European Congress of Radiology
ECR 2016
Vienna
March 2–6

INTEGRATED CARE / THE ROLE OF MEMBER STATES AND REGIONS

How imaging can contribute to personalised medicine?

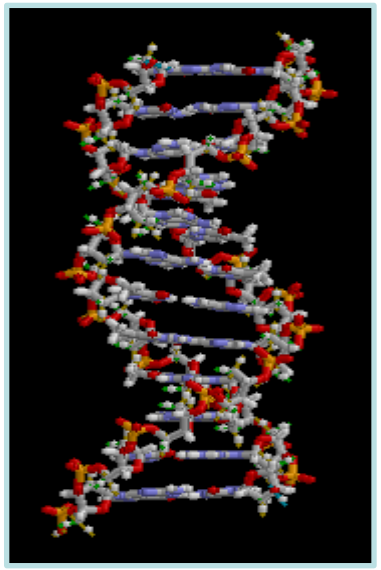
Guy Frija, Paris - ESR Past President

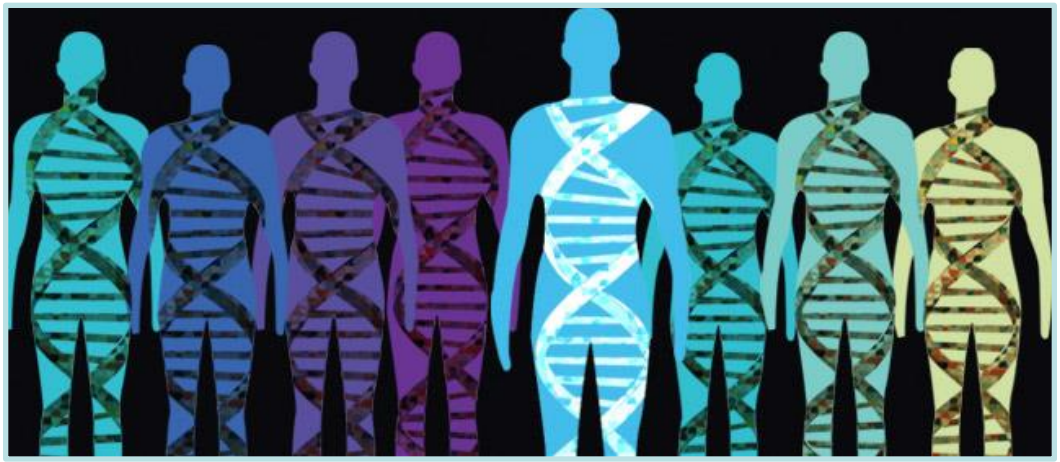
COCIR Summit-Brussels, Jan 2016

DISCLOSURE:
No conflict of interest in relation with this presentation

BIG CHANGES

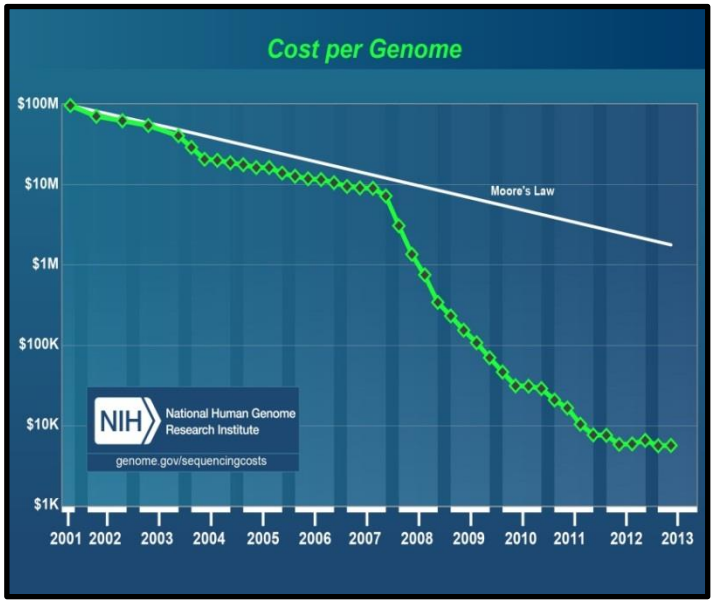
- HUMAN GENOME PROJECT





PERSONALISED MEDICINE

BIG CHANGES



AFFORDABILITY

SEQUENCING

- Personalised Medicine

VOLUME

- Data Explosion

OMICS

- Data Fragmentation

POPULATION

- Low frequency differences
- Statistical power
- Large programmes of data collection

Need of data collecting and integrating vast amount of data from as many individuals as possible in representative samples of the population

DATA VOLUME

Science

Three Pittsburgh institutions.
One goal.
Pittsburgh Health Data Alliance
Carnegie Mellon University
University of Pittsburgh
UPMC
The future of health care is in the data.
The Pittsburgh Health Data Alliance represents an

MIT Technology Review
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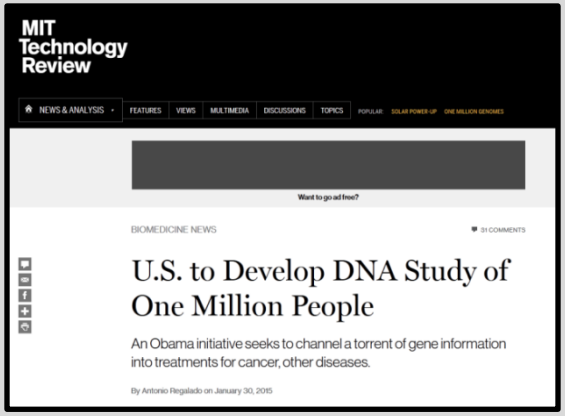
Genome Study Predicts DNA of the Whole of Iceland
Large genome databases are starting to reveal critical health information—even about people who have not contributed their DNA.
By Antonio Regalado on March 25, 2015


MIT Technology Review
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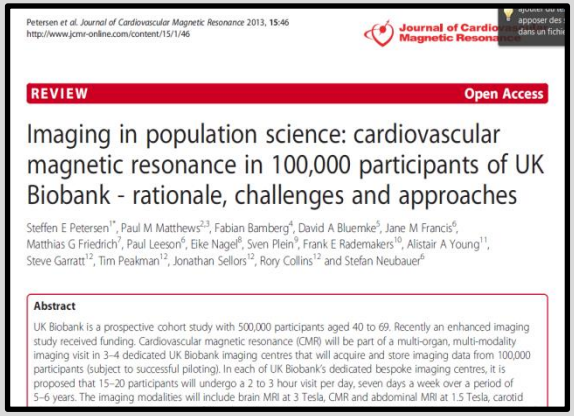
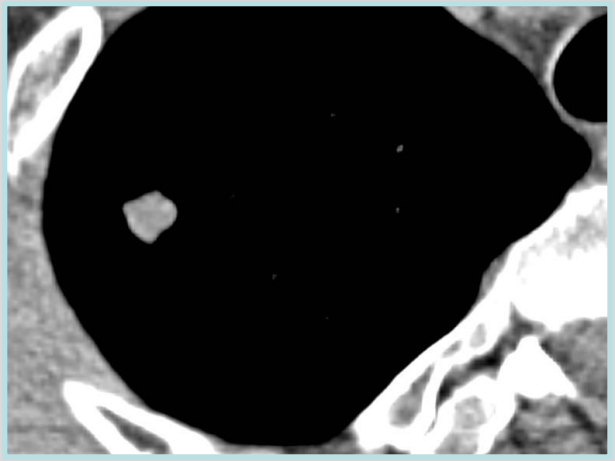
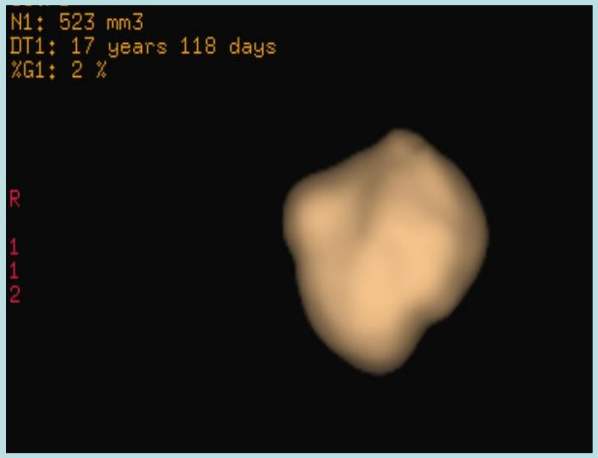
U.S. to Develop DNA Study of One Million People
An Obama initiative seeks to channel a torrent of gene information into treatments for cancer, other diseases.
By Antonio Regalado on January 30, 2015


Petersen et al. Journal of Cardiovascular Magnetic Resonance 2013, 15:46
http://www.jcmr-online.com/content/15/1/46
REVIEW
Open Access
Imaging in population science: cardiovascular magnetic resonance in 100,000 participants of UK Biobank - rationale, challenges and approaches
Steffen E Petersen, Paul M Matthews, Fabian Bamberg, David A Bluemke, Jane M Francis, Matthias G Friedrich, Paul Leeson, Eike Nagel, Sven Plein, Frank E Rademakers, Alistair A Young, Steve Garratt, Tim Peakman, Jonathan Sellors, Rory Collins and Stefan Neubauer
Abstract
UK Biobank is a prospective cohort study with 500,000 participants aged 40 to 69. Recently an enhanced imaging study received funding. Cardiovascular magnetic resonance (CMR) will be part of a multi-organ, multi-modality imaging visit in 3–4 dedicated UK Biobank imaging centres that will acquire and store imaging data from 100,000 participants (subject to successful piloting). In each of UK Biobank's dedicated bespoke imaging centres, it is proposed that 15–20 participants will undergo a 2 to 3 hour visit per day, seven days a week over a period of 5–6 years. The imaging modalities will include brain MRI at 3 Tesla, CMR and abdominal MRI at 1.5 Tesla, carotid

FROM PICTURE TO DATA





SEMANTIC

VOLUME

Radiology

Radiomics: Images Are More than Pictures, They Are Data[1]

Robert J. Gillies, PhD
Paul E. Kinahan, PhD
Hedvig Hricak, MD, PhD, Dr(hc)

In the past decade, the field of medical image analysis has grown exponentially, with an increased number of pattern

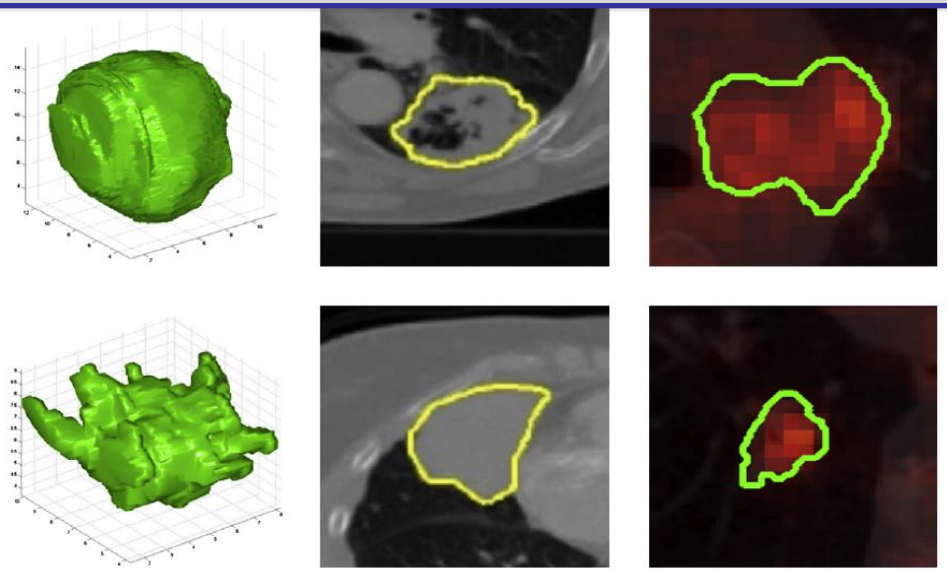
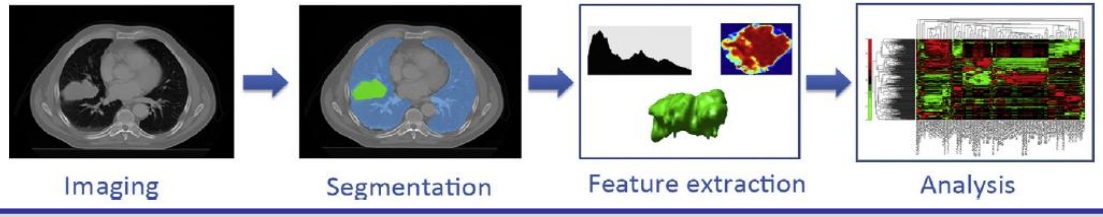


Fig. 3. (A) Two representative 3-D representations of a round tumour (top) and spiky tumour (bottom) measured by computed tomography (CT) imaging. (B) Texture differences between non-small cell lung cancer (NSCLC) tumours measured using CT imaging, more heterogeneous (top) and more homogeneous (bottom). (C) Differences of FDG-PET uptake, showing heterogeneous uptake.



DATA FRAGMENTATION

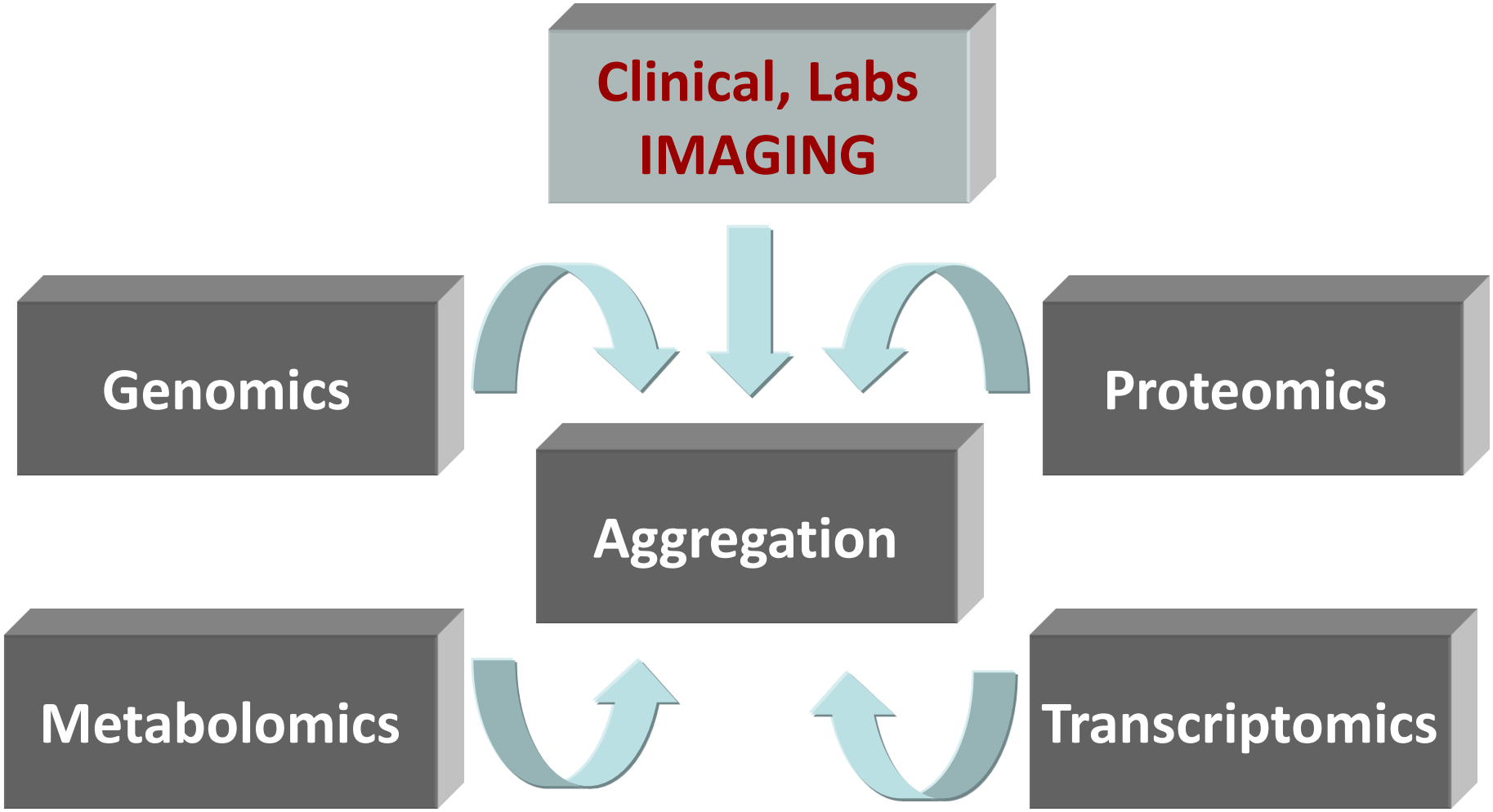
Genomics

Proteomics

Metabolomics

Transcriptomics

DATA INTEGRATION



RADIOMICS

Figure 1

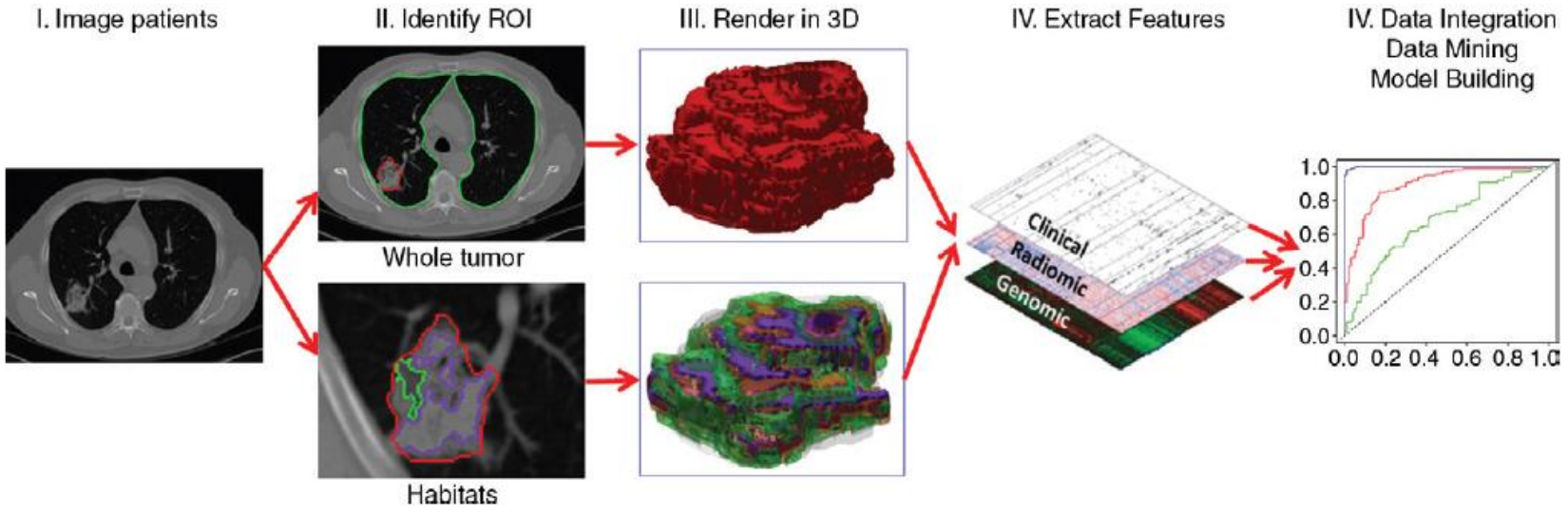


Figure 1: Flowchart shows the process of radiomics and the use of radiomics in decision support. Patient work-up requires information from disparate sources to be combined into a coherent model to describe where the lesion is, what it is, and what it is doing. Radiomics begins with acquisition of high-quality images. From these images, a region of interest *(ROI)* that contains either the whole tumor or subregions (ie, habitats) within the tumor can be identified. These are segmented with operator edits and are eventually rendered in three dimensions *(3D)*. Quantitative features are extracted from these rendered volumes to generate a report, which is placed in a database along with other data, such as clinical and genomic data. These data are then mined to develop diagnostic, predictive, or prognostic models for outcomes of interest.

INTEROPERABILITY

- A cat is not a dog…

INTEROPERABILITY

- A cat is not a dog…

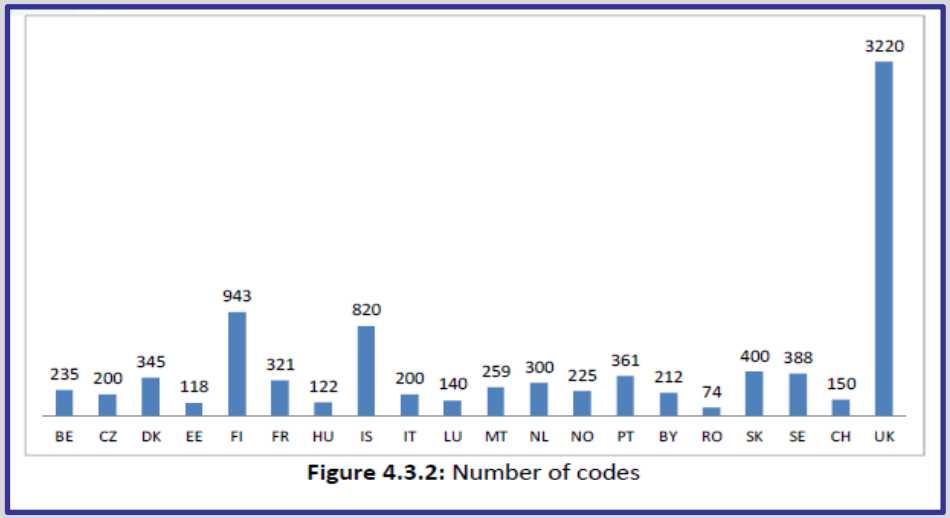
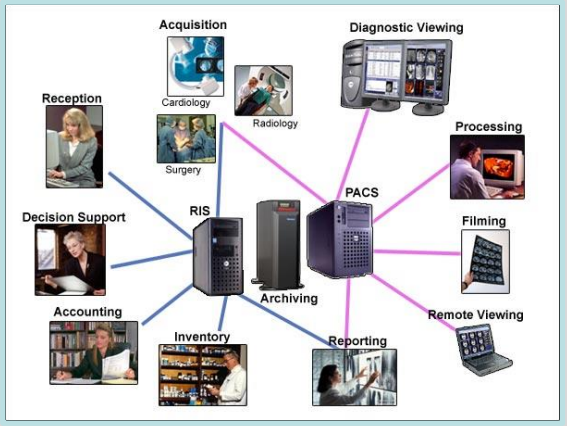
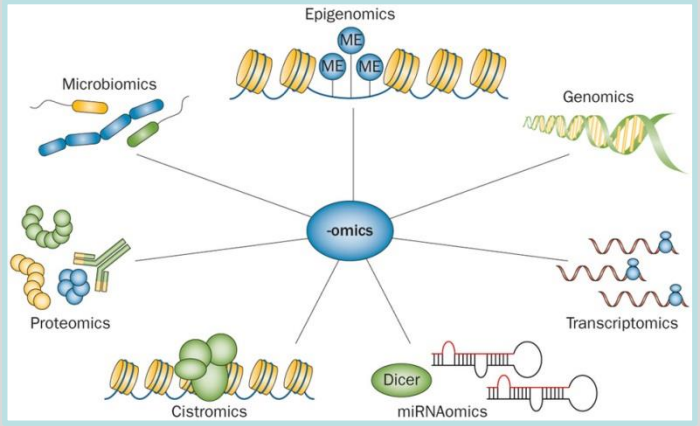


Figure 4.3.2: Number of codes

STORAGE 1.0

COMMUNICATION 2.0





INTEGRATION 3.0

KEY MESSAGES

- Organise Big Data in imaging
- Develop multi-source heterogeneous data integrative platform
- Address the subsequent data complexity with the development of decision support tools
- Involve the relevant professional organisations

THANK YOU!!!