Genomics England

- 100,000 whole genome sequences in NHS patients with rare inherited disease, cancers and pathogens from the NHS in England
- Whole Genome Sequencing
- Generate health and wealth
- Legacy of infrastructure, human capacity and capability
Cancer

• Disease of disordered genomes – over 200 drivers known
• Drugs targets, Tumour heterogeneity, evolution of cancer, Stratified medicine

• Lung, breast, colon, prostate, ovary and, Leukaemia and
• Sarcoma and Renal
• Rare and Childhood Cancers, unknown primary

• Sequential biopsy of recurrent cancer
• Stratified medicine- Focus 4
• Optimise Molecular Pathology
• WGS at 75x somatic and 30x germline

• International Cancer Genomes Consortium- the Cancer Genome Atlas
BRAF inhibitors for Melanoma
# Cancer – current plans

## 100,000 Genomes current thinking
- 50,000 genomes on cancer
- 25,000 Tumour- Normal Pairs

## Clinical Interpretation Partnership roles
- Help set scientific priorities
- Focus on global-leading cancer programme
- Get additional WGS
- Stratified healthcare/ CFCT DNA
- Sequential and multiple biopsy
- Stimulate and support GMCs to enrol
- Organise yourselves to do research to drive up clinical interpretation

<table>
<thead>
<tr>
<th>Tumour type</th>
<th>Allocation</th>
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<tbody>
<tr>
<td>Breast Cancer</td>
<td>2,000</td>
</tr>
<tr>
<td>Colorectal Cancer</td>
<td>2,000</td>
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<tr>
<td>Ovarian cancer</td>
<td>2,000</td>
</tr>
<tr>
<td>Lung Cancer</td>
<td>2,000</td>
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<tr>
<td>Prostate Cancer</td>
<td>2,000</td>
</tr>
<tr>
<td>Childhood solid</td>
<td>500</td>
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<tr>
<td>Renal</td>
<td>750</td>
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<tr>
<td>Sarcoma</td>
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<tr>
<td>Unknown Primary</td>
<td>250</td>
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<tr>
<td>Reserve</td>
<td>10,500</td>
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</table>
EXPERIMENTAL WORKSTREAMS

- WS 1: upstream handling
- WS 2: tumour processing, fixative, embedding
- WS 3: tumour assessment
- WS 4: DNA extraction
- WS 5: DNA quantification and quality assessment
- WS 6: Library preparation and sequencing

Molecular pathology leads: Schuh, Verrill, Henderson, Flanagan, Gonzalez del Castro, Thomas
Implementing the programme
Ethics

• Ethics Advisory Group - Mike Parker
• Working toward an NHS Genomic Medicine Consent

• Genomics England
• Life Course Refreshable Dataset
• Return of findings
• Release of data to third parties – academics, clinicians and industry
• Recall for research
Genomics England – The main programme

11 Wave 1 NHS Genomic Medicine Centres
Rare diseases, cancers and pathogens
Broad consent, characteristics, molecular pathology and samples

NIHR Biosample Centre
DNA & multi-omics Repository

Sequencing Centre
Wellcome Trust £27m

Refreshable identifiable Clinical Data
Life-course registry
Linked to anonymised Whole Genome Sequence

MRC £24m Research Data Infrastructure
Sequential builds of pseudonymised data and WGS
Safe haven - users work inside

Primary Care
Hospital episodes
Cancer Registries
Rare Disease Registries
Infectious Disease
Mortality data
Patient entry

Oxford Big Data

Annotation & QC
Scientists & SMEs
Product comparison

Clinicians & Academics
Training HEE & Funders
Industry GENE Consortium

Fire wall
Patient data stays in safe haven

Only processed results pass outside
11 NHS Genomic Medicine Centre Awarded 20th December 2014

Wave 1 GMCs
2nd wave to commence

- Greater Manchester NHS GMC
- North East and North Cumbria NHS GMC
- North West Coast NHS GMC
- West Midlands GMC
- Oxford GMC
- South West GMCs
- Wessex GMC
- Imperial College Health Partners NHS GMC
- East of England NHS GMC (inc E Midlands)
- University College London Health Partners NHS GMC
- South London NHS GMC

NHS GMCs working in partnership with academia, patients and industry through the AHSNs. Regional Genetics Labs and Clinical Genetics Services central to all GMCs

Contracted NHS GMC Lead Organisation working with Local Delivery Partners across the geographical footprint
Apple ResearchKit
Opportunity for clinical trials inside the 100,000 Genomes Project

• Novel drug targets
• Combine sequence and Clinical Trials
• Test novel molecules for rare disease and Cancer
• Stratified Healthcare
• Enhanced patient enrolment
• Identify the right genotype and predictive biomarkers
• Identify important genetic predictors of adverse effects
• Adaptive designs
Why do we need a Clinical Interpretation Partnership?

The standard way

Genomics Research
Form hypothesis
Get funds and form collaboration
Collect, analyse data and validate results

Publication, dissemination, translation
Publish and disseminate results
Attempt to translate into healthcare

Healthcare adoption and implementation
NHS and NICE evaluation and Guidelines
Education and implementation programme

The GeCIP way

The 100,000 Genomes Project
hypothesis – WGS will enhance diagnosis
Coalition of NHS, academics and trainees
Work together on WGS within GeCIP domains

Enhanced interpretation linked to implementation
Validate, publish, educate and translate
The GeCIP Collaborative accelerates Implementation
Evaluate therapeutic innovation potential

Earlier Healthcare adoption and implementation
Accelerated diagnosis and health economic evaluation
Framework for therapeutic innovation

Securing Patient Benefit

Start

17 yrs

2014

?3 yrs
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<tr>
<th>Rare Disease</th>
<th>Cancer</th>
<th>Functional</th>
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<td>Validation and Feedback</td>
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<td>Lung</td>
<td>Ethics and Social Science</td>
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<td>Hearing and Sight</td>
<td>Ovarian</td>
<td>Functional Effects</td>
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<tr>
<td>skin</td>
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GENE Consortium

• 12 pharma/diagnostics/SMEs
• Precompetitive consortia
• Work together on 5000 WGS
• To shape data centre

• Larger consortia
• Individual company interactions

• AbbVie
• Alexion Pharmaceuticals
• AstraZeneca
• Biogen
• Dimension Therapeutics
• GSK
• Helomics
• Roche
• Takeda
• UCB*
• Berg
• Boehringer Ingelheim
International Partnership

• Global Alliance for Genomic Health

• Veterans Administration
  • Large cohort (1M), contract let for 5000 WGS

• US Integrated Healthcare Systems
  • Scripps – Wellderly Study sequenced 2000 volunteers to study lifestyle
  • Inova Health – aims to provide world's largest WGS database, 1500 completed thus far

• Clinical Research programmes
  • Oxford 500 WGS, DDD (Sanger) up to 12,000 children (mainly exomes)
  • International Cancer Genome Consortium
  • Seattle – 100K WGS – Lee Hood
  • Garvan Institute
  • Genome Canada/British Columbia
  • UPenn - Prenatal
  • St Jude and the Moffit Cancer Centres
  • Middle Eastern programmes in Saudi, Abu Dhabi and Qatar
  • Chan Shoon-Shiong Foundation
  • Personal Genome Project – aims for 100k, all open data
Genomics England- the future

- 100,000 WGS on NHS patients and pathogens
- WGS deployed routinely- also in other diseases
- Harnessing electronic health records
- Patient reported outcomes and more remote monitoring
- New diagnostics and therapies and opportunities for patients
- By end of 2017
Genomics England – who are we?

• **Officers:** Sir John Chisholm (Executive Chair)
  - Mark Caulfield (Chief Scientist), Nick Maltby (Company Secretary), Jim Davies (Informatics), Viv Parry (Outreach), Graham Colbert (COO)

• **Board:** Prof Dame Sally Davies (CMO), Kevin Dean (Cisco), Prof Sir John Bell, Jon Symonds (Audit), Prof Sir Malcom Grant (NHSE)

• **Advisory Committees:**
  - Science: Sir John Bell, IT: Kevin Dean and Ethics: Mike Parker
Team members

- **Science** - Tom Fowler, Jeanna Mahon-Pearson, Laura Riley, Nora Wong, Andrew Devereaux, Suzanne Wood, Ellen Thomas, Mina Ryten, Clare Turnbull.

- **Informatics** - Jim Davies, Tim Hubbard, Augusto Rendon, Matthew Parker, Katherine Smith, Ellie McDonagh, David Brown
Thanks

Cambridge, UCLH, GOSH, Moorfields, Newcastle, Manchester, Guys and St Thomas’s, Oxford, Liverpool, Sheffield, Leeds, Birmingham, Royal Marsden, Southampton, UK CLL Consortium, CRUK, RCPath, NHSE, DoH, Biobank UK, Sanger, EBI, KCL, UCL and QMUL