

Integrated Diagnostics

The Future

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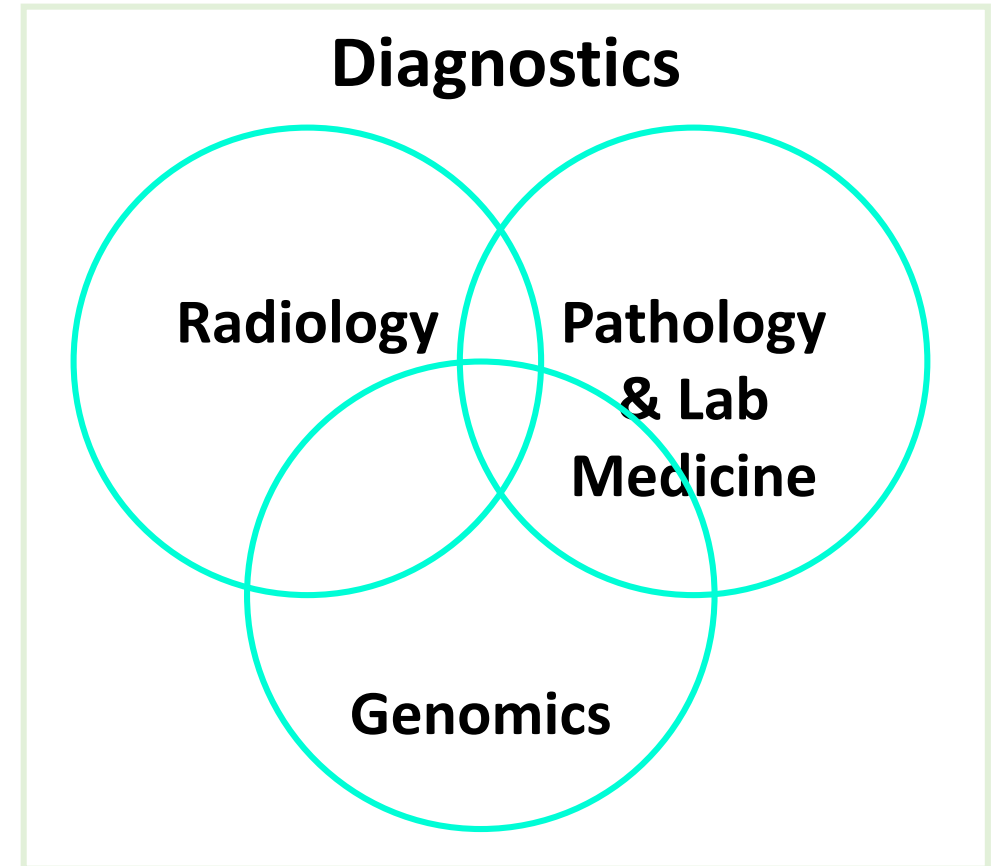
Founder & Chairman, Mahajan Imaging & Labs

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What is Integrated Diagnostics?

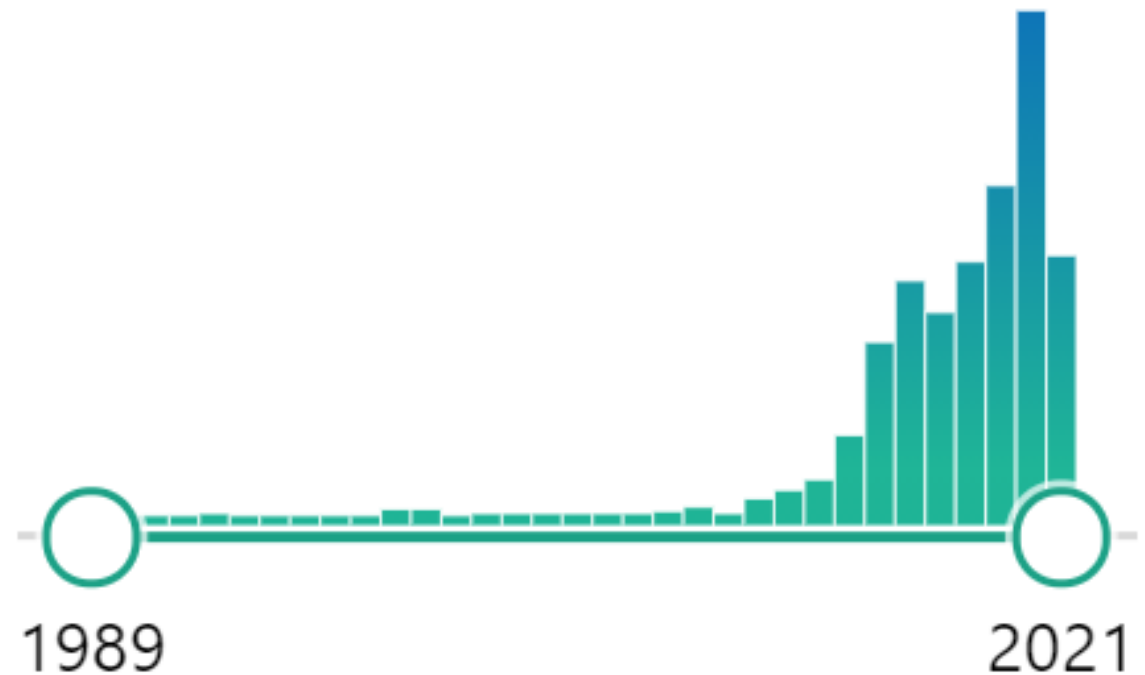
- Combining pathology & lab medicine, radiology and genomics
- Mutual interdependence but limited touch points!
- Deeply integrated workflows – we need to communicate!
- Move beyond the traditional ‘radiological-pathological’ correlation



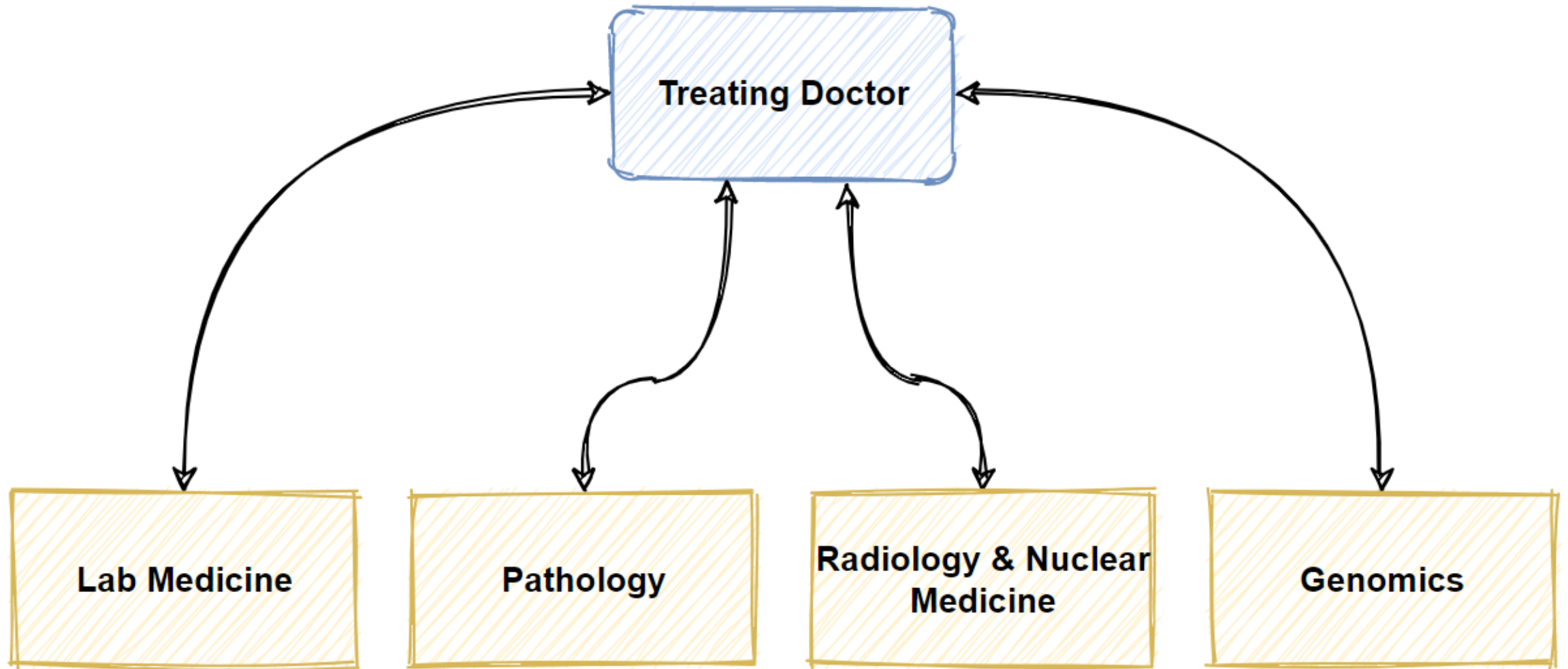
Gaining popularity!

A search on PubMed for “Integrated Diagnostics” shows a increase in results over the past few years...

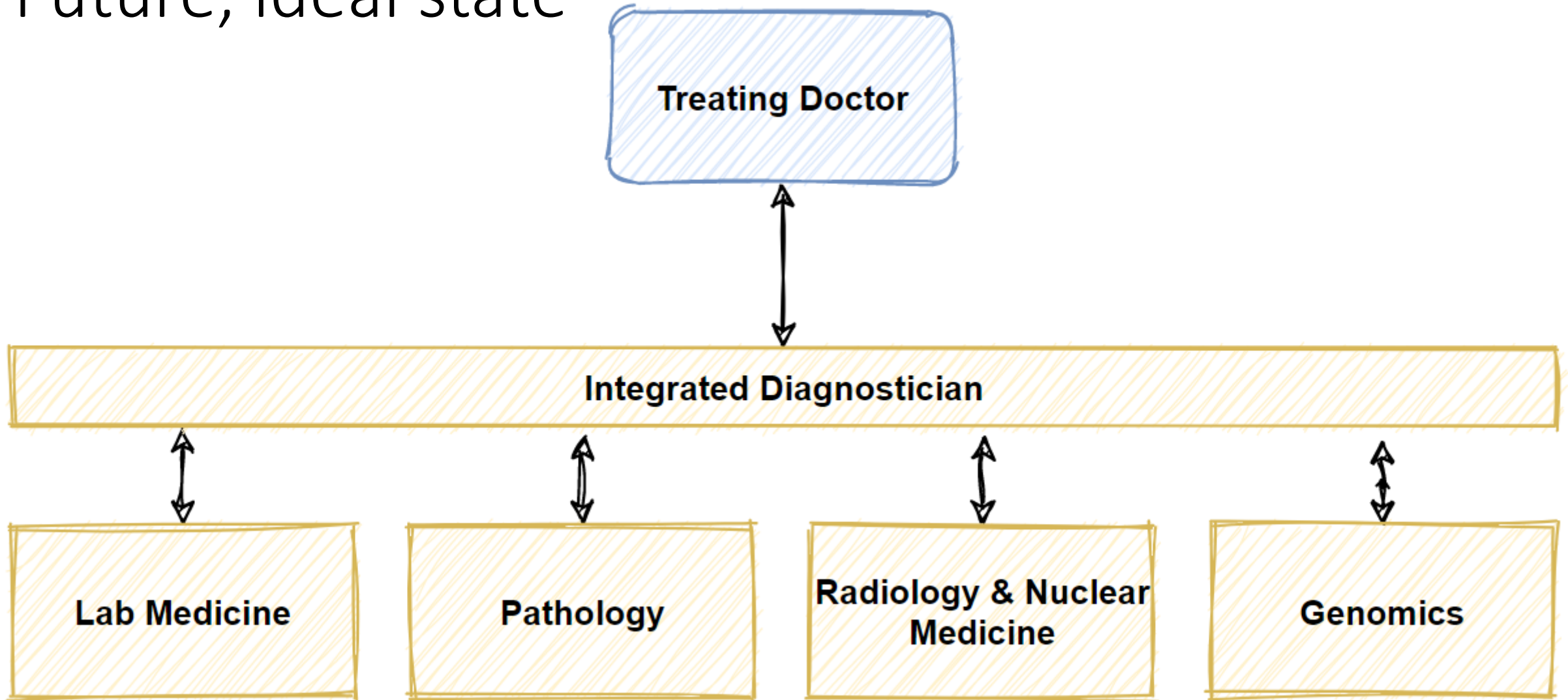
RESULTS BY YEAR



Current “siloed” workflow



Future, ideal state



Challenges of the Integrated Diagnostician

Too much data

- Volume
- Variety across patients
- Diversity across modalities/
departments
- Too much data for
human processing



Too little data

- Available data is unstructured
 - Free text data, with person to person variation
 - Data even within the same hospital system is broken
- Reluctance to share data
 - Within hospital systems
 - Across hospital systems
 - Across geographies
- Lack of normative data



COVID-19 – A case for learning

- World went through the greatest crisis in recent past
- Despite honest attempts at sharing data and experiences and learning from each other in the past 18 months, yet the tools and regulations for sharing, analysing and decision making across the world, were far from ideal
- Could we have controlled / limited the impact of this pandemic if more robust methodologies / engines of rapid data sharing and disease response were in place?
- Across the world thousands of groups created AI algorithms for chest X-rays / HRCT, but did they really make a difference?

What can we learn from this from this apparent failure when the intent was right?

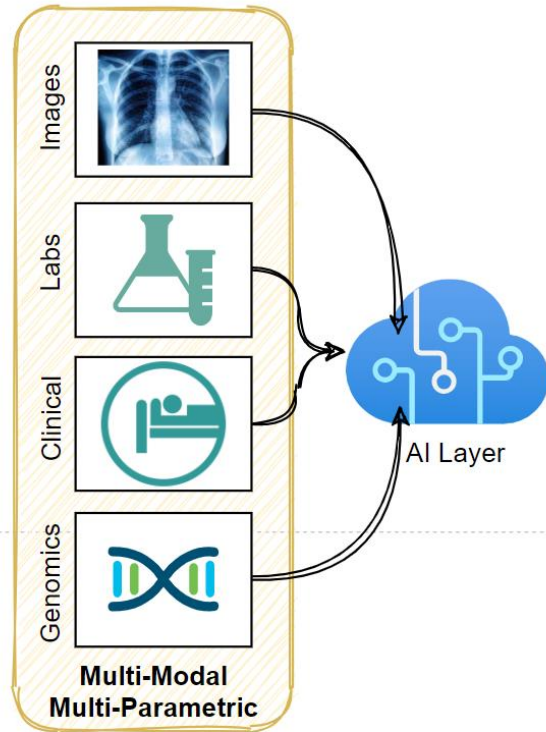
COLLABORATE! COLLABORATE! COLLABORATE!

The solution lies in using AI, but...

- Too many algorithms – no easy way for clinicians to access all of them
- Algorithms are too narrow / niche
 - Anatomy → Modality → Pathology
 - Chest → CT → Nodule
- Most algorithms ignore clinical / lab parameters
 - Current AI analyses images, not patients
- No easy way to test AI
- Limited real-world evidence
- Clinical workflow integration remains a challenge

AI solutions need to overcome technical and integrative shortcomings to be clinically valid and acceptable...

Informatics tools that the Clinical Diagnostician will need



Real-Time Data Search

- At Patient Level – past records and history
- At Health System Level – similar patients across hospitals
- At Population Level – publications, outcomes, normative datasets

Seamless Integration

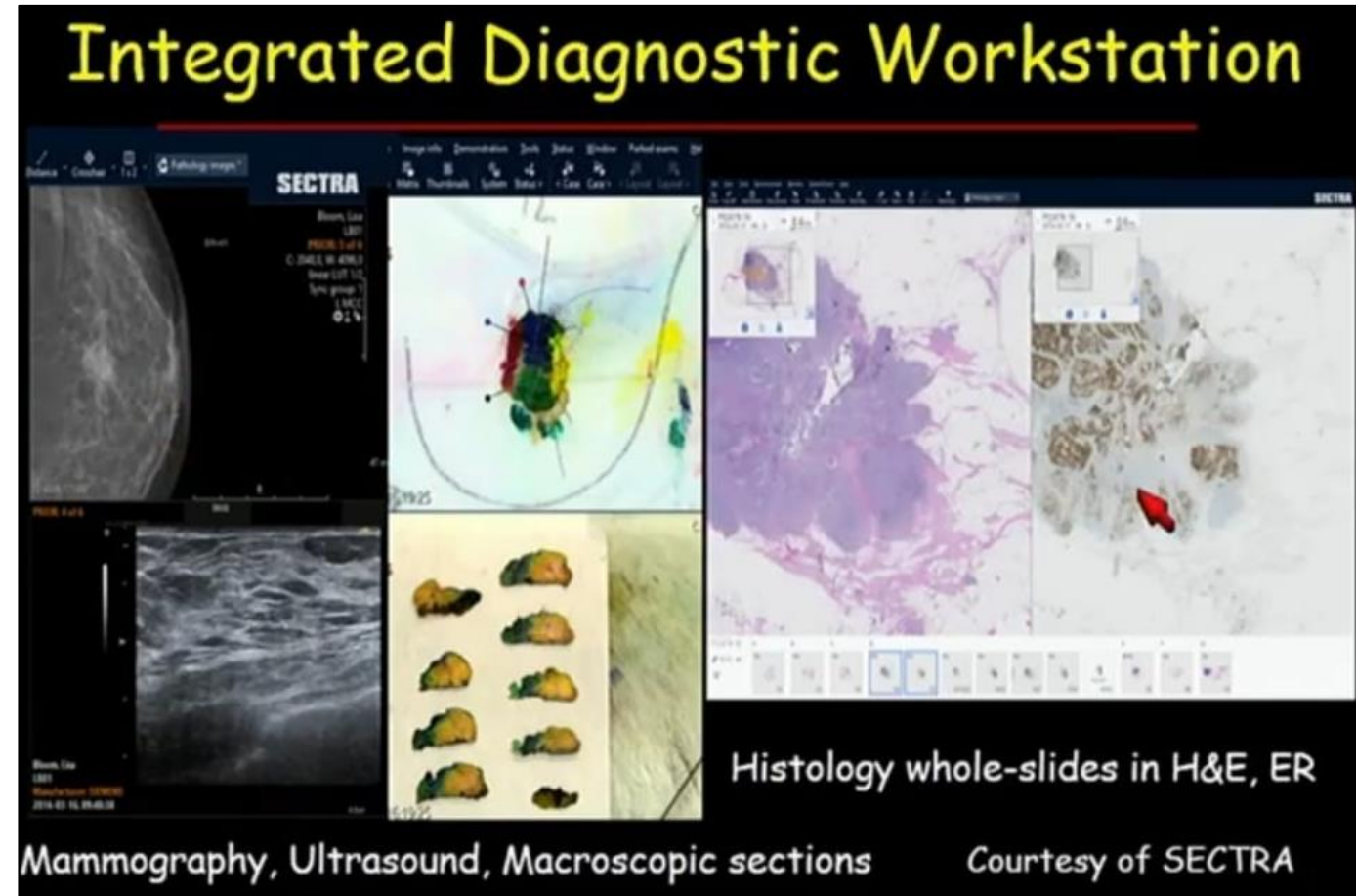
- Single view for all records, investigations
- Single view to all algorithms and outputs
- Ability for new analytics tools to come on board seamlessly

Are radiologists ideally placed to play this role?

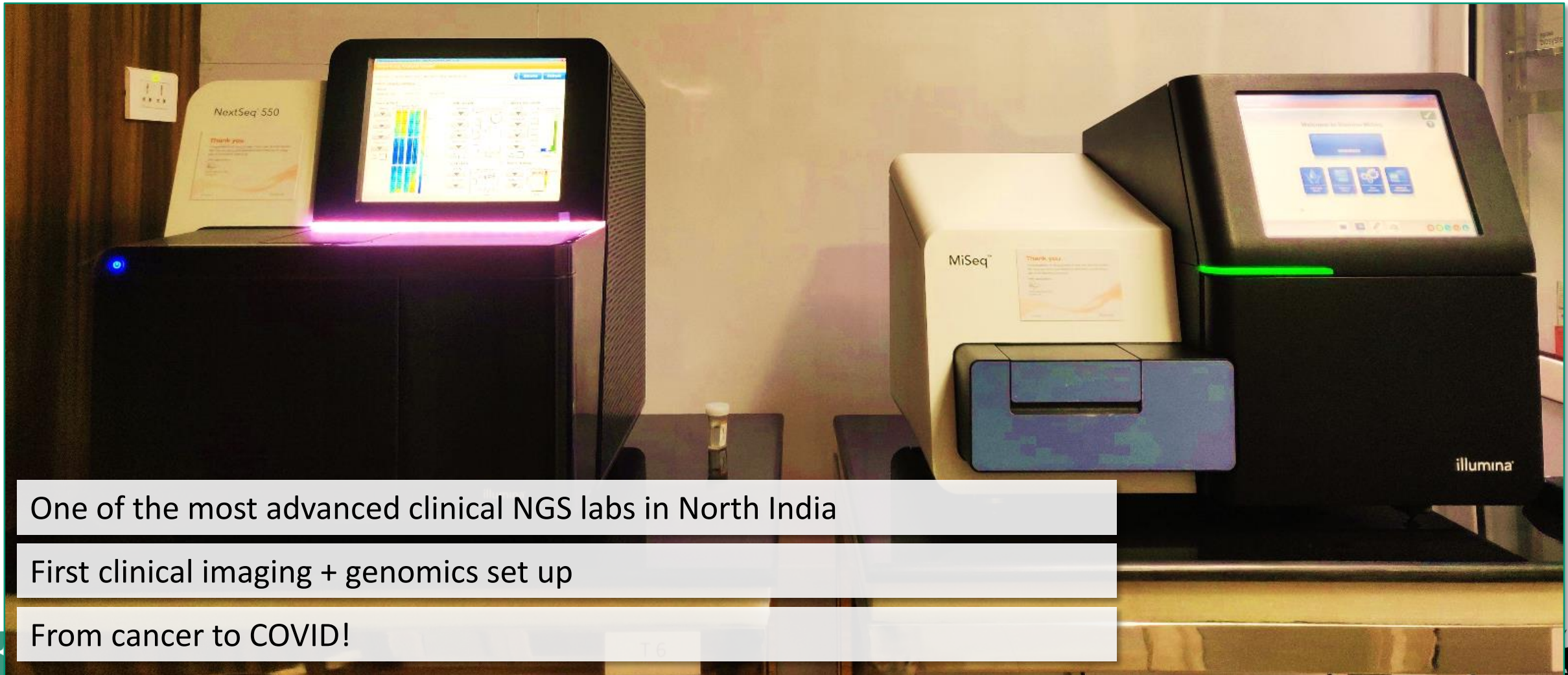
- Already trained in assimilating multi-modal data
- Radiology is “**digital from the get-go**”
- Earliest adopters of informatics and AI
- But,
 - Need to be “clinical” radiologists, and not arm chair radiologists
 - A new form of turf war may start → who becomes the integrated diagnostician?
 - Need to quickly learn skills across domains and technologies, including data science, informatics and statistical decision making

Where are we today? Integrated tumour boards!

- Images – rad + path – side by side, viewed together
- Instantly resolve any discordances
- Provide a reconciled report in all concordant cases
- Improve quality, reduce risk
- Instant potential in breast cancer



Set up an advanced clinical NGS lab in an imaging facility – our attempt at “integration”



One of the most advanced clinical NGS labs in North India

First clinical imaging + genomics set up

From cancer to COVID!

Three possible ways of 'integration' of imaging and genomics

1

Techno-Commercial

How does genomics drive imaging, and vice-versa

2

Clinical Synergies

Genotype-phenotype correlation, single viewer for oncos

3

Thought Process

What can one learn from the other to improve the practice

Single 'patient-centric' window for clinicians...

IntelliSpace Precision Medicine - Oncology MDT MDT ⚠️ ⓘ ? Gabriel Smith ▾

John Smith MRN 121212 8 Sep 1953 (66.0y)... Gender Male Ethnicity All Items (2) ▾

CRC MDT MDT-19-8EXGZIHN 🔗 💬 ✕ 👤 Preparation MDT Ready Completed Mark as ready

Patient Info Tumor Info

2019 10 Feb 15 Feb 03 Mar 11 Jun 👤 GE 🔬 Biopsy 👁 CT 📄 Events

Tumor Staging Show all

TNM cT3N1M0


Stage IIIB

Disease State Metastatic

Metastasis Location External lower lip

Radiology Show all

Based on CT (03 Mar 2019)




Existing Findings

Procedure Mesorectal fascia Positive

Pathology Show all

Based on Biopsy (15 Feb 2019)



Malignant (red dot)
Benign (green dot)
Suspicious (blue dot)

Cell Type Adenocarcinoma

Grade Well differentiated

Surgery (3/6) Show all

Procedure Transverse Colon Excision

Excised Lymph Node(s) 4

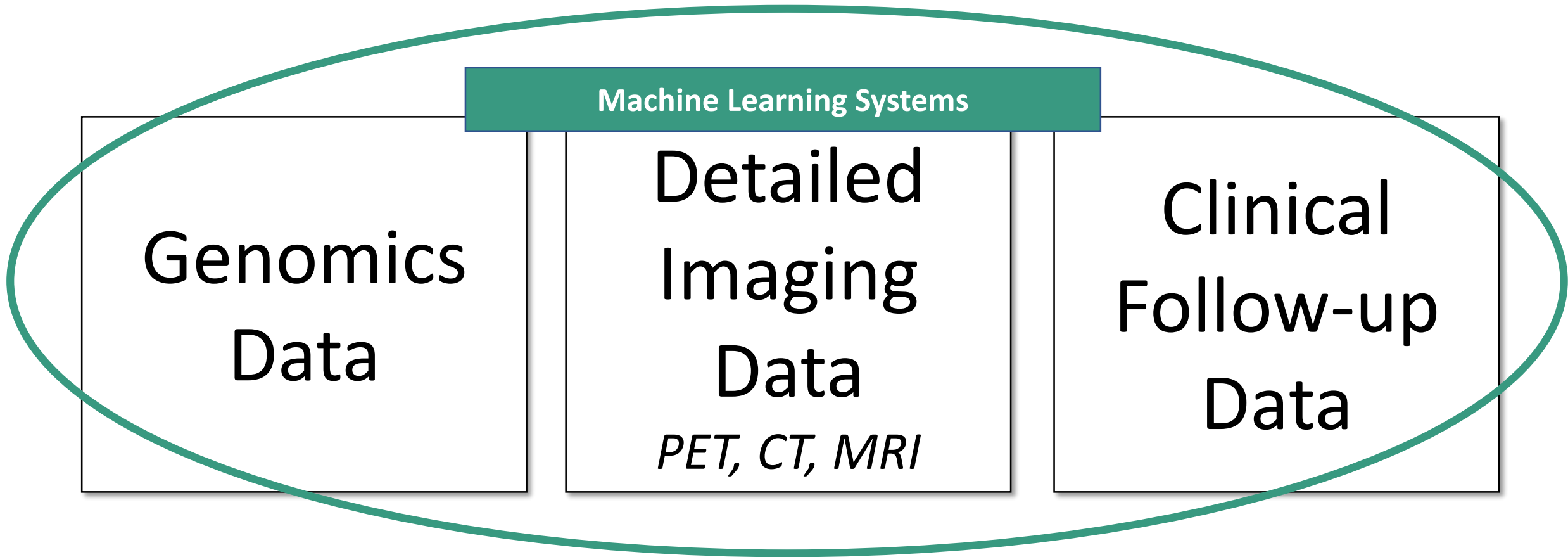
Removed Length(cm) 2

Biomarkers Show all

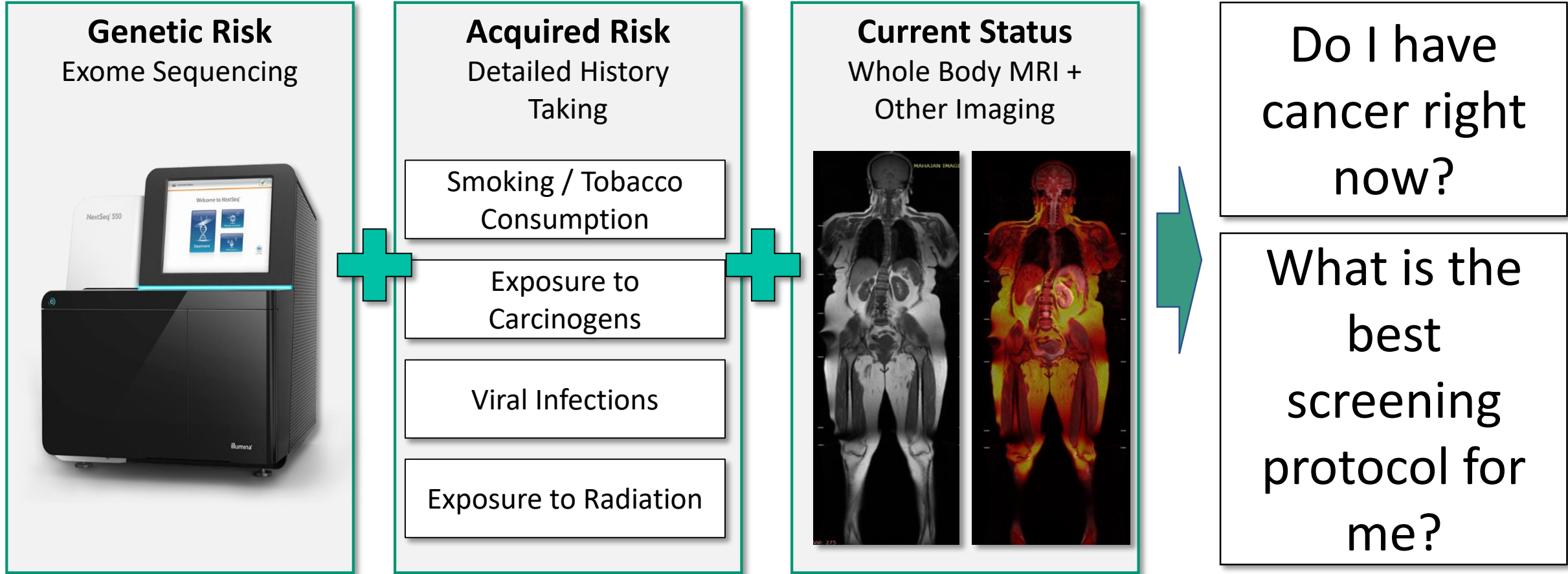
RGS4 2 (U/ML)

Courtesy - Philips Healthcare, Netherlands

...which enables radio-genomics analytics in the future

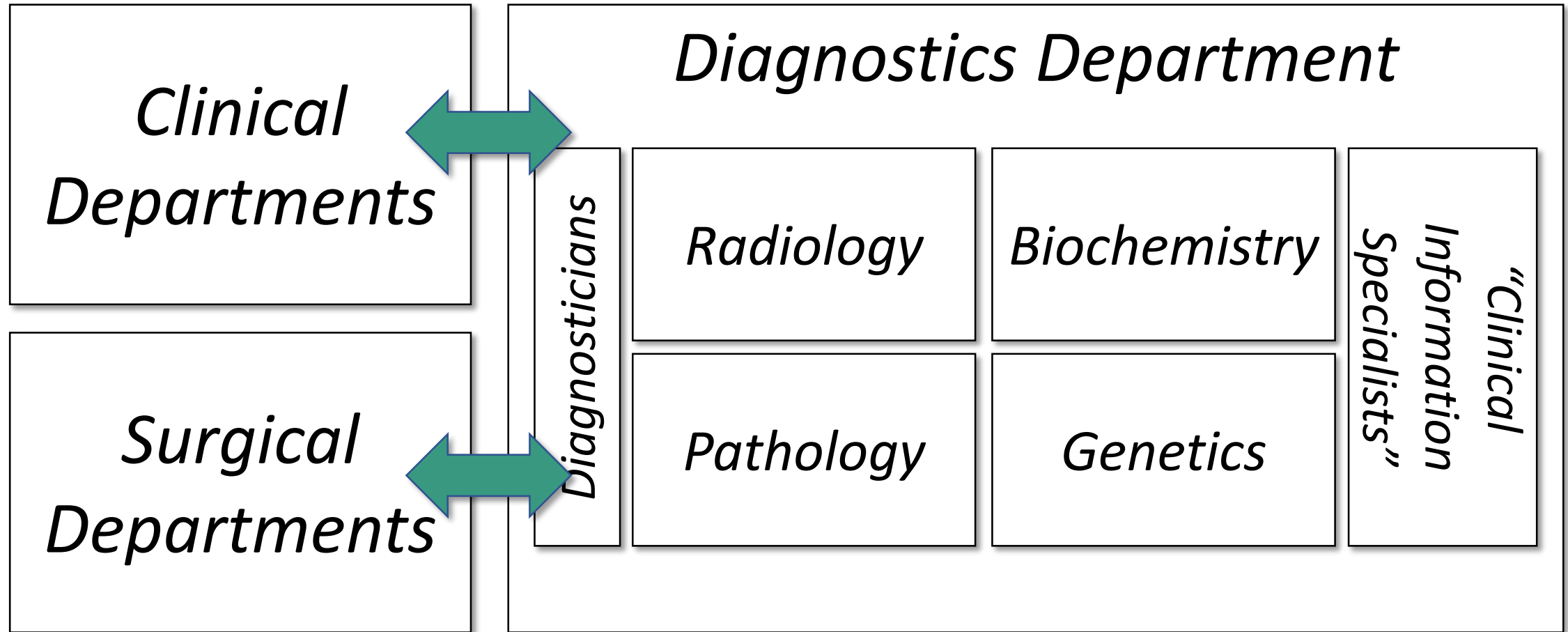


Does the future of screening and preventive health checks lie in integrated diagnostics – an example

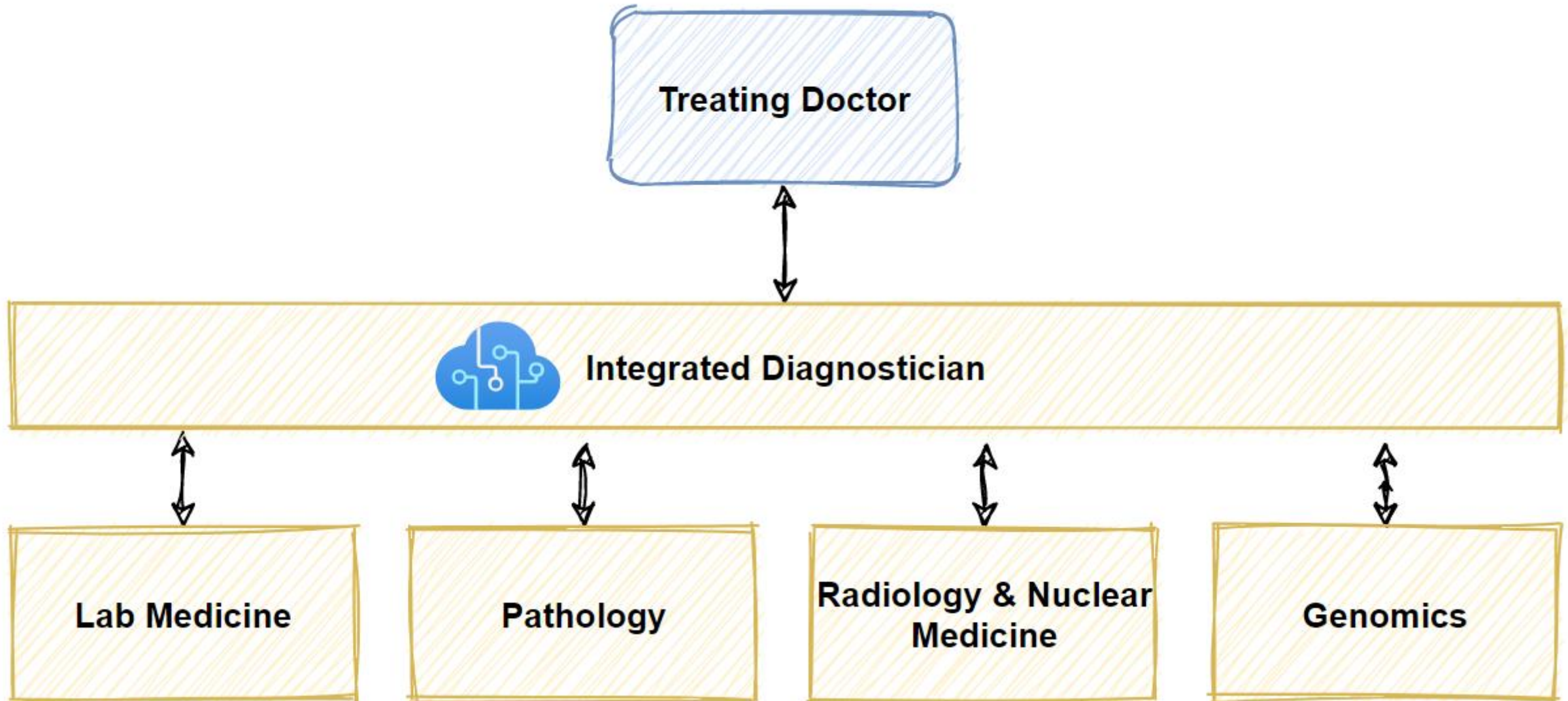


AI will be the bedrock on which this will be made possible

The hospital of the future will have an 'integrated diagnostics' department...

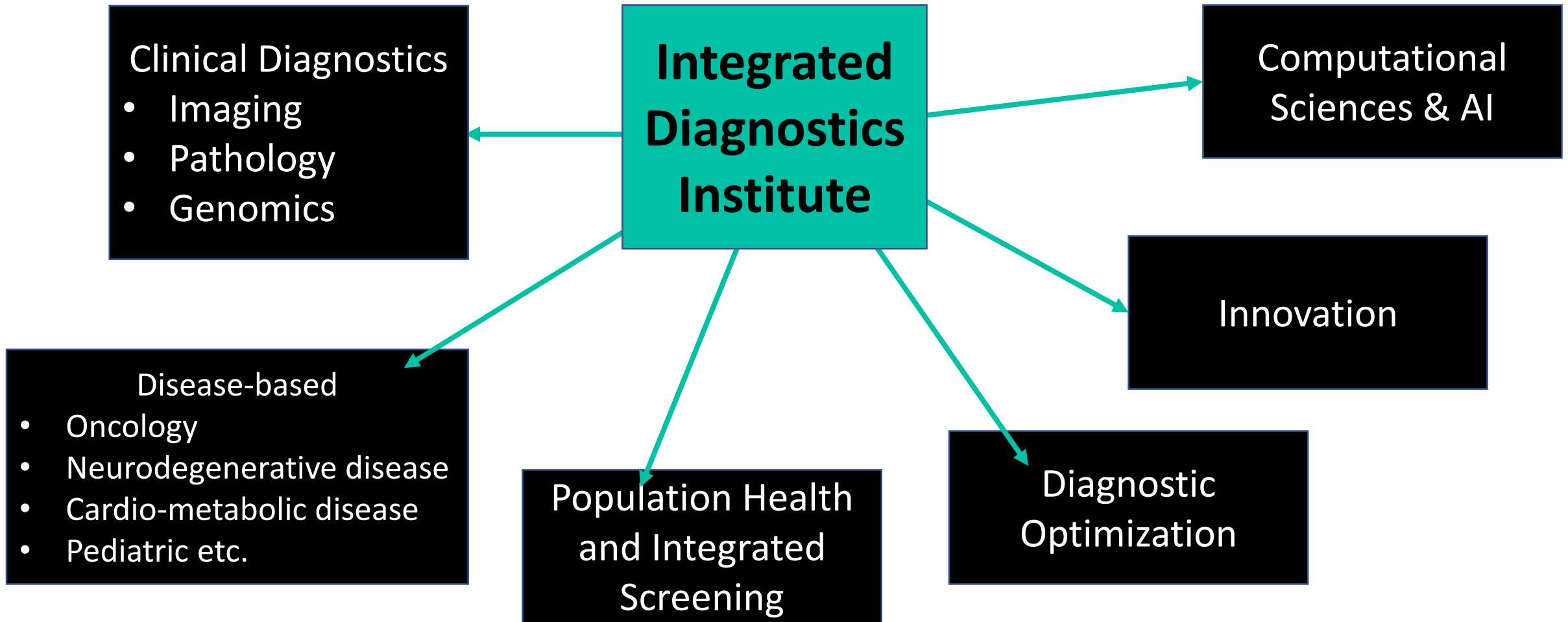


Integrated diagnostician would be “AI Enabled”



Integration of Computational Sciences

- Applying deep learning and machine learning to diagnostics
- Large scale data curation and autonomous analysis using AI
- Automated workflows – low cost, high quality, lower errors
- Need to create *Normative Data*
- Develop and deploy precision medicine tools
- Need for collaboration across public and private sector to develop AI algorithms in India, for India to reap the benefits of newer technologies for better patient care



30,000 square feet, Integrated Diagnostics and Research Facility – Our Attempt at “Integration”



Integrated Diagnostics Institute

4	Conference Halls & Internal Admin Areas
3	AI + Genomics Research
2	Molecular Imaging, PET-CT
1	USGs, X-Rays, CBCT, DEXA
0	Waiting Area + Parking
-1	3 x MRI scanners + CT Scanner



Future for Young Radiologists and Physicians

AI will work as a radiologists' assistant improving productivity and quality

Will replace radiologists for certain areas of reporting

Will help clinicians read scans and lead to turf erosion

Will help in reading scans in under-developed parts of the world with limited # of radiologists

Will impact teleradiology providers and improve accuracy, productivity and lower costs

Questions regarding liability of AI generated reports – supervising radiologist / physician / AI company which developed algorithm / someone else?

Will definitely improve TAT and reduce healthcare costs



**Change before
you have to.**

Jack Welch



**Control your own destiny
or someone else will.**

Jack Welch

Thank you!