

East of England Science and Innovation Audit

Appendix 1 - Life Sciences

May 2017

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1. SIA workshops summary



East of England Science and Innovation Audit - Life Sciences Theme

Data gathering via sub-theme workshops

Rationale & process

A key part of the data and opinion gathering in the life sciences theme of the East of England Science and Innovation Audit took place in small workshops. A total of six workshops were held across the region as follows:

1. March 14 - Cambridge big data/healthcare IT/digital health (held at EBI)
2. March 14 - the Cambridge cluster, CEOs of start-ups & scale-ups (held at the Babraham Institute)
3. March 21 - **Precision medicine** (held at Precision Medicine Catapult)
4. March 22 - **Microbiome** (held at Norwich Research Park)
5. March 24 - Genomics & bio-data (held at Wellcome Genome Campus)
6. April 12 - **Cell & gene therapy** (held at Stevenage Bioscience Catalyst)

The sub-themes of the life sciences audit are highlighted in bold; the other topics are important cross-cutting/underlying themes. The workshops were invite-only, with the aim of having around 20 key players in each field present across industry and academia. Dr Andy Richards, a leading Cambridge entrepreneur and investor, had previously volunteered to help with data gathering for the audit, and he organised the meetings on March 14. The others were organised by SBC and the hosts.

In each meeting, representatives from SBC were on hand to explain the SIA and put the workshops in context. They did not lead the workshops - rather the expert hosts were undertook this role.

This format allowed informal roundtable discussions of three key questions informing the audit:

- Is the East of England world class in the area under discussion? If so how, why - what's the evidence?
- What would it take to be world class - or to continue building on it?
- What projects &/or opportunities are there in the region to partner and collaborate on specific themes, intra-region and beyond?

Asking the same three questions in each of the six workshops, we were able to build up a systematic view of the current and future life sciences excellence of the East of England.

1. March 14 - Cambridge big data/healthcare IT/digital health (held at EBI)

Attendees:

Andy Richards - Chair
Lydia Drumright - PhD MPH, Cambridge University Lecturer in Clinical Informatics
Adrian Ibrahim - Wellcome Genome Campus
Andy Blackwell - Ieso Digital Health
Andy Herbert ??
Malcolm Lowe-Lauri - Cambridge University Health Partners
Woodward??
Mike Anstey - Cambridge Innovation Capital
Tom Weaver - Congenica
Wendy Arntsen - Wellcome Genome Campus
Jessica Vamathevan - EBI
Steven Wilson - GCGP LEP
Anthony Finbow - Eagle Genomics
Paul Flicek - WGC
Matthew Willcock - MedImmune/AZ
Emma Palmer Foster - SBC
Martino Picardo - SBC

Andy invited what turned out to be a very positive and forward thinking group which was very forward thinking. The meeting was in two parts

- Data gathering
- Validation and examples

- It was apparent that things were being done, involving new business models through Andy, showing evidence of NHS clinical and data engagement in specific areas (reference to the schizophrenia project/Ieso)
- Ieso - focus on depression and anxiety, 450 psychotherapists, 38 CCGs. 'Virality in the way it is being adopted', 'could not happen elsewhere'. Hired team from Amazon, team was already based in Cambridge. Service procurement is a barrier.
- Accessing clinical data to inform clinical trials and patient care
- EBI/EPIC project - talked about accessing clinical data for research and then making the same data available for commercial outcomes - using a two-way policing system and the usual required ethical procedures. Need to make data accessible.
- VCs to invest in the convergence area are needed - these activities may not generate so much IP so this could be a barrier. Billions worth of potential deals go through VCs like CIC but mainly drug discovery - hybrid models are seen less often. Cambridge should be the ideal place.
- We are in a great position in Cambridge/ the UK to make this happen and one of the challenges is to bring the patient along for the journey (already happening significantly in rare diseases) - needs to spiral across other activities. This is a real opportunity for the Eastern region- to develop these kinds of projects- the challenge will be relating to the regulatory and ethical access to patient data.

- The activities at Addenbrookes were highlighted by Malcolm Lowe-Lowri in different ways- the innovation centre and precinct model for industry access is coming up everywhere and needs to be showcased.
- The new generation of Medtech was described as being “clinical data plus hardware” and it is encouraging to see investment and new business models moving hand in hand with this progress.
- Of course, NHS access could always be better and access to clinical data in ethical ways that still allow commercialisation is still under development - we seem to be making significant headway here at Addenbrookes and EBI-Sanger in particular.
- Generating a fully electronic e-hospital at Addenbrookes. Global Digital Exemplars are NHS digital flagships in NI, England and Wales. Need integration with clinical pathways and cost coding
- The other issues raised were the usual skills basis - some are convinced that new investors will be happy to see the NHS as the first market- this probably requires validating - as does what the 'new medtech' looks like - we should emphasise this new model as an opportunity for the region.
- Skills around bioinformatics, AI and statistics were raised as being necessary. Incentivisation of academic clinicians needs to move away from publication - and we do need to continue improving access to the NHS - even though the round table did provide real evidence of access. Need to generate STEM competent people.
- People with healthcare informatics skills are often picked off to places like IBM, outside of the cluster. 'We need a workforce that we don't have yet'. Health economic skills also needed.
- EPIC/Cambridge Big Data
- Cross-cutting skills are important in clusters. eg AR approached by a chip maker that wants to move into healthcare. Microsoft in Cambridge is of 'absolute importance'.
- EBI'S basic research is computational biology - generating a skilled diaspora via the nine-year leaving rule. Voracious appetite for staff.
- Need to make sure that UK NHS/genomics data is not locked up in exclusive deals with companies. 'Selling data will never work, access to data will'.
- Use of data lakes in different parts of the country - regional curation of cleaned and analysed data. Driven by local research agenda and engagement with the outcomes. Bring the analytics to the data and not vice versa.

Quotes

'Other clusters would kill to have what we have in Cambridge'

2. March 14 - the Cambridge cluster, CEOs of start-ups & scale-ups

Andy Richards - Chair

Peter Pack - Crescendo

Anker Lundermose - Mission Therapeutics

Kevin Lee - Bicycle Therapeutics

Allan Marchington - Touchstone Innovations

Derek Jones - Babraham

David Chiswell - Kymab
Jeanette Walker - Cambridge Biomedical Campus
Robert Tansley - Cambridge Innovation Capital
David Grainger - Medicxi
Rod Richards - VHSquared
Emma Palmer Foster - SBC
Martino Picardo - SBC

- Kymab is 130 people, two buildings in the UK, 8 people in Taiwan. Raised \$225m - Chinese investors, Malin, Woodford, patient capital. Would like to be one of the \$20bn companies. Need to raise \$5bn to get there. Fully integrated pharmaceutical company.
- Mission - 50 people, raised £90m.
- Crescendo - raised £55m, always looking for space and people.
- Bicycle Therapeutics - Has spent £8m, big idea company. Has set up in Boston US to access talent, capital and partners.
- Babraham - 60 companies, 1000 people
- Medicxi - build to buy, not \$20bn companies
- Diversity in terms of where the technology in the companies has originated - it's not always the University. Also diversity of business models. Clusters need to be concentrated to work (the idea of place as per the Industrial Strategy)
- Some companies have power bases elsewhere eg Gilead Otsuka Amgen Illumina Upsher-Smith. Companies come to Cambridge because it's the leading biocluster in Europe - another US company would make it even more attractive.
- There was an air of confidence across the SME CEOs of what had been accomplished to date and what needed to happen next. The CEOs around the table were single minded as to what was needed for their companies to grow.
- Andy shared the John Bell challenge of creating billion dollar high growth companies in life sciences in the Eastern region. Scale-ups. AR - it can be hard to grow to \$20bn without floating on NASDAQ.
- More capital for more building at Babraham
- Some new skills gaps are being caused by pharma shutting down and losing "drug development skills". Also the newer skills around data, AI and bioinformatics are needed.
- The general trait is towards very old male senior executives (average age above 55) – one CEO said they were moving more towards Boston for their R&D to address this issue more seriously - acquiring younger senior managers with drug development (portfolio) experience from working in big pharma.
- All the CEOs saw the value of the Biomedical Catalyst funding- but this does not help scalability (or productivity) - and patient capital and more of it is what was required. Andy suggested that he was seeing more "build to buy" models coming from investors, which don't necessarily grow talent in the industry if virtual companies are created, and don't build scale-ups. Virtual companies don't train others - people are building companies again so training is needed.

- Corporate venture arms coming in early - and with new VC types looking at the big data/Health Informatics space.
- All extolled the virtues of the Cambridge biotech network- the diversity and yet the connectivity at the same time - developed by entrepreneurs for entrepreneurs- and mentor-mentee relationships which was invaluable. Where will the next generation come from and do they have to move more R&D to Boston?
- There was general dissatisfaction around the NHS, clinical trials, the regulatory issues and most of all Brexit impact on EMEA-FDA.
- The key thing Cambridge needs is more lab space for incubates and unicorns - prospects for fast growth include scale-ups (Horizon, Circassia, Convergence, Heptares, Kymab and Mission) is there for all to see.
- We could do with more early stage (angel investment)- and more IPOs so that “home-grown” growth can continue alongside trade sales and exits. The issue is more about scale-up than incubation.
- The cluster provides a portfolio effect for jobs - it's a low risk environment
- In order for the cluster to grow, needs to be able to do clinical engagement, regulatory.
- Some big pharma companies come into the region and then close later - but this can still seed activity in the region eg Warner-Lambert bought by Pfizer - people didn't want to move to Sandwich/leave Cambridge so set up CBT.
- The issue in the UK is that there is no link-up/streamlining with industry in terms of ethics and regulatory - it takes a lot of effort to get one clinical trial site started. It would be a game changer if this worked differently, and also linked seamlessly to adoption and health economics.
- Effect of Brexit on hiring and willingness of staff to stay in UK
- Is 4 x \$20bn companies the right focus? Should we focus on the scale of the cluster instead?

3 March 21 - **Precision medicine** (held at Precision Medicine Catapult)

Attendees:

Joanne Hackett - Precision Medicine Catapult

Mark Bechter - Precision Medicine Catapult

Terry O'Neill - KTN

Mark Otto Smith - EAHSN

Jane Reed - Linguamatics

Richard Owen - PlaqueTec

Shahid Hanif - ABPI

EddieBlair - Integrated Medicines

Kevin A. Auton Ph.D - Aseptika

Maxim Rossmann - Camonx

Nick Taptiklis - Cambridge Cognition

Jack Jachmann - Cambridge Medtech

David Russell-Graham - Invest Essex

Dr Hans Hagen - CUHP

Darragh Murnane - University of Hertfordshire

Nuno Alves -SBC

Martino Picardo - SBC

We started by trying to define Precision Medicine more as a process rather than a generalised treatment. This definition brings future challenges in areas such as regulatory, manufactory, patient data, health psychology, etc. The East of England (EE) must then focus its resources in creating the right environment to foster collaborations, access to libraries, clinical samples, clinicians and pathological laboratories (facilities). It must also focus its efforts to facilitate access to the NHS as a market. As it stands now, there are few incentives to develop new products for the NHS if the regulatory issues and uptake are not solved.

We must also understand what sections of Precision Medicine work well in EE and what are the gaps. As an example, EE currently has access to the biggest biobank in the UK, but there is a need to improve advertising this access. Likewise, there must be a focus on how to translate research knowledge into product and understand the different regional strengths by capturing the right metrics.

Ultimately, Precision Medicine will be targeting the individual leading to a more complex and deep segmentation (patients, biomarkers, etc) that will require a better understanding on how it will react and behave in the future. Hence the need for a better data driven healthcare system that will provide more information to SMEs, researchers and clinicians. This will loop back to the patients and institutes for better treatments and product delivery.

Some thoughts were express regarding the ecosystem in EE for SMEs to operate:

1. It is easier for SMEs to work together and achieve success in other areas in the UK (Liverpool, Manchester, Sheffield, etc.);
2. The region of EE is unbalanced: strong in Research (Academia) but not in Development (and manufactory);
3. EE is not good at converting science into money when compared to other regions;
4. All investment in EE goes to the academic side to 'build more science', but there is a lack of investment (Angels, Seeds and VCs) in SMEs;
5. Resources in EE go to big institutes such as the Sanger, Catapults, Universities (Cambridge specially), etc. because the science in the region is strong and there is inertia to translate that into a product;
6. There is also a cultural issue between regions that might affect how resources are allocated and processes developed;
7. There is a lack of synergies between institutions across the EE region;
8. There shouldn't be a focus on what research is coming out of the academic world, but what products are being taken by clients;
9. The uptake of these services/products by the NHS is slow and difficult (due to regulatory/adoption issues);
10. IP protection issues adopted by the institutions need to be addressed and reformed;
11. NHS in Cambridge is too focused in research and its metrics, such as publications and less in developing (or adopting) new products;
12. The region is risk adverse for development of new products and technology;

13. There is a need to change the demographics of the people in start-ups. Help the new generation to take risk by educating them and creating initiatives (i.e. providing access to libraries, labs, clinicians and clinical samples, etc.) for the development of new products;
14. Create platform(s) with a mission to facilitate access, inform about trusts/institutes and promote initiatives & grants; (note: isn't this the role of AHSNs??)
15. In Cambridge, most technologies come from the consultants's cluster (PA, Sagentia, etc) and not the academic institutions;
16. There is a need to be a pull from the market (example: rare diseases).

Some suggestions to create a vibrant and catalysing EE region:

1. Facilitate access to academic talent (graduate and post-graduate);
2. Biodata in EE is biggest in the UK and there is a need to facilitate SME access to it;
3. Implement a similar MedCity model to the NHS in the region (or UK?);
4. Improve visibility of services available by marketing it properly (different channels);
5. Improve IP and regulatory issues around the development of new technologies and products;

Suggestion by the American gentleman on how to improve the EE region:

6. Get government procurement
 7. Attract big companies
 8. The SME will cluster around these big companies
 9. Have world class universities in the region to create the science
- Medtech Companies are in the region and why don't they cluster?
 - Key contributors from a positive stance were the guy from ABPI- good info regarding APBI stance on precision medicine-there are regional strengths, Hans Hagen- CUHP- very positive and able to evidence some clinical engagement in this space and Darragh Murnane from the U of Herts.
 - Harlow and Anglia Ruskin made a play for the M11 Medtech corridor- and we must highlight this as a potential growing strength (likewise, the importance of having Tony Young as part of that cluster- and his links to NHS IP already
 - It did feel like it was still early days to pinpoint examples in the PM space- but there were diagnostic and Medtech companies around the table- and the Universities are building their assets and (so far) we do have the PM Catapult.
 - We should be suggesting a med tech directory and possibly a clinicians directory- if this were possible- see also Malcolm Lowri and the CUHP plans for Addenbrooks- including a Medtech centre- and also the developments at Harlow. CUHP will be a conduit for clinical engagement with industry and we should find out more about how they plan to do this.
 - The engagement of SME's with the NHS is currently proving difficult- this represents an opportunity for the region and we can learn from Oxford and Northern AHSNs who have real live case study examples of SME engagement- we need to improve this piece significantly

4 March 22 - **Microbiome** (held at Norwich Research Park)

Need attendee list

At the beginning of the discussion, a relevant point was raised as to where to focus the discussion: all type of microbiome or just gut microbiome. We started discussions with the former in mind, i.e. **broader microbiome**.

Metrics and areas of research:

The timescales to deliver results need to change from 3-5 years to 10 years minimum.

The EE region should apply efforts in Public Health (food, pathogens in hospitals, etc) for the benefit of the patient. Efforts should focus in understanding also how to align the knowledge of the bacteria with patient disorders and align it all with the interests of funders (government, charities, private, etc).

Try also to bring business closer and earlier to microbiome research- partnering is extremely important. The metrics for research need to change so that the model no longer should rely only on published papers but also partnerships and other metrics. Thus, there is a need to find the right translational research model. A platform of networks (face-2-face interactions, etc.) and contracts should be created to facilitate the translational process, and researchers should be educated about these platforms. For example, there are a number of current opportunities to make the connection between Synthetic Biology and Microbiome. (Action: Frederica to send some information about this). How to foster these clusters to interact and network? The Catapults might help by creating the right platforms.

During discussions, it was agreed not to consider microbiome as an island but to apply its research to a health research area where East of England is strong already, such as oncology. Hence, we can combine known data, efforts and resources to the right context and deliver better results that will benefit the patient.

Economic value in microbiome:

The region will need to introduce new policies and programmes in order to facilitate the mindset change of academic researchers, such as commercialisation and/or change of careers, because there will be a need to calculate the return of investment in microbiome research, thus providing a realistic economic value. There are already training courses and industrial studentships. Example: Kings College London "Masters in Microbiome" (October 2017) – validation that there is a need to develop expertise in Microbiome.

Bioinformatics in the Microbiome space: there is a need to get the bioinformatics skills but also the tools that can be accessed by (non) specialised people, therefore it will be important to educate the academics/professionals how to deal with the massive amount of data and how to analyse it properly. The Farr Institute is currently working with Norwich Science Park to get the data delivery and partnership.

Investment in Microbiome:

Deal flow is strong and there is money and different business models, such as the food microbiome where there is more data health, attracting more investment. There are also

too many early-stage risky companies and the challenge is to find the utility in microbiome that will translate into success (benefit for the patient/consumer). Like other areas, investment is larger in US (vs Europe) and the East of England region needs to understand the best way to measure success (financially) in microbiome and to create a shop-window that will bring investment. There will be a need to have a consortium of industries investing in pre-competitive space, thus creating a vehicle of investment that is able to invest and allocate resources in an academic institute and its IP. The money would have to be available in non-diluting but also VC/Angels/Seeds.

Norwich strengths:

Quadram Institute is ready to take lead by applying several processes (collection and processing data, etc.) and delivering great results in the microbiome area (in the region). Translation is key, so not only there is a big research academic centre but also a place to translate that academic science into developed products for the consumer. It also offers places for companies to allocate there. There are several big companies and academic that can provide access to market in this area, so there are a lot of opportunities. Great research done in Norwich about microbiome and this will enable more commercialisation routes/exits.

Additional points

There is no doubt that NRP has the assets and the people to build a world class activity in the microbiome- the key issue is how to manage translation.

- Ian Charles on the Quadram was very helpful as an overview of the science and ambition
- Christian's comments regarding uncertainty regarding their commercialisation strategy for the Quadram was very insightful- the general theme is fantastic science not translated very well -"translation is key"- his team are looking around for "best practise in translation".
- The interest from Corporates is very impressive
- Ian Wilcox (Seventure) gave a helpful insight into VC perspectives on what is going to be good at NRP
- Slide from the Nestle guy, Scott Parkinson, comparing the microbiome journey to the drug discovery process. Scott has a really good perspective and would be interesting to keep in contact with.
- See links across Earlham and EBI planned in this area- there were attendees (Wendy) from the Sanger Campus and from EBI (Mary Barlow)- there was a real willingness to work together that should be encouraged.
- EBI bring the potential for >45,000 data sets- all of which require management and curation- this will be a challenge- not many sites in UK could deal with this? This is a real potential strength for this mini-cluster.
- Barry from Unilever made repeated requests for the skin (as well as gut) microbiome to be a part of the aspiration - Unilever and Nestle are able to provide the "commercial/market pull" that we regard as being vital in all of the sub-themes in Life sciences (too much technology push in the region).

- The cross-over between Agri-tech and food health/Microbiome is an interesting “convergence “ piece for the region and SBC.
- Sally Ann argued that having a strong centre of excellence for this topic area would be crucial (“like a Catapult”- The vision as portrayed by Sally Ann (and the role played by the Quadram by Ian Charles at a previous event) is very simple to follow and should be easy to monitor and track for success from Science to translation.
- There will be a critical need for sample banking on the Campus also.
- Scott Parkinson in his presentation (around the drug discovery/development similarities), clearly outlined where there are leaders in the field that are becoming associated to the NRP Campus- but not quite critical mass yet- and so far behind the US - is a key challenge (can we catch up? What do we have to do? The Campus cannot be great at everything in the microbiome field- so where are the key targets to go after versus key strengths? (Note-it was felt that the ICT infrastructure could handle the demands moving forwards)
- The key issue repeatedly returned to was how to handle transactions - and translation- the team to support this would need to have the necessary skills - and could they afford this- Mary Barlow suggested that translation could also involve partnerships and collaborations and we need to get better at capturing these (open innovation is a strength in the region)- this is key also- improving our ability to capture success and relevant metrics needs to develop alongside this Campus- and note-other regional centres also. Martin Postle proposed looking at models like the CRT translation model. Note - other skills relating to bioinformaticians, statisticians also came up- cost of living in Norwich was not a barrier (as it is for Cambridge)- and represents an opportunity
- The Biology research centre in Cambridge- was highlighted as a key player alongside this centre/campus- and John Innes (validated to be world class)- there was much support around the table for building up exchanges across Cambridge and NRP- this should be encouraged.
- Ed from PA when asked about Medtech in this area suggested that most of the opportunities for PA currently come from the US - and certainly confirms our stance on medtech generally in the region- where is it and how do we find it?
- There was a discussion around the importance of synthetic biology in this sub-theme, moving forwards and how NRP was in a great position to exploit the connections in these two areas (synthetic biology versus microbiome)- this is new, novel and should be referred to. Frederica also confirmed this-Earlham has had considerable BBSRC funding- for yeast sample banking and analysis - and this could be a great resource in this area, moving forwards- even proposing Fellowships in Synthetic Biology at NRP
- Connections with NHS were evidenced. I think these connections generally will become increasingly important for the Campus and for the region - can the EAHSN help them with this?
- Open targets example for collaboration and partnership-at EBI was referred to by Mary Barlow- we need to capture this as an exemplar.
- One of the summary points was “we will never compete with the US”- but do we need to was discussed- capturing market share and having a Centre to build around is crucial moving forwards- and this is truly cross-sector (including probiotics and

Pharma applications)- and links to Synthetic biology where there are strengths already at the Center.

- People and skills- how to find them was discussed- does the centre need a skills database of some type- to help facilitate cross-engagement? This will be a real challenge- “silo mentality is an issue”!-Sally Ann says they will address this as they grow- and is doing so already.
- Abel referred to the distinct lack of exposure of students to translation and its importance- again this has come up in several round-tables- and raised the usual training versus mentoring discussions- we need more of both in the region as they are aware of the “ageing and non-diverse CEO population in the region
- We returned again to the importance of “deal flow”-Ian Wilcox spoke positively around what needs to be done “translation is not meant to be easy” and “ I see opportunities at the Campus already”-which was really encouraging (and backed up by his Seventure colleague who spoke at the One Nucleus event previously at NRP) on Campus and how crucial translation will be to attract “successful entrepreneurs”
- What is also encouraging is the growing influence of Nestle and Unilever at the Park- and this should be encouraged-what is a concern will be the time taken to establish a confident translation group that has credibility internally and externally and is seeking to explore all different types of opportunities (from IP to open Innovation)
- Ian Wilcox encouraged the Campus “to be different” and to find the gap- and their own usp- which is crucial, should be encouraged and Seventure can hopefully help moving forwards- they need to identify and measure from day 1, their own KPIs for success (short-mid-term to long-term)
- All the pieces are there to help fill the translation gap- the time-frames are critical and as with every Campus, early success will help to build and grow the ambition level.
- There is nothing else like this in the Eastern region and this should be highlighted as “future excellence” for the region- there was even a discussion led by Ian Wilcox around the potential for a “consortium” fund which sounded interesting- CIC, Arix and Touchstone are starting to circle around this theme- and Ian made reference to the “IP Group Model”- would strongly recommend that they are consulted regarding any translation model put in place- but also that there should be space for non-competitive or pre-competitive collaborations , like the SBC or “Open targets” models in the Eastern region already.
- Sally Ann concluded with the need for new funding and business models, the potential for a catapult model (we should support this) with different levels of input and collaboration across academic and industry.

5 March 24 - Genomics & bio-data (held at Wellcome Genome Campus)

Attendees:

Ewan Birney - EMBL-EBI (Chair)

Paul Flicek - EMBL-EBI

Julia Wilson - Sanger

Adrian Ibrahim - Sanger

Matt Garnett - Sanger

Matt Hurles - Sanger and Congenica
Trevor Lawley - Sanger
David Aanensen - Sanger; CGPS
Jeff Barrett - Open Targets and Sanger
Manj Sandu - Sanger
Abel Ureta-Vidal - Eagle Genomics
Allan Bradley - Kymab Ltd
Philippe Sanseau - GSK
Andrew White - Unilever
Matthew Woodwark - Health Informatics Director AstraZeneca
Mischa Kapuchesk - GeneStack
Nigel Brooks - Cellcentric
Chuck Cook - EMBL-EBI
Jessica Vamathevan - EMBL-EBI
Lindsey Crosswell- EMBL-EBI
Mary Barlow- EMBL-EBI
Martino Picardo - SBC
Emma Palmer Foster - SBC
Martin Dougherty - WGC
Wendy Arntsen - WGC

Overview

Due to the numbers of people invited, the format used was slightly different to the others we scheduled. In the first session, three presentations from the Sanger Campus, showing scientific excellence (EBI), SME engagement (Eagle Genomics) and Pharma engagement (AZ)- as well as a short presentation from the Campus development team showing their intent and desire to build the Campus with a more serious commercial presence- they will have to explore new business models and new ways of partnering and collaborating - but what they have across EBI and the Sanger, is unique. What they need now is real commercial expertise.

Ewan made the point about the regional boundaries being false. Despite this, there is a real willingness to help with the audit- and to validate. There is no doubt whatsoever about the world leading quality of the science and its importance to drug discovery and development- as well as patient benefit? Is this last piece less clear?

The session was interactive and we were able to put in context the outcomes desired from the meeting.

Comments included:

- Being at EBI has accelerated the development of Eagle Genomics. Clusters make people meet serendipitously - 'no need for agendas or diaries'.
- Need to foster academic industry awareness at an early stage of career development. Teach entrepreneurial skills in mid- to late 20s when people have some experience of industry, not to PhD students.
- 'Toxic' preconceptions about age and experience

- Cuts to US research funding in the US could have a significant effect on attractiveness of the UK to scientists, especially combined with a strong commitment to the science base and industry from Government.
- 9-year turnover rule means around 120 people leave each year.
- 120% rule at EBI means people can spend a day/week on outside interests such as spin-outs - requirement for number of papers published is reduced pro rata

In the second session, two groups were split. The following items and issues were raised

- Showing the data/evidence- some of the scientific work shown in the EBI presentation was awesome
- Providing examples and case studies
- Agreeing on what implementation, KPIs and success will look like moving forwards
- New HR policies required for retention and incentivisation of scientists (Earlham)
- Clusters are low-risk environments for taking high-risk jobs - people from 14M Genomics recruited to Inivata after company failure. The two body problem - two people in life sciences can move to the area, one can take a high risk job, the other low risk. Couples are moving to NRP. Couples can be 'brilliant at taking risks'.
- Incentivisation of scientists to do translational research as well as basic

Across the Campus, there is significant evidence of scientific excellence (the assets are clearly evident) with some seeds of start-up success (like Kymab, VHSquared, 14M Genomics, Congenica, Microbiota coming out of the Campus). Adrian Ibrahim is busy translating opportunities from across the Campus - the data innovation centre is now open and filling up- but what with? entry criteria? There are future plans to have lab-based companies on the campus-what type –CROs , service providers, technology developers- some analysis will be required here and a clear coherent strategy (to differentiate and not compete with other Science parks and Campuses).

There is a need for more structure around how to translate more efficiently the quality science opportunities- do they require more commercial expertise in the process? People like Andy Richards do make themselves available but is this sufficient? Surely a real example of the need to enhance and build the Innovation Capacity?

EBI it feels has “come out” to be more aware of translation more recently than the rest of the Campus. However, it has made great strides with examples like the Open targets project with GSK and Biogen involved- and there are lots of data-driven opportunities that are coming through.

There is a skills agenda requirement here- around mathematicians, statisticians and bioinformaticians- but this should really be the “engine room” for the rest of the UK on this issue/. Note - I asked about connections to the Digital catapult and to the Farr institutes? Very little going on- likewise, not really obvious of connectivity with Norwich research park- and not too much going on with Stevenage Bioscience Catalyst.

Some evidence of connectivity with the Cambridge campus - but not a whole lot.

Conclusion

Highly unlikely that translation will be a quick success here at the Campus- there is intent. Andy Richards felt that serious “step-change” was happening.

I also liked Andy’s comments here and in the other round table about “mapping the people”- which is where the region scores hands-down above others in the UK- the quality and calibre of the people in Life Sciences is amazing.

There is most definitely some intent- but it is all about the translation process here- and of course a significant culture change along the way- without losing the science quality. Needs a translation implementation plan that is more robust than it appears currently.

Really important discussion around the need for mentors, alongside young scientists- as well as the “basic training” on business.

6 April 12 - **Cell & gene therapy** (held at Stevenage Bioscience Catalyst)

Attendees:

Martino Picardo - SBC (Chair)

Emma Palmer Foster -SBC

Miranda Knaggs - SBC

Amanda Keightley-Pugh - SBC

Sharon Brownlow - Cell & Gene Therapy Catapult

Simon Ellison - Fisher Bioservices

Miquel Costa - Aglaris

Rebecca Todd - independent

Yen Choo - Plasticell

Alex Blyth - Lift Biosciences (phone)

Davide - KCl (phone)

- We are Europe leading and world leading in research but not in translational or clinical/CMC. Question asked - how could the industry/supply chain possibly work in the UK without manufacturing. Once manufacturing goes off shore it stays off shore.
- Sweden and Denmark have described themselves as second only to the UK so perception that UK leads Europe in some aspects. The US doesn't consider the UK world leading.
- There is a gap in the market where commercial CROs will not invest in a pilot GMP plant for cell and gene (eg viral production facilities) because they are “busy trying to make money”- that the CGT Catapult is struggling to fill the void- but is a huge gap in the strategy for cell and gene therapies in the UK- how will this get done if Government doesn't fill the gap
- Skills gap- we have invested heavily in infrastructure, there is investment but we have the potential to forget the skills needs for advanced therapies- from apprentices to undergrads and post-grads- from ICT to engineering to biology (Catapult - North Herts College link)
- We only have a window of opportunity - note GE investment in Canada (Toronto) in this space- when we had hoped for investment here- the opportunity is to create an industry - rather than simply a cluster, for the UK

- Aglaris comments on decision to move from Spain to UK - compared the UK to the rest of Europe, also considered the US and Israel. There is not as much funding here as expected but better access to people than Spain. Proximity to the Catapult. They do collaborate with CGT. Proximity to Spain for going home.
- Importance of know-how as well as patents
- Academic clean room facilities will not cut it- it needs to be a commercial (QC-GMP) facilities- note the CGT “franchise” model - Stevenage could be a benchmark- and we are being bench-marked (e.g. Paris Genopole)
- Manufacturing - perception of better quality if made by larger player
- Need logistics at good clinical trial sites for cell therapies
- Technology platform development lab at Kings (Davide)
- Building the supply chain for the UK will be crucial and we do have some signs of progress in this space - and also collaboration with CGT Catapult- e.g. Trakcel, Plasticell
- Cell and Gene Therapy Catapult Manufacturing Centre is attracting companies - recent visits include 1 US stem cell company, 1 Japanese cell therapy company, 1 leading US Biotech in the CAR-T arena. Companies in the UK for a conference and attracted to the manufacturing centre for a visit.
 - Opportunity: not enough manufacturing facilities anywhere so opportunity for the UK but needs to be a Gov run initiative to protect IP
 - Gap between research and development-manufacturing- IUK money doesn't allow people to come into the manufacturing centre in a significant way
 - Conferences – is there something to do around encouraging more international conferences here – ie. attract Phacilitate to UK rather than Berlin – these events are bringing people together from all over Europe and further afield including the VCs.
 - European manufacturing facility and Fisher storage – that it is a global first.
 - SBC should cluster platform companies (eg viral manufacturing) alongside manufacturing
 - Shortage of process development skills - are Doctoral Training Programs keeping up?
 - Plasticell experience - learnt from GSK, GSK people enjoyed working with Plasticell. More secondment?

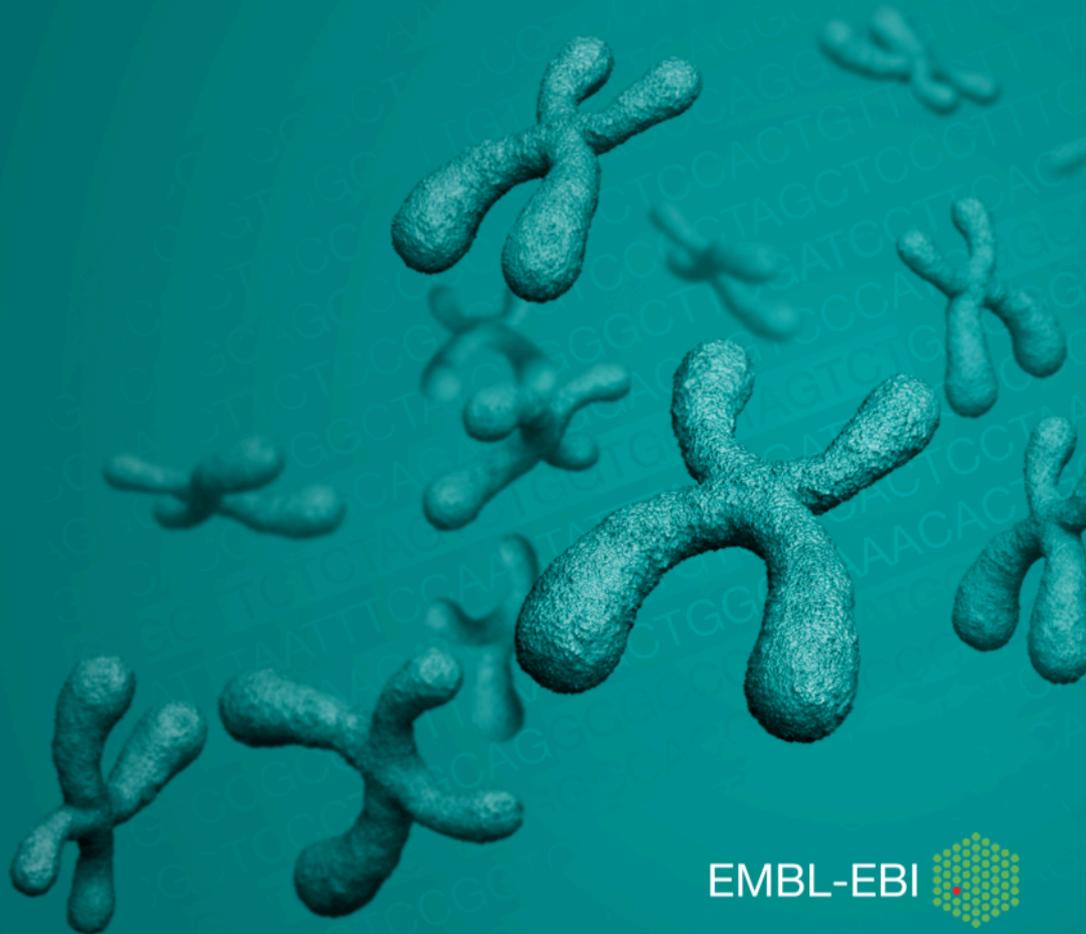
2. Flicek 24 March 2017 (presentation from Wellcome Genome Campus workshop)

EMBL-EBI collaborations and innovation in genomics and big data

Paul Flicek

Vertebrate Genomics

www.ebi.ac.uk



Organisation profile

- EMBL-EBI is the world leader in managing biological big data resources
 - 600 staff
 - More than 100 petabytes of storage and growing
- EMBL-EBI resources are freely available and critically important for academic and commercial life-science research
 - Over 27 million web requests per day from worldwide community
 - UK science benefits through rapid access to data, analysis tools and professional training
 - UK pharmaceutical, biotech, agriculture and biomedical R&D sectors use available resources extensively for research and product development
- EMBL-EBI helps attract and develop the best talent in the UK in an area where a critical skills gap has been identified
 - Our policies require extensive staff turnover leading to over 900 skilled data scientists and bioinformaticians who have moved on from EMBL-EBI in the last decade

Economic impact and funding

- An economic analysis of EMBL-EBI highlighted the profound utility of open data both globally and within the UK
 - Globally estimated annual efficiency savings of between £1 billion and £5 billion (£88 million and £450 million to the UK directly)
 - Future annual global research impacts worth £920 million (£75 million to the UK)
- Sustainable funding model: €67.2 million in 2015
 - EMBL member states contribute €37.8 million
 - €29.4 million from external funders including the Wellcome Trust, European Commission, NIH (USA), UK Research Councils
- Previous government funding has helped create a large-scale pre-competitive drug discovery collaboration (Open Targets) and to host the hub of ELIXIR, the pan-European research infrastructure for data sharing.

Overview of EMBL-EBI activities

- **Archive resources**

- Record of scientific publications and output
- Ensure stability and reproducibility in the future
- Submission records have the concept of ownership and can only be updated by the owner
- Normally have been databases in other parts of the world (eg. NCBI)
- Example: European Nucleotide Archive / GenBank / DDBJ

- **Value-added resources**

- Usually built on the data contained in the archived resources
- Data analysis by world leaders (normally in collaborations)
- Enabling science
- Examples: Ensembl & UniProt

- **Research & special projects**

- 10 dedicated research groups across computational biology
- Projects include the 1000 Genomes, PCAWG, IMPC, ENCODE & others

The IMPC

International Mouse Phenotype Consortium

- G7 Recognised Global Research Infrastructure
- Create and Characterize 20,000 knockout lines
- To date:
 - 5789 strains
 - Phenotype associations: 28,406
 - Data points: 23,200,213
 - Images: 270,804
- All strains available for researchers
- Publish & Annotate Data in near real-time (EMBL-EBI, MRC Harwell, QMUL)



mousephenotype.org



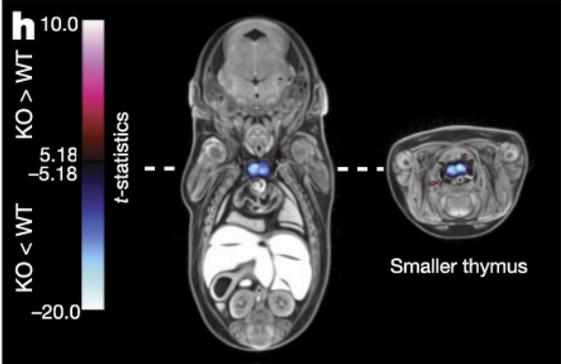
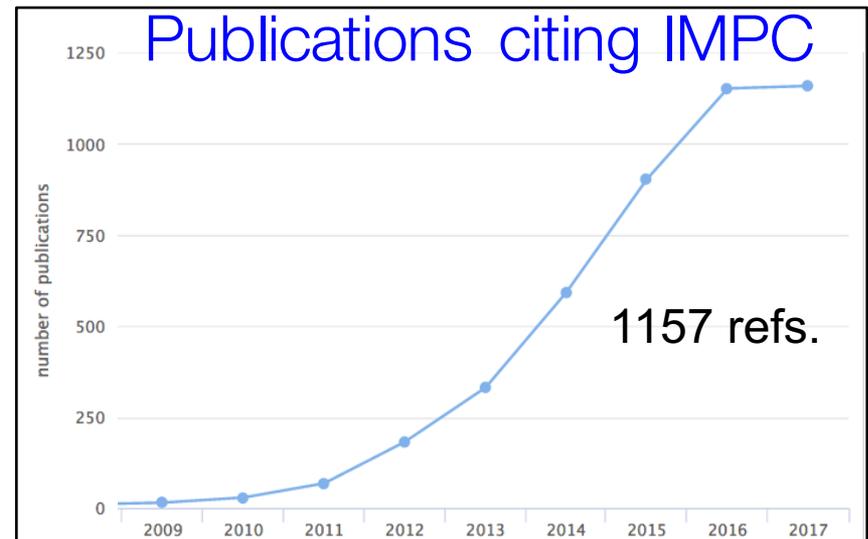
Impact of the IMPC

nature International weekly journal of science

High-throughput discovery of novel developmental phenotypes Sept 2016



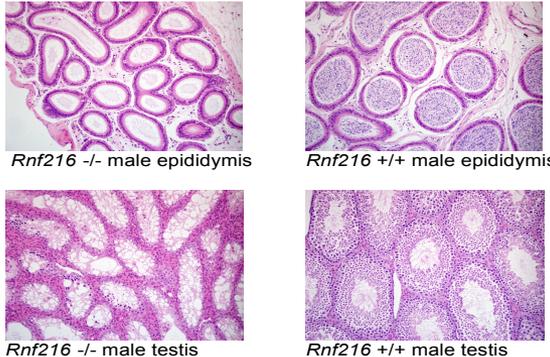
High Profile Research



Automated dysmorphology detection

Smaller thymus

Technology Innovation



Rnf216 $-/-$ male epididymis

Rnf216 $+/+$ male epididymis

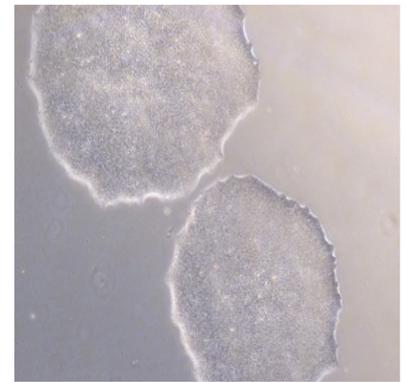
Rnf216 $-/-$ male testis

Rnf216 $+/+$ male testis

Gordon Holmes Syndrome

- aspermia
- seminiferous tubule degeneration

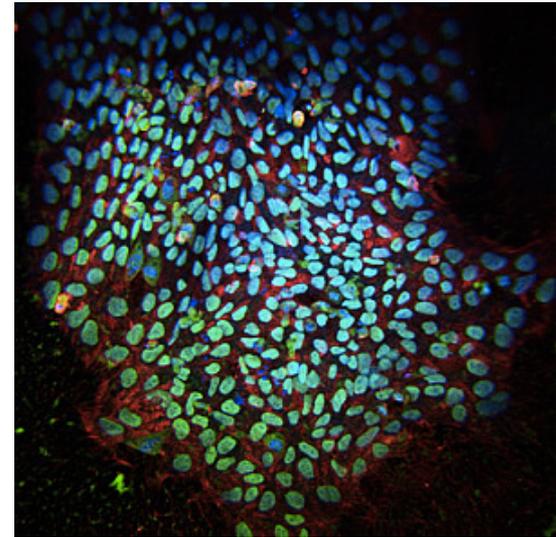
> 800 New Disease Models

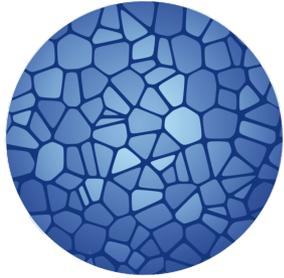


- iPSC Resource
 - 731 lines selected for banking
 - 402 lines available to researchers
- 441 Normal donors
- 242 Rare Disease donors from 15 cohorts
- Deep Characterization
 - Exome
 - RNA-Seq
 - Methylation Array
 - Proteomics
 - Cellular Phenotyping
- Data from Healthy donors in the ENA
- Data from rare disease cohorts in the EGA
- Partners
 - Wellcome Trust Sanger Institute
 - EMBL-EBI
 - The University of Dundee
 - Kings College, London
- Distributed to researchers via ECACC
- Funders
 - The Wellcome Trust
 - The MRC
- <http://www.hipsci.org>



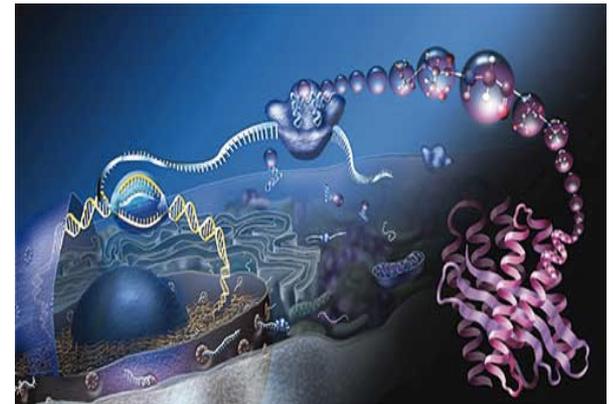
- iPSC collection
 - Quality Controlled
 - Research grade
 - Disease relevant
- 346 lines available today
 - 227 healthy
 - 119 affected by disease including Alzheimer's and Parkinson's
- Available for academia and companies to use in research
- Providing distribution routes for large collections like StemBancc
- Distributed world wide by ECACC
- Funded through European Innovative Medicines Initiative
- Interested in adding new lines to the EBiSC collection
- <http://www.ebisc.org>





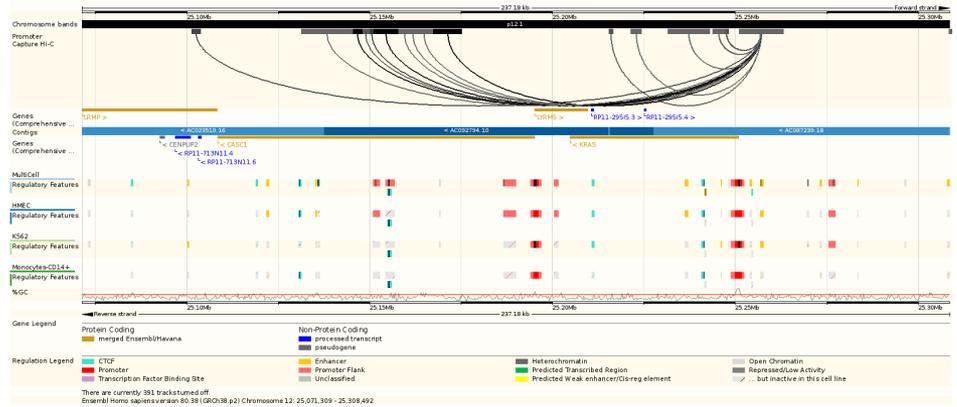
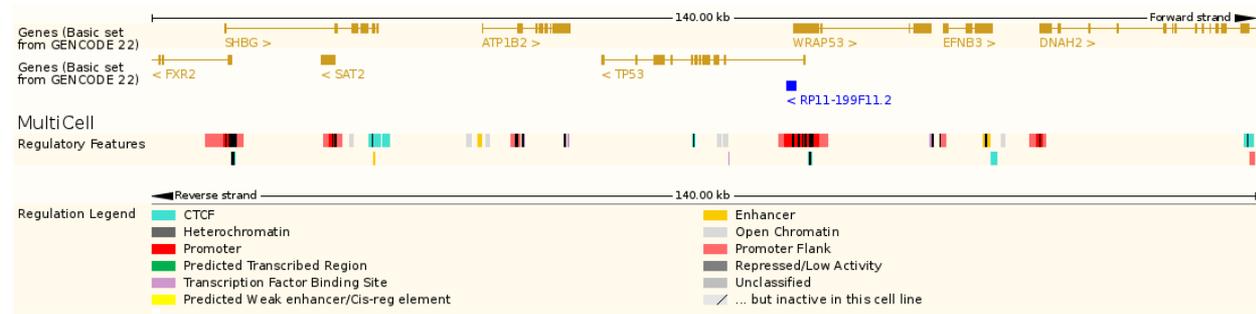
HUMAN CELL ATLAS

- Aims to create a comprehensive reference map of human cells
 - Understanding human health
 - Diagnosing, monitoring and treating disease
- Starting with Single Cell RNA-Seq on healthy donors
- Aims for a truly open access reference collection
- Data Flow coordinated by
 - EMBL-EBI
 - UCSC
 - The Broad Institute
 - The Chan Zuckerberg Initiative
- All data archived at EMBL-EBI
- All data will be available via at least 2 public cloud systems
- Portals will be built to support community access



Ensembl genomics information resource

- Gene annotation: splice variants, proteins, non-coding RNA
- Small and large scale sequence variation, phenotype associations
- Whole genome alignments, protein trees and homologous genes
- Regulatory annotation: promoters, enhancers, DNA methylation
- User upload
- Custom data



- Web browser
- Open API
- Open source / No restrictions

e!Ensembl
<http://www.ensembl.org>

From Data to Knowledge



European Bioinformatics Institute



3. Sanger and Innovation (presentation from Wellcome Genome Campus workshop)

Collaboration and innovation in Genomics and Biodata

Ross Rounsevell

24th March 2017

The benefit of proximity

Translation Office founded in 2011

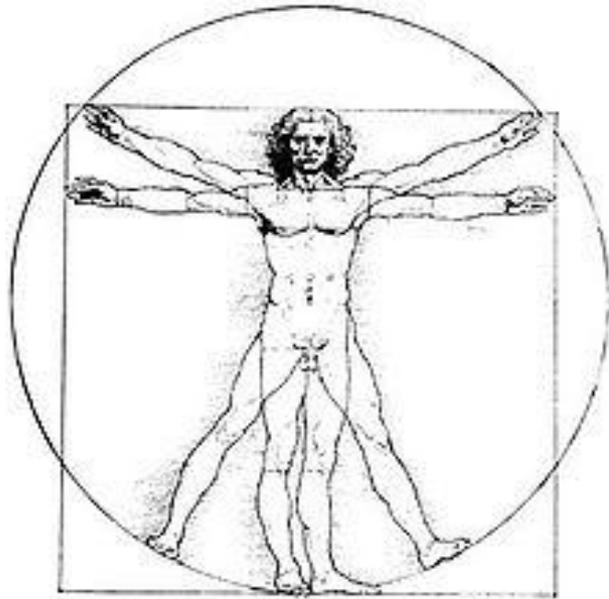
Vision:

Exceptional Healthcare Opportunities from Extraordinary Science

Mission:

To identify, protect, develop and partner high quality research with the potential to advance healthcare and science

Sanger Institute history



Human Genome Project

- Academic consortium (~\$3Bn)
- Declared complete in 2003
- Open Access and Open Source
- Collaborative
- Science at scale
- Specialism and focus (QQR)

“We use genome sequences to advance understanding of human and pathogen biology in order to improve human health.”

Sanger Institute science and infrastructure

Cancer, aging
and somatic
mutation

Cellular
genetics

Human
genetics

Infection
genomics

Malaria



1.7 petabases (10^{15})/year



Genome engineering,
phenotyping



Highly collaborative culture



- High Income Countries
- Low & Middle Income Countries



1000 Genomes



INSIGNIA



Contributing to standardising data sharing and management



Global Alliance
for Genomics & Health

“... accelerate progress in human health by helping to establish a common framework of harmonized approaches to enable effective and responsible sharing of genomic and clinical data, and by catalyzing data sharing projects that drive and demonstrate the value of data sharing.”



Clinical »

Aims to enable compatible, readily accessible, and scalable approaches for sharing clinical data and linking it with genomic data.



Data »

Concentrates on data representation, storage, and analysis of genomic data to develop approaches that facilitate interoperability.



Regulatory and Ethics »

Focuses on ethics and the legal and social implications of the Global Alliance, including harmonizing policies and standards.



Security »

Leads the thinking on the technology aspects of data security, user access control, audit functions, and developing or adopting data security standards.

Influential initiative in both academic and commercial sectors

Enabling pathogen surveillance



OUR AIMS

- Global surveillance of pathogens using whole genome sequencing.
- Understanding drug resistance, emergence and spread.
- Providing actionable data.

OUR APPROACH

- Structured large-scale pathogen surveys and sequencing.
- Provision of tools for data integration, visualisation and interpretation.



Epicollect



Microreact



WGSA



Phylocanvas

Imperial College

London



**Public Health
England**



Pre-competitive commercial collaboration



[About Us](#) [Projects](#) [People](#) [News](#) [Jobs](#) [Contact](#) [Open Targets Platform](#) >

Welcome to Open Targets

For biomedical researchers who need to identify a biological target for a new therapy, Open Targets is a public-private initiative to generate evidence on the validity of therapeutic targets based on genome-scale experiments and analysis. Open Targets is working to create an R&D framework that applies to a wide range of human diseases, and is committed to sharing its data openly with the scientific community.

[About Open Targets](#) >



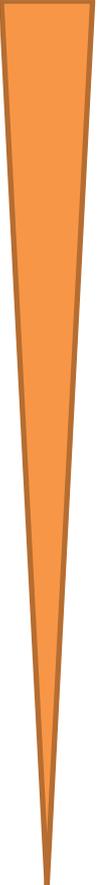
Response to significant attrition rates in drug development

Endeavours to elucidate the causal links between targets, pathways and diseases

Makes methods, data and results publically available



Sanger Institute spin-outs



kymab

Humanised mouse antibody discovery platform

 **VHsquared**

Antibody fragment discovery for GI disease

14m
genomics

Cancer genomics analysis


Congenica
Genome based medicine

Rare genetic disease diagnosis

Microbiotica

Bacteriotherapeutic discovery and production

The Biodata Innovation Centre



Add value to and capture value from Campus capabilities

A new community on campus



Microbiotica

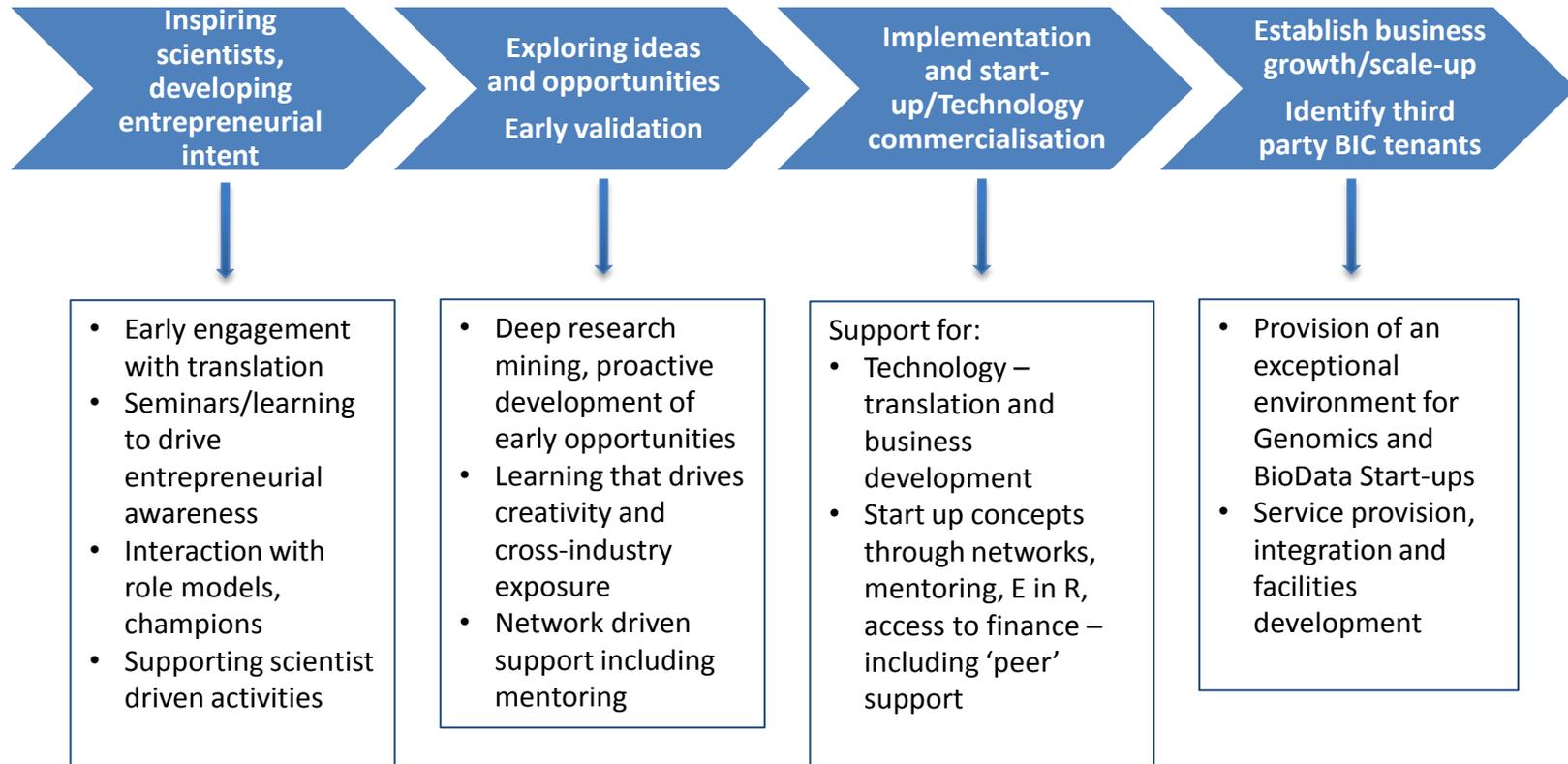


A campus gateway



- Strategic Fit: Genomes and BioData
- Innovative activities, undertaking basic or translational research
- Collaboration with campus institutes or entities
- Benefit from proximity to Campus research and infrastructure
- Demonstrates campus core values
- Willingness to *give back*

The path to new ventures



Education and skill development

Conclusions

- Large scale, high throughput, high quality research
- Deep knowledge in a focused field
- Strong culture of academic and commercial collaboration
- Considering expanding access to Sanger core capabilities to commercial parties
- Biodata Innovation Centre (BIC) reflects a changing campus
- BIC gateway for commercial interactions and lowers engagement barrier
- Future ambitions to consolidate a culture of innovation and entrepreneurship on campus

Challenges

- Supporting and maintaining the research community that drives innovation
- Brain-drain to new Sanger spin-outs or to external enterprises
- Skills shortage in both the academic and commercial sectors in the field

4. Science and Innovation Audit - food, health, microbiome (submission from Earlham Institute)

Science and Innovation Audit – Food, Health, and the Microbiome

EI capabilities

DNA foundry and Single-cell platform

The Earlham Institute operates two strategically funded BBSRC National Capability laboratories:

1. The National Capability in Genomics and Single-Cell Analysis enables the provision of a dedicated, efficient, high-throughput genomics and single-cell analysis facility to support UK research communities, either in collaboration with EI, or as a provider of sequencing services.
2. The Plant and Microbe DNA Foundry provides a national resource for the UK bioscience community to enable high-throughput nanoscale DNA fabrication. Focusing on construct assembly from standard biological parts, allied with validation, we automate a number of processes in the synthetic biology life-cycle.

These dedicated, high-throughput facilities are out of the reach of most organisations due to the large capital investment and the requirement for skilled, multidisciplinary staff.

The National Capability in Genomics and Single-Cell Analysis provides researchers with access to new technologies, bespoke bioinformatics and high-throughput lab pipelines with a focus on crop, microbial and non-model animal genomics. Driven by interactions on the Norwich Research Park (NRP), national and international research programmes it delivers strong scientific impact. The complementary genomics platforms and expertise of EI Faculty supports complex genomics questions in agriculture and food security and bioscience for health.

The Plant and Microbe DNA Foundry complements the strengths of the Norwich Research Park to allow the design, generation and exploitation of high-value compounds and bioactives obtained from plants and microbes by providing researchers with a platform to perform large-scale synthetic biology experiments. This enables new research directions and approaches to drive innovation contributing to UK SynBio sector growth, one of the UK's 'Eight Great Technologies'.

A computational registry and repository will host parts from across BBSRC Foundry groups to provide robustness and resilience, allowing parts to be developed and distributed under an open Material Transfer Agreement, building a growing, open access resource, with training to build multi-disciplinary expertise and further extend the resource.

Systems biology

Systems biology and systems medicine are two powerful approaches that can provide mechanistic understanding on complex questions, such as how the plant, animal or human microbiome impacts its host functions (yield, health, behaviour), and how these functions could be restored upon a disease. To carry out successful systems projects, coordinated activity and project design are needed, where standardised and reproducible workflows are developed, tested, validated, fine-tuned, and then, translated to provide commercial and/or economic impact.

While there are several key, world-class institutes in the UK, where many research groups focus directly or indirectly on systems biology and multi-scale understanding of biomedical problems, nowhere else in the UK you can find such a multi-disciplinary expertise and infrastructure within a single campus than in the Norwich Research Park. The Earlham Institute is leading and coordinating several projects that builds on the institute's computational biology and sequencing resources, and

exploit them by combining the local expertise and wet lab validation capabilities on plants and plant pathogens (John Innes Centre and The Sainsbury Lab) as well as on food, gut and microbial projects (Quadram Institute) to understand living systems.

The systems biology and computational tool development expertise of the Earlham Institute is facilitated by cross-institutional projects ranging from joint studentships to institute-level long term strategic collaborations together with the other partner institutes of the Norwich Research Park. This multidisciplinary approach allows us to carry out complex projects from in silico predictions to validation, and clinical intervention studies in the Norwich and Norfolk University Hospital, also located in the Norwich Research Park.

HPC, bioinformatics, and Big Data

EI is world-renowned for deploying large shared-memory supercomputer platforms for life sciences, critical to delivering our strategic objectives. EI's e-Infrastructure encompasses the integration and interconnection of computational hardware and software technology, data resources and services, communications protocols and networks, as well as experienced teams and organisational structures required to support modern, internationally leading collaborative research. EI significantly values the impact of empowering collaborative research via world-class highperformance computing (HPC) technology.

As part of our core capability, we deploy and maintain some of the largest HPC systems for Life Science research in Europe. In particular, a state-of-the-art SGI UV 300 platform with 12TB of shared RAM has the ability to enable UK researchers to assemble large, complex genomes that are currently intractable on other UK computing infrastructure (including the UK's national HPC Service). By having this expertise in HPC, software development, and network design, we can enable and collaborate with others in the scientific community via the development and deployment of versatile digital platforms for 'omics-based data sharing and discovery.

Our commitment to delivering open systems for data access and analysis is undisputed, and we contribute our scientific outputs to further open science. We contribute our expertise to the development of international initiatives such as DivSeek and the Wheat Initiative, which have potential to expedite international wheat research.

We are developing four e-Infrastructure platforms to support collaborative data analysis and sharing with national and international user bases:

- **Large genome assembly** including wheat and other cereals - the SGI UV systems at EI support the software assembly of genomes requiring up to 12 Terabytes of shared RAM in a single system – not even Archer, the UK's national HPC service, is able to currently support such a computation
- **CyVerse UK**, the first federated node outside the US of the international CyVerse cyberinfrastructure project
- **UK-Seed**, a Galaxy-based e-Infrastructure platform developed at EI for the advanced analysis of genotyping data in association with the international CIMMYT Seeds of Discovery project
- **Signalink**, a curated database of intertwined biological pathways integrated with regulatory networks, utilising novel modelling techniques to allow systems-level analysis of major intracellular signalling pathways in model species and humans

Training

EI is one of only a handful of places in the world that carries out high-throughput research from sample, to data analysis, to publication. The expertise that drives this approach to our own research is reflected in both the diversity and the advanced nature of our training courses. We provide in-depth knowledge from DNA extraction, library preparation and sequencing, to data QC, genome assembly, variant analysis, annotation, through to highly specialised expertise in areas such as population genomics, immuno-genomics, algorithm development, data management and visualisation. EI's programme of training events is demand led, addressing PhD students and Early Career Researchers with greater potential for impact on future research projects. Our training programme is unique in that it provides opportunities to develop skills that enable experimental design through to data analysis, and is complemented by the general training provision available from other UK training providers.

EI's expertise in data-driven and integrative and systems biology allows delivery of hands-on training using real data, and we encourage delegates to bring their own data and/or experimental design to work with. Training at EI promotes technical excellence and attracts credits for Norwich Research Park's (NRP) Doctoral Training Programme (DTP) students in attendance. Training courses support research in model and non-model species, providing new skills, conceptual understanding, scenario-based learning and data analysis across diverse genomics data sources. Courses also provide opportunities to discuss research with trainers and other delegates to increase valuable peer-to-peer learning and networking across research areas.

Attendance is largely UK based (~75%) and 30% are from the BBSRC community although we have global attendees from the Americas, Australia, Europe, Africa and Asia. As demonstrated through studies, and our own experience when considering the applicant pool for faculty positions, bioinformatics suffers from gender inequality with disproportionately low numbers of females. EI aims to address this through best practice in the design of training courses, ensuring that we cater for all learning styles and capturing our target audience of early career scientists. In addition, we promote women in bioinformatics by aiming for gender equality in our training faculty for each course.

5. SIA LS Anglia Ruskin University

East of England Strategic Innovation Audit Life Sciences Theme:

Case Study evidence submitted by Anglia Ruskin University

Anglia Ruskin is involved in a number of innovation partnerships and initiatives which provide opportunities for the East of England to support the growth of the Life Sciences including medtech sector through increased collaboration and linking agendas. As an institution collaboration and partnership are part of the way we operate and our mission is to innovate and make a real difference through our work. We are part of a very vibrant innovation eco-system around both our campuses in Cambridge and Chelmsford and know through our own experience (illustrated by the case studies in three areas of our work below) that joining up activity, connecting people and different interests/sectors and working across research disciplines is key to making innovation happen.

1. Anglia Ruskin MedTech Campus

Overview

*A collaborative **MedTech Innovation Partnership** drawing together industry, academia, government to define, develop and deliver medtech solutions for societal challenges. By working together to share knowledge, expertise and experience we aim to accelerate the rate of innovation within the regional medtech sector to support and drive forward transformation of the health and care system.*

Meeting the need

The partnership between Anglia Ruskin University, Chelmsford, Harlow and Southend Councils was established in 2011 (launched as the Anglia Ruskin MedTech Campus) in response to the identified need to facilitate commercialisation of near-market medtech goods and services in the UK, the rates of which are comparatively low, and to enable innovation in the NHS.

It has a triple helix approach of bringing the public sector, university and business together by developing: physical infrastructure, which is already underway; a business services network providing sector specific support to business; and the innovation partnership as a mechanism for cross-sector collaboration and innovation - not only making it easier, but adding value through a unique partnership.

Because of the foundations which have already been laid in this regard we have a good understanding of the needs of those groups and how the innovation partnership can help address them.

Needs of Business	Needs of Government/NHS	Needs of Localities/University
Include access to:	Include:	Include:
1. Markets	1. Reduction in demand for ill-health treatment	1. Inward investment
2. Skills	2. Improvements in the efficiency and effectiveness of ill-health treatments	2. Retention and growth of existing businesses
3. Knowledge	3. Improvements in the efficiency	3. Jobs growth, particularly higher value added, higher reward jobs
4. Investment		
5. Clinical trials		
6. Links to good communications		

networks (digital, road, air)	and effectiveness of care in the community	4. Up-skilling of the workforce
7. A streamlined regulatory regime	4. Investment in innovation for the prevention of ill-health, the treatment of ill-health and care in the community	5. Local economic growth
8. Premises	5. Savings of £22 billion	6. Place and institutional brand enhancement
9. Centres of research excellence	6. Workforce retention as staff involved in innovation	7. Transformation of the socioeconomic value equation
10. Major customers	7. Enhancement of integration of the health and care system	8. Realisation of the potential of the comparative advantages of places
11. Clusters of similar companies	8. Exemplar test bed for new technologies etc in support of integrated health and care system	9. Recognition of places and institutions as leading nationally and internationally in MedTech Innovation
12. The supply chain	9. All of the above within a definition of political acceptability	10. Academic development and synergy with other academic activity

What the partnership will do

Built around the existing MedTech partnership which is already delivering physical assets for innovation and development by way of the business parks and the innovation centres and the relocation of Public Health England in Harlow, as well as being supported by the existing medtech clusters in the three cities, it will offer horizontal and vertical opportunities for the support, development and testing of markets through the close working between Councils, local NHS system and university.

Physical infrastructure- The Partnership has already commenced infrastructure works at two of the three sites, with the Southend site having recently been awarded £19.89m through the Local Growth Fund third round. These will offer business innovation space, larger commercial space and access to specialist facilities to support the prototyping, development and testing of new products, including via the Anglia Ruskin Clinical Trials Unit and research facilities e.g. Gait Analysis Lab and Simulation Suites.

Anglia Ruskin established **the MedBIC** on its **Chelmsford** campus in 2014 with support from Essex County Council and Chelmsford City Council. The MedBIC is an innovation centre which specialises on supporting the needs of medtech and advanced engineering companies. It was fully occupied (90%) within a year of opening and is currently supporting 23 growing businesses to develop new products and services by facilitating access to expert support from professional, academic and clinical specialists, R&D facilities, routes to market and funding. Work is therefore underway to enable phase II of MedBIC Chelmsford to be delivered which would increase capacity to be added to the existing centre by 2019/20. ARU is now working with Essex County Council, Harlow Council and Harlow Enterprise Zone to develop another MedBIC innovation centre on the Harlow Science Park which, subject to final feasibility checks, will see its first occupants moving in by September 2018.

MedBIC, Harlow

Anglia Ruskin University's Board has given the go ahead for the creation of a £5m Medtech and advanced engineering Innovation Centre (MedBIC) on the London Road North site of the Harlow Enterprise Zone. The

project is being developed in partnership with Essex County Council together with active support from Harlow District Council.

The planned Innovation Centre would be developed as an owner-occupied new build construction providing 15,000 sq. ft. gross building (ground, and first floors), utilising 80-85% of this as lettable space, including meeting and networking space. The MedBIC would be targeted at pre-start-up, start-up and small and medium sized enterprises, and companies operating in the Medtech and associated Advanced Manufacturing fields. The project is expected to be completed and the facility opened by 30th September 2018. The innovation centre, through its business support and incubation activity, would help to catalyse the delivery of the wider 51 hectare Enterprise Zone site which equates to 130,000 sq. metres of innovation floor space, by creating an environment of open innovation where companies of all sizes can create networks and opportunities across sectors.

This project is also part of a wider project at the London Road South which will see a further investment in enabling infrastructure. Public Health England will also be relocating its facilities to the former GSK site in Harlow, there is an opportunity for the facility to support the growing Medtech and Life Science cluster in Harlow and the wider West Essex area.

Business Support- In addition to the physical innovation infrastructure, each centre, will provide access to academic, clinical, professional and industrial expertise through a programme of activities that support the development of new technologies and the exploration of challenges faced by the health and care sector. As a business hub, the innovation centres will support the take-up of business support programmes accelerating access to external feasibility, R&D and pilot funding of new solutions.

Networks - An example of a thriving innovation network is our Medtech Meet Up network which now has a membership of over 100 healthcare innovators and was founded by Professor Tony Young who is Director of Medical Innovation at ARU and National Clinical Lead for Innovation in NHS England.

<https://www.meetup.com/Med-Tech-Campus/>

The MedTech Innovation Partnership - is galvanising the medtech sector and its supply chains, specifically in Essex and wider south east in a new way bringing together public, private and education sectors to support accelerated growth of the medtech sector. It connects the demands for innovation within the local health and care system ensuring that medtech innovation, research and workforce development activities deliver measurable improvements in health and care services in our region.

The partnership also benefits from close working links to the **Anglia Ruskin Health Partnership**. The ARHP is a strategic collaboration between Essex health organisations, academia (ARU and UCL Partners) and local government who share a commitment to improve the health and lives of local people, with a particular focus on innovation, research, and developing people. The partnership is an advocate of a whole systems approach to innovation and focusses on areas that require organisations to work collectively to look at problems that affect the lives of people as a whole and includes delivering programmes which interact across organisations and which need collaboration.

Two of the ARHP work programmes are of particular relevant to the SIA and medtech: Digital and Research and innovation.

Their **digital programme** aims to:

- Develop a Digital Champions programme; for front line staff to become part of early adopter communities of new technologies and ongoing action learning and coaching
- Run an annual Digital Greater Essex 2020 event to bring together the tech leaders in health, industry and academia and to incorporate best practice from outside the Essex system.
- Continuing the match-make digital/tech offers into the Essex system
- Launch the Digital Healthy Schools pilot programme with local schools and ORCHA UK <link to <https://www.orcha.co.uk/>>. The programme will test the effectiveness of health apps to improve the health and well-being of young people and assessment of whether this increases take-up in their families and wider communities.

Their **innovation and research programme** aims to:

- Establish a Care City test bed into the Essex system
- Bring together organisation research and development leads to develop a local university/ Herts and Essex NHS programme to work on areas of common interest.
- Develop an innovation round table to provide a coherent innovation infrastructure in Essex
- Provide advice and support for local innovators and to sign-post to various programmes.

Other Evidence supporting the hypothesis that medtech is an opportunity sector for growth requiring focussed support.

Essex Growth Commission

http://www.essexgrowth.co.uk/Portals/70/Essex_Economic_Report.pdf

LSCC Growth Commission

<http://www.lsccgrowthcommission.org.uk/wp-content/uploads/2016/07/LSCC-Growth-Commission-Final-Report-EXEC-SUMMARY.pdf>

2. Wider Anglia Ruskin Activity: Growing Research and Impact

Our 2014 REF results showed that we are generating world class research in areas relevant to the SIA – see links.

<http://results.ref.ac.uk/Results/ByHei/46>

<http://www.anglia.ac.uk/research/ref2014/anglia-ruskin-research-recognised-for-its-great-impact>

As an institution our strategy is to continue to grow the quality and quantity of our research and continue to lead and participate in innovation activity that enable our research to have real world impact.

A key part of our research strategy is the establishment of research institutes to enable inter-disciplinary research across our institution and with external partners. One of our most successful institutes is the **Postgraduate Medical Institute**.

<http://www.anglia.ac.uk/postgraduate-medical-institute/about-us>

Founded in 2008, the Postgraduate Medical Institute (PMI) is a partnership, unique in the United Kingdom, of all the acute, mental health, primary care trusts in the county of Essex, the Royal Society for Public Health, Essex County Council, two national private health providers and Anglia Ruskin University. The PMI brings together considerable clinical and academic resources to undertake research, innovation and postgraduate education for the enhancement of health and social care. The PMI has many research groups which bring together academics and clinicians to carry out research in a wide variety of areas including the Molecular Diagnostics, Neuroscience and Vascular Simulation, Burns and Plastic Surgery, Clinical Trials and Vision and Eye Units.

<http://www.anglia.ac.uk/postgraduate-medical-institute/groups>

Meeting Medical and Healthcare Higher Skills Needs

Our Faculties of Medical Science and Health and Social Care we are the largest provider of health, social care and education courses in the East of England.

<http://www.anglia.ac.uk/medical-science>

<http://www.anglia.ac.uk/health-social-care-and-education>

Anglia Ruskin was recognised in the Witty Review Oct 2013 (p117) as being sixth in the Top Ten universities producing graduates in STEM subjects allied to medicine.

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/291911/bis-13-1241-encouraging-a-british-invention-revolution-andrew-witty-review-R1.pdf

School of Medicine

We are working with local healthcare providers and a variety of stakeholders, to establish a School of Medicine on our Chelmsford campus. The Essex health economy is experiencing significant workforce challenges that require innovative solutions. Our region has particular issues around primary care, with an ageing GP workforce and – more generally – we face under-recruitment and poor retention in a number of specialties.

Anglia Ruskin University, in collaboration with our healthcare partners, has been developing this exciting project for the last two years. We commenced the General Medical Council (GMC) approval process in January 2016. If we progress to plan, then subject to GMC approval, we hope to have our first intake of students, subject to HEFCE (Higher Education Funding Council for England) places, in September 2018. The consultation plan for the allocation of HEFCE numbers opened on 14 March 2017.

We welcome the announcement from the Government of 1,500 extra places for medical students. We will be looking to secure a proportion of those places for the new School of Medicine in Chelmsford, and we aspire to recruit intelligent and motivated students from the region to 50% of the places.

We have already started the development plans for a new £20million building on our Chelmsford campus which will include state-of-the-art skills facilities, specialist teaching space, lecture theatre, and a cadaveric anatomy suite. This facility will complement our existing skills facilities and our brand new £3.4million SuperLab.

<http://www.anglia.ac.uk/medical-science/about/school-of-medicine>

3. Supporting Regional Development and SME Innovation

Anglia Ruskin has a long track record of providing support to SMEs through delivering successful ERDF projects and proactively linking them to our research capabilities.

In the latest round we are leading two projects which are co-funded by the European Regional Development Fund : KEEP+ and REACTOR.

REACTOR

The project's aim is to support the growth of an applied games sector in the Cambridgeshire/Peterborough region, finding new ways to use games to innovate products and services that enhance life and improve the human experience and enabling connections between businesses and our talent, expertise, facilities and grants.

A total of £1 million will be committed to help new and existing businesses in all sectors to use games technologies and user-based design in innovative products and services – creating applied games and, ultimately, a new applied games sector in the region.

Health applications are a key area for the project and REACTOR is an example of how ARU is using its long established and strong links and connections with the gaming and creative sectors to enable the development of new applications in other sectors and links to be made across our other research disciplines.

<http://www.anglia.ac.uk/business-employers/knowledge-exchange/reactor/about-reactor>

KEEP+

KEEP+ is a European Regional Development (ERDF) Funded programme, which opened on 1st January 2017, to support Small and Medium Sized Businesses (SMEs) to access knowledge and expertise through collaboration with the University sector. KEEP+ provides SMEs with flexible opportunities for innovation, with a focus on developing new products or services, increasing profitability, reducing costs, providing opportunities to collaborate and accessing graduate talent. KEEP+ is a partnership of eight delivery partners and is operating in four Local Enterprise Partnership (LEP) areas:

- Cambridgeshire, Peterborough and Rutland (Greater Cambridge/Greater Peterborough LEP)
- Hertfordshire (Hertfordshire LEP)
- Suffolk and Norfolk (New Anglia LEP)
- Essex, Kent and East Sussex (South East LEP)

The longer term aim of the project is to enable longer term collaborations between universities and businesses and support smart specialisation.

Sector Strategy

We are developing a **Sector Strategy** to help drive innovation in the region by bringing together owners of societal challenges in the public sector with our academics and businesses.

Our focus is on 5 “sectors” or areas:

- Medical Technologies
- Smart and Assisted Living
- Future Cities
- Blue Lights Services
- Digital and Creative

Our work entails:

- Comprehensive Capability Map of the expertise that we have at ARU by Sector, including Key Strategic Themes and Grouped Capabilities which are relevant to key societal challenges (i.e. align with external market demand from both the public and private sectors)
- Strategic Stakeholder Map outlining key stakeholders for each sector including:
 - 'Problem owners' (Health & Social Care providers, Local Authorities etc.)
 - 'Solution providers' - large private sector industrial primes who can develop and deliver the solutions at scale
 - 'Innovators' – SMEs and Start Ups who develop the innovative ideas and technologies who need development funding and/or a route to market (either directly or via large private sector partners)
- A directory of 'innovators' who have previously, are currently or would like to work with ARU to develop their technologies and solutions

6. Eastern AHSN response to BEIS audit

Eastern AHSN response to the Life Science audit for BEIS

5 April 2017

Introduction to the Eastern AHSN

The Eastern Academic Health Science Network works across the East of England to promote health service innovation and improvement. Our role is to both improve the health and wealth of local people. We work with the NHS and industry to accelerate access to the best innovations – the focus of these is on improving health and securing efficiency for the NHS and care providers.

We connect health and social care providers with researchers and businesses in our region to accelerate the spread of service and technology innovations – all with clear focus on improving people's health outcomes. We champion evidence-based, collaborative solutions and support networks to enable widespread adoption

Our support to companies is described in the innovation pathway detailed below:



Eastern AHSN provides direct assistance or supports companies to connect with other providers who can aid the development of innovations along this pathway. Eastern AHSN has several activities that it provides in conjunction with key regional and/or national partners.

DESCRIBING NEEDS AND MARKET MAKING

NHS Programmes and Innovation Exchanges for NHS & Industry

The Sustainability and Transformation Plans (STPs) are the vehicles that the NHS has created to plan services over the next five years. They are the articulation of plans for a geographical area – bringing acute (hospitals) provision together with community (primary care) and other care providers (e.g. Mental Health). The STPs are planning the clinical pathway changes necessary to support innovation adoption and clinical improvements.

Eastern AHSN has a number of programmes to support the NHS in Sustainability and Transformation Plan implementation, with a focus on provider productivity and transforming primary care business models. These programmes are strongly linked to the industry engagement programmes of the AHSN to enable SMEs and other companies to introduce innovations into the NHS.

Innovation exchanges – Eastern AHSN has worked with each STP area to identify key programmes of change that are a first order priority. These priorities are then matched to innovations that are quality assured and assessed for their ability to deliver improvements. At Innovation exchange events the innovations are introduced to STP decision makers and supported by users who are drawn from the citizens' senate (a community of patient leaders who bring expert user voice to decision making in the NHS)

Two events have taken place to date:

- Nov 9th 2016– a whole region exchange – with a health focus on self-care – where 21 company representatives from 14 different innovative companies met with 40+ clinical and patient leaders. From this event three contracts were agreed with a value of £200k to the companies.
- March 29th 2016– Cambridgeshire & Peterborough focused innovation exchange – health focus on Mental Health, Women and Children, Urgent and Emergency care and Primary Care with integrated pathways the focus. 35 company representatives from 18 different innovative companies met with over 80 clinical and patient leaders. From this event ten projects are being assessed.

Further events are planned:

- Early July 2017 – an innovation exchange planned for the North East Essex and Suffolk STP
- Sept 2017- an innovation exchange is planned for a region-wide focus on theatres

DEVELOPING CLINICAL INNOVATIONS

Clinical Entrepreneurs and National Innovation Accelerator Fellows

Eastern AHSN in conjunction with Health Enterprise East has a vibrant pipeline of innovations that have been developed and commercialised by clinical entrepreneurs. Two innovations from the region have been particularly successful as they have made it onto a list of only six products on the NHS Innovation Technology Tariff.

Eastern AHSN supported the initial development of two safety innovations the Non-injectable arterial Connector (NIC), and Pneux designed to address Ventilator Associated Pneumonia (VAP). Both were invented by doctors at Queen Elizabeth Hospital, King's Lynn.

Eastern AHSN supported the initial roll out into hospital trusts in the region which gave the platform for the innovators to apply to the National Innovation Accelerator programme.

Further development and testing was supported by Eastern AHSN and the regions patient safety clinical study group gave advice for user development. Eastern AHSN has also provided support for IP protection, investment and production.

The innovations supported are detailed below:

Company	Technology	Owners	Investment	Date Completed	Investors	Location
Ablatus Therapeutics Ltd	A novel tissue ablation technology to treat the most challenging and often inoperable, solid cancer tumours	Norfolk & Norwich University Hospitals	£0.5m	Jul-16	Anglia Capital Group, New Anglia Local Enterprise Partnership and the Low Carbon Innovation Fund	Norwich
Medtech Accelerator Ltd	Proof of Concept Finance Scheme	JV between Health Enterprise, EAHSN, GCGP LEP & New Anglia LEP	£1.5m	Nov-16	GCGP LEP, New Anglia LEP & Eastern AHSN	Region-wide
Northwood Medical Innovation	EarFold™ is a pioneering implant technology as an alternative to conventional otoplasty surgery in the correction of prominent ears.	West Hertfordshire NHS Trust	£1.1m	2010-2015	High Net Worth (US entrepreneur)	Herts

Company	Technology	Owners	Exit	Date Completed	Acquirer
Northwood Medical Innovation	EarFold™ is a pioneering implant technology as an alternative to conventional otoplasty surgery in the correction of prominent ears.	West Hertfordshire NHS Trust	<u>\$25 up-front plus further contingent milestones</u>	Oct-15	Allergan plc

HORIZON SCANNING AND COMPANY CONNECTIONS

Economic Growth & Innovation Programmes

Eastern AHSN provides support to SME companies across the innovation pathway and some larger organisations primarily supporting their navigation and connection across the NHS. Primarily this support is provided in two forms:

NHS Readiness series: SME workshops

A rolling programme of events has been developed focused on the needs of companies who want to sell to the NHS and are focussed on key areas that SMEs identified as needing.

The following have been completed during 2015 and 2016:

- 19th May 2015 attended by 43 companies from the Cambridge area who were supported to understand how to progress their products through the clinical trial process. A bespoke on-line tool was provided free of charge to attending companies. (*attendance list attached*)
- 24th June 2015 – attended by 44 companies from the Hertfordshire area who were supported to understand how to progress their products through the clinical trial process. A bespoke on-line tool was provided free of charge to attending companies. (*attendance list attached*)
- 12th February 2016 – attended by 73 companies from the Norfolk and Suffolk area who were supported to navigate the NHS Procurement processes. A bespoke on-line tool was provided free of charge to attending companies. (*attendance list attached*)
- 12th Dec 2016 – attended by 59 participants – who were supported understand the needs of the NHS as articulated in the STP plans. (*attendance list attached*)

The following events are planned through the rest of 2017:

- 10th April 2017 (50 booked to attend); focus on needs as articulated in the STPs – Cambridgeshire & Peterborough area
- 15th May 2017 - focus on needs as articulated in the STPs Norwich/Ipswich area –
- 19th June - focus on Clinical trials for the Herts/Essex area business community
- 17th July 2017 - focus on Clinical trials for the Cambridgeshire & Peterborough area business community
- 4th Sept 2017 - focus on Clinical trials for the Norwich/Ipswich area business community

- 2nd Oct 2017 - focus on Commissioning and Tariffs for the Herts/Essex area business
- 6th Nov 2017 - focus on Commissioning and Tariffs for the Cambridgeshire & Peterborough area business
- 4th Dec 2017 - focus on Commissioning and Tariffs for the Norwich/Ipswich area business

Over the course of the year the AHSN will support 480 company attendances at these events. Each of these will have access to the specialist knowledge of the EAHSN team and will be supported to connect to the NHS.

One to one Bespoke surgeries for Companies

Eastern AHSN is currently also supporting one to one bespoke surgeries with companies – 12th Dec 2016– 9 companies were supported with tailored advice and support.

Our second set of surgeries is booked for 10th April 2017 and 9 companies are booked to attend. Somewhere between 45 and 108 companies will be supported in this way during 2017/18.

Direct support by the AHSN to companies

In addition to the events above, the AHSN receives contacts from companies directly and provides a level of support along the innovation pathway. Through the various interactions above the AHSN enables companies to enter a dialogue with the NHS, the AHSN can confidently forecast 500-600 hosted interactions between the NHS and innovators during 2017/18.

The support provided includes taking companies to key NHS events such as the NHS Expo and Confederation conferences. These forums enable the companies to connect with a national leadership cadre and commissioners from across the NHS.

Through the AHSN Commercial Directors forum the AHSNs share knowledge and understanding of the innovations that could be adopted on a national scale. The SBRI Healthcare programme innovations and the National Innovation Accelerator supported products are routinely supported across a national footprint.

Digital self-care in Suffolk

Eastern AHSN is working in partnership with the Suffolk Local Digital Roadmap team to implement a digital self-care support for up to 40,000 people across three primary care practices.

The technique has already been successfully used in secondary care and show benefits such as improved medication adherence and good patient experience. The roll out has started and evaluation is built in to check that the benefits reported in secondary care are transferable to the primary / community setting.

The project contains a plan for adoption and spread built in so that should evaluation show positive results, others could benefit from this support quickly.

Several companies supported by SBRI programme (see below) are engaged in this initiative include myCOPD, Active8rlives (Aseptika Ltd), Docobo and uMotif.

Innovation Technology Tarif

The six nationally selected innovations are being supported in their roll out with dedicated base line analytics and bespoke introductions to commissioners. Eastern will look to provide direct implementation funding and support on a case by case basis.

FUNDING OPPORTUNITIES

The Medtech Accelerator

The Medtech Accelerator is aimed at health and care innovators and has been set up to facilitate the early stage development of innovations in the broad area of medical technology (devices, diagnostics, software and eHealth) that meet unmet clinical needs within the NHS. It is a joint venture between Eastern AHSN, Health Enterprise East, New Anglia and Greater Cambridge and Greater Peterborough Local Enterprise Partnerships.

Proof of Concept Awards of between £15,000 and £125,000 are available to individuals or teams with innovations based primarily on NHS intellectual property (IP) that show the potential to create new company opportunities within the East of England.

Launched in November 2016 the Accelerator has received 18 applications to its first round and three projects are in the process of contracting. The anticipation is that the programme will receive approx. 80 innovations on an annual basis.

SBRI Healthcare programme

The Small Business Research Initiative (SBRI) - Healthcare is an Academic Health Science Network (AHSN) led programme for NHS England, delivering the Innovation Health and Wealth agenda.

Since the Eastern AHSN took responsibility for the overseeing the delivery of the SBRI Healthcare programme on behalf of NHS England the programme has launched 24 competitions, awarded 90+ Phase 1s, 40+ Phase 2s and 8 Phase 3s over a 3-year period. The total award value in that time now stands at over £40m. A little over a quarter of this funding has been to companies in the Eastern region (proportionally more than its share on other economic metrics).

SBRI Entries from the eastern region

Date	Competition	Entries from the Eastern region
Jan-13	SBRI 4	28
Sep-13	SBRI 5	45
Dec-13	SBRI 6 (Phase 3 only)	1
May-14	SBRI 7	19
Oct-14	SBRI 8	26
May-15	SBRI 9	17
Nov-15	SBRI 10	15
Jun-16	SBRI 11	18
Mar-17	SBRI 12	30
	Total	199

Since January 2013, a total of 199 entries have been made for the SBRI programme from the Eastern region. Of these a total of 25 were successful in receiving Phase 1 awards and all but 2 went on to receive Phase 2 awards as listed below. There was a single company that achieved a Phase 3 award following Phase 1 and 2.

The companies are listed below with the total funding received by them across all phases.

Companies receiving one or more SBRI awards since January 2013 in the Eastern Region

	Total SBRI funding Phases 1-3	Total SBRI awards Phase1*
Eastern Region	£10,223,001	25
Aseptika Ltd	£2,690,115	3
Bespak	£497,900	1
Cambridge Respiratory Innovations Limited	£1,199,107	2
Exhalation Technology	£82,867	1
HandleMyHealth	£99,900	1
Hidalgo	£99,981	1
Inotec AMD Limited	£1,089,574	1
Owlstone Ltd	£1,094,772	1
Pneumacare	£87,949	1
Sonovia	£392,640	1
Team Consulting Ltd	£98,930	1
TwistDX Ltd	£199,928	2
Alan Brundle Medical Systems Ltd	£99,052	1
Cambridge Design Partnership	£599,993	1
Obex Technologies Ltd	£830,964	1
Ieso Digital Health (PsychologyOnline)	£98,032	1
Healthera (Serket)	£643,091	1
Ubisense	£131,456	2
Cambridge Clinical Management Analytics	£90,149	1
6.P.M. Management (Uk) Ltd	£96,600	1

Example SBRI company profiles from the East of England

OWLSTONE

Funding: £1,094,772

Owlstone is developing a non-invasive screening device for early stage lung cancer utilising breath diagnostics. As for most cancers, early diagnosis of lung cancer leads to better patient outcomes. The LuCID (Lung Cancer Indicator Detection) project will allow Owlstone's existing chemical detection technology to be used to diagnose lung cancer, by measuring the trace chemicals present in the breath of lung cancer patients.

Eastern AHSN were also able to connect the company to NHS organisations who wanted to trial and test their diagnostic.

ASEPTIKA Inexpensive COPD home monitoring and treatment management device

Funding: £1,099,344

Aseptika is developing a medical-version of a Smartwatch to help people with respiratory disease to better manage their condition at home. The device will alert the wearer, their family and their medical team of rapid decline in health. Aseptika has applied for patents for its inventions.

Early advice from Eastern AHSN led to Aseptika securing SBRI funding to extend its Activ8rlives self-care system which tracks and analyses blood oxygen, heart rate, temperature, blood pressure, body mass and lung function.

SBRI Alumni Programme

The Eastern AHSN has been supporting companies funded through the SBRI programme and in the region on a one to one basis. During 2017/18 the Eastern AHSN will define and lead a programme for SBRI companies nationally. This aims to formalise support for SBRI companies through programmes to promote engagement with the NHS and to develop interrelationships and knowledge sharing between SBRI companies. This programme will be for the 45 SBRI companies (as of April 2017) that have completed Phase 2 funding contracts.

Attached lists:

Attendance at NHS Readiness Series events

19th May 2015

24th June 2015

12th February 2016

12th Dec 2016

10th April 2017

Karen Livingstone, Director of Strategic Partnerships & Industry Engagement, Eastern AHSN
Mark Otto Smith, Business Support Manager, Eastern AHSN

7. Bio life sciences companies Bishops Stortford

BIO / LIFE SCIENCES COMPANIES IN & AROUND BISHOP'S STORTFORD, HERTFORDSHIRE

Company name	Postcode	Registered Number	Website	Address
AGAR SCIENTIFIC LTD	CM24 8GF	09897580	http://www.agarscientific.com	Unit 7, M11 Business Link, Parsonage Lane, Stansted, Essex CM24 8GF
ALCOHOLS LTD	CM23 2ER	00547325	http://alcohols.co.uk	Charringtons House, The Causeway, Bishop'S Stortford, Hertfordshire, CM23 2ER
ALLINSON FLOUR (part of Associated British Foods plc)	CM23 3XZ	293262	http://www.allinsonflour.co.uk	10 Dane Street, Bishop's Stortford, Herts CM23 3XZ
COBELL LTD	CM23 3AJ	03876527	http://www.cobell.co.uk	Riverside House, Riverside, Bishop's Stortford, Herts CM23 3AJ
CORNELIUS GROUP PLC	CM23 5RG	01936460	http://www.cornelius.co.uk	Cornelius House, Woodside, Dunmow Road, Bishops Stortford, Herts CM23 5RG
CPL AROMAS LTD	CM22 7LE	01031292	http://www.cplaromas.com	Barrington Hall, Hatfield Broad Oak, Bishop's Stortford, Herts CM22 7LE
DIAGEO PLC	CM23 5RG	00023307	http://www.diageo.com	Unit D, Woodside, Bishop's Stortford, Herts CM23 5RG
DOTMATICS LTD	CM23 2ND	05614524	http://www.dotmatics.com	The Old Monastery, Windhill, Bishop's Stortford CM23 2ND
ELCOMPONENT LTD	CM23 3DY	01963289	http://www.elcomponent.co.uk	Unit 5, Southmill Trading Centre, Southmill Trading Road, Bishop'S Stortford, Hertfordshire, CM23 3DY
EV3 LTD	CM23 3YT	04299895	http://www.ev3.net	1 Twyford Business Centre, London Road, Bishops Stortford, Herts CM23 3YT
FISHER BIOSERVICES UK (part of Thermo Fisher Scientific)	CM23 5RG	FC028273	http://www.fisherbioservices.com	Woodside, Bishop's Stortford, Herts CM23 5RG
GENEWIZ UK LTD (formerly Beckman Coulter Genomics)	CM22 6TA	09937828	https://www.genewiz.com	Hope End, Bullocks Lane, Takeley, Bishop's Stortford, Herts CM22 6TA
HARLOW AGRICULTURAL MERCHANTS LTD	CM22 7PJ	01520770	http://www.harlow-ag.co.uk	Latchmore Bank, Little Hallingbury, Bishops Stortford, Herts Latchmore Bank, Little Hallingbury, Bishops Stortford, Herts CM22 7PJ
IGEA MEDICAL UK	CM22 7WE	07065560	http://www.igeamedical.co.uk	Thremhall Park, Start Hill Bishop's Stortford Hertfordshire CM22 7WE
INTERAGRO (UK) LTD	CM23 4AT	02849808	http://www.interagro.co.uk	Thorley Wash Barn, London Road, Thorley, Bishop's Stortford, Herts CM23 4AT
K&H MEDICAL LTD	CM23 3AR	1867373	http://www.khmedical.co.uk	Unit 25, M11 Business Link, Parsonage Lane, Stansted, Essex CM24 8GF
LIFE ENVIRONMENTAL SERVICES LTD	CM23 3AR	03053057	http://www.lifeenvironmental.co.uk	Unit 4, Ducketts Wharf, South Street, Bishop'S Stortford, Herts CM23 3AR
MEDA PHARMACEUTICALS LTD	CM22 6PU	SC043236	http://www.medapharma.co.uk	Skyway House, Parsonage Road, Takeley, Bishops Stortford CM22 6PU
MEDISAFE UK LTD	CM23 3LJ	2533282	https://www.medisafeinternational.com	Twyford Road Bishop's Stortford, Herts CM23 3LJ
NQUIX LTD	CM23 3BT	07808822	http://nquix.com	Causeway House Dane Street, Bishop'S Stortford, Herts CM23 3BT
RONSEK LTD	CM23 5LE	05133530	http://www.ronsek.com	7 Boundary Road, Bishop'S Stortford, Herts CM23 5LE
SECTRA LTD	CM22 6DR	04571654	https://www.sectra.com	First Floor, Water Circle, City Meadows, Stansted Airport, Essex CM22 6DR

Company name	Postcode	Registered Number	Website	Address
SOUTH WOODFORD ELECTRONICS LTD	CM23 3DY	01203430	http://www.sweconnect.com	Unit 13, South Mill Trading Centre, South Mill Road, Bishops Stortford, Herts CM23 3DY
STORT CHEMICALS LTD	CM23 3AR	01625837	http://stortchemicals.co.uk	6 Ducketts Wharf, South Street, Bishops Stortford, Herts CM23 3AR
STORT MEDCHEM CONSULTING LTD	CM23 2PE	06475262	http://www.stortmedchem.co.uk	The Courtyard, The Old Monastery, Windhill, Bishop'S Stortford, Herts CM23 2PE
THIN METAL FILMS LTD	CM23 3DY	05783983	http://www.tmf.uk.com	15 Southmill Trading Centre, Southmill Road, Bishop's Stortford, Herts CM23 3DY
TRITHIN PRODUCTS LTD	CM23 2ER	02660699	http://www.trithin.com	Charringtons House, The Causeway, Bishop's Stortford, Herts CM23 2ER
VACZINE ANALYTICS GROUP	CM23 2NN	05807728	http://www.vaczine-analytics.com	Assay Advantage Ltd, Warren House, Bells Hill, Bishop's Stortford, Herts CM23 2NN
W.H.PALMER & CO. (INDUSTRIES) LTD	CM23 2ER	00727228	None available	Charringtons House, The Causeway, Bishop'S Stortford, Herts CM23 2ER

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8. Innovation Capacity - a framework for diagnosis

Accelerating Innovation: A Framework for Identifying Priorities

April 2017

The Language of Innovation: Terminology

- ***Innovation***: the set of activities required to translate an idea or invention into a product or service that creates value for which customers will pay
 - Good ideas translated out of the research space and into the hands of caregivers and the bodies of patients
 - The pace and volume of job creation, capital investment and economic development accelerates as we move *from* research (ideation and invention) *to* application and commercialization (innovation)

The Language of Innovation: Terminology

- ***Entrepreneurship***: the process of starting a business that offers (an innovative) product, process or service
 - The willingness to take risks (and fail) to bring new ideas into application.
 - Culture, human capital, investment, connections, support systems and places to grow new business

The Language of Innovation: Terminology

- ***Innovation ecosystem***: a highly coalesced group of organizations, programs, activities and relationships working together to enable innovation
 - All of the necessary ingredients working together to support the production and diffusion of new knowledge, products and services

Innovation Capacity

What is Innovation Capacity?

“The ability to produce and commercialize a flow of innovative technology, products and services *over the long term.*”

Furman, Porter and Stern (2002)



Create



Develop



Grow



Sustain

Strategic priorities are targeted to close gaps and build strengths across the innovation lifecycle

Why Invest in Building Innovation Capacity?

- Promotes the goals of Innovation Acceleration
- Strengthens the “platform” that supports innovation
 - All stakeholders benefit

“Geographies with high *innovative capacity* usually develop faster economically, attract highly skilled populations, and experience rising incomes and trade.”

(Harvard Business School 2011)

States with Low Innovation Capacity Underleverage Investments in Research

The ratio of VC investment to research dollars is a proxy for commercialization

Life Sciences VC Investments per NIH dollars by State
Fiscal Year 2014
In dollars

Rank for FY 2014 NIH Dollars	State	FY 2014 NIH Dollars	FY 2014 VC Dollars	VC\$ per NIH\$
1	CA	\$ 3,499,391,307	\$ 3,515,935,800	\$ 1.00
2	MA	\$ 2,404,097,828	\$ 1,567,264,500	\$ 0.65
16	CT	\$ 467,188,982	\$ 260,576,800	\$ 0.56
23	NJ	\$ 246,964,069	\$ 130,704,300	\$ 0.53
8	WA	\$ 906,173,368	\$ 462,317,200	\$ 0.51
Total US		23,014,884,144	\$ 8,092,102,100	\$ 0.35
7	TX	\$ 981,024,135	\$ 344,374,000	\$ 0.35
10	OH	\$ 670,092,509	\$ 129,084,200	\$ 0.19
9	IL	\$ 733,227,259	\$ 134,511,800	\$ 0.18
4	PA	\$ 1,516,874,603	\$ 247,973,900	\$ 0.16
6	NC	\$ 1,067,282,781	\$ 117,321,100	\$ 0.11
5	MD	\$ 1,333,845,959	\$ 93,651,000	\$ 0.07
3	NY	\$ 2,125,150,125	\$ 102,094,800	\$ 0.05

FY 2014 = October 1, 2013 - September 30, 2014

Source: PwC Moneytree, <https://www.pwcmoneytree.com/HistoricTrends/CustomQueryHistoricTrend>
Includes: Biotechnology, Healthcare Services, and Medical Devices and Equipment

What is the Economic Impact?

Example:

In 2014, New York State received over \$2B in NIH research funding (#3), but only \$100M in VC dollars – **\$0.05 of venture money per NIH dollar.**



The Opportunity Cost:

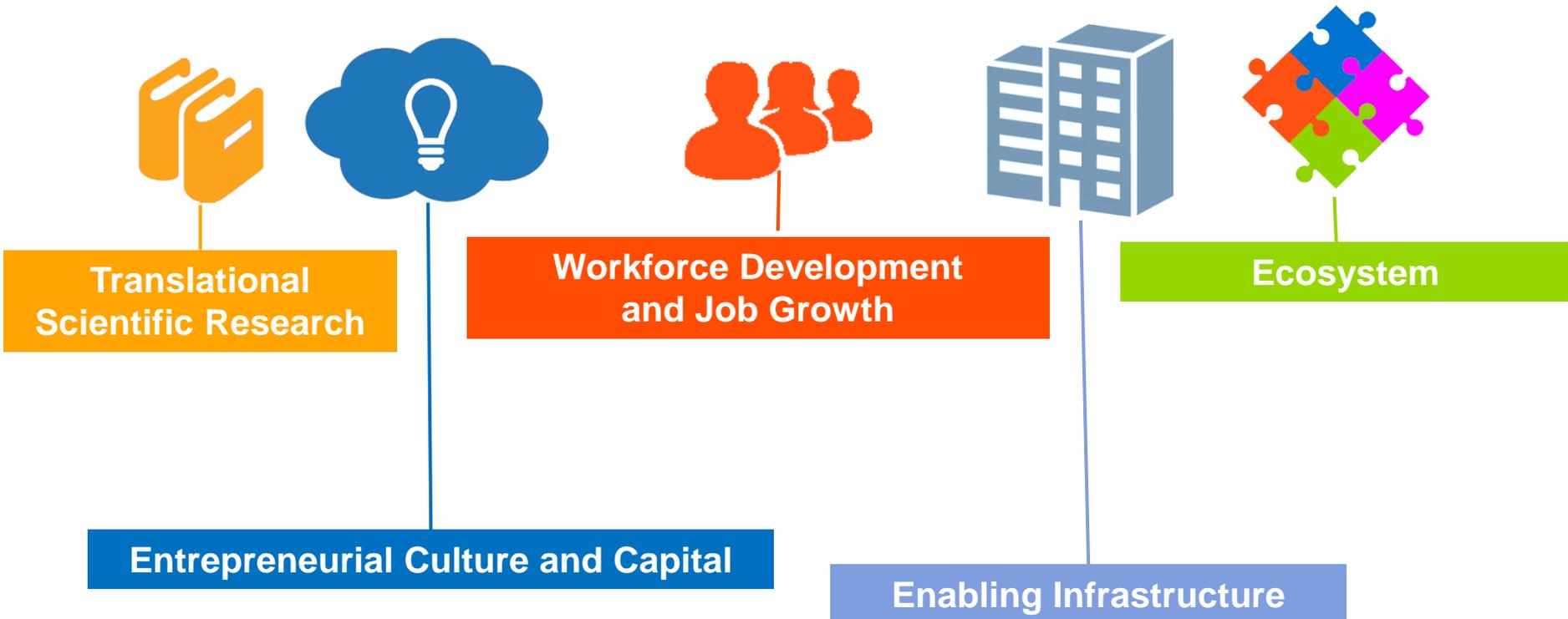
KPMG estimates that if commercial activity in (Downstate) New York was on par with its NIH funding, the region could see an additional

18,000–25,000 jobs and \$2.2–3.1 billion of additional economic growth!

(Commercial Life Sciences Can Be New York's Next Big Industry, 2016)

Investing to Build Innovation Capacity: A Framework for Identifying Strategic Priorities and Investment Targets

Target the **Five Key Enablers** of Innovation Capacity



What is the Rationale for Each Component of the Framework?

- **Translational Research**

- Enables Discovery – the starting point for innovation
- Attracts industry partners and capital for infrastructure
- Trains the next generation of workers who will be entrepreneurs, scientists in applied fields, etc.

- **Entrepreneurship – Culture, Capital, Ability to Thrive**

- Provides the next generation of companies that will commercialize (academic) discoveries
- Mature companies are heavily reliant on “external innovation” -
- *A rich pipeline of new companies is a magnet for mature companies*
- Attracts investment capital
- Attracts talent
- Creates a “buzz”

What is the Rationale for Each Component of the Framework? (cont'd)

- **Supply, distribution and inclusiveness of workforce**
 - Workforce is a draw for mature companies and entrepreneurs
 - Ensures that there is alignment between company needs and workers' skills – *not just research skills!*
 - Enables (mature) companies to locate “wherever” it makes the best business sense for them
 - Promotes ability to compete for jobs for workers who wish to pursue them
 - Can create pathways into the life sciences for *mid-skilled workers*

What is the Rationale for Each Component of the Framework? (cont'd)

- **Infrastructure**

- Cutting edge facilities for research institutions supports discovery and may provide unique resources that can be found only in a certain geography(ies)
- Basic infrastructure helps a geography compete to host companies – roads, transportation, housing, wastewater management, etc.
- Can be used to promote regional economic development
- Business incubators provide places for young companies to grow
- Convening spaces support collaboration and ecosystem
- Web-enabled tools promote collaboration and ecosystem

Infrastructure includes technology and systems!!

What is the Rationale for Each Component of the Framework? (cont'd)

- **Ecosystem**

- Collaboration, new models of partnership and “connecting the dots” accelerates the pace of innovation ($1+1=11$)
- Increases the leverage on investment dollars
- A sense of *community* is attractive to entrepreneurs, mature companies, investors and researchers
- Enables easy entry to the community for newcomers -- access to people, organizations, skills, people
- Attracts mature companies who want “expedited” access; Encourages young companies to remain and grow jobs
- Includes professional service companies and other supporting players
- Active partnerships with state agencies enables the development and implementation of successful economic development strategies

A “Cluster” vs. an “Ecosystem”

A “**cluster**” is a collection of assets – universities, medical centers, companies, investors, service providers, etc.

In an **innovation “ecosystem”** all members of the cluster work well **individually and together!**

Ecosystems generate leverage on a cluster!

1+1 = 11



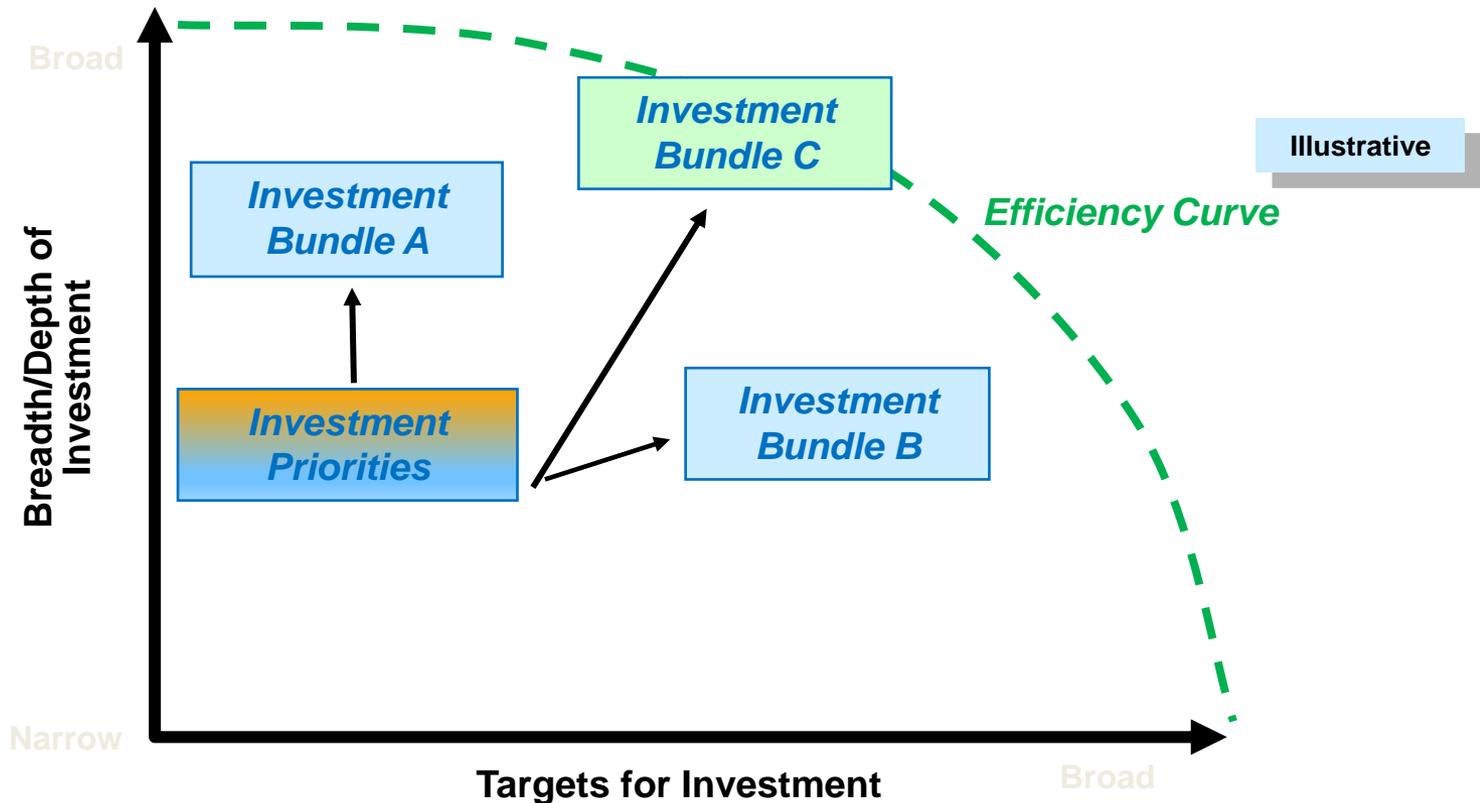
Creating an Ecosystem

Target the **Five “A’s”** of Ecosystem Creation and Effectiveness



Building Innovation Capacity: Why Set Strategic Priorities?

- Identifies the *optimal “bundle”* of investments that will *enable your goals* and deliver economic value
- Determines the *required level of investment in each component* of this “bundle”



Building Innovation Capacity: Decision Making Challenges

All initiatives face a number of challenges:

- **Where to invest** to make an impact and yield a return on public tax dollars?
- **How to obtain the best leverage** on investments?
- **How to balance competing targets** for investments?
 - Promising science vs. economic development
 - Large vs. small constituencies
 - Which sectors and constituents
 - Well-established vs. emerging players
- What investments are **broadly responsive** to the needs of the innovation community **but sufficiently focused** to “make a difference?”



Initiatives need strategic frameworks for setting priorities and “rationalizing” decision making among competing demands for investments

Translating Priorities into Implementation: Investments and Impact

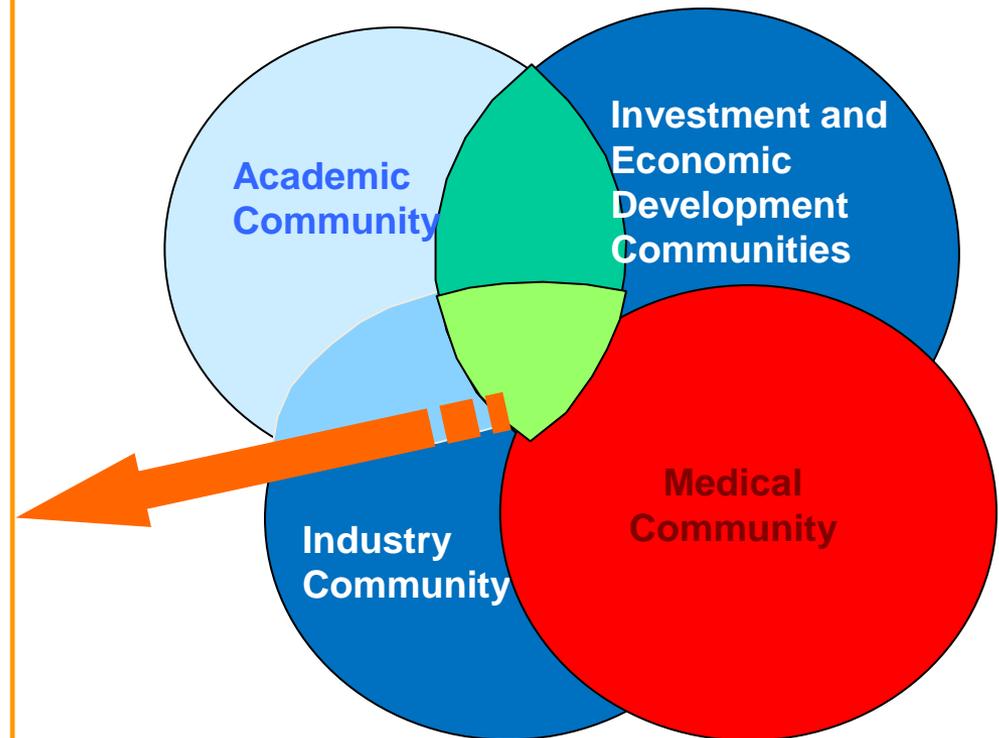


Applying the Framework: The Massachusetts Life Sciences Initiative

Areas of Greatest Convergence Across Stakeholders

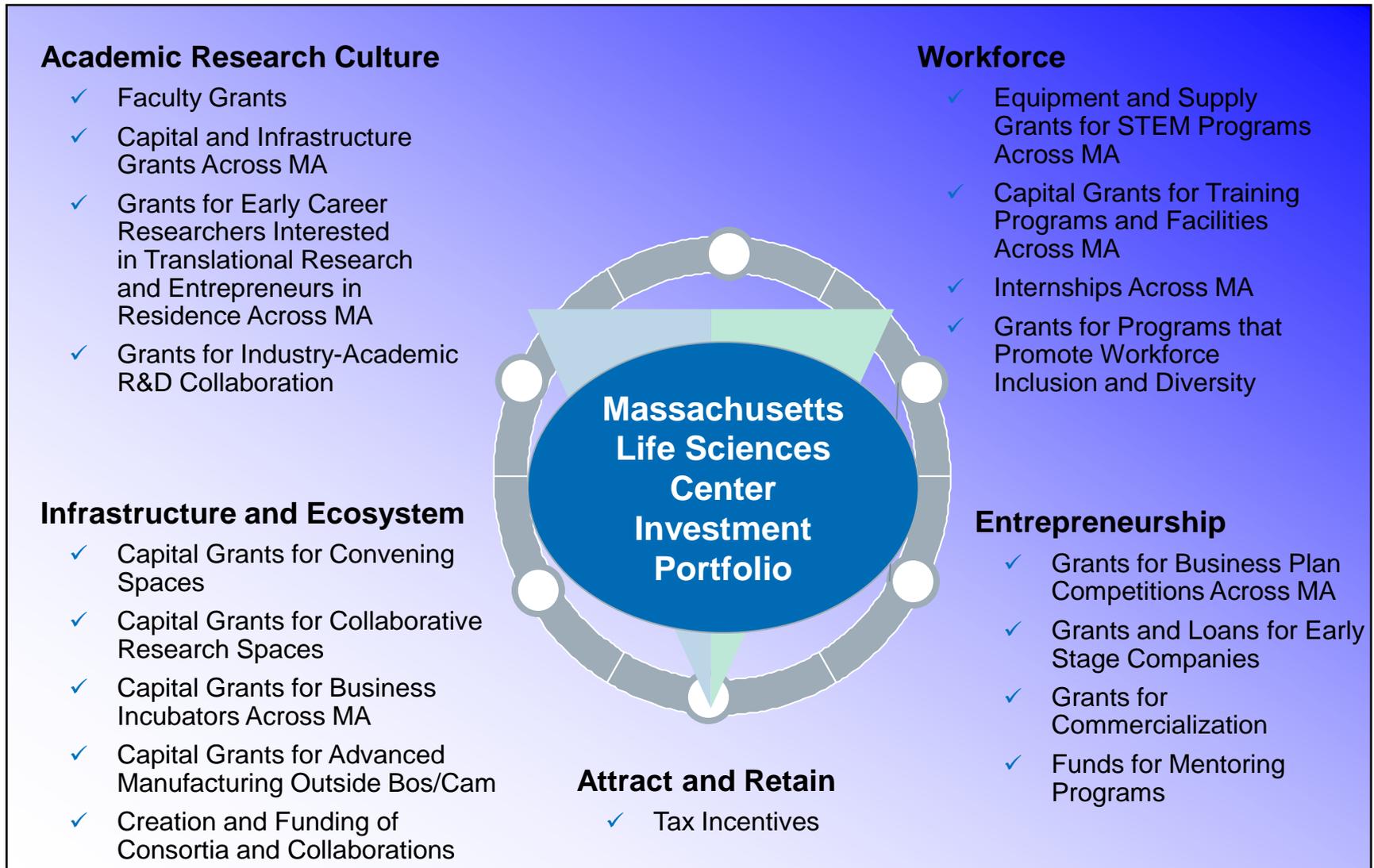
- ✓ **Current Culture at Academic and Medical Research Institutions DOES NOT ENCOURAGE TRANSLATIONAL RESEARCH**
- ✓ **Limited Support for TECHNOLOGY TRANSFER AND EARLY-STAGE COMPANIES**
- ✓ **Need a WORKFORCE THAT SUPPORTS COMMERCIALIZATION OF RESEARCH**
- ✓ **Limited infrastructure FOR RESEARCH TRANSLATION AND BUSINESS INCUBATION**
- ✓ **Need improvements in CUTTING EDGE RESEARCH INFRASTRUCTURE**
- ✓ **No real ecosystem (NEED A CONVENER AND COORDINATOR TO PROMOTE GREATER COLLABORATION)**
- ✓ **Incentives to ATTRACT AND RETAIN COMPANIES**

Stakeholders Included in the GAP ANALYSIS*

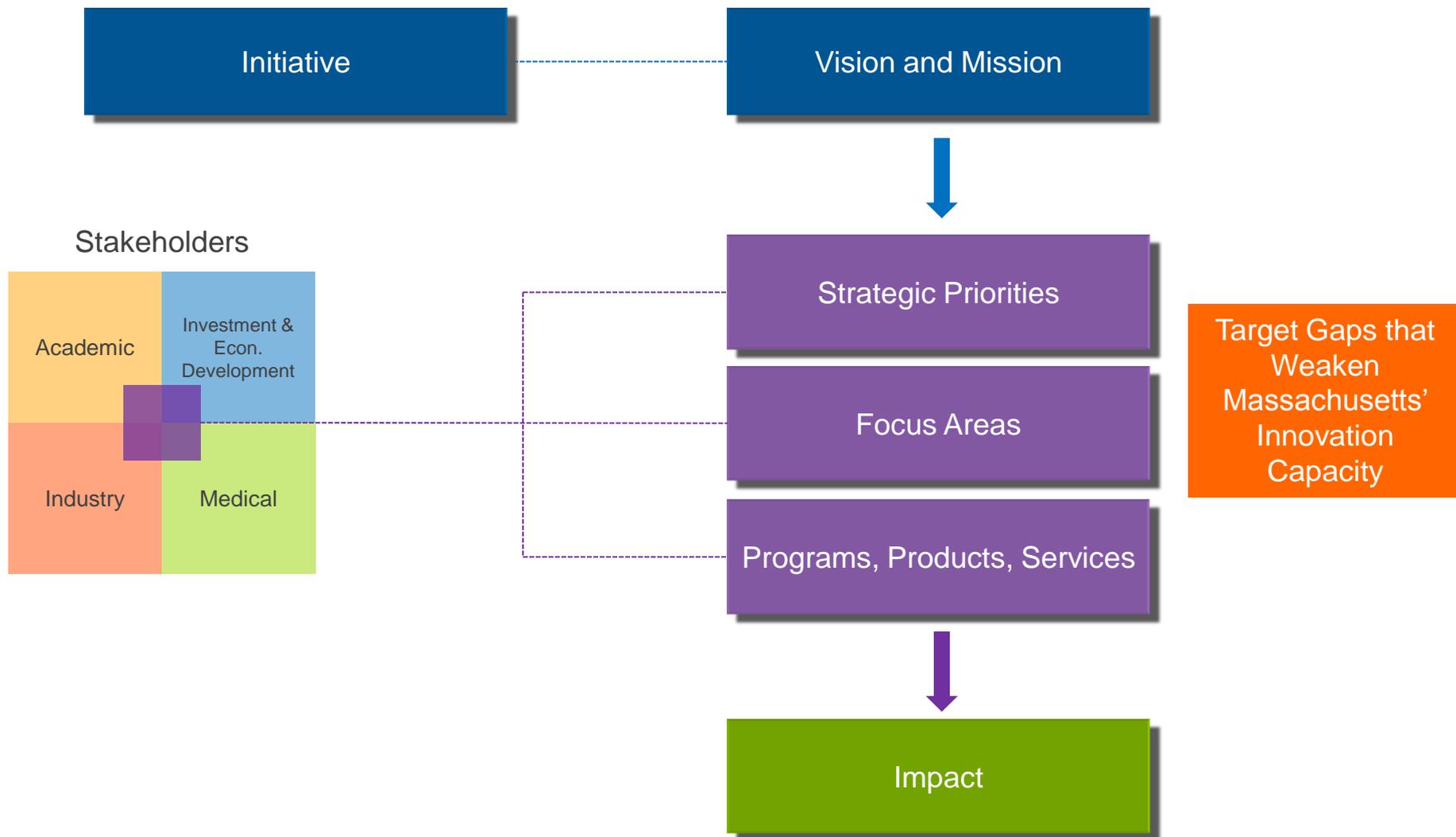


* meetings/interviews with 100+ stakeholders at the outset of the Life Sciences Initiative in 2008

Implementation: A Strategic Investment *Portfolio*



The Investment Portfolio Was Customer-Driven



9. East of England SIA - medtech

East of England Science and Innovation Audit – Medical Technologies Sector Overview

Definition

A Medical Technology (MedTech) is defined as any instrument, apparatus, appliance, material or other article, whether used, alone or in combination, (including the software necessary for its proper application), intended to be used on human beings for the purposes of diagnosis, prevention, monitoring, treatment or alleviation of disease^{1,2}.

UK Market Size

The Med Tech sector contains 3,463 identified companies that generate a turnover of £22.0bn and employ 122,100 people across the UK. The sector showed strong employment growth estimated at 9.5% over 2011-2016. The MedTech sector has the largest number of companies in the Life Science industry, with 65% of all companies. The sector has a concentration of economic activity in four regions of England. Of the 2,843 companies and sites in the sector 1,771 are located in the South East and East of England, the Midlands and Yorkshire and the Humber. Together, these four regions contain 54% of all employment and turnover in the sector³.

Overview of Sector Landscape within the Region

The most recent MedTech landscape survey of the region was conducted in 2006 and found that there were approximately 200 innovative SME companies with products and applications ranging from orthopaedic devices to surgical instruments⁴. At that time, the sector expertise areas were:

- Sensors and diagnostics
- Medical materials
- Nanotechnology
- Miniaturisation and micro-systems engineering
- Drug delivery
- Orthopaedics
- Product modelling, design and engineering

Since 2006, the sector itself has developed rapidly with the emergence of big data analytics which has enabled healthtech, digital health, machine learning and artificial intelligence capabilities to become part of the MedTech sector. The current MedTech sector broadly covers the following 4 categories:

- Medical Devices: Devices used to diagnose, monitor or treat patients.

¹ European Parliament and the Council of the European Union (2007) Council Directive 2007/47/EC of 5 September 2007 amending Council Directive 93/42/EEC concerning medical devices.

² <https://www.nice.org.uk/Media/Default/About/what-we-do/NICE-guidance/NICE-medical-technologies/Medical-technology-definition.pdf>

³ Strength and Opportunity 2016, The landscape of the medical technology and biopharmaceutical sectors in the UK, HM Government

⁴ East of England MedTech SME Companies List, 2006, BioMed Connections.

- HealthTech: Digital health apps, wearables, hearables etc which are used as part of a smart device to monitor health signals and feed back to user, carer or physician.
- Diagnostics: Companion or *in vitro* diagnostics and medical imaging equipment.
- Advanced Manufacturing/Precision Engineering: Manufacturers of clinical, medical or surgical components.

As a region, our levels of innovation in each category are first rate. Appendix 1 illustrates case studies of exemplar companies in all 4 categories, and the expertise of the region has drawn in multinational organisation.

In 2015, a Government report showed that the East of England employed 11% of the UK's MedTech workforce and that the sector itself had a CAGR of 12% - the highest across the Life Sciences⁵. Data from 2016 show that the South East and East of England regions dominate the UK MedTech sector³. However, a key gap for the region is that there is no comprehensive, up to date directory of companies covering the MedTech sector in the East of England. Given the diverse range of companies involved in the sector, compilation of such a directory for the East of England will require significant resource to identify and map each company within the sector supply chain. A MedTech directory for London has been generated by SEHTA and MedCity⁶. A directory covering the East of England would enable the skills, services and supply chain links between the regions to be strengthened.

Key Opinion Leader Feedback: Current MedTech Issues

- “One big issue is supply chain management. We have many highly innovative but small medtech firms each of which needs to cope with sometimes long supply chains. Why buy in China when a company down the road can supply the component...but you didn't know it was there!” William Springs, Managing Director, BioMed Connections
- “Tendering to continue selling products and services, part of the legislative process, takes weeks. Helping MedTech businesses to meet appropriate regulations and set up quality systems would be of enormous benefit, along with access to clinical evaluations and trials.” Daniel Coole, Managing Director, Surgical Holdings⁷
- “Most commercial MedTech manufacturing is done in Ireland. This is limiting the investment in infrastructure in the UK. Innovation is primarily coming from consulting and design houses, for example, The Technology Partnership or PA Consulting. Some innovation is coming from universities, but very little is coming from large companies.” Gino Martini, Country Medical Leader, Roche & Professor of Pharmaceutical Innovation, Kings College London

Key Opinion Leader Feedback: MedTech in the East of England

- “The MedTech Campus will help the NHS to further improve its patient care, enhancing experiences and outcomes while delivering more cost-effective interventions. At the same time, it could generate jobs as the NHS – a major investor in healthcare – becomes more closely

⁵ Strength and Opportunity 2015, The landscape of the medical technology and biopharmaceutical sectors in the UK, HM Government.

⁶ <http://www.sehta.co.uk/londonmedtechdirectory/>

⁷ Anglia Ruskin MedTech Campus Vision Document

http://www.medtechcampus.com/downloads/MedTech_Campus_Our_Vision.pdf

aligned with the UK's MedTech industry." Jacqueline Totterdell, Chief Executive, Southend University Hospital NHS Foundation Trust⁶

- "Our core business is supporting patients at home, particularly assisting with the management of chronic conditions and reducing the length of hospital stays. Medical technologies play an increasingly important role in these areas, with ever-more sophisticated tools being used to deliver good quality of life at reasonable cost. We look forward to the new opportunities and technologies that a MedTech Campus might generate, and are keen to get involved in bringing innovations forward. As well as being a key customer for the sector, we can offer 'real world' settings for clinical trials, the possibility of making test facilities available, and a network of experts and technology users across the NHS and private sectors." Stephen Flanagan, Managing Director, Bupa Home Healthcare, Harlow⁶

Clusters and Communities

- Anglia Ruskin MedTech Campus – Based over three sites in Chelmsford, Harlow and Southend-on-Sea. These sites will provide the infrastructure necessary to support innovation with a combined space of at least 120 acres. The Campus will accommodate up to 1.7 million square feet for MedTech and ancillary businesses, including innovation centres for SMEs and a dedicated Anglia Ruskin MedTech Business Support Service. The Campus will⁶:
 - Leverage ~ £500m of private sector site-related investment.
 - Help grow the UK MedTech turnover for the sector by £1.2 billion (8% of the current UK total).
 - Generate up to 12,500 jobs.
- MedBIC - Business Innovation Centre for Medical and Advanced Engineering in Chelmsford, Essex which offers 1,000 sqm of purpose-built business accommodation to start-ups and early-stage companies.
- MedTech Campus Meet Up community run by Professor Tony Young, Clinical Lead for Innovation at NHS England, Director for Medical Innovation at Anglia Ruskin University and Consultant Urological Surgeon at Southend University Hospital. Founded in Jan 2014, the group runs events at least quarterly to enable and translate MedTech innovation⁸.
- MedTech Accelerator. Led by Health Enterprise East as a joint venture with New Anglia and Greater Cambridge & Greater Peterborough (GCGP) Local Enterprise Partnerships (LEPs), and the Eastern AHSN, the MedTech Accelerator supports and finances projects at an early stage in order to maximise the potential for success in bringing new life enhancing technologies to patients. A total of £1.5 million is available with individual awards to be made of between £15,000 and £125,000 to innovation projects that show the potential to create future spin-out companies primarily out of NHS organisations.
- Surgical instrument manufacturers mini-cluster in south Essex.

Future Cluster Opportunities for MedTech

- GlaxoSmithKline (GSK) Stevenage and the Stevenage Bioscience Catalyst (SBC): Galvani Bioelectronics was established at GSK Stevenage in November 2016 and is dedicated to the development of bioelectronic medicines – a new class of medicines consisting of miniaturised,

⁸ <https://www.meetup.com/Med-Tech-Campus/>

implantable devices. The company was formed through a partnership between GSK, and Google's Verily Life Sciences. Bioelectronic medicine is an emerging scientific field, aiming to use tiny implantable devices to change precise electrical signals in nerves to treat a range of debilitating chronic diseases. As this field develops, there is significant opportunity for clustering of innovators (researchers and companies) and supply chain members around the GSK site in Stevenage and indeed SBC.

- Cambridge Biomedical Campus Technology and Medical Technology Innovation Hub – Proposed hub which will reside on the Cambridge Biomedical Campus at the Addenbrooke's Hospital site. The proximity to clinical setting, clinical trials and access to "real-world" feedback from clinicians/patients would be of significant benefit to companies residing within the hub.

Key Recommendations:

1. An East of England MedTech Company Directory should be compiled and maintained in order to:
 - Fully ascertain the expertise within the region;
 - Map out the supply chain, identify key linkages for easy wins and gaps for current and emerging MedTech product requirements;
 - Estimate the size of the future opportunity for growth and the investment and infrastructure requirements to enable it;
 - Benchmark with the London MedTech directory to determine, and capitalise upon, critical adjacencies in expertise and supply chain.
2. To ensure deliver of the MedTech Directory, a regional MedTech Steering Team should be set up. The Steering Team should include individuals such as:
 - Tony Young, Clinical Lead for Innovation at NHS England, Director for Medical Innovation at Anglia Ruskin University and Consultant Urological Surgeon at Southend University Hospital
 - Martino Picardo, CEO, Stevenage Bioscience Catalyst
 - Tony Jones, Director of Business Development, One Nucleus
 - Claire Thompson, Director, Agility Health Tech
 - William Sprigings, Managing Director, BioMed Connections
 - Julie Houston, Strategy & Economic Development Manager, Harlow Council,
 - Steve Feast, Managing Director, Eastern AHSN
 - Gino Martini, Country Medical Leader, Roche & Professor of Pharmaceutical Innovation, Kings College London
 - Malcolm Lowe-Lauri, Executive Director, Cambridge University Health Partners
 - Sara Wren, Principal Consultant, PA Consulting
 - Anne Blackwood, CEO, Health Enterprise East
3. The Eastern AHSN must continue to take a leadership role, alongside and working with Cambridge University Health Partners and others like One Nucleus, to help continue to build and grow industry-clinical engagement.

Appendix 1: Exemplar Company Case Studies

Medical Devices: Clement Clarke International

Clement Clarke International has been a major force in the manufacturing of innovative medical instrumentation worldwide since 1917. Based in Harlow, Clement Clarke International became part of the Haag-Streit group in 1989. From the beginning of Peak Flow Measurement in 1956, Clement Clarke International has been involved and the widely acclaimed "Mini-Wright" Peak Flow Meter, was first launched in 1976, and became the original portable Peak Flow Meter, now supported by hundreds of published papers.

It is recognised in the industry as "The Gold Standard" for Expiratory Flow Measurement. From here, Clement Clarke International has diversified its range of peak flow meters, adapting and developing current products, along with new innovations to suit the needs and requirements of patients and physicians in a modern environment. The company's range of respiratory medical devices covers diagnosis, monitoring and treatment of many respiratory conditions.

<https://www.haag-streit.com/clement-clarke/>

HealthTech: Ieso Digital Health

In July 2011 Ieso Digital Health was launched with initial investment from Cambridge Angels. Cambridge Angels followed on with further investment in 2013, this time being joined by investors from Imperial Innovations, Clearly So and Harvard Business School Alumni Angels of London.

The company provides evidence-based mental health therapy online. Discreet one-to-one therapy is delivered in real time using written (typed) conversation, with patients meeting an accredited therapist in a secure virtual therapy room, at a time and location that is both convenient and comfortable for them. The use of technology and written conversation offers patient choice and more widespread access to effective, evidence-based mental health therapy, with improved outcomes.

<https://uk.iesohealth.com/>

Diagnostics: Owlstone Medical

Owlstone Medical has developed a breathalyzer for disease. With a focus on non-invasive diagnostics for cancer, inflammatory disease and infectious disease, the company aims to save 100,000 lives and \$1.5B in health care costs.

The company's microchip FAIMS (Field Asymmetric Ion Mobility Spectrometer) sensor is a platform technology that can be programmed in software to detect targeted biomarkers of disease in breath (and other bodily fluids). FAIMS can be used in clinical diagnostics and precision medicine with application in cancer and a wide range of other medical conditions. Highly sensitive and selective, these tests allow for early diagnosis when treatments are more effective and where more lives can be saved.

Owlstone Medical is currently developing tests for lung and colorectal cancer, two of the most common cancer killers worldwide, and for asthma stratification by therapeutic response. The company also sells R&D tools and services to academic, clinical and pharma partners who want to develop breath based diagnostics for their own applications.

In Mar 2017, the company announced an investment from Aviva Ventures, the venture capital arm of Aviva plc, a global leader in insurance. The investment takes Owlstone Medical's total funding to \$23.5 million USD (£19.3 million GBP) since its spin-out from Owlstone Inc in 2016 and will be used to drive test adoption and commercialization of the company's Breath Biopsy® platform.

<https://www.owlstonemedical.com/>

Advanced Manufacturing/Precision Engineering: Enplas

Japanese company, Enplas, is a global corporation with offices in Asia, N.America and Europe. Enplas' worldwide facilities produce advanced electronics combined with plastic technology including ultra-precision design, manufacturing technologies and moulding.

Enplas also develops and mass-produces various life science products. The company specialises in micro-engineered products for life sciences such as 'lab on a chip' (LOC) a device that integrates laboratory functions on a single chip of only millimetres to a few square centimetres in size.

In November 2016, the company announced that it would open a new facility in Essex, its first R&D facility outside of Japan. The company identified the region as a world leader in MedTech and, therefore, has placed its new R&D facility at Chesterford Research Park.

Future plans for activities at the Enplas Chesterford facility include developing products in microfluidic arrays, with particular reference to cancer research and immunotherapy.

<http://enplas.co.jp/english/>

10. SIA Life Sciences bibliography

East of England SIA - Life Sciences Theme, Selected Bibliography

[A Digital Health Hub - Cambridge Oxford London](#)

Agri-Bio Sector Intelligence (Go-Bio, Innovation New Anglia, Hethel Innovation, Norwich Research Park, EU/ERDF)

[Cambridge Growth Update 2016 Data Draw \(Cambridge Ahead Annual Conference January 2017\)](#)

[Enterprising Essex: Opportunities and Challenges \(January 2017\)](#)

[Findings and Recommendations of the London Stansted Cambridge Corridor Growth Commission \(July 2016\)](#)

[Geographical clusters: a vision for the future \(Academy of Medical Sciences, March 2017\)](#)

[Growth Spaces for Life Sciences: Future Growth and Demand \(London Stansted Cambridge Consortium 2015\)](#)

[Making an Impact - UEA's Economic Influence](#)

[Science Industry Partnership Strategic Skills Action Plan](#)

The Cambridge Biomedical Campus and the Cambridge Cluster (Cambridge University Health Partners)

[The economic contribution of the UK Life Sciences industry \(March 2017\)](#)

[The UK Life Sciences Industry and the Public Markets, 2016/17](#)