

# STRONGER TOGETHER

## – harnessing the power of collaboration across borders

Den nordiska välfärdsmodellen är satt under press och life science-sektorn som helhet står inför stora omvälvningar, inte minst genom intåget av nya teknologier och kravet på ökad digitalisering. I både Sverige och Danmark kraftsamlar regeringarna för att positionera sig som ledande life science-nationer. Var för sig har länderna begränsade möjligheter att konkurrera globalt, men genom ett utökat skandinaviskt samarbete står vi starkare i kampen om investeringar, företagsetableringar och internationella talanger. Det Öresundsregionala samarbetet inom ramen för Medicon Valley är ett exempel på att en sådan utveckling är möjlig. Klusterorganisationen Medicon Valley Alliance (MVA) kan nu presentera ett antal nyckelfaktorer för framgångsrika forskningssamarbeten som stärker konkurrenskraften i svensk och dansk life science.

The life science industry is undergoing a period of transition worldwide. Pricing pressures by healthcare systems who are under cost pressures themselves due to ageing populations and the rise of chronic diseases, technological changes towards biopharmaceuticals and personalised therapies, sector disruption driven by digitalisation with technologies such as artificial intelligence and big data that gives patients greater knowledge about and influence over their treatments, are just some of the trends affecting the life science sector globally. Furthermore, across all industries, competition in terms of talent, investment, trade and technological development is intensifying.

Against this backdrop, countries are not standing still – nations such as the UK have been explicit with their ambition to strengthen the development and growth of national life science industries.

In Sweden, life science is no less strategic to us as a nation, as evidenced by the strong political will to keep Sweden on the competitive forefront as a leading life science nation, that should also strengthen the development of the healthcare system in Sweden and generate economic development opportunities. As part of this strengthened focus on life science, the national life science office is in the process of developing a national life science strategy, which prioritises the following areas:<sup>1</sup>

### **1. Partnerships, coordination and having a long-term perspective**

This reflects the Swedish model where responsible parties cooperate and contribute towards common goals.

### **2. Better utilisation of health and clinical data for research and innovation**

Given the large amounts of health and clinical data generated, it holds the potential to contribute significantly to the development of future healthcare and prevention efforts, if used properly and with respect for the individual's privacy.

### **3. Policy development and ethics**

Moving to more personalised care requires that law and regulation keeps pace from an ethics and privacy perspective, while providing the right conditions for development.

4. Integration of research and innovation in healthcare  
Research and innovation should be embedded and be a natural part of the delivery of health and social care.

### **5. Welfare technology in social care**

This requires the development and implementation of technologies that strengthen the user's independence, create a more secure environment, and facilitate new ways of working.

### **6. Research and infrastructure**

Access to existing advanced technologies creates the conditions for being on the forefront of research and innovation – a key factor to being a leading nation in life science.

### **7. Competence supply, talent attraction, and lifelong learning**

The need for competencies in both the private and public sector must be met, especially when increasingly specialised expertise rises in demand.

### **8. International attractiveness and competitiveness**

It should be attractive to establish a life science presence in Sweden, and easy for startups to flourish.

Just across the border, Denmark is in turn also prioritising the sector as key for the country's growth and employment in the coming future. In 2018 the Danish government published a growth plan for life science,<sup>2</sup> that similarly seeks to make Denmark a leading life science nation in Europe, by focusing on the following six key areas that are aimed at improving the growth conditions of the national life science industry:

#### **1. Making it attractive to conduct R&D in Denmark**

This includes: increased tax deductions for R&D; the prioritization of public funding to research areas related to life science; strengthening excellent research; and creating better opportunities for promising young scientists.

#### **2. Increasing clinical research in Denmark**

This includes: the establishment of a national organization to promote clinical trials in Denmark; reducing fees for

commercially-initiated clinical trials.

#### **3. Developing a top-class Danish Medicines Agency**

This includes: increasing dialogue with the life science industry; piloting a scheme for the introduction of risk sharing in the drug subsidy system; and strengthening the Danish Medicines Agency's engagement in the European Medicines Agency (EMA)

#### **4. Creating better access to skilled labour**

This includes: expansion of the tax scheme for foreign researchers; evaluating the student intake of higher education programmes; and having the life science industry represented on the Danish Health Authorities' forecast and student intake committee

#### **5. More start-ups and digital transformation**

This includes: investigating opportunities to increase investments in life science, e.g. via a new fund; better conditions for compensating employees with warrants; introducing tax deductions for investors; strengthening technology transfer from universities; and ensuring a simple and effective framework of cluster and innovation initiatives within life science.

#### **6. Targeted international efforts**

This includes: strengthened international cooperation with health authorities to promote Danish exports; strengthened life science expertise on key markets to ensure increased market access and export; increased efforts to attract knowledge-intensive life science investments to Denmark; and strengthening Healthcare Denmark with particular focus on life sciences.

One life science cluster, two national life science strategies and three regions

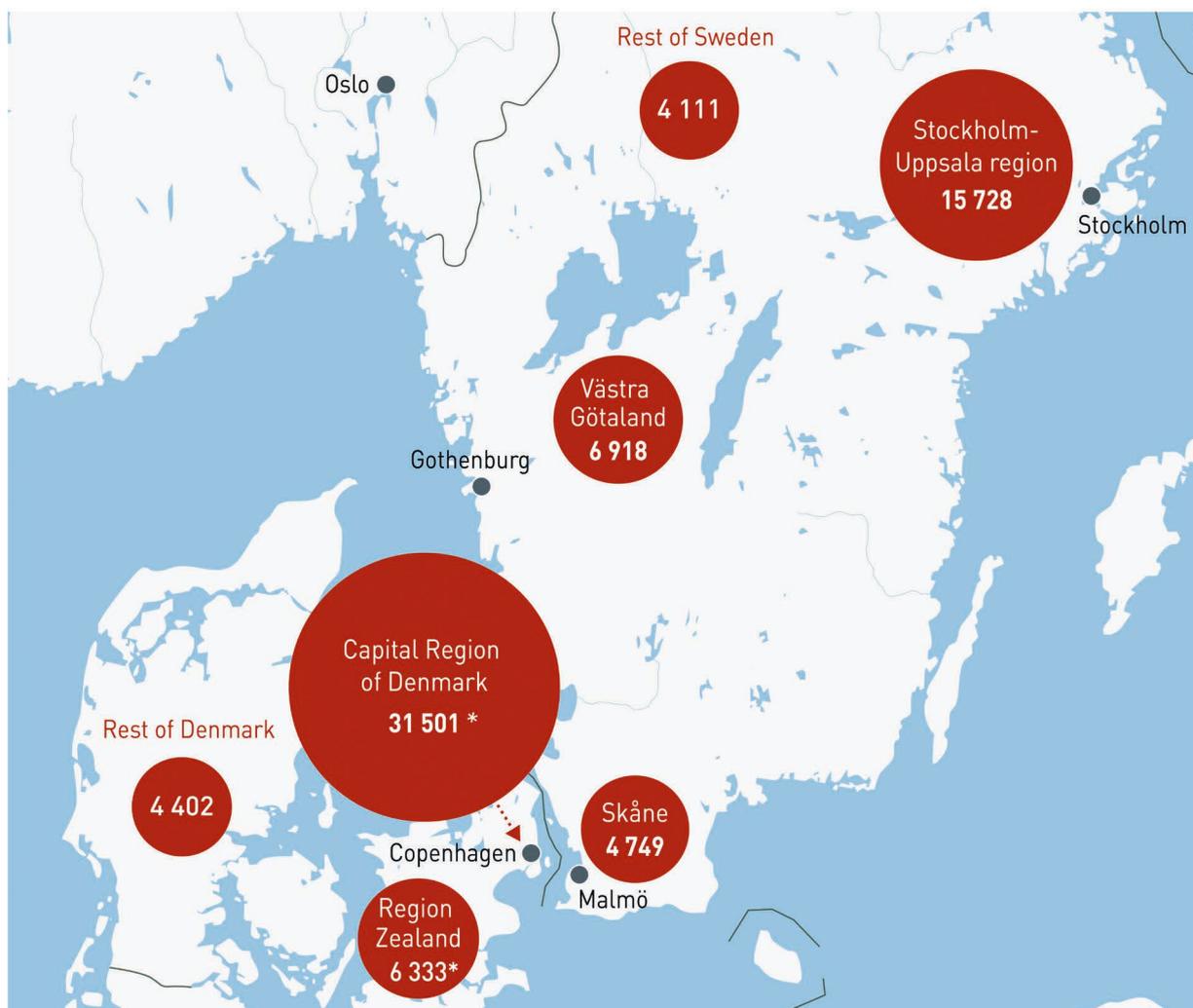
There are clear similarities between the two national strategies – both recognize the importance of adopting an international perspective, not just for strengthening exports but also for attracting talent and investments; both see competence supply and skills development as foundational for future growth; both see the strengthening of research, both basic and clinical research, as well as its associated infrastructure, as a key cornerstone; and both also recognise the key role that the healthcare system plays in the life science ecosystem, through clinical research, the appropriate use of health and clinical data, and the adoption of innovations for the betterment of healthcare system and ultimately the patient.

We have also observed some overarching differences between both strategies. While the Danish strategy has a more explicit growth-oriented and internationalisation perspective, the Swedish one emphasises on collaboration as being a cornerstone for future success.

For example, the Danish growth plan includes an explicit strategy towards supporting startups, including increasing financial opportunities through investments and funding, as well as strengthening technology transfer from universities, which would be an important area for Sweden



## EMPLOYMENT BY REGION IN DENMARK AND SWEDEN



Source: Statistics Denmark, Statistics Sweden and information from the biggest life science companies in Denmark.

## EMPLOYMENT AND CHANGE OVER TIME\*

	2016	Change 2015-16	Annual change 2008-16
<b>Denmark</b>	<b>42 236</b>	<b>3.9%</b>	<b>1.7%</b>
Capital Region of Denmark	31 501	3.5%	2.1%
Region Zealand	6 333	4.0%	1.1%
Denmark, rest of	4 402	6.4%	0.2%
<b>Sweden</b>	<b>31 506</b>	<b>0.9%</b>	<b>-2.2%</b>
Skåne	4 749	-1.5%	-4.6%
Stockholm-Uppsala region	15 728	2.2%	-2.3%
Västra Götaland	6 918	-0.1%	0.5%
Sweden, rest of	4 111	0.7%	-2.6%
<b>Medicon Valley</b>	<b>42 583</b>	<b>3.0%</b>	<b>1.0%</b>

Source: Statistics Sweden, Statistics Denmark and information from the biggest life science companies. \* The figures from Statistics Denmark have been adjusted due to a systematic review of the employment figures for all of the Danish municipalities in Medicon Valley. The figures have been corrected to take two types of sources of error into account: 1) Companies that have changed their industrial classification code to life science during the period 2008-2016 have been included in the entire period; 2) Life science companies with a non-life science industrial classification code have been included (for instance Novozymes). As a result, the figures from last year's report cannot be compared directly with this year's figures.

Figure 1: Share of life science employment in Denmark and Sweden.

as well. The Swedish Agency for Growth Policy Analysis (“Tillväxtanalys” in Swedish) noted that in 2016, 40% of life science employees in Sweden came from small- or medium-sized life science companies, contrasting with just 29% in 2007.<sup>3</sup> Furthermore, the number of micro- and small-sized life science companies (0–49 employees) has grown by 57% during the same period, numbering close to 1,800 companies as of 2016. Given the importance of SMEs in the Swedish life science sector, it is key that they are given the right conditions to grow and succeed in an international market.

In turn, we agree that the Swedish stated focus on partnerships and collaborations, with a shared ambition, is key for the future. The life science industry is global in nature, and from a global perspective, Sweden is the eleventh largest exporter of pharmaceuticals and medtech globally, measured in export per capita in 2017, while our neighbour Denmark holds fourth place on the global list. At the same time, Medicon Valley (the life science cluster based in the Öresund region that spans the Capital Region of Denmark and Region Zealand in Denmark, and the region of Skåne in Sweden) employs 58% of those working in life science in Denmark and Sweden combined, making it Scandinavia’s leading life science region and showcasing the strength of collaborating across the border [see Figure 1].

Similar strengths exist within the research environment, which is a particularly important building block for the development of a life science cluster like Medicon Valley. A strong research environment can serve to attract companies and talents, and generate new ideas and innovations.

In 2017, the Dutch research institute CWTS at Leiden University, on behalf of Medicon Valley Alliance, conducted a bibliometric comparison of ten European life science clusters based on their total influence in terms of research. Their study showed that, between 2006 and 2016, Medicon Valley experienced the greatest percentual increase in the number of scientific publications compared to nine other outstanding European life science clusters<sup>4</sup>, totalling 32,027 scientific publications. 13% of these publications were among the ten percent most frequently cited in their respective fields.

In turn, 54% of Medicon Valley’s scientific publications arose from international collaboration, and such international collaborations has led to significantly more citations than publications resulting from national collaborations of the work of individual research groups [see Figure 2 and Figure 3]. For example, among all the ten clusters analysed, publications produced in international collaborations are more frequently cited than those resulting from national collaborations or no collaborations, with an average MNC average of 1.8–1.9, versus 1.1 for the latter two categories. Given the impact of international collaborations on research quality, this is something to be encouraged. The presence of the large research facilities, European Spallation Source (ESS) and Max IV, on the outskirts of Lund, are also expected to attract many international researchers to the region and thus further boost the level of international collaboration.

Transborder collaboration within the Öresund region is also a feature – between 2006 and 2016, every research in-

## SHARE OF INTERNATIONAL COLLABORATIONS BENCHMARKS 2006-2016/17

Region	Output Share
Scotland	67%
Flanders	62%
Zurich	61%
Stockholm-Uppsala	61%
London-Cambridge-Oxford	59%
Medicon Valley	54%
Netherlands	54%
BioValley	51%
Munich	51%
Île de France/Paris	48%

Source: CWTS B.V.

Figure 2: Share of international collaborations benchmarks

stitution in Medicon Valley have co-produced at least 20 scientific publications in the life sciences with an actor from the other side of the border within the Öresund region. The University of Copenhagen and Lund University have in particular been key drivers to these trans-Öresund collaborations.

It is however worth noting that the research networks in Medicon Valley are still predominantly national, signalling that there are certain structures that favour national collaborations, for example national education and research structures, with grants often national in nature. We believe that there are synergies to be won in strengthening cross-border collaboration, particularly in Scandinavia with a shared culture as well as proximity to a strong ecosystem of industry, academia and healthcare actors.

### A successful case in point: ReproUnion

A good example of this is the ReproUnion initiative, which aims to increase knowledge about involuntary infertility and reproductive diseases, develop new treatments, and strengthen prevention in the area, through the joint mobilisation of forces across the Öresund region. ReproUnion started in 2010 and is built on a public-private collaboration with support from the European Union, Ferring Pharmaceuticals, Region Skåne, Lund University, Malmö University, Copenhagen University, the Capital Region of Denmark, and Medicon Valley Alliance.

The initiative currently represents more than 50 PhD students and approximately 30 senior researchers from both sides of the border. The clinics who are partners of ReproUnion have access to large patient materials, including 4,000 IVF/ICSI cycles per year, 1,500 seeking andrological management, and 6,000 semen analyses.

There are three key features to the ReproUnion initiative that we see as having contributed to its success:

#### 1. Adopting a challenge-driven approach

The collaboration is built around the identification of top challenges in reproductive health, which has served to bring together the top research talent both internationally as well as regionally to jointly address these challenges. For example, one of the five challenges<sup>5</sup> that ReproUnion aims



## INTERNATIONAL COLLABORATIVE PARTNERS IN THE LIFE SCIENCES (2006-2016)

National collaborations are most common in Denmark as well as Sweden, as shown by this network analysis of the research institutions with which actors in Medicon Valley collaborate with most frequently, nationally as well as internationally. The international institutions with which Medicon Valley's researchers work are primarily in western Europe, particularly in Scandinavia. There are also a few American universities in the diagram – Harvard, Stanford, Duke University, the University of California and the University of Washington – as well as the University of Sydney; these are the only universities outside of Europe whose collaboration with Medicon Valley is extensive enough to be included here. It is important to remember that the diagram only includes research institutions that collaborated with a Medicon Valley actor at least 150 times between 2006-2016 and jointly produced a scientific publication. It does not show the collaboration of external actors with other research institutions in the world.

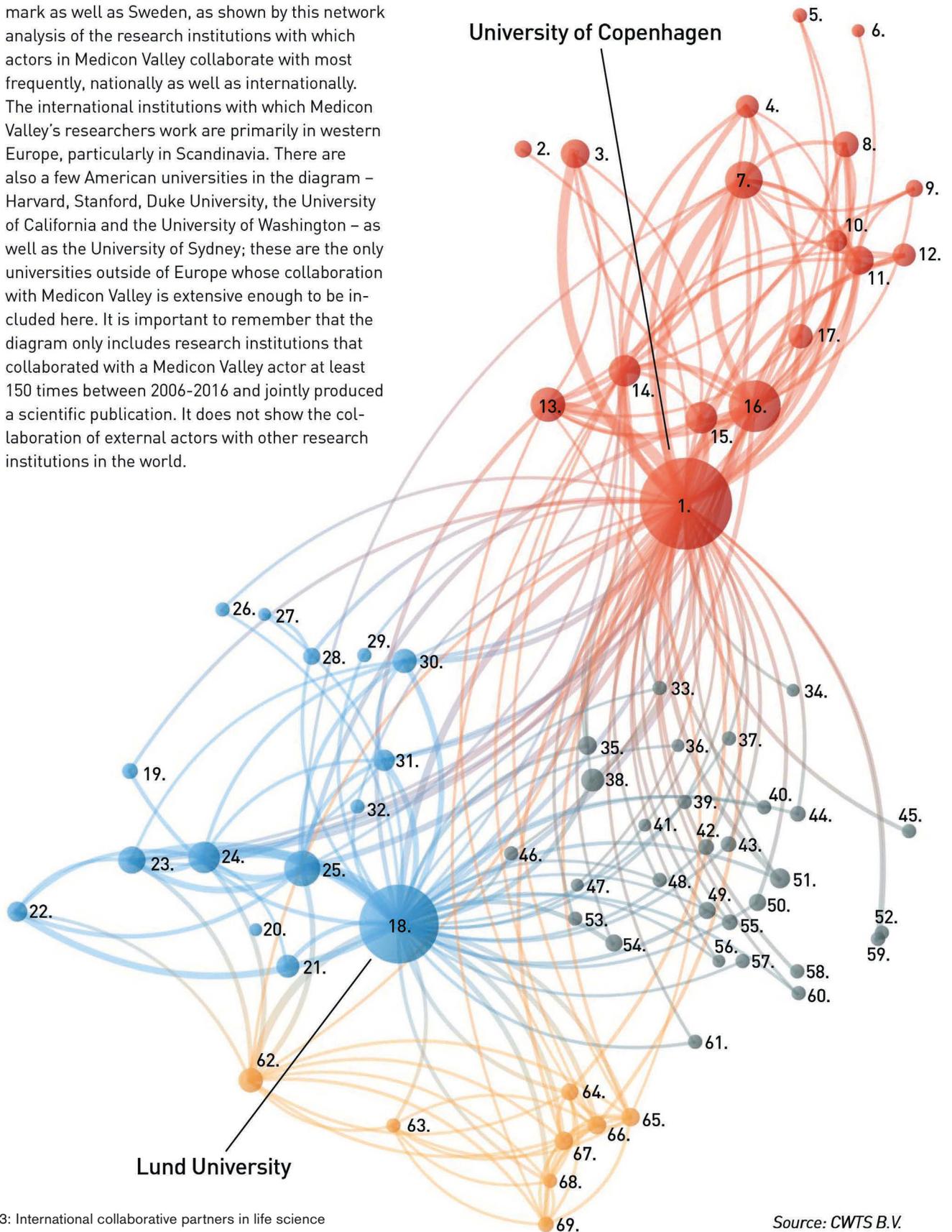


Figure 3: International collaborative partners in life science

Source: CWTS B.V.

## RED

### The Danish research institutions

1. University of Copenhagen
2. Roskilde University
3. Technical University of Denmark
4. Aalborg University
5. Roskilde Hospital
6. Hillerød Hospital
7. University of Southern Denmark
8. Herlev Hospital
9. Frederiksberg Hospital
10. Gentofte Hospital
11. Bispebjerg Hospital
12. Hvidovre Hospital
13. Aarhus University
14. Aarhus University Hospital
15. State Serum Institute
16. Rigshospitalet
17. Glostrup Hospital

## BLUE

### Most of the Swedish institutions as well as the Scandinavian institutions

18. Lund University
19. Swedish University of Agricultural Sciences
20. Kristianstad University
21. Malmö University
22. Linköping University
23. Uppsala University

24. University of Gothenburg
25. Karolinska Institute
26. Norwegian University of Science and Technology
27. Haukeland University Hospital
28. University of Bergen
29. University of Iceland
30. University of Oslo
31. University of Helsinki
32. University of Turku

## GREY

### International research institutions that collaborate with both Swedish and Danish institutions

33. Duke University
34. University of Sydney
35. National Institutes of Health
36. University of California SF
37. University of Toronto
38. Harvard University
39. University of Manchester
40. Maastricht University
41. King's College London
42. VU University Amsterdam
43. Erasmus University Rotterdam
44. Leiden University
45. Max Planck Society
46. University of Washington Seattle
47. University of Bern

48. University of Groningen
49. Katholieke Universiteit Leuven
50. University of Amsterdam
51. University College London
52. Humboldt-Universität zu Berlin
53. Ghent University
54. Stanford University
55. Radboud University Nijmegen
56. Ludwig-Maximilians Universität München
57. Heidelberg University
58. University of Zürich
59. Freie Universität Berlin
60. University of Milan
61. French Institute of Health and Medical Research

## YELLOW

### International research institutions that primarily collaborate with the Swedish institutions

62. Umeå University
63. The Arctic University of Norway
64. University of Cambridge
65. Utrecht University
66. Imperial College London
67. University of Oxford
68. National and Kapodistrian University of Athens
69. German Cancer Research Center

## Network analysis of Medicon Valley's international collaboration

- The graphic shows collaborations in the life sciences between research institutions in Sweden and Denmark (at least one of which is located in Medicon Valley) that led to publications between 2006–2016. A minimum of 150 instances of collaboration is required for an institution to be included in the graphic. The thickness of the lines and dots shows the collaboration volume – the larger the dot or the thicker the line, the greater the number of collaborations.
- The colours are generated automatically in the computer program VOSViewer, which classifies groups or networks of research institutions with more frequent joint collaborations. The Danish research institutions are shown in red, while most of the Swedish institutions as well as the Scandinavian institutions are in blue. The (usually) international research institutions that are in a network with closer connections to the Swedish institutions are in yellow, and in grey are the international research institutions that have as many connections to both Swedish and Danish institutions.

to address is the securing of the female ovarian function, through the creation of a human artificial ovary within a ten-year period. This challenge-driven approach has led, among others, to the attraction of more than 20 doctoral students to the Öresund region, who are being trained as future reproductive medicine researchers. This builds on collaborations with international research associations such as the European Society of Human Reproduction and Embryology (ESHRE) and European Association of Urology (EAU).

### 2. Collaborating across borders, sectors and disciplines

Solving these top challenges within reproductive health requires the engaging of partners, not just across borders, but also across sectors and disciplines. ReproUnion's partners range from fertility clinics, to specialists engaged with research in cellular and molecular medicine, environmental and occupational medicine, social work, and public health. A concrete example of cross-border collaboration can also be seen in the establishment of a formalized patient mobi-





lity agreement between the Capital Region of Denmark and Region Skåne, allowing free mobility for some categories of patients with reproductive disorders within the region. Another example is the establishment of an Öresund fertility counselling clinic, consisting of one unit in Denmark and one in Sweden, with the aim of preventing infertility through information and counselling of patients.

### 3. *Creating innovative funding mechanisms*

A key factor for ReproUnion's success has been its choice of financing model. To overcome the challenge associated with national funding mechanisms, ReproUnion has adopted a joint financing model, where a common funding platform grants resources to projects which aim to combat infertility. This joint funding platform requires that the various regional partners are together responsible for assessing potential projects and related issues. This ensures that priorities and interests within the partnership are aligned towards common goals, thus combating fragmentation and the pursuit of special interests.

### **Small vessels navigating an increasingly turbulent sea – a way forward**

Given that Denmark and Sweden jointly combined contributed to 3.6% of global life science exports in 2017, the two countries can be likened to small vessels navigating in a big sea, that is in turn facing turbulent times. There are therefore definite advantages to be had in adopting a joint Scandinavian face towards global markets, harnessing the strengths and resources of both nations to create a multiplier effect generated by regional synergies. We see three concrete steps that could be taken towards this end:

#### 1. *Identify joint areas of strongholds – and collaborate across shared challenge-driven platforms*

With the two nations adopting a stronger and more strategic focus with the development of national life science strategies, this could be taken one step further by identifying common areas of strength, and collaborating around shared challenge-driven platforms through research and innovation, in order to create a stronger international profile for both countries. These areas can include reproductive health, oncology, CNS and diabetes, which are already established scientific strongholds in Medicon Valley, and can be further complemented by developments in other regionally strong sectors (such as ICT, mobility and food). A challenge-driven, multi-disciplinary and cross-sectoral approach to research and innovation can provide the conditions to thrive in an increasingly complex environment.

#### 2. *Creating bi-national funding mechanisms*

The success of ReproUnion shows that creating joint bi-national funding mechanisms can enable a more focused and aligned mechanism for collaboration within the triple helix (industry, academia and government), thus bringing the best resources and talent from both sides of the border to address an issue of strategic importance to the region. We would thus like to see a more coordinated approach from the Danish and Swedish life science offices in increasing the flexibility of funding mechanisms to encourage a cross-border approach to research and innovation, including supporting startups and micro-enterprises within life science.

#### 3. *Harness data at a Scandinavian level*

Given how digitalisation is transforming both the healthcare and life science sectors, data will increasingly be the

new currency of choice in determining the attractiveness of countries as a base for research and innovation. The Swedish national life science office has explicitly mentioned the better utilisation of health and clinical data as a key priority area, and we see value in exploring opportunities for aligning this ambition and Swedish health data assets (health registers, clinical databases and biobanks) with our Danish counterparts (such as the "Data Saves Lives" initiative, which also aims to ensure the better use of Danish health data), to provide enhanced data volumes for the conducting of research. This will require a coordinated approach to the treatment of and access to data to ensure that data security and personal integrity is maintained, while also serving to propel the development of personalised treatments and therapies that will benefit patients in both countries.

Medicon Valley, with its strong university environments and deep research traditions, innovative companies, large and small, and high-quality healthcare systems, all located in a small geographic radius, shows how strong we can be together, if borders become less of a barrier and we see instead the benefits of adopting a transnational perspective towards industry, research and growth in Denmark and Sweden.

#### FOOTNOTES

1. <https://www.dagensmedicin.se/artiklar/2019/06/10/sverige-ska-bli-ledande-inom-life-science/>
2. <https://eng.em.dk/media/10524/03-15-2018-factsheet-for-the-danish-governments-growth-plan-for-life-science.pdf>
3. <https://www.tillvaxtanalys.se/publikationer/pm/pm/2018-04-06-den-svenska-life-science-industrins-utveckling---statistik-och-analys.html>
4. These nine clusters include: London-Cambridge-Oxford, the Netherlands, BioValley (a German-French-Swiss cluster that includes Basel, Alsace, Freiburg, Karlsruhe, Mulhouse and Strasbourg), Scotland, Flanders, Zurich, Munich, Ile de France/Paris, and Stockholm/Uppsala. The clusters in the comparison that resemble Medicon Valley most closely are Stockholm-Uppsala, Flanders, and to a degree, Munich.
5. See <https://reprounion.eu/science/> for further details on the five challenges that ReProUnion is aiming to address.

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