

Health Material Innovation

A summary of the Accelerating Innovation in Health Materials workshop of the June 5 2018 and next actions.

Background

A one-day workshop with a dinner the preceding evening was held at Lancaster House Hotel on June 5th. This workshop was co-ordinated by the Lancaster University (LU) Material Science Institute (MSI) and the Health Engagement and Innovation Team (HEIT) [@ the Health Innovation Campus (HIC)]. The meeting was funded the Medical Research Council (MRC).

The workshop brought together 68 delegates (30 academics, 12 clinicians and 26 from industry) with interests in the areas of anti-microbial resistance (AMR), next generation sensing (NGS) and biointerfaces (BIO). These had previously been identified as potential areas for growth at Lancaster (the rationales are given below).

The purpose of the workshop was to help:

- 1. Align Lancaster University materials' research at the Material Science Institute (MSI) and broader developments within the Health Innovation Campus (HIC) to clinical and industries' needs for materials in improving health outcomes and in Life Science Research*
- 2. Achieve scale and create environments to foster new interdisciplinary collaboration*
- 3. Build capability and capacity in the context of major funding opportunities*
- 4. Broaden and deepen the degree of industry engagement (utilisation and impact)*
- 5. Guide our internal investments to ensure the greatest impact*

This document reports a summary of the findings/outcomes from this workshop, and when matched against likely government "direction of travel" re: funding in the Life and Health Sciences, provides the basis for a strategic outline for health materials innovation at Lancaster University and future funding requests.

In the context of addressing *research direction* in health care (challenges and unmet patient needs) and likely future funding opportunities, one of the most important documents in recent years is the ***Life Science Industrial Strategy – a report to the Government for the life science sector*** (Sir John Bell, 2017)¹.

Taken with the Sir Andrew Whitty '*Encouraging a British Invention Revolution*', report² and the Government's 2017 Industrial Strategy White paper³, a clear post Brexit picture emerges of:

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https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/650447/LifeSciencesIndustrialStrategy_acc2.pdf

² Encouraging a British Invention Revolution,

http://www.ncub.co.uk/index.php?option=com_docman&view=download&category_slug=publications&alias=83-witty-review&Itemid=2728

- The priorities that government funding will address
- The way that this funding is likely to be allocated
- The expectation of government on Universities and the NHS to deliver a healthy and more productive nation

Sir John notes “[the] advantage of very high productivity (in Health Life Sciences) compared to other sectors... generates a wide range of products including drugs, medical technology, diagnostics and digital tools”. Furthermore, Health Life Sciences sector is widely distributed across the whole of the UK, and bring significant jobs and growth to virtually every region.

The strategy places an emphasis “on putting the UK in a world-leading position to take advantage of the health technology trends of the next 20 years” and highly relevant to Lancaster are the ambitions to:

- Create a platform for developing effective diagnostics for early, asymptomatic chronic disease

A goal that dovetails excellently with phase 2 of the HIC (the potential colocation of regional pathology at the HIC).

- improve UK clinical trial capabilities, so that “the UK’s clinical trial capabilities can best compete globally in our support for industry and academic studies at all phases”

Sir John makes clear that the UK “should be in the top quartile of comparator countries, both for the speed of adoption and the overall uptake of innovative, cost effective products, to the benefit of all UK patient”

In terms of priority and under-researched areas, the report highlights:

- effective diagnostics for early, asymptomatic chronic disease, and
- increased research that will combat the rise of AMR (noting that the UK research base is relatively low – a point that emerges in Lord O’Neil’s report ([Tackling Drug-Resistant Infections Globally: final report and recommendations](#))⁴)

These ambitions require there to be both strong academic/ NHS / industry interfaces, but also the capacity to undertake the activities of basic and translational research.

They also match well with areas that health material innovation can play a pivotal role. At the MSI there is a broad capability and capacity to work at surfaces and interfaces, from fundamental modelling through to the fabrication and utilisation of new surfaces. This is supported by 42 academic appointments (+75 researchers) and underpins both NGS and AMR (and, are broadly non-competitive with other recognised UK centres of excellence in health materials research.) This is relevant to materials to combat AMR, NGS and BIO.

The potential co-location of regional pathology at the HIC (phase 2) provides a distinct “comparative advantage” in the field of developing new diagnostics which aligns with NGS.

June 5th event:

On June 5th, three separate presentations from Profs O'Shea, Jenkins and Short highlighted some of these research strengths. Based upon these presentations we invited comments.

In light of these comments in this summary of the June 5 meeting we have responded to the information captured on the day along with further feedback, and prioritised with respect to the role that Lancaster could play in the context of research into health materials innovation, regionally and nationally in helping to ensure a productive and healthy nation.

Information was captured against the following headings: Staff, Engagement, Research (which we identify as the "Big Three") and Buildings, Equipment, New partnerships and Consultancy, which are informed by the Big 3.

We have prioritised these lists on the grounds that we set out below.

1. STAFF

Sir John Bell's report places a strong emphasis on increasing national productivity and driving innovation in health and life sciences (termed "Health Life Sciences") by leveraging upon the resource of the NHS to conduct clinical trials of new medical technologies, devices, biologics and medicine (reflecting higher TRLs).

However, throughout the consultation process, we have found that this is an area presenting the greatest challenge. Put most simply, in the NHS staff are already "maxed out" in the delivery of patient healthcare and do not have the capacity to deliver on the ambitions of the report. However, this is a "gap" that University-led research could potentially fill. On June 5th we received a significant amount of feedback (see Table 1 below) for the need for building our capacity to work at the academic/ NHS interface, which surfaced in several of the comments received (1.1, 1.2, 1.5, 1.6, 1.7)

	Comment:	Our response:
1.1	Increase resources at UHMBT (and other health trusts) R&I Department to facilitate collaboration	<p>Following on from Sir John Bell's industrial strategy document, this is probably one of most important elements for successes. It is also one that feeds into the other categories and makes achieving things possible.</p> <p>University investment could be targeted at improving this interface and more broadly the academic/NHS interface and this could be achieved through appointments of researchers who are motivated to take basic research into clinical trials.^{5, 6}</p>
1.2	Increase the number of clinical academics x2 - as only 2 in all of LANCS currently	This ties into the above and will be a further discussion point with the Faculty of Health and Medicine at Lancaster.
1.3	An experienced product-to-market role to assist innovations get to market.	<p>Putting these positions in place at Lancaster means we would be able to respond to the required increase in resources and support for facilitation of clinical research.</p> <p>This would seem to fit with the Health Innovation Campus plans for phase 3 developments.</p>
1.4	Product development manager: taking material from "Lab to Patents"	As above.
1.5	More postdoctoral researchers – to do the research.	We believe by building academic capacity first, as in 1.2, this would naturally follow in due course through growth of grant income and industrial projects.
1.6	Industrial secondees – bring in 2-way knowledge exchange + KTPS into industry.	Discuss with HIC how this might be achieved. Access KTP funding
1.7	More PhD projects / students.	See 1.5

Table 1: Collated list of feedback on staff

Conclusion: Investment in new staff to build capacity for translation research is a top priority, but one that needs to be done in partnership with our Faculty of Health and Medicine and in line with (anticipated) broader developments in the HIC. Possible research areas for appointments informed by Tables 2 and 3 below. These then in turn will inform other decisions about investment in buildings, labs, etc.

⁵ Note. The University cannot directly invest in UHMBT

⁶ We do not see these posts being clinical academics, but rather researchers who are keen to conduct translational research

2. ENHANCING ENGAGEMENT:

This we prioritise as the next logical category to consider, as it fits very closely with building our staff capacity (above) and clearly building capability and capacity in 1 (Staff) and 2 (Engagement) are iterative.

The comments received and our initial responses are in Table 2 below.

	Comment: Areas for Enhanced engagement	Our response:
2.1	Physiotherapists	Identify where is relevant to research in health materials innovation.
2.2	Microbiologists	This fits well with anti-microbial focus .
2.3	Veterinary Institutes	This is an interesting angle that we had not previously thought of.
2.4	NHS in Pathology, oncology, dental surgery, urology,	As per 2.1
2.5	NHS executives and managers	In any capacity building exercise (e.g. Staff) we would involve this group in validating potential areas for appointment, re unmet patient need, research questions and likely future funding.
2.6	Existing networks	We accept the point that we can leverage effectively off existing networks within the HIC and BioNOW.
2.7.	Targeted patent audiences	This is a good point that should be considered as we develop a strategic plan.
2.8	AHPs, domestic nurses	As 2.7
2.9	NHS and Industry	To be consider in the context of broader HIC development.

Table 2: Feedback on Engagement

3. Research:

We received substantial feedback on possible areas of research that we could develop at Lancaster University. The information captured is shown in Table 3:

	Comment	Response
3.1	Bio-feedback sensors	This is consistent with developing next generation sensors as a research activity.
3.2	Funding for collaborative research	It is not clear whether this means that the University should provide a source of funding for collaborative research (as Promixity to Discovery) or should enable partners (NHS/Industry) to access new funding streams.
3.3	Integration of Sensors for movement recording	As 3.1
3.4	Joint research positions Lancaster Uni + NHs organisations	This is covered in response to staffing.
3.5	Interdisciplinary research in biomaterials and bioengineering	This is consistent with all 3 areas of research activity, AMR, NGS, BIO.
3.6	Cyrobiology. Cyro-preservation of tissues, cells & biomaterials	May fit with AMR (in biobanking).
3.7	Linking Research projects b/w universities (eg. UCLAN, Lancaster, Manchester, etc.)	This certainly something we would encourage existing and new appointees to do.
3.8	Companion diagnostics for narrow spectrum drug discovery programs.	Consistent with AMR, NGS and BIO.
3.9	Non-invasive diagnostics for deep-seated infections (Eg. Brain abscesses, endocarditis)	Builds depth into AMR and NGS activities.
3.10	Non-antibiotic antimicrobials	NGS
3.11	Microsampling	NGS
3.12	Support staff – for clinical teams eg. Funding for research podiatry in diabetic foot clinics	Highly relevant to infected wounds (AMR) but his would not be a direct University funded activity.
3.13	Functional aspects of proteins	Probably out of scope; many well-funded research groups in the UK.
3.14	Wearables	NGS
3.15	CE Marketing / MDR / Compliance Testing . Rigs and Competency	Fits with consultancy – see later
3.16	Biofilms	AMR

Table 3: Feedback from June 5 event on Research areas

Areas to exploit for research growth have to be patient-need led, fit with existing strength at Lancaster (that could be strengthened to achieve critical mass), and consistent with the direction pointed in the Sir John Bell report (for example increased capacity for translational/clinical trial work).

With only finite resources available there is a need that investment (in people and follow-on investment in labs, equipment etc) is highly strategic, and does not take Lancaster into “congested” research spaces (e.g. regenerative medicine). The consequence of this is that any strategy developed from the June 5th event, and similar consultations, firms up 2-3 activities that we can do really well.

4. Others Categories:

Valuable information was fed-back on other areas for future investment and growth including Buildings, Infrastructure and Equipment, Consultancy and New Partnerships. These comments have been collated, with generic feedback in Appendix 1. This information is extremely useful in informing Lancaster about e.g. the types of infrastructure investment that will be required, following academic appointments to optimise interactions with NHS and perhaps more so industry partners. This information is particularly pertinent in the phase 3 development of the HIC, as this stage focuses on spaces for industry engagement and start-ups.

Particularly worthy of mention in this section are comments pertaining creating an “ecosystem” for ideas to generate and collaborations to form, and this obviously cannot wait until the University executes strategic plans for growth. The HIC (through the HEIT) provides an ideal vehicle from the University side of this equation to co-ordinate follow on events, create and sustain fora that encourage engagement and innovation. Our sponsors of this event BioNow provide a similarly excellent vehicle for continuing engagement from the Industry/NHS side of the equation.

Conclusion and next steps.

The strategic use of new staff appointments could achieve a number of important aims in the near term:

- Consolidate and build critical mass in health innovation materials research.
- Appointees with a keen interest in translational research (clinical trials) would help build capacity for collaboration with e.g. NHS partners and AHPs.
- These appointees would also help build collaborations with SMEs, and be able to access a range of different funding schemes and increase our capacity to write grants and work with SMEs.
- Focussing appointments into targeted fields would address the need for research in areas of unmet patient need, whilst being complementary (and non-competitive) with other UK research activity in health materials.

Additionally, the University needs to consider how to maximise opportunities for IP and commercialisation (spin-outs).

Broader issues that feed into the HIC project include infrastructure (labs and equipment), expertise in regulatory, product development and creating an “ecosystem”. These are equally important and should be addressed through phases 1-3 of the HIC ie. from now out to ca. 2021.

Acknowledgment: We would like to thank Dee Hennessy who excellently facilitated the event and Lizzie McAdam whose organisational ability was exemplar (and without her the event would not have worked!).

Appendix:

Buildings		A lot of these aspirations could be met by the HIC development and will be being raised to the appropriate people involved in that who could make it happen.
	Creating healthy environments	
	Use the HIC for regular events - tailored to specific audiences such as clinician workshops, general public, teachers, elderly, parents, businesses	
	Make it "The Place" to go to with good coffee and adhoc seating	
	Clean room facilities for manufacture of material based medical devices	
	Prototyping Equipment / facilities	
	Reusable space close to academics	
	social space to match problems (clinical to solutions (technical)	
	SME hot Desk - accessible and open for casual collisions and collaborations	
	loan kit to experiment with	
	Clinical research space for PTS	
Consultancy		
	ISO 13485 Regulatory Expertise and a QMS (Quality Mg't System)	
	IP – who owns what?	
	F.D.A	
	MHRA / Brexit?! How can we turn it into an advantage? Get MHRA & partners involved <u>earlier</u> to guide & speed up development.	
	Health Technology Assessment	

	How can we speed up (safely) the regulatory journey? To get products to market more quickly (currently 17 years!)	<p>The second concerns expertise in regulatory, product development, prototyping etc. This is a bit out of the scope for the Material science Institute, or indeed normal University business. However, it is highly likely that this will fall under the scope of the Health Innovation Campus</p>
	Health Economics	
	What needs to happen to make getting it wrong be ok?	
	Who owns the intellectual property rights as the innovator moves jobs?	
	ISO implementation testing team - regulatory, pathway, optimisation, A7	
	Managing innovation	
	Initial discussion of idea with industry to identify potential & feasibility before starting the work	
	Friendly investors / VC - get their perspective	
	Engage good design experts early! Fail fast, fail cheap!	
New Partnerships		<p>As above, some of these comments fall under the scope of usual University business (grant writing), whilst others will feed into the scope of the Health Innovation Campus.</p>
	Partner with SMEs (who funds it?)	
	Partner with veterinary schools – vets are the main cause of AMR. But also the Hub of development (DW)	
	Pharmaceutical companies	
	Large life sciences companies	
	Cancer research	
	Tissue banks	
	Collaborations to prove early clinical proof of tech concepts	
	Industry contacts to know whether they are in the idea.	
	Industry clusters – eg. Bionow – who have the reach & relationships with SMES.	

	Initial commercialisation organisations to incubate ideas and start the go-to market research.	
	Template easy to read IP Agreements for various cases	
	Grant writing assistance / co-ordination.	
	Get the message out about the health inequalities by age / area. People don't realise the scale.	
Equipment		<p>To know the equipment for current and future requirements is very useful and provides a basis for planned equipment purchases, particularly leveraging existing research council schemes.</p> <p>Some items could be readily obtained under existing schemes by means of responsive mode grant applications. For University led purchases, the list will need to be tested against, and be driven by, the nature of the appointments of staff that will be made. All equipment must support the new staff as well as existing.</p>
	Advanced Manufacturing for health	
	Metrology	
	Equipment to help characterise surfaces eg. XPS for WC purposes + characterisation / optimisation	
	NGS (sequencers)	
	Surface Mass Spec - imaging SIMS / MALDi	
	Mass Spec equipment for molecular characterisation / quantification	
	Testing efficacy of antibiotics against clinical isolates from infected joints.	
	IuR - Confocal Microscopy, Light sheet Microscopy, IP> Raman micro-spectroscopy + SORS, Micro-CT,	
	OvK - Cyro EMC (block-face SEM), TEM, nanimoentation, plasma coating amchine, BIOL lab adjacent (eg. Cell work), cell sorter	