Considerations for creating effective academic-industrial partnerships

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On 12th February 2025, a joint meeting of the UK Ageing Networks was held in Liverpool, UK. It was convened by the 'ECMage' (extracellular matrix ageing) network and EuroAgeNet; an initiative led by ECMage but involving four other UK ageing networks; namely the building links in ageing science and translation network (BLAST), the cognitive frailty interdisciplinary network (CFIN), the ageing and nutrient sensing network (AGENTS) and the food systems for older people (Food4Years) network, together with industrial and European partners. In this Meeting Report we summarise the opinions of an industrial panel and round-table discussions on barriers and opportunities related to academic-industrial partnerships.

The initial driving force behind the meeting was the emerging importance of the extracellular matrix (ECM) in biological ageing [1] and the potential to modulate processes of tissue ageing via existing and novel longevity interventions [2,3], biomaterials [4] and ECM-derived biomolecules [5-7]. The meeting convened a panel of experts (see acknowledgements) spanning academia, industry, and the interface between the two, to explore barriers, opportunities, and recommendations for successful collaboration - particularly in the context of ageing research and commercialisation. Two panel members were academics who had launched start-ups, one had launched a start up

after a research fellowship, one was a programme manager at a UK 'catapult' which provides innovation support for business, and the others had moved from academia or post-doctoral research into scientific leadership roles in industry.

Whilst translational geroscience has been criticised for assuming that translational success can be achieved without establishing the underpinning mechanism[8], commercial products to slow ageing based on ECM-derived peptides are already on the market, albeit via less regulated means such as supplements. To bridge the gap and fuel development of regulated and targeted therapies based on mechanistic insights, an understanding of the commercialisation process and effective working with industry will often be a prerequisite for real-world impact. Indeed, key emerging themes from the meeting included the importance of early commercial thinking to address the mismatch in timescales between academia and industry as well as the fruitful approach of aligning research with a company's strategy: thereby allowing development of breakthrough and targeted therapies grounded in mechanistic insights that are poised for regulatory approval. This report sets out considerations for effective industrial-academic partnerships, academic entrepreneurship and funding mechanisms (Fig. 1). It considers the feasibility of a multi-partner, cross-sectorial approach to academia-industry collaboration – an 'industry club' – for ageing, the economic challenges, and key aspects of health equality and equity in slowing or reversing ageing.

Considerations for effective industrial-academic partnerships

A key theme of the discussion was the widespread challenge of mismatched timescales between academia and industry. Industry increasingly uses contract research organisations (CROs) for cost-effective laboratory testing, data analysis, trial management, intervention evaluation and implementation development, unless they know an academic group that is very well set up and able to act more like a CRO. Delays in project approvals, procurement, and legal processes can hinder new academic-industrial collaborations. These issues are especially challenging for spinouts or newer companies when legal teams are under-resourced. One pragmatic approach for academic researchers and companies with an interest in partnering could be to anticipate what the research work in 18 months will be and focus the collaboration on that, not what's happening right now. Otherwise, by the time the contracts are in place, the opportunity may have passed.

Panel members saw a significant need for training for academics in the basic aspects of contract law, specifically in the context of collaborating with companies. One reason contracts take so long to negotiate is lack of legal knowledge by academics and lack of scientific knowledge by generalist lawyers. Academics need to know what terms they should be fighting for within the contract and what they can just let go, which could be mitigated by training and better understanding industrial priorities.

Panel members emphasized aligning research with a company's strategy. Companies won't invest in academic work unless it fills a strategic gap and aligns with their mission sufficiently to justify their attention and application of resources. The best matches occur where the company lacks expertise or perhaps the model system but can provide insight or translational thinking to the academic group, such that regular communication and contributions from both sides build a true collaboration. However, some companies may, on occasion, choose to get involved in the fundamental science, particularly where the context is less time-pressured and

setting up a PhD project for example, or even a direct financial or indirect resource-based contribution to a research project, may be viable.

The panel felt persistence and resilience are important in overcoming barriers. All parties need to be as flexible and creative as possible. For example, innovative solutions to a need may be to involve a CRO but for the academic group to provide training in key research methods that are often required in ageing research. This training can include working with old/aged primary cells, where use of cell lines may otherwise have been the norm, or include the input of intended end users such as clinicians or older adults themselves to understand feasibility and improve acceptability.

Industrial research and development representatives are looking for academics who are interested in being part of the continuing journey and onward development of what they have generated to date as a partnership. There should be an understanding on both sides of the differing timescales and focus between industry and academia as well as the balance between IP protection and publication for academics. Academic researchers are not expected to have an in-depth understanding of the business's strategy or to have clinical data, but they should have a clear understanding of the clinical need, potential market, a realistic assessment of the need for and readiness-level of their technology and its clinical outcome when applied. Company size can influence technology development and commercialisation. Participants considered that smaller companies provide more exposure to broader aspects of the business, whereas larger companies typically have more funding and more expertise but may be less influenced by a single researcher's vision.

Finding the right academic-industrial links and specific contacts within an organisation can be a challenge. For both parties, having a professional, well-populated and up-to-date online profile, such as on LinkedIn, and also institutional webpages, for academics, is essential to maximise the chances of being found for the right thing and then taken seriously. Publication and patent searches may also be used by industry to find relevant academics. Smaller projects can be important in establishing long term collaboration and trust. Participants felt that more work is needed to improve and increase networking possibilities between academia and industry, across all fora but with a platform analogous to 'FindaPhD.com' being mooted (see Table 1 for examples).

The right product and the right time for industry development

The panel were asked what makes a really good product for development and when in development is it ready for investment and management by industry. There was a view that university technology transfer offices (TTOs) can be very conservative about launching commercialisation processes. Academics may need to engage with industry, at least informally, to develop serious interest before TTOs feel justified in allocating their scarce resources. Academic and TTO interests are not exactly aligned in this respect. TTOs and impact teams can be siloed, and incentives could encourage a more joined up approach. For an academic wanting a smooth path, the ideal technology should be interesting enough to get a patent application supported, but not so interesting as to incur unmanageable fees to license it out of the university! Before starting the process, academics should talk to other people who have experience of spinning out from their institution and understand where that sweet spot is.

It is equally important to talk to venture capitalists and other early-stage investors to gauge opinions ahead of developing business partners and a commercial case. There was a general view that most industry representatives and investors are willing to have an initial

conversation. If academics wait until they have a fully developed target and a disease model in humans, it could already be way too late to involve industry. If an academic researcher has an idea about a disease model and a target that works *in vitro* or in organoids it's probably time, if not already too late, to start thinking about commercialisation. It was reiterated that it is never too early to think about commercialisation. If academic researchers publish too early, they won't be able to get patents, and without IP, the project won't be able to get investment.

In the early life of a start-up, the founder's vision is the most important driving force as no one else is going to understand the potential so well. However, founders need to think about the point at which they are willing to part with the idea to grow the business, how much time and effort they are willing to put in, and what they want from the process. Participants familiar with the challenges and opportunities of company formation stressed the importance of being clear about career development plans and whether this includes the full-blown option of leading a spin-out. Founder enthusiasm is vital, alongside realism about skills and capacity. Mentorship from more experienced individuals in industry or academia or both can help mitigate some shortfalls in expertise. Ensuring a safety net for potential failures is something institutions could do to ease the path.

There are many mechanisms to help academics commercialise ideas and gather the data that will convince TTOs that the idea is viable and raise awareness of investors. Questions to consider for a start-up include what kind of people you need to surround yourself with; where is investment going to come from; what is your market like and what is the long-term commercial viability of the product or service? Joining a business accelerator (Table 1) was recommended as a way forward, especially if you have no prior expertise.

A critical factor in the success of academic entrepreneurship is a solid understanding of business fundamentals. Scientific innovation alone is not sufficient to ensure impact; researchers must either acquire business knowledge themselves or collaborate with partners who possess it. This enables a clearer definition of the value proposition, alignment with market needs, and the development of a viable commercial strategy. Without this foundation, promising solutions risk being misdirected or failing to gain traction. Strategic partnerships that combine scientific excellence with business insight are essential to translate research into sustainable ventures.

Table 1. List of relevant business accelerators, venture investors and networking organizations

Name	**Link**	**Specialism**
Ada Ventures	https://www.adaventures.com/	Healthy Ageing (UK)
Apollo Health Ventures	https://www.apollo.vc/	Healthy Lifespan (transatlantic)
Barclays Eagle Labs	https://labs.uk.barclays/about	Entrepreneurs (UK)
Earlybird	https://health.earlybird.com/	Health (Europe)
Elmes Venture Partners	https://emlesbioventures.com/	Aging and health
Generator Ventures	https://generatorvc.com/	Aging and health
KQ Labs	https://www.crick.ac.uk/research/applying-our-research/entrepreneurship/kq-labs	AI in healthcare (UK)

Halo	https://www.halo.science/	Partnering
Innovate UK ICURe	https://iuk-business-connect.org.uk/programme/icure/	Pre-accelerator (UK)
In-Part	https://www.inpart.io/	Partnering
Longevity Ventures Partners	https://www.longevityventurepartners.com/	Silvertech
Pioneer Group Accelerator	https://thepioneergroup.com/accelerator-programme/	Life Sciences
Praetura Ventures	https://www.praeturaventures.com/	Life Sciences (UK)
Rocket Bio	https://rocketbiocapital.com/	Tissue engineering and regenerative medicine
Third Act Ventures	https://www.thirdact.vc/	Agetech
Zinc	https://www.zinc.vc	Science for health (UK)

Funding mechanisms and recommendations

The discussion focussed on UK Research and Innovation (UKRI) based funding schemes (as this was a UK-based meeting) and highlighted best-practice approaches. However, mechanisms can be generalised as 1) market assessments to help academics understand potential, 2) moving from technology readiness to clinical trial, 3) co-funding academic projects with industrial input, 4) funded challenges set by industry to address specific needs or questions and 5) co-creation via PhD projects. Matching with existing organisations early in the process is important – finding a common goal requires contributions from both academic and industrial parties.

1) The Innovation to Commercialisation of University Research (ICURe) program (BBSRC/Innovate UK) was praised for its early-stage support to academics to help find what is unique about particular products and how they may succeed in their market. 2) The Developmental Pathway Funding Scheme (DPFS) (MRC/Innovate UK) focusses on clinical development, with a pathway to commercialisation. It is valuable in directing academics to engage with stakeholders and includes critical upskilling on IP. 3) The academic-led industrial partnership awards (IPAs) (BBSRC) were also cited as a means to start working with industry with industry only being required to contribute a proportion of the cost and at discovery stage which may circumvent some IP issues.

4) Some industry representatives reported difficulty in identifying the first steps for interacting with UKRI. The NC3Rs CRACK IT scheme was highlighted as a means for commercial organisations to begin academic collaborations. This industry-led scheme links an industrial need with academic researchers. This is a great way for companies to have specific problems and questions addressed by the academic community whilst accessing large scale UKRI funding and parallel support. It's a staged process with a gated approach and there is an opportunity to develop excellent ageing-related applications.

5) Industry representatives highlighted positive experiences with UKRI's industry-led collaborative training partnership awards to train doctoral (PhD) candidates, which has developed academically brilliant students with a business understanding. Doctoral Training Partnerships (DTPs) and CASE (Co-operative Awards in Science and Technology) studentships or direct or co-funding can support the placement of students in institutions and research groups

that would normally be inaccessible to industry because of the limited capacity of the leading academics to engage. PhD studentships are a channel for industry to work with new people and foster interaction around application-centred problems and were cited as part of the solution to strengthening the academic-industry interface. In this way, collaborations can be built from the ground up.

In a grant funding model where costs are reimbursed retrospectively, rather than the grant being allocated as a cash sum, commercial cash flow can be impacted and this can be a particular problem for smaller companies that have just started out. Furthermore, there can be years of negative cash flow before generating income in ageing-related industries, so cash investment is required. Different funders can recognise non-monetary contributions to projects such as access to facilities or data or may be more focused on job creation as an output. Customised approaches could therefore be considered for the ageing sector.

A gap in scientific knowledge was identified in underpinning biology and mechanisms of disease. A systematically weak understanding of underpinning biology and mechanisms makes it difficult to build robust cases to commercialise discoveries. Research to rectify this can be insufficiently application-led for industry to be involved whilst the funding for the necessary foundational research is spread too thinly in academia. This creates a bottleneck for drug-development that could be solved via public-private partnerships in key areas. For UKRI-funded projects in underpinning biology and disease mechanisms an associated follow-on commercialisation fund was recommended to maximise commercialisation opportunities, though the institution-led 'impact acceleration account' mechanism is noted. Participants also suggested that research funding could be less compartmentalised and more holistic and interdisciplinary. In this way the biological sciences can link with the psychosocial aspects that will support adoption. These would include feeding in understanding and methodologies to examine health behaviour change principles; for example, what are the attitudes and beliefs, influences, facilitators and barriers affecting whether people will adopt or adhere to new health interventions? This can also ensure that social factors such as health inequalities that can affect access to care or involvement in trials, or health literacy that can influence when someone first seeks support for a health issue, can be considered in any implementation programmes. The idea that funders could have a greater risk appetite and go for more blue-sky projects with bigger potential was also aired, because something truly innovative isn't going to tick all the boxes.

An industry club for ageing

Around 2007, the UK's Biotechnology and Biological Sciences Research Council (BBSRC) proposed an industry club for healthy ageing aimed at facilitating pre-competitive collaboration between industry and academia and between different parts of industry. Industry clubs are a form of multi-partner collaboration in which work outputs are shared amongst participants enabling the cost and/or risk of research or development to be spread across a number of entities. Often, an annual or other periodic membership structure is used, sometimes with tiers, hence "club". Industrial members can contribute to their leadership and can direct allocated governmental

funding towards relevant pre-competitive academic research. The panel were asked whether industry was currently reluctant to participate in such initiatives because routes to market in the ageing sector were too immature, although industry clubs have been successful in other sectors.

Some panel members felt this approach was hampered as the science of ageing was still not sufficiently mature, for example not yet having identified validated biomarkers of aging [9] to support the assessment of interventions and robust economic and investment models, to underpin the workings of an industry club as well as inform routes to market.

The panel felt that a club is potentially more relevant to start-ups and there are many more of these than 20 years ago. Many already sit at the intersection between academia and industry and a club could be useful for establishing and testing ideas around ageing and drug mechanisms. However, most start-ups in every area fail and this is not commonly appreciated outside the venture community. One reason for failure can be that the underlying biology is not well-described or understood. The business model is also not well suited to preventative medicine in some sectors.

For larger companies, it can be difficult to engage in industry clubs because of intellectual property (IP) contamination – a risk of other members claiming in future that IP development running independently somewhere else in the business was enabled by IP developed in the club. This is hard to mitigate due to the near impossibility of knowing everything that a large organisation is working on.

One point of view is that clubs work best in sharing best practice – not necessarily sharing biological or development details but sharing methods and ways of saving money and making things faster. Once there is some trust, a club might move on to the next level of scientific collaboration.

Economic and other challenges for ageing research and therapies

The long-term nature of ageing can pose challenges due to the costly longitudinal perspective required particularly for human studies, combined with the need for near-term delivery of outcomes in commercial and government-funded research. Meeting participants suggested longer-term grant funding and scoring ageing research grants differently to other health-related grants could compensate for the different timescales of their outcomes. Improved biomarkers to measure healthy ageing were recognised as important to enable measurement of trajectories rather than endpoints, providing interim measures or leading (predictive) indicators and supporting a preventative approach. Parallel improvements in clinical trial design could be leveraged to shorten timelines. Alternative approaches would be to study exemplar diseases as a proxy for ageing and to leverage big data sets to identify the genetic and environmental factors influencing ageing. There was a strong appreciation of the societal and economic value of preventative medicine, contrasting with its apparent disconnect from current funding approaches and research timelines.

Participants felt there is a growing commercial interest driven by an increased awareness of health. The commercial drivers for therapies to slow ageing include cosmetic, therapeutics, and lifestyle interventions. Participants suggested that customers may choose to purchase personal products to slow or reverse ageing, but a demographic shift in the health of older persons could be more effectively driven by meeting their food and nutritional needs via societal interventions. Marketing and promotion of interventions to older populations and cohorts could therefore be more accurately targeted and implemented. New therapeutics arising from research

on the basic biology of ageing may lead to increases in longevity, but participants recognised that this should be accompanied by a corresponding increase, if not expansion, in health span, defined as the number of years lived in good health. This itself would have huge direct and indirect economic implications and it was noted that individuals may choose to work longer to help finance their "health-span" (healthy life years).

Some participants believed business investors and conventional research funders were likely to focus on ageing reversal rather than preventative treatments. Changing the emphasis towards healthy ageing and prevention rather than reversal and treatment will be important. Research funding strategies should respond accordingly and remain mindful of the associated risk of health inequalities if ageing-reversal is only available to those who can afford it.

Health equality and equity in the development of therapies related to ageing

Ensuring health equality and equity in the development of therapies and interventions related to ageing is a significant concern. Clinical trials would ideally involve representative groups across age ranges, ethnicities and other characteristics. Past improvements in healthy life expectancy have tended to benefit the rich and healthy rather than the poor and unhealthy, with interventions having often been tested in naturally healthier groups with less diversity than in groups with poorer health. Connections need to be drawn between the social and economic benefit of intervention and the necessary expenditure by government to enable the intervention for poorer groups. Studying past models of public intervention, such as hypertension control, may be fruitful.

Equally, use of big data should consider whether data sets are inclusive and address issues within under-represented groups. Ethical reservations about use of people's personal demographic, health and lifestyle information also need to be addressed. Work is needed for the public to be informed enough about ageing research and its possible benefits to consent to the sharing of information for the purpose of developing better models of ageing. Maintaining consistent priorities and continuity over time and through changes of government is a potential challenge.

Commercial innovation is necessarily driven by an expected financial return, hence meeting participants recognised the scale of the task in advancing specific therapies or interventions, such as improving diet and exercise, that do not have strongly linked economic drivers. However, society is most likely to benefit economically from an increased health span in older people. It was suggested that the research community has a significant public engagement task to articulate the strong case for research focused on public health benefit through healthy ageing that is accessible to everyone, with consequent, substantial economic benefits. Here government-led initiatives, charitable activities or social enterprises could play a key role.

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Diseases of Aging and Regenerative Medicine (DARe) at the Biomedical Research Institute at Novartis; Professor Lorna Harries, University of Exeter, Co-Founder director and Chief Scientific Officer for SENSICA; Dr Carina Kern, CEO and Founder of LinkGevity; Dr Victoria L Newton, Senior Research Scientist at No7 Beauty Company, Walgreens Boots Alliance; Dr Hadi Mirmakel-Sani, Senior Programme Manager, Cell and Gene Therapy Catapult; and Professor Cathy Merry, University of Nottingham, Co-Founder and CEO of Peptimatrix. Panel members were given the opportunity to review the meeting report for accuracy.

Competing interests

J.S. reports research funding from Walgreens Boots Alliance. I.T. is founder and CSO of Lipiwell. The other authors declare no competing interests.

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Figure Legends:

Fig 1: Summary of recommendations for academics, industrial and commercial partners, and universities, research institutes and funders arising from the discussion.