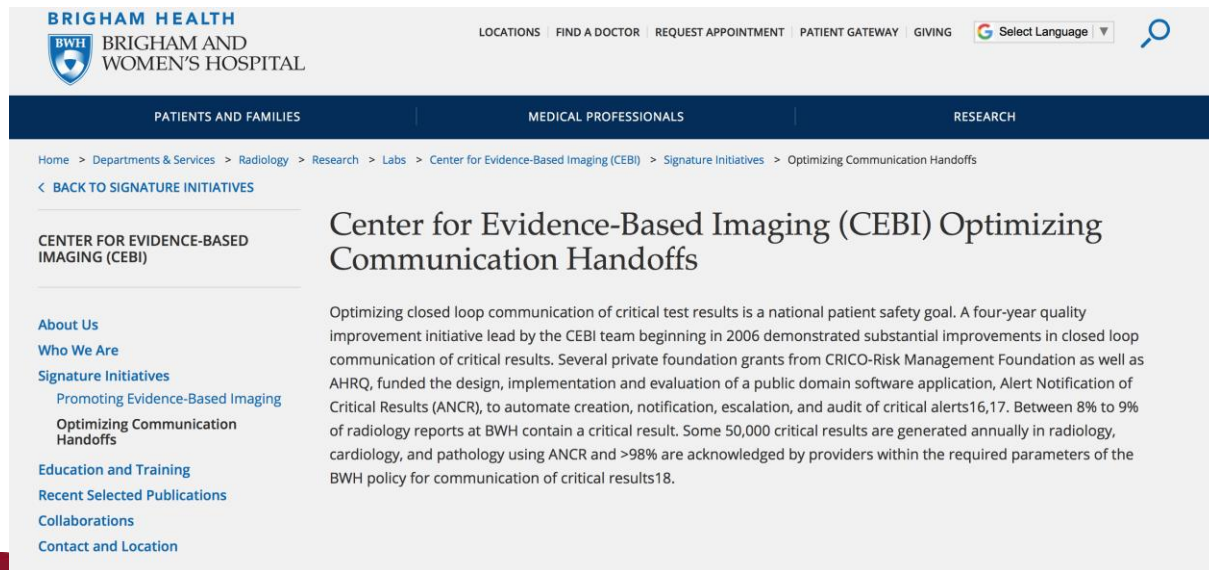
Quality assurance and peer learning at DFCI

- **DFCI consultation service**

- Part of a multidisciplinary team, radiologists imbedded in the clinics, providing immediate interpretation of in-house and outside studies for “live” patients
- Allows for open dialogue with the clinical team, and daily QA of peer reads
- Decreases interruptions in the reading room

Quality assurance and peer learning at BWH/DFCI

BWH/DFCI automated “**Alert Notification of Critical Results**” or “**Alert Notification of Critical Results (ANCR)**, to automate critical alerts” to facilitate notification, documentation, management and communication amongst providers



The screenshot shows the Brigham Health website. The header includes the Brigham Health logo and navigation links: LOCATIONS, FIND A DOCTOR, REQUEST APPOINTMENT, PATIENT GATEWAY, GIVING, and a language selector. The main navigation bar has three tabs: PATIENTS AND FAMILIES, MEDICAL PROFESSIONALS, and RESEARCH. The breadcrumb trail reads: Home > Departments & Services > Radiology > Research > Labs > Center for Evidence-Based Imaging (CEBI) > Signature Initiatives > Optimizing Communication Handoffs. The left sidebar contains a list of links: About Us, Who We Are, Signature Initiatives (with sub-links for Promoting Evidence-Based Imaging, Optimizing Communication Handoffs, Education and Training, Recent Selected Publications, Collaborations, and Contact and Location). The main content area is titled "Center for Evidence-Based Imaging (CEBI) Optimizing Communication Handoffs" and contains a paragraph describing the initiative: "Optimizing closed loop communication of critical test results is a national patient safety goal. A four-year quality improvement initiative lead by the CEBI team beginning in 2006 demonstrated substantial improvements in closed loop communication of critical results. Several private foundation grants from CRICO-Risk Management Foundation as well as AHRQ, funded the design, implementation and evaluation of a public domain software application, Alert Notification of Critical Results (ANCR), to automate creation, notification, escalation, and audit of critical alerts^{16,17}. Between 8% to 9% of radiology reports at BWH contain a critical result. Some 50,000 critical results are generated annually in radiology, cardiology, and pathology using ANCR and >98% are acknowledged by providers within the required parameters of the BWH policy for communication of critical results¹⁸."

Worth Another Look’ (WAL) purple ANCRs are designed to **promote, enhance and encourage peer learning..... considered privileged communication among radiologists for peer review purposes**

 Critical Radiology Results: Worth Another Look Alert (WAL)

ANCR - Alert Notification of Critical Results

Sent: Monday, October 16, 2017 at 4:27 PM

To: Fennessy, Fiona Mary,M.B.B.C.H.,Ph.D.

A patient in your care has a Critical Radiology Result that requires your acknowledgement. The Worth Another Look Alert (WAL) was created by Pamela Dipiro on 10/16/2017 4:27:31 PM.

To view and
<https://ancr>

Images/Report

Important No
Worth Another
initiative.

Critical Result Descri

Critical Result Description (this is not the full radiology report)

☒ Result has been acknowledged

Clinical follow-up
got cardiac ECHO

This thigh mass that we did an US had an MR and biopsy - sarcoma

Audit Trail

Critical Result Description (this is not the full radiology report)

☒ Result has been acknowledged

Looks like a new lesion in right medial femoral head on MR of same day. Maybe too small to detect by BS, although when windowed I think I can see it? Can you check?

Audit Trail

User: Christopher Sakellis

Time: 1/18/2018 2:59:23 PM

Notes: There might be some extremely faint uptake there, but as it's really subtle on CT too, it would be unlikely to be generating the bone turnover needed to be avid on the bone scan.



List



Create New Alert



Alert Finder



Questions



Information

Last update

Document
BWH Rad
BH DFOI
Communi

Technical
Notify Syste



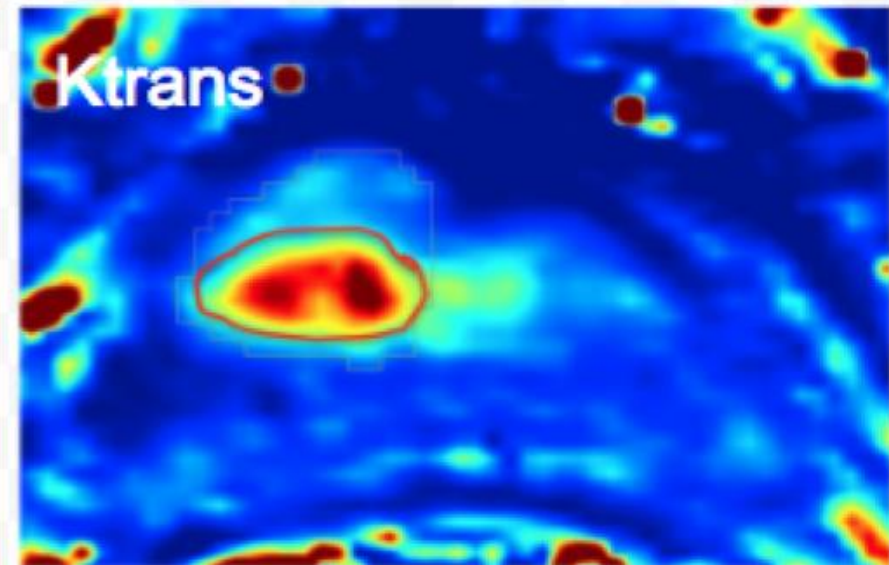
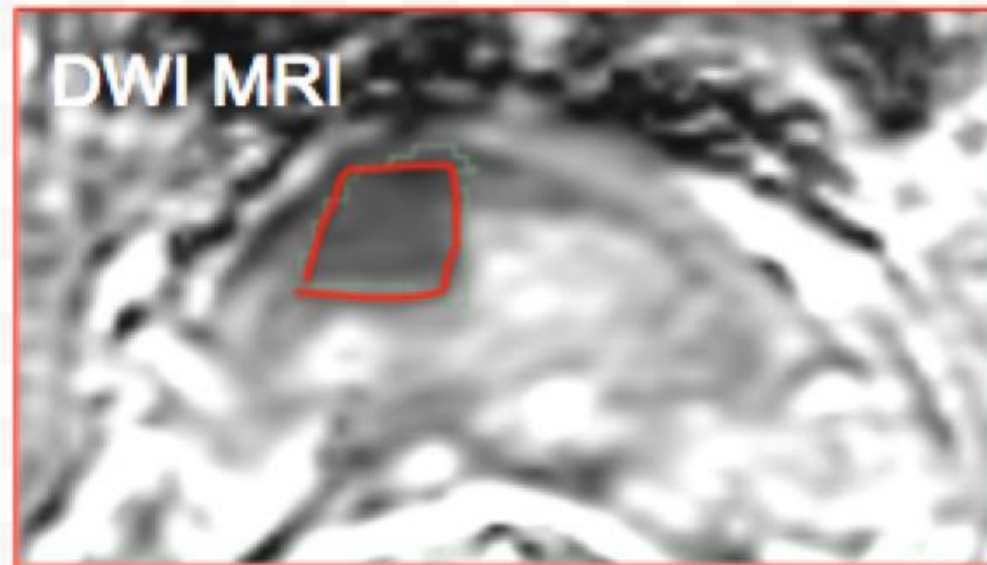
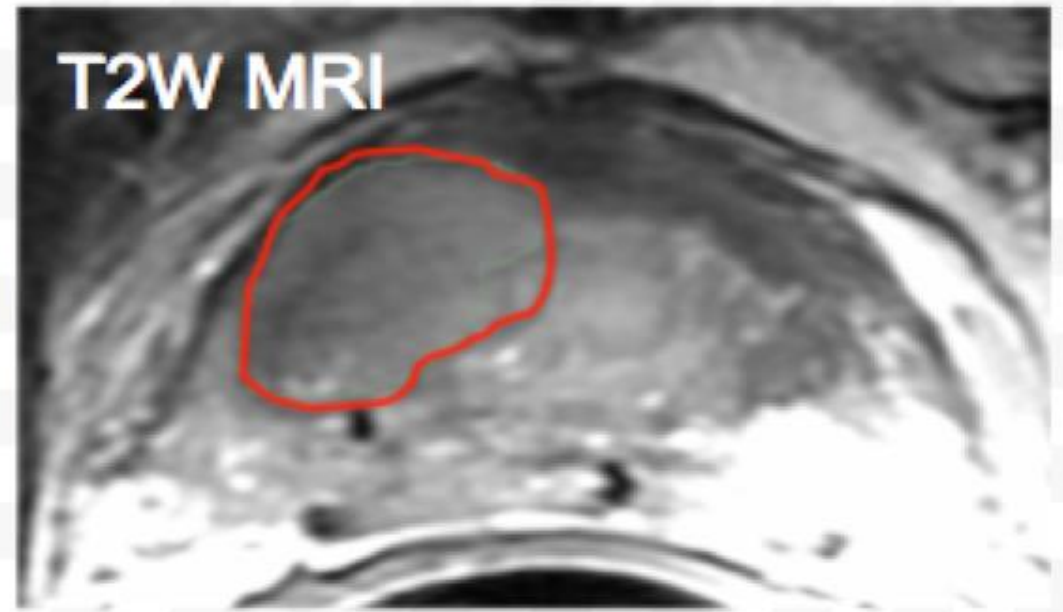
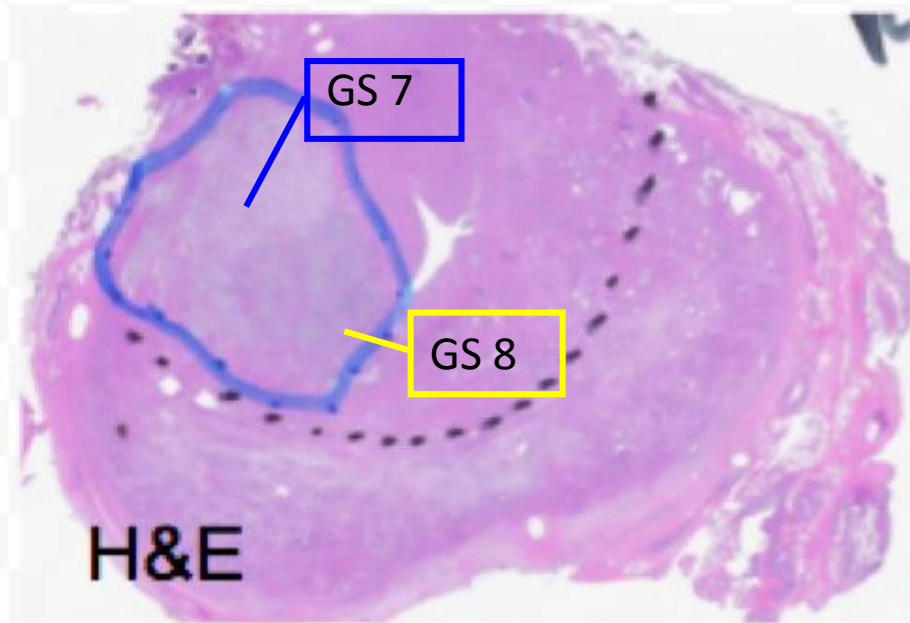
Challenges for the Community Radiologists

- Very challenging to keep up to date!
- Summarize chest/abdomen/pelvis/legs into succinct report and summary
- Feedback not easy to facilitate
- **Solutions????**
 - Have opportunity to avail of CIP seminars through WebEx
 - Community Radiology Division are part of BWH/DFCI ANCR "worth another look" system

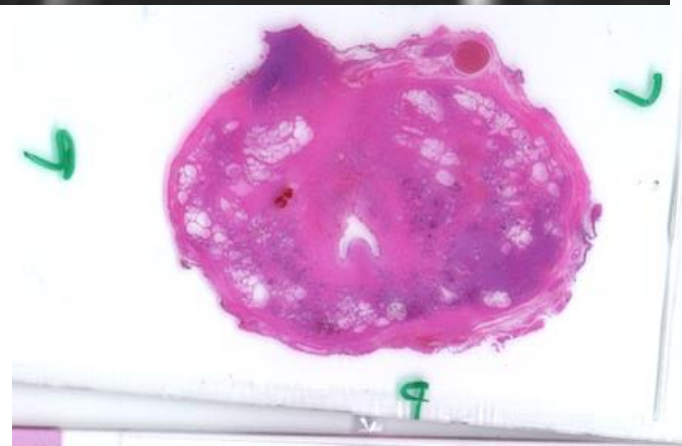
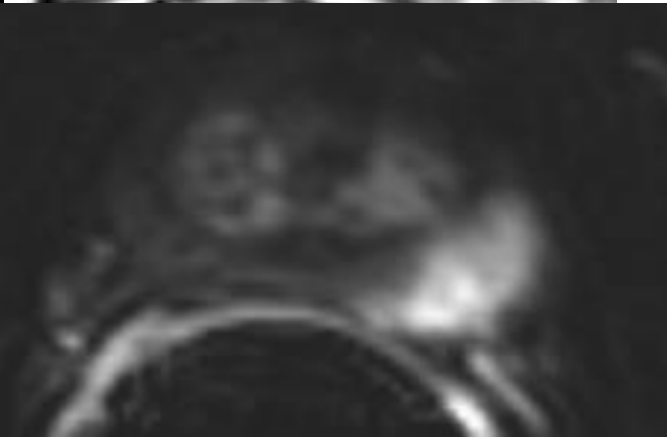
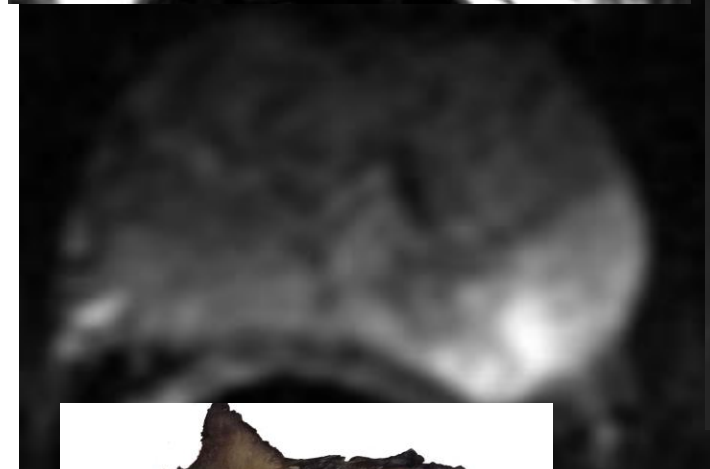
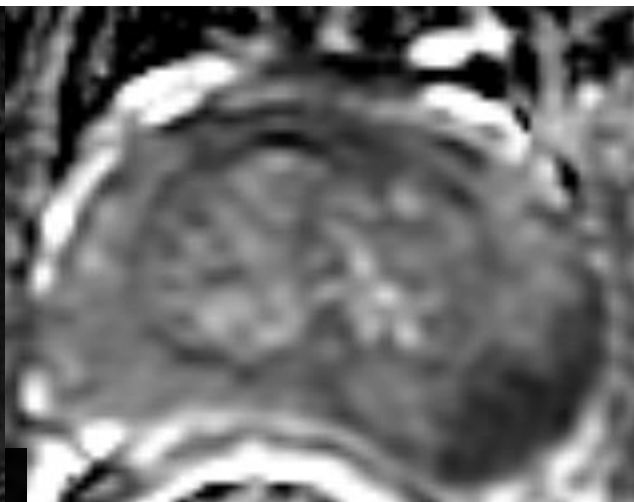
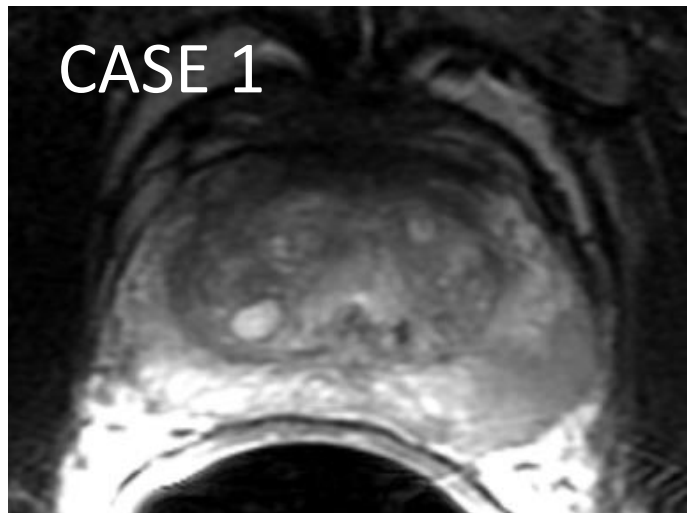
How to improve training and performance in future?

- Correlate with digitized pathology/genomic maps?
 - Aggressive vs. non–aggressive tumor
 - Active growth vs. no growth
 - Response vs. no response

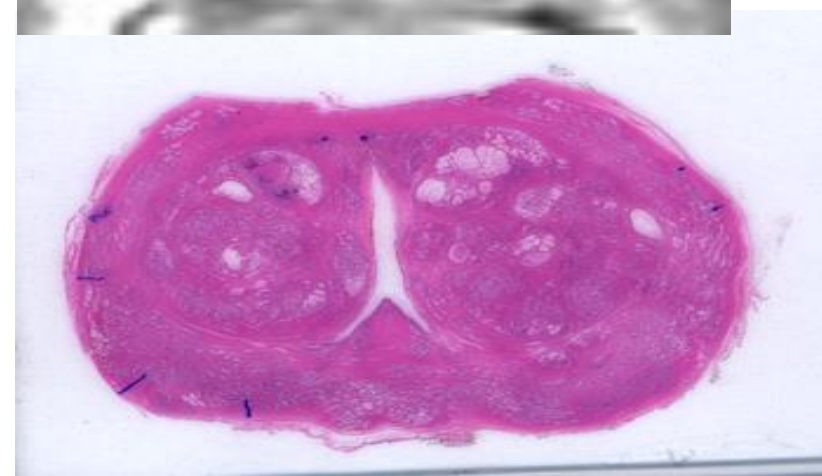
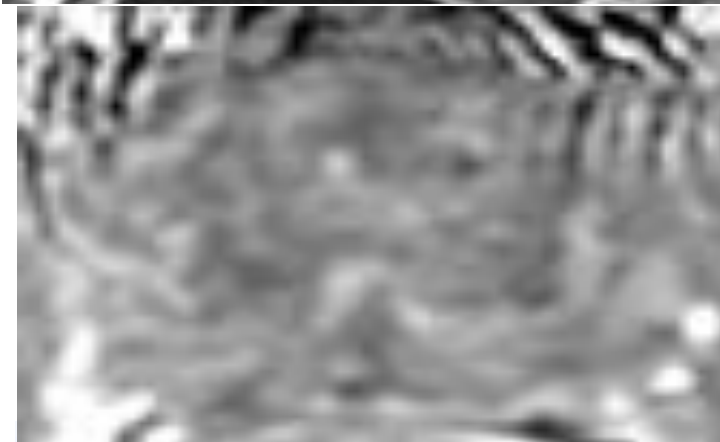
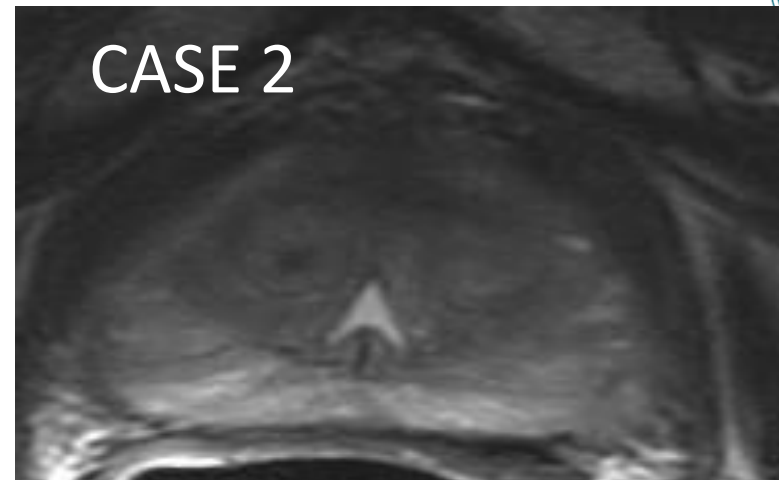
Tumor heterogeneity within Pca

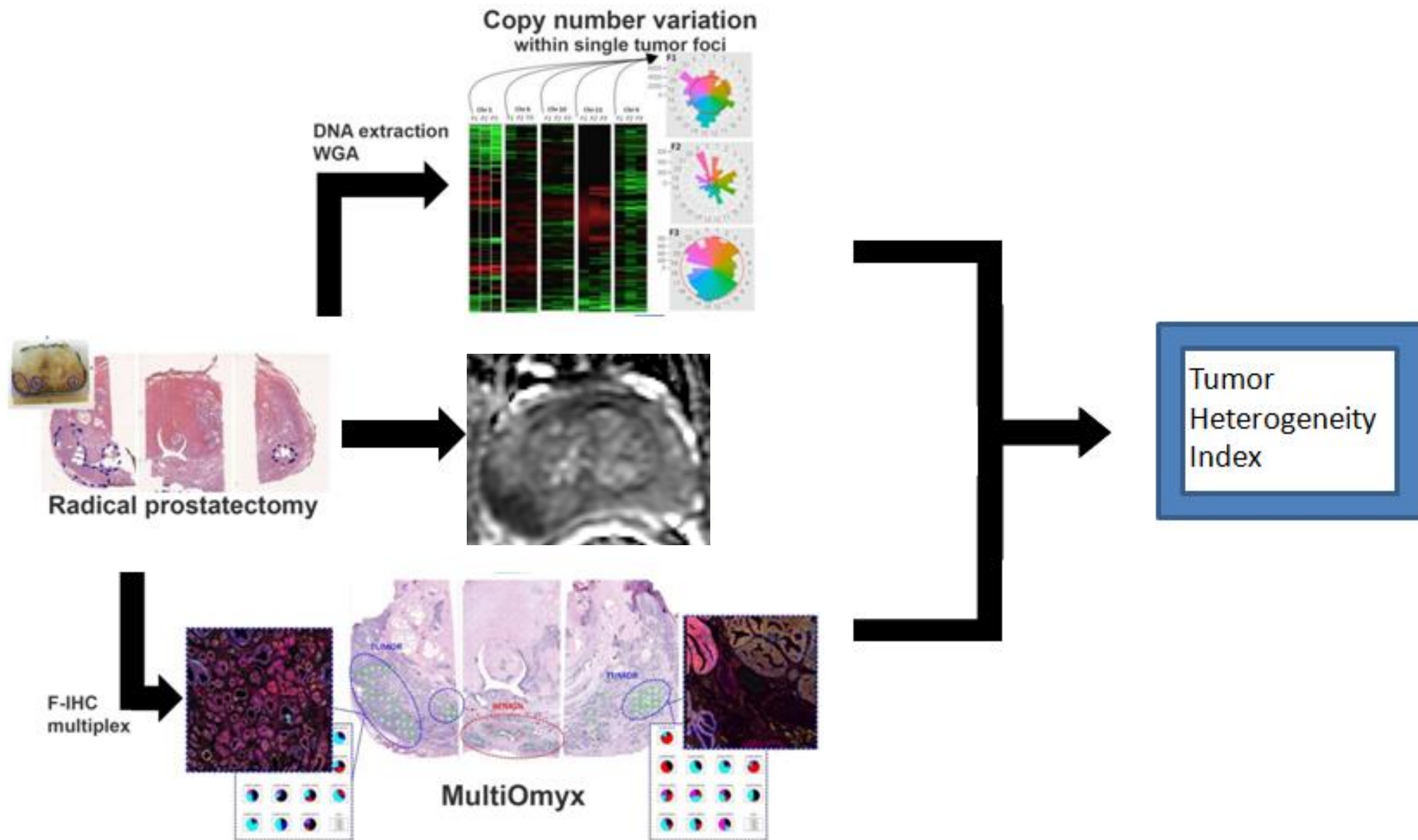


CASE 1



CASE 2





Summary

- Imaging is an increasingly integral component of cancer care. However, given the rapid evolution of cancer biology knowledge and novel targeted therapies, the complexity of radiology interpretation has increased, necessitating cancer imaging expertise and training.
- A rich, dedicated curriculum for training cancer imaging specialists will provide fellows with the knowledge necessary to be an integral part of a multidisciplinary team. However, continued education and ongoing feedback both from peer radiologists and from clinical colleagues will be necessary to remain up to date in such a dynamic field.

References

- **Cancer Imaging at the Crossroads of Precision Medicine: Perspective from an Academic Imaging Department in a Comprehensive cancer Center.** Van den Abbeele AD, Krajewski KM, Tirumani SH, Fennessy FM, DiPiro PJ, Nguyen QD, Harris GJ, Jacene HA, Lefever G, Ramaiya NH. J Am Coll Radiol 2016; 13:365-371
- **Cancer Imaging fellowship training: Utility and added value in the modern era.** Krajewski KM, Howard SA, Shinagare AB, Van den Abbeele AD, Fennessy FM. J Am Coll Radiol. 2017 Oct;14(10):1345-1348
- **Practical suggestions on how to move from peer review to peer learning.** Donnelly LF, Larson DB, Heller RE III, Kruskal JB. AJR Am J Roentgenol. 2018 Jan 11:1-5.
- **Peer Feedback, Learning, and Improvement: Answering the Call of the Institute of Medicine Report on Diagnostic Error.** Larson DB, Donnelly LF, Podberesky DJ, Merrow AC, Sharpe RE Jr, Kruskal JB. Radiology. 2017 Apr;283(1):231-241.