

# Amsterdam Knowledge Capital

Where life sciences and business meet



**AIM** Amsterdam Innovation Motor

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# Contents

Introduction	5
1 Knowledge Capital	7
Knowledge Clusters	
Infrastructure	
ICT	
Business and Financial Services	
Knowledge Workers	
2 Life Sciences	13
Dissemination of Knowledge	
Think-tanks	
Life Sciences in the Amsterdam Metropolitan Area	
Highlights of Amsterdam Life Sciences	
Oncology	
Neuroscience	
Cardiovascular Diseases	
Infectious Diseases	
Amsterdam's Tools and Technology Platforms	
3 Amsterdam Life Sciences: Largest Research Institutes	18
The Academic Medical Centre (AMC)	
The VU University Medical Centre (VUmc)	
The Netherlands Cancer Institute (NKI)	
Sanquin	
Swammerdam Institute for Life Sciences (SILS)	
4 Amsterdam Life Sciences: Some of its spin-off Companies	24
Agendia	
Avantium	
SARA	
5 Facilities	28
Science Park Amsterdam	
Medical Business Park AMC	
Other Facilities	
Amsterdam Life Sciences: Your Contact Point	
Colophon	32





# Introduction

Amsterdam, the capital of the Netherlands, is an excellent business location for life sciences. This brochure brings together the key facts and figures. While Amsterdam is not the only city dedicated to building a solid base in the knowledge economy, it nevertheless has assets that are difficult for its European rivals to match. You'll discover the highlights of Amsterdam's life sciences strengths, in particular in the medical sciences. We hope you'll enjoy getting to know Amsterdam, the knowledge capital.

## An Inspiring City

Amsterdam has a strong tradition as a city of inspiration. It was already leading the way in trade and creativity at the close of the Middle Ages. It remains an open city, with its sights firmly fixed on the future.

The City of Amsterdam was built around the Dam, which separated the sea from the River Amstel. The last reach from the river was called Rak-in, now the street Rokin, beneath which, in 2013, the new underground railway, the North-South line, will transport around 200,000 passengers per day.

Around the Dam, the city was built in horseshoe-shaped concentric rings. After centuries of expansion, the outer ring is nowadays formed by the A10 ring road. Along this ring road are several clusters of knowledge-intensive activities. The financial centre is based in the south, in the Zuidas area, scientific research is found in the east, the ports in the west, and Amsterdam Airport in the south-west. The medical cluster is distributed around the bottom half of the ring.

Centuries of expansion have nevertheless preserved Amsterdam's authentic old city centre, which

remains as a unique kind of creative breeding ground for knowledge-intensive expansion. In the centre, not surprisingly, there is lots of activity, especially in the creative sector and the arts. Moreover the Netherlands, and Amsterdam in particular, is number three in the list of the world's pleasantest places for expats. All of this goes to show that Mick Jagger was quite right, when he called Amsterdam "the world's smallest metropolis."





# 1 Knowledge Capital

Amsterdam is a knowledge capital with a strong tradition of developing and applying knowledge. Centuries ago, the city's trade guilds were already beginning to establish and develop knowlege from an entrepreneurial perspective.

In Amsterdam, the city of the philosopher Spinoza (1632-1677), Jan van der Heyden – the ‘Dutch Leonardo da Vinci’ – invented (in 1672) the hose fire extinguisher, a hydraulic pump which achieved a constant pressure. His idea for street lighting using oil lamps found a ready market, and was soon found everywhere from Paris to the Japanese island of Deshima. In the field of life sciences, the Amsterdam naturist Jan Swammerdam (1637-1680) discovered the unprecedented possibilities of microscope research: he was the first

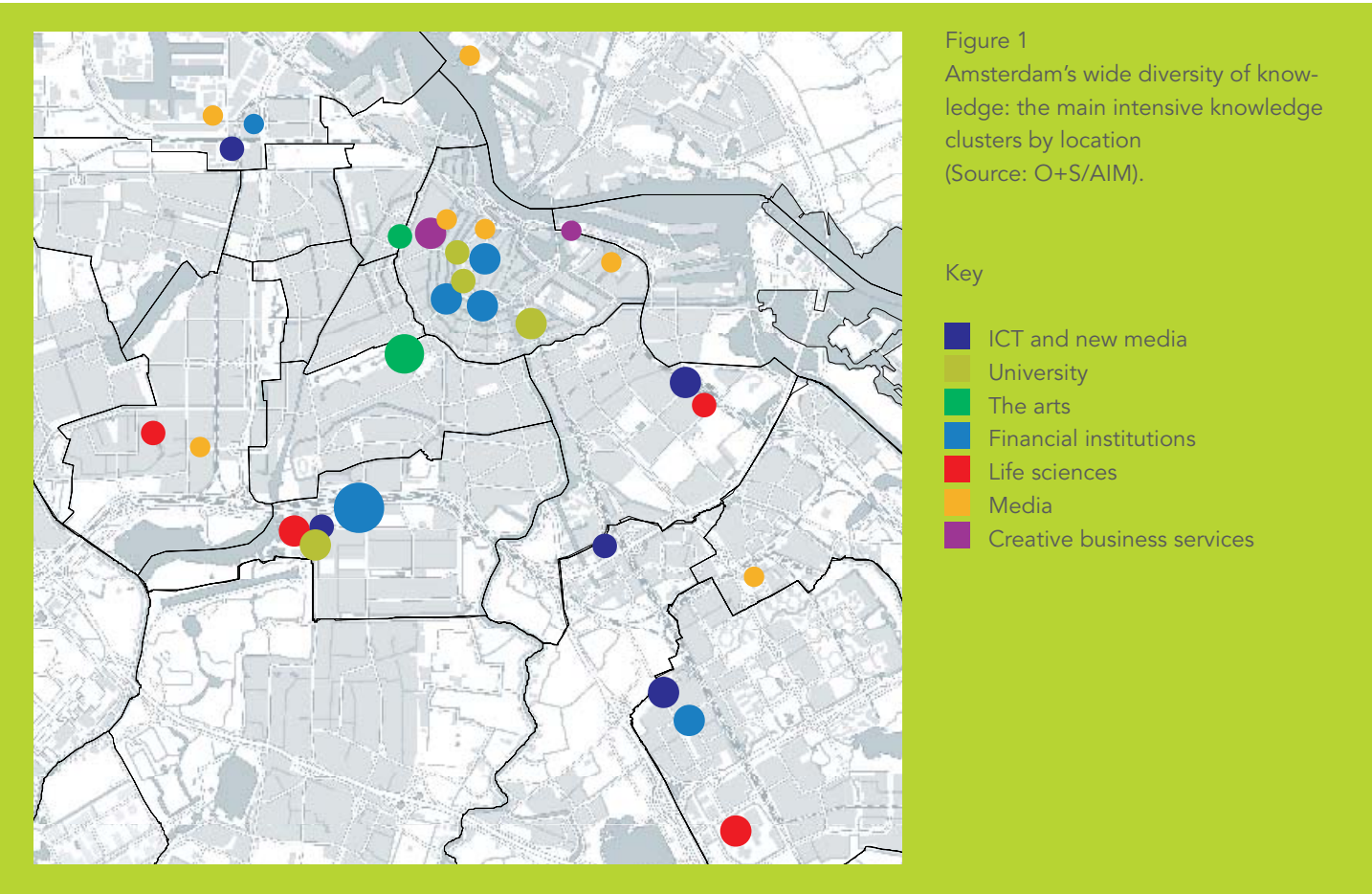
human to see red blood cells and to describe the structure of the brain, lungs, and spinal marrow.

## Knowledge Clusters

There are still discoveries to be made and knowledge to be acquired in Amsterdam. ‘Knowledge is power’, according to the familiar proverb. Yet knowledge alone is no longer enough: in the 21st century, it is the development, exchange, application and commercialisation of knowledge that spell success for economic regions. In a worthwhile knowledge

capital, therefore, not only universities are necessary to develop knowledge: close cooperation is needed between the city council, businesses, academia and the remaining ‘knowledge clusters’ (see figure 1) to make knowledge accessible and to commercialise it.

The presence of sufficient knowledge workers, good physical and technological infrastructure, and a selection of facilitating companies are other essential factors. More on that next.







### Infrastructure

Amsterdam is a multi-purpose hub, and Amsterdam Airport Schiphol is one of the largest airports in Europe. Schiphol employs around 58,000 people, and 42.5 million travellers pass through the airport every year. There are connections to all the world's regions, and yet the city centre is only 20 minutes away. Amsterdam also has excellent international train connections to Germany and (as of 2008) a high-speed line to Brussels and Paris. Furthermore, a network of roads and

waterways links the region to the rest of Europe. Finally, Amsterdam also has an innovative port: the first in the world to have a covered terminal and a container terminal where transshipments can be loaded on one side, and unloaded on the other.

### ICT

Amsterdam also has a great ICT infrastructure: the European heart of information technology can also be found near the ring road. SARA Computing and Networking Services is located here, along with the

national supercomputers Teras and Aster, the academic network SURFnet and the virtual reality facility, the CAVE™. Along with the Amsterdam Internet Exchange (AMS-IX), SARA is one of the world's largest Internet hubs.

### Business and Financial Services

The largest financial institutions in the Netherlands, plus an assortment of supporting service agencies, have grouped themselves in Amsterdam's Zuidas area. Of the 24 companies that determine the AEX, 15 are

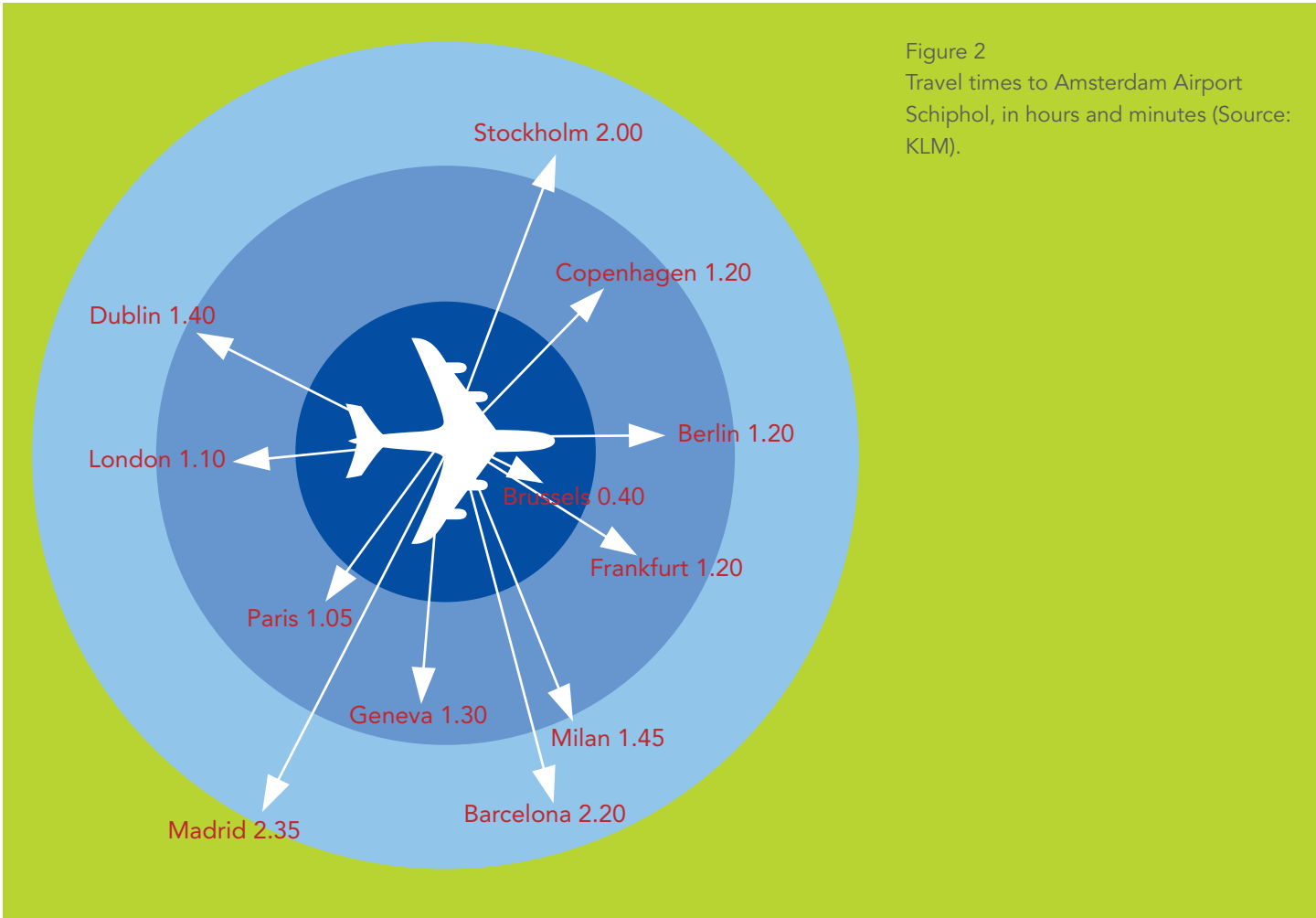
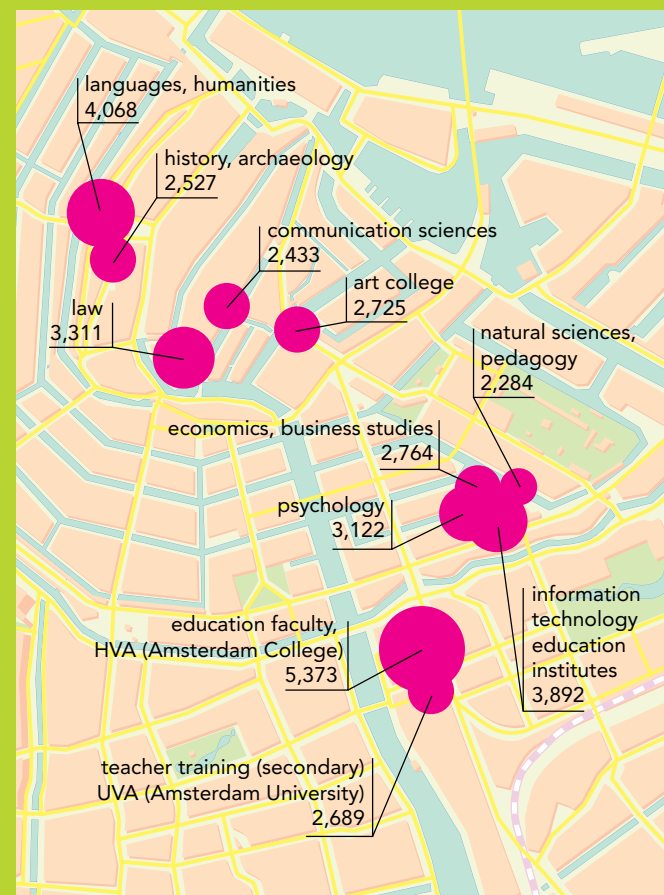
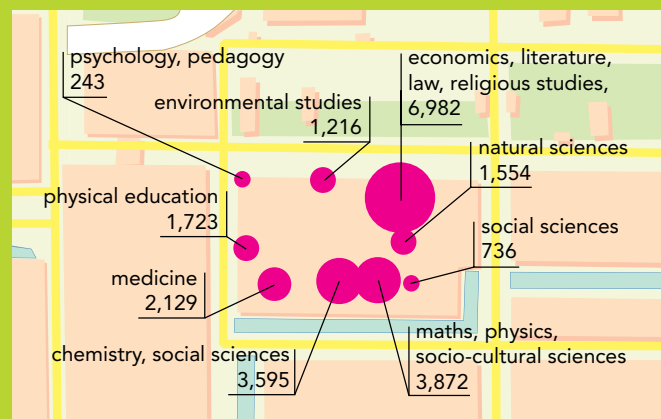
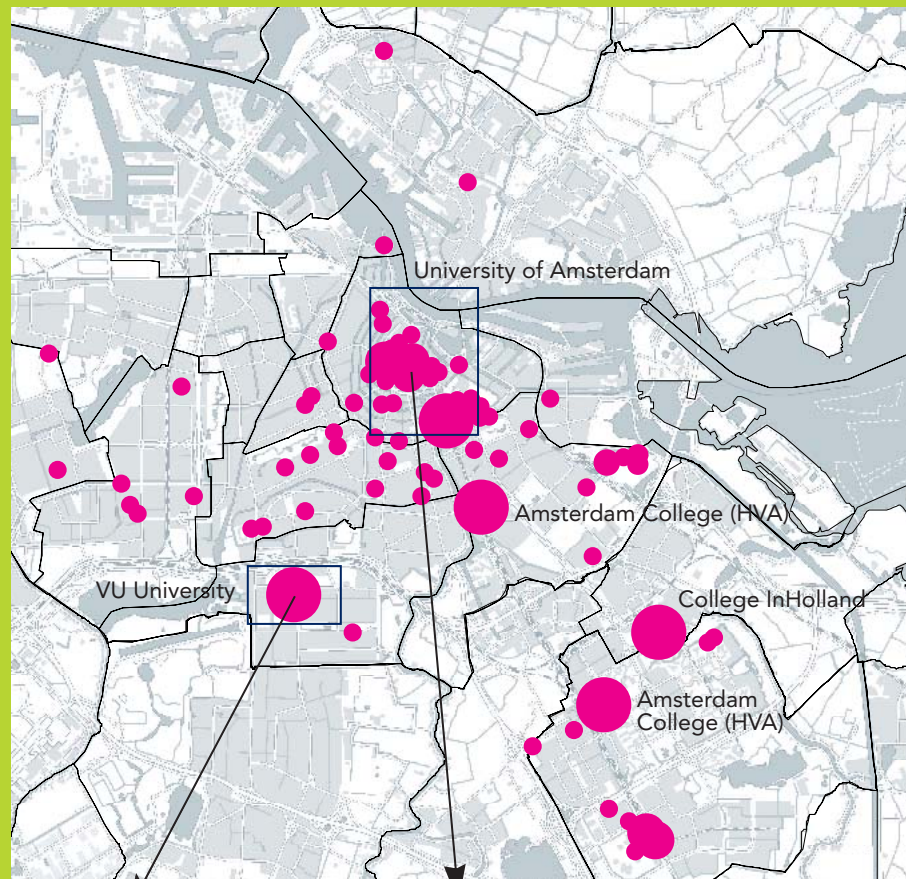


Figure 2  
Travel times to Amsterdam Airport Schiphol, in hours and minutes (Source: KLM).



Figure 3  
Students in higher education in the City of Amsterdam (Source: O+S).

Key  
500 Students  
5,000 Students



located here. For this reason, it is the prime place in the Netherlands for internationally oriented companies to base their headquarters, with Amsterdam Airport Schiphol on the corner and international train connections a short stroll away.

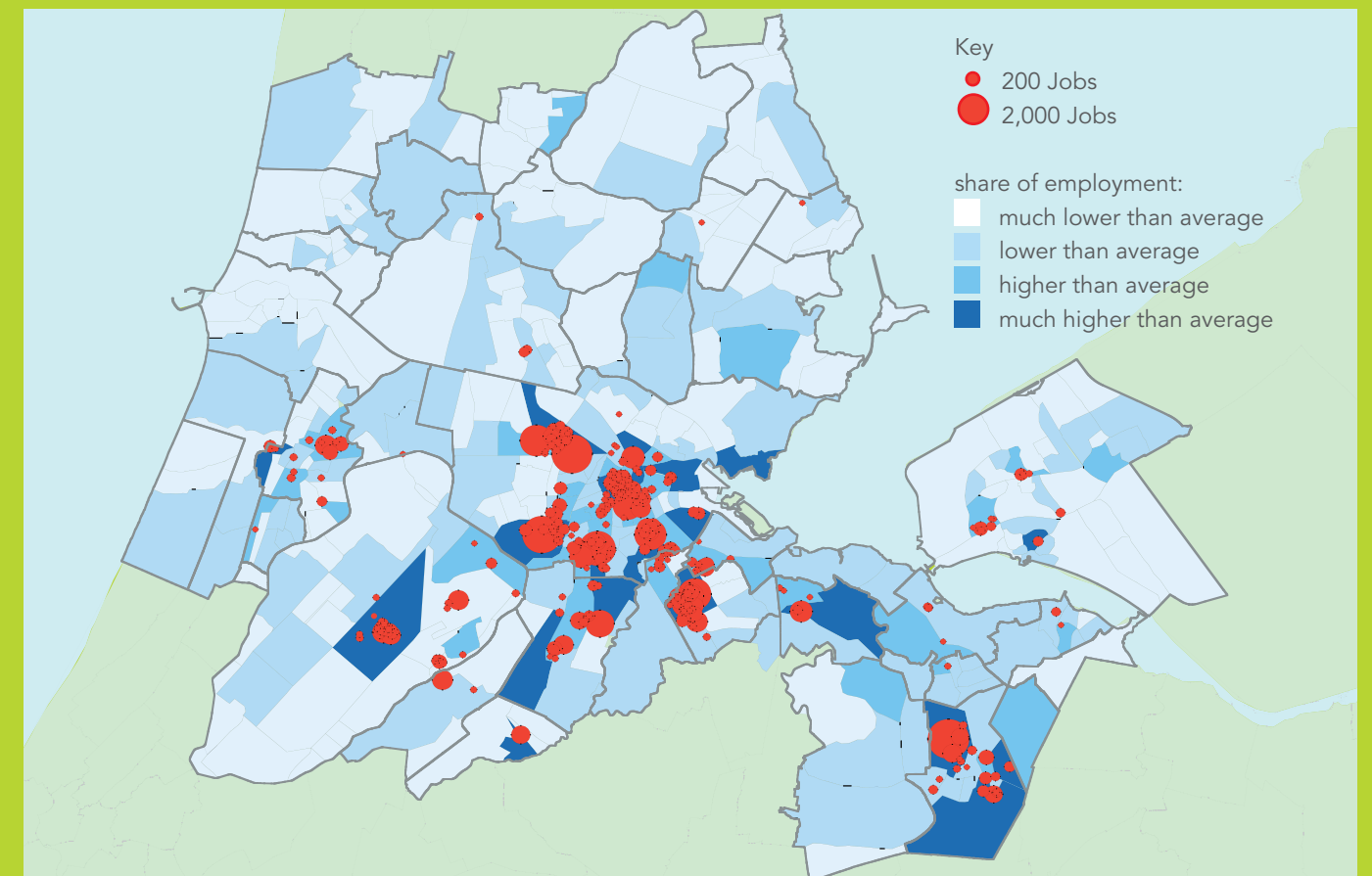
### Knowledge Workers

The Amsterdam metropolitan area has 2.2 million inhabitants, two universities, six colleges, two academic hospitals, 40 independent research institutes, and over 100,000 students in higher education.

The city offers high-tech companies a large pool of highly educated and well-trained professionals. Of the people working in Amsterdam, 44% have been in higher education. Knowledge intensive businesses account for 330,000 jobs, which amounts to a third of total employment in the region. The academic environment is international, with English as the classroom language. Scientists and technicians have extensive job opportunities in the region, both in research institutes and with innovative companies.

In the field of life sciences too, Amsterdam has all the facilities you could want. We'll explore these in the next section.

Figure 4  
Knowledge intensive employment in the Amsterdam metropolitan area: people working at financial institutions and in business services, higher professional education and scientific education, ICT and new media and the creative industries (Source: O+S/LISA).







## 2 Life Sciences: The Amsterdam BioMed Cluster

The city is home to two universities, numerous dedicated research institutes, and six healthcare institutions, of which two are major university associated hospitals, and one is an internationally renowned dedicated cancer hospital. Together, these institutions have a long tradition of excellence in research in areas such as oncology, neurosciences, autoimmunity, and cardiovascular and infectious diseases. Together, they also provide industry with easy access to many innovative technologies, huge clinical trial capabilities and patient cohorts, biobanks and expert centres in imaging, bioinformatics, and a broad range of diagnostic technologies, plus genomics and proteomics capabilities.

The life sciences knowledge sector has been defined as follows by the Dutch Ministry of Economic Affairs (EZ): "Life sciences constitutes a dynamic science and technology field that creates a 'toolkit' of continuously updated technologies and processes to analyse forms of biological life and use them for the development of improved product and production processes in a range of application areas."

Life sciences has the following subsectors: agro-food, human health, environment and general biotechnology (source: Ministry of Economic Affairs).

In the Amsterdam metropolitan area, the human health subsector has an especially strong presence, and has organised itself as the Amsterdam BioMed cluster ([www.amsterdambiomed.com](http://www.amsterdambiomed.com)).

The Amsterdamse BioMed cluster is a unifying force in the city's life sciences, bringing together businesses, academia, healthcare institutions and local government. This network organisation, devoted to furthering cooperation, forms a strong foundation for future developments in the field of life sciences. The Amsterdam BioMed cluster is ready to be your contact in Amsterdam life sciences.

### Dissemination of Knowledge

The region's strength has made it

possible to step easily into the next phase of life sciences valorisation. In the not too distant past, industry used its own labs to create innovation through research. This has changed in more recent times: industry now looks increasingly to academia and small, innovative companies for commercially viable opportunities based on innovative research results. Meanwhile, universities too have changed: their core business used to be education and research, but the dissemination of

knowledge and technology transfer are now additional essential activities for them.

The many excellent universities and research institutes in Amsterdam are no exception to this rule. Together with local and regional government agencies and the Chamber of Commerce, they have set their sights on building a healthy economic base around the cutting-edge technologies coming out of their research programmes. Regional economies are increasingly dependent on the generation and dissemination of knowledge, and the City of Amsterdam realises that an optimal knowledge commercialisation process requires networking between industry, universities and governments. It therefore created multiple incentives to foster partnerships between its universities and the regional and national private sector, and is expanding its science parks to attract global partners as well.





### Think-tanks

The best way for a city or region to promote the commercialisation of research and technology is to first design a long-term strategy, together with all interested parties. That involves forming think-tanks in which industry, universities and government agencies all participate, and Amsterdam is doing just this in all the advanced scientific programmes at its universities. The Amsterdam Area is home to strong science and technology developments in many fields, including ICT, artificial intelligence, business informatics, bio-informatics, computer sciences, bio-pharmaceuticals, chemistry, medical devices, imaging, biomaterials, gene therapy, vaccine development and virus discovery. Amsterdam is dedicated to working with its universities and with companies to promote health, quality of life and economic performance.

The rest of this section takes a more detailed look at these developments, the research areas covered, and the most important players involved.

### Life Sciences in the Amsterdam Metropolitan Area

Several global life sciences and pharmaceutical companies have

chosen Amsterdam as their gateway to Europe. The Amsterdam metropolitan area has more than 100,000 students in higher education. Over 6,000 of these are studying for a master's degree or PhD in life sciences or medicine. Amsterdam has about 70 life sciences companies and 4,000 life sciences researchers.

### Highlights of Amsterdam Life Sciences

The international recognition of Amsterdam's medical life sciences programmes is illustrated by the large scientific output of its institutes and universities, by the abundant representation of its scientists in many international research programmes, and by the many clinical studies that the pharmaceutical industry conducts here. Among the major programmes are those concerning autoimmunity, immunology, infectious diseases, oncology, vascular medicine, gastrointestinal and liver diseases, metabolic disorders, and neurological and psychiatric disorders. We will highlight those areas of research in which multiple interactions exist between different programmes.

### Oncology

Amsterdam is home to some excep-

tionally strong centres for oncology research and treatment: the VU Medical Centre (Vumc), the Netherlands Cancer Institute (NKI), and the Academic Medical Centre (AMC). All have impressive track records in fundamental, translational and clinical research in many key areas, and are equipped with all the necessary cutting-edge technology platforms. Today's clinical development strategies for cancer are geared towards designing patient-tailored therapies, and it is crucial that fundamental research occurs in a translational research setting. Amsterdam's oncology programmes provide just that, and have built up many partnerships with industry in key areas of pre-clinical and clinical development. Oncology research programmes in Amsterdam centres cover a broad range of topics, from designing novel early diagnostics procedures to target identification, from tumour cell biology to angiogenesis, and from gene therapy and immunotherapy to advanced radiotherapy and optimisation of chemotherapy.

### Neuroscience

The scientific and clinical community in Amsterdam has invested heavily in building the interdisciplinary infrastructure best suited for translational

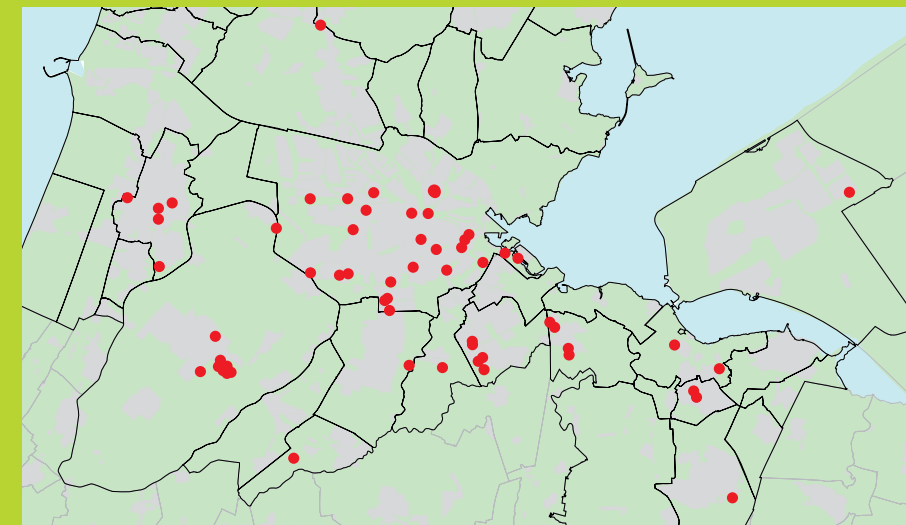


Figure 5  
Life sciences companies in the Amsterdam metropolitan area Amsterdam  
(Source: O+S/AIM).





research in the neurosciences. There is a Brain Bank accessible to the international community, a Multiple Sclerosis centre at the VUmc, and Alzheimer's centres at both the VUmc and the AMC. The MS and Alzheimer's centres are built on a multidisciplinary approach in order to optimise patient care, scientific research and education around these diseases. They have a strong international reputation and long track records of multiple collaborations with industry on drug development and fundamental research, and they exploit state-of-the art imaging technologies.

The VU also harbours a Centre for Neurogenomics and Cognitive Research, which has developed an integrated neurosciences programme, based on genomics and pharmaco-genomics and proteomics.

Neurological research programmes focus on the design of novel early diagnostic tools and biomarkers to follow the efficacy of new drugs. Developing such new clinical outcome measurements is crucial to drug development for neurological disorders.

#### Cardiovascular Diseases

The number of people suffering from cardiovascular diseases is vast, and many medical researchers in Amsterdam work in that field. Cardiovascular diseases are often the result of multiple different factors, and therefore demand a multidisciplinary research orientation. As with cancer and neurosciences, this requires strong interactions between

pre-clinical and clinical researchers, to optimise translation to the clinic. It also requires links between programmes on metabolic disorders that cause vascular dysfunction (such as diabetes and lipid disorders and obesity), and programmes on thrombosis and atherosclerosis. Innovative cardiovascular imaging platforms support these programmes. In addition, there is a strong focus on epidemiological studies to fine-tune prevention programmes, and extensive databases derived from family studies have been built up to obtain in-depth knowledge of the inheritability of cardiovascular diseases. This knowledge is directly translated into innovative therapeutics and diagnostics.

#### Infectious Diseases

Several research institutes in Amsterdam have built up extensive expertise in infectious diseases. Sanquin and AMC work together on blood transmittable diseases, and AMC has a strong track record in the identification of novel viruses. Another main focus of the AMC is its AIDS programme, and the design of novel antiretroviral therapies has been the basis for many productive scientific and industry collaborations. The AMC has also built a strong international reputation in the prevention of HIV infection. VUmc and AMC are working together on the development of rapid high throughput microbiological and immunogenetic typing and diagnostic systems, to improve the prevention and treatment of bacterial and parasitic diseases. In addition, the VUmc has strong programmes devoted to Epstein-Barr

virus (EBV), mycobacterium tuberculosis (MTB), and human papilloma virus (HPV). Some subtypes of HPV play a causative role in the development of cervical cancer, and the VUmc has recently developed a home test for these HPV subtypes.

#### Amsterdam's Tools and Technology Platforms

Amsterdam can provide different tools and technology platforms relevant to the medical life sciences:

- Micro-array technology and molecular profiling
- Biomarkers
- Advanced imaging technologies in MRI, PET-CT
- Proteomics
- Genomics
- Gene and cell therapies
- Patient cohorts in many areas
- Tumour banks
- Pharmacodynamics
- Mass spectrometry
- Advanced microscopy
- Bio-informatics
- Electrophysiology in brain research
- Viral validation studies and safety testing of biologicals
- Cleanrooms
- Immuno-reagents and biomaterials for research and diagnostics
- DNA-banking and cell banking
- High-throughput screening facilities for siRNA, small molecules, antibodies
- Conditional mouse models
- Structural biology
- GMP production facilities

Section 3 contains further information about Amsterdam's life sciences facilities.



# 3 Amsterdam Life Sciences: Largest Research Institutes

Knowledge commercialization, also in the life sciences, begins with scientific results generated by universities and research institutes. The largest of these in the Amsterdam region are highlighted here.



## The Academic Medical Centre (AMC)

The AMC is one of the largest medical centres in the Netherlands, with one of the largest hospitals. It employs over 6,500 employees, of whom more than 1,400 are scientifically involved.

It is internationally renowned for its expertise in HIV, cardiovascular diseases, metabolic disorders and gastroenterology. The AMC is focused on the following research fields:

- Infectious diseases
- Vascular medicine
- Gastro-intestinal and liver diseases
- Immunology
- Metabolic disorders
- Neurological and psychiatric disorders

Additionally, the AMC has advanced facilities and highly qualified personnel in the areas of gene and cell therapies, viral vector production, genomics, proteomics, metabolomics, bioinformatics, imaging, and animal models. The AMC complex houses several dedicated research institutes such as the Netherlands Institute for Ophthalmic Research and the medical department of the Royal Tropical Institute. In order to accommodate more biomedical institutes and companies on the

campus, AMC is currently building the Medical Business Park, which will provide 100,000 m<sup>2</sup> of new space for laboratories and offices, and an incubator for start-ups. This concentration of expertise makes the AMC much more than an academic hospital, and provides a breeding ground for fruitful scientific collaboration and business.

[www.amc.nl](http://www.amc.nl)





### The VU University Medical Centre (VUmc)

The VUmc is the second university-associated medical centre in Amsterdam, and is home to over 6,000 employees and 1,500 knowledge workers.

Its scientific research programmes are dedicated to solving issues that will accelerate translation of research results to the clinic. In achieving this goal, the VUmc also profits from being located on the same campus as other faculties of VU University. It fosters many interdisciplinary programmes in drug development, imaging, pharmacology, bioinformatics, proteomics and genomics. The university and medical centre's Technology Transfer Office facilitates the knowledge valorisation process.

VUmc has strong research programmes in many areas, including:

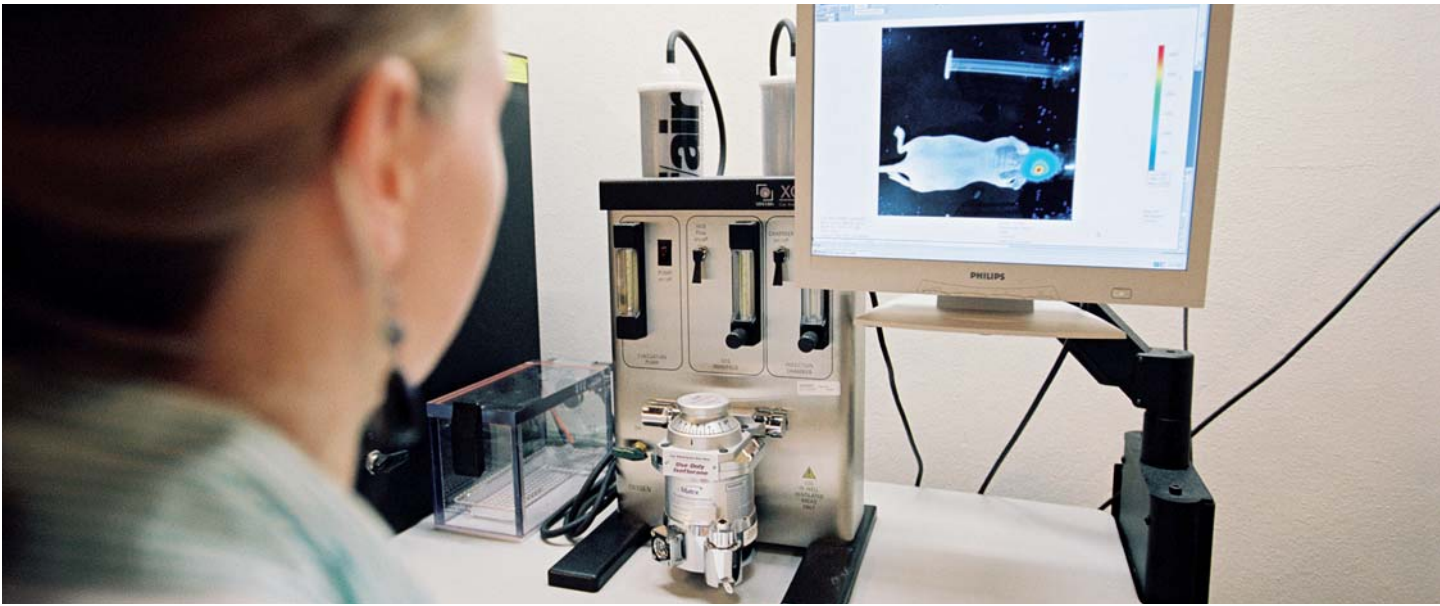
- Cancer
- Immunology
- Alzheimer and MS
- Infectious diseases
- Autoimmunity

VUmc is also home to a number of dedicated research institutes in its main medical research areas:

- VUmc Institute for Cancer and Immunology (V-ICI)
- Alzheimer Institute

- MS Centre
- Institute for Extramural Medical Research (EMGO)
- Research Institute for Clinical and Experimental Neurosciences (ICEN)
- Institute for Cardiovascular Research (ICaRVU)

[www.vumc.nl](http://www.vumc.nl)



### The Netherlands Cancer Institute (NKI)

Improving cancer treatment depends heavily on a better scientific understanding of the function and development of normal cells and tumour cells. Through fundamental and clinical research, the NKI hopes to contribute to better cancer treatment.

Discoveries made in the laboratory are rapidly introduced into the clinic through the translational research programme driven by close collaboration between the scientists and clinicians of the Antoni van Leeuwenhoek Hospital, NKI's integrated partner. Together they accommodate approximately 550 scientists and scientific support personnel, 53 medical specialists, 180 beds, and an out-patients clinic that treats 24,000 new patients each year. The NKI aims to be a national and international centre of excellence in cancer research. To reach its goals, the NKI has a dedicated staff of internationally recognised scientists, highly motivated students and state-of-the-art support facilities: e.g. a mouse clinic with advanced tumour models to develop new treatment protocols; high-throughput siRNA and a small molecule screening facility, advanced microscopy to perform single cell biochemistry. The NKI has become an internation-

ally recognised centre of scientific excellence in many key areas relating to cancer. Recognition of this status is evident from the publication record, from the many invitations that staff members receive to organize and speak at major conferences, from the prestigious prizes that staff members receive, and from its ability to attract funding.

[www.nki.nl](http://www.nki.nl)





## Sanquin

Sanquin Research is a high-expertise centre of basic, clinical and applied research. Its key research areas are (auto-) immune and infectious diseases, inflammation, transfusion, and cellular and antibody therapies. Sanquin has a strong track record in the development of therapeutic and diagnostic products and services. Sanquin employs 3,000 people, of whom 350 are involved in R&D.

### Autoimmune Diseases

Within the Amsterdam Rheumatology Network ARTHRON (whose members include the Jan van Breemen Institute and VUmc), Sanquin looks for biomarkers that predict prognosis and response to treatment of RA, ankylosing spondylitis and psoriatic arthritis. It investigates antibody formation against therapeutic antibodies and demonstrated antibody development against various anti-TNF antibodies. Sanquin develops assays to monitor biopharmaceuticals and their immunogenicity in clinical practice.

### Oncology

In collaboration with the NKI, Sanquin develops versatile peptide-exchangeable MHC class I and II tetramers to monitor antigen-specific T cell responses and defines new T cell epitopes in antigens. It also

aims to establish procedures using tetramer-purified antigen-specific CTLs for clinical application in adoptive transfer therapies. Sanquin and the AMC are initiating clinical trials to use dendritic cells in esophageal cancer therapy.

Another focus of Sanquin Research is the generation of clinically applicable dendritic cells for use in immunotherapy trials against cancer and infectious diseases. Sanquin investigates the generation of tolerance-inducing dendritic cells to correct undesired immunological responses in transplantation settings and autoimmunity.

### Infectious Diseases

Sanquin develops tests, inactivation and removal procedures, and studies epidemiology of infectious diseases. Basic and applied research into the

mechanisms of blood transmittable diseases is performed mainly in the setting of the joint Sanquin-AMC Landsteiner Laboratory.

[www.sanquin.com](http://www.sanquin.com)



## Swammerdam Institute for Life Sciences (SILS)

SILS is a dedicated institute of the University of Amsterdam that brings together more than 200 researchers with knowledge of many different areas of science, including biology, (bio)chemistry, (bio)physics, medicine, and data analysis and information technology.

Integrating the knowledge from these different areas is essential to reach the institute's goal: understanding life processes in organisms and cells. The research themes include neurobiology, microbiology, DNA structure and expression, plant signalling and plant pathology. Although diverse in interest and topic, there are many interfaces between the different themes: overlaps in approaches, used technologies, studied problems or similarities in basic molecular or cellular phenomena. The sharing of expertise, combined with joint technology development in genomics and advanced microscopy, allows the institute to achieve excellence in research and develop breakthrough innovations.

Important and unique discoveries are made via interaction with strategic research partners that help to unlock the secrets of life itself, and lead to

applications that improve the quality of life. When applicable, the SILS stimulates the founding and development of spin-off companies required for these applications. Innovations and commercialisation of research results are recognised as being increasingly important for society to benefit from life sciences research and technology.

[www.science.uva.nl/sils](http://www.science.uva.nl/sils)



# 4 Amsterdam Life Sciences: Some of its spin-off Companies

New companies have the power to introduce innovation to society. More than 70 life sciences companies, or companies performing associated expertise, have been founded in the Amsterdam region over the past few years. Several of these are highlighted here, and information on all others can be found at the website of the Amsterdam BioMed Cluster, [www.amsterdambiomed.com](http://www.amsterdambiomed.com)



## Agendia

**Applying genomic profiling to enable personalised medicine.**

Each cancer is unique and therefore requires treatment specifically tuned to the properties of the tumour. Focusing on the genetic characteristics of a tumour reveals these properties. This, basically, is the way Agendia tackles cancer – by providing innovative tools based on genetic profiling for diagnosis and prognosis that allow oncologists and physicians to design tailor-made treatment plans. This, in turn, will significantly improve treatments rates and the quality of life of cancer patients, as unnecessary therapies can be avoided.

**Breast Cancer: MammaPrint®**  
Agendia's lead product is Mamma

Print®, a gene expression profiling that predicts the risk of metastasis in breast cancer patients. MammaPrint® is based on groundbreaking research performed at the NKI and Antoni van Leeuwenhoek Hospital in Amsterdam. It entered the market in 2005 and is currently available in 11 countries worldwide. Early in 2007, MammaPrint® received market approval from the US Food and Drug Administration (FDA), making it the world's first in vitro diagnostic multivariate index assay (IVDMIA) that has received such clearance. MammaPrint® is currently the most powerful predictor of recurrence of breast cancer.

**CupPrint® and DiscoverPrint®**  
The company's second product, also launched in 2005, is CupPrint®, which serves to identify the primary

tumour in patients diagnosed with Cancer Unknown Primary (CUP). With DiscoverPrint®, Agendia offers its expertise in identifying, developing and validating gene expression profiles to pharmaceutical companies active in oncology.

### Company profile

Agendia was founded in 2003 as a spin-off from the NKI and currently employs 45 people. The company's headquarters and laboratories are located in Amsterdam. Agendia is ISO 170025 certified and possesses CE marking to fulfil EU regulations.

[www.agendia.com](http://www.agendia.com)





### Avantium

How to accelerate your R&D. Faster and more productive R&D: that's what Avantium is about. It provides high speed R&D services and research tools to pharmaceutical and chemical companies.

Avantium operates a state-of-the-art laboratory and employs highly trained scientists and engineers from all over the world to execute customer R&D programmes and develop cutting-edge technologies to accelerate R&D. The company has developed a rational experimental design approach on the basis of statistical and computational methods to focus on executing the most relevant experiments and for rapid correlation to data. Avantium uses a customer friendly IP arrangement and business model. It is recognised as a world leading high-throughput experimentation company.

Avantium was established in 2000 and has a staff of 110. Over the years, its role has expanded, from a dedicated services supplier to a strategic partner for accelerated drug development and strategic product portfolio management

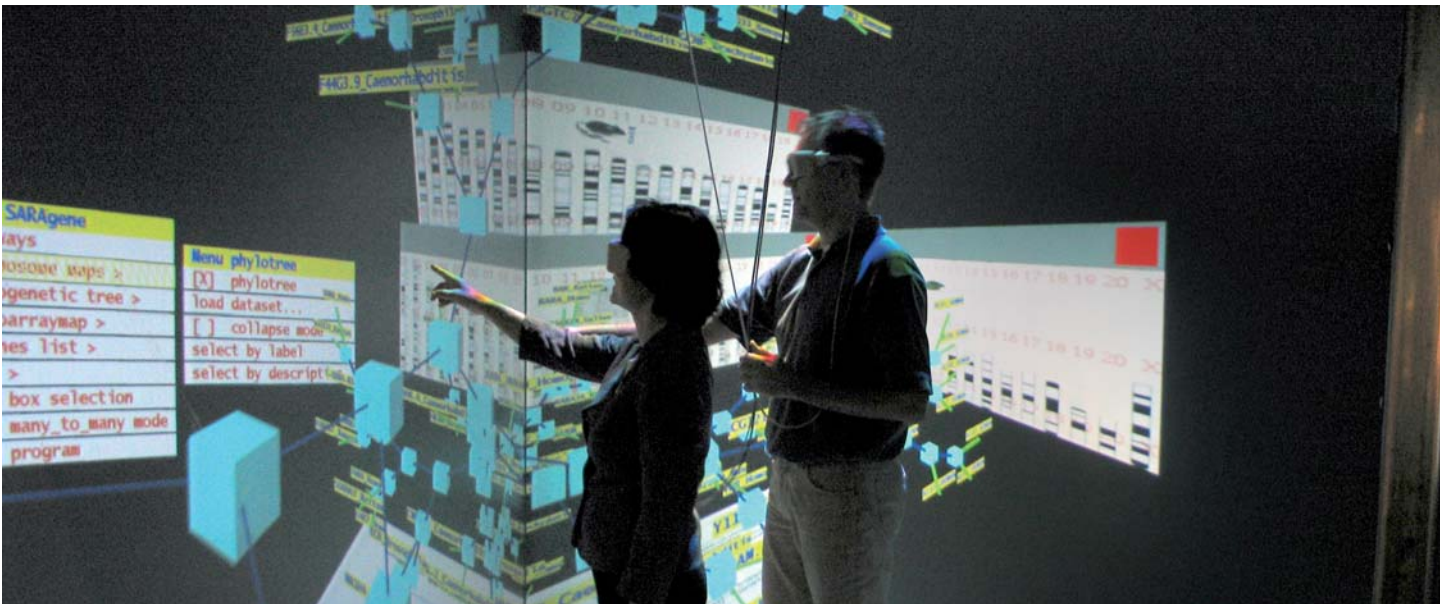
through the identification of new patentable solid forms of the active pharmaceutical ingredient (API), and through crystallization process optimization solutions. The development of proprietary high throughput techniques and the availability of expertise – typically more than 1,000 crystallization experiments per week – means that Avantium has strategic importance for many pharmaceutical and biotech companies.

Avantium provides high-throughput solid-state research services for preformulation and process development purposes. In addition they provide crystallization screens that are focused at protecting the core intellectual property of your API by means of the discovery of polymorphs, salt forms, polymorphs of salt forms and co-crystals. As a cutting-edge company in this field, Avantium continuously sharpens their techniques and approach.

The crystallisation services for pharmaceutical companies include:

- Polymorph screening
- Salt selection studies
- Co-crystallization screening
- Crystallization process optimization

[www.avantium.com](http://www.avantium.com)



### SARA

SARA Computing and Networking Services has one of Netherlands' most powerful computers. From 2008, it will boast a speed of 60 teraflops, which means 60,000 billion calculations per second.

SARA is a sophisticated ICT service centre with about 100 employees. It provides a complete package of services and products, from fast connections to processing support, visualisation, storage and security. SARA's clients include scientific and educational institutions, government institutions and commercial companies.

#### SARA and Life Sciences

As an e-Science Support Centre, SARA offers life scientists sophisticated facilities in high performance computing (HPC). With HPC, complex calculations can be reduced in time, from weeks to days and even hours. With the Life Science Grid (LSG) project, SARA aims to bridge the distance between HPC and life sciences. Computer clusters and data storage facilities have been installed at several locations in the Netherlands and are managed remotely by SARA. The

cluster forms the grid (a virtual super-cluster), which is interlinked by the super-fast network SURFnet, which has been connected to the European grid infrastructure.

In 2005, SARA entered into a core partnership agreement with Netherlands Bioinformatics Centre (NBIC), a foundation whose activities include stimulating scientific research and coordination in the field of bioinformatics and genomics. As the ICT partner, SARA takes care of the housing and hosting of the servers which NBIC provides for life sciences. In addition, within the framework of NBIC programme BioRange and by means of the project BioAssist, SARA supports biologists and bioinformatics with processing capacity, programming help and data storage facilities.

The Virtual Laboratory for e-Science (VL-e) is used for this. VL-e makes multidisciplinary cooperation pos-

sible between scientists from all over the world, thanks to SARA's HPC infrastructure.

[www.sara.nl](http://www.sara.nl)



# 5 Facilities

Life sciences companies can take advantage of the many facilities offered by businesses and knowledge institutions. A number of these are based in Science Parks in Amsterdam. Two of these are described here: Science Park Amsterdam and Medical Business Park AMC.



## Science Park Amsterdam

Science Park Amsterdam has a reputation as the home of a number of important knowledge-based institutions, including the nationally renowned research institutes of the Faculty of Science of Amsterdam University (UvA), and SARA Computing and Networking Services. Amsterdam is also the base for knowledge institutes like the international research organisation, NIKHEF (high energy physics), CWI (mathematics and computer science) and AMOLF (atomic and molecular physics). The Faculty of Science of the University of Amsterdam has research institutes focusing on areas such as life sciences, informatics en astronomy.

The Swammerdam Institute of Life Sciences (SILS-UvA) is also located in Science Park Amsterdam.

This range of research initiatives and service offerings creates an environment in which knowledge valorization is clearly visible in new initiatives and start-up businesses: the science park houses over 80 (starting) companies. Science Park Amsterdam will grow into an environment of inspirational cooperation and knowledge

exchange. A total of 500,000 m<sup>2</sup> offers room for office space, laboratories and educational buildings, a hotel, conference facilities, sport and cultural facilities, hundreds of homes, childcare and a train station.

### Internet hub

Over the next 10 years, Science Park Amsterdam is set to develop into an international knowledge centre, in which cooperation between scientific education, research and knowledge-intensive activity will be powerfully stimulated. This ambition will be achieved through world-class infrastructure and advanced computational and network services. Science Park Amsterdam will be able to take full advantage of the Amsterdam Internet Exchange (AMS-IX), one of the most powerful internet junctions in the world.

### Amsterdam nanoCentre

One of the principal aims of Science Park Amsterdam is scientific research directed towards life sciences. This means research from different perspectives, such as the living cell, neurobiology, system biology, nanophotonics, microscopy and visualization, from disciplines like biology, physics, information technology, and mathematics.

Amsterdam nanoCentre is also located in Science Park Amsterdam. It is a facility for nanofabrication and nanocharacterisation using a combination of techniques. It includes a cleanroom with facilities for optical- and electron beam lithography and plasma etching, a facility for thin film deposition, a biophysics/chemistry laboratory, and innovative optical tools for nanofabrication, manipulation and analysis that include optical tweezers, confocal microscopy, and near-field optical microscopy. A cleanroom with a total area of 57 m<sup>2</sup> houses an electron beam pattern generator, resist processing equipment, a reactive ion etching system and an inspection microscope. The Amsterdam nanoCentre is a facility open to researchers of nanotechnology also from outside Amsterdam.

[www.scienceparkamsterdam.org](http://www.scienceparkamsterdam.org)

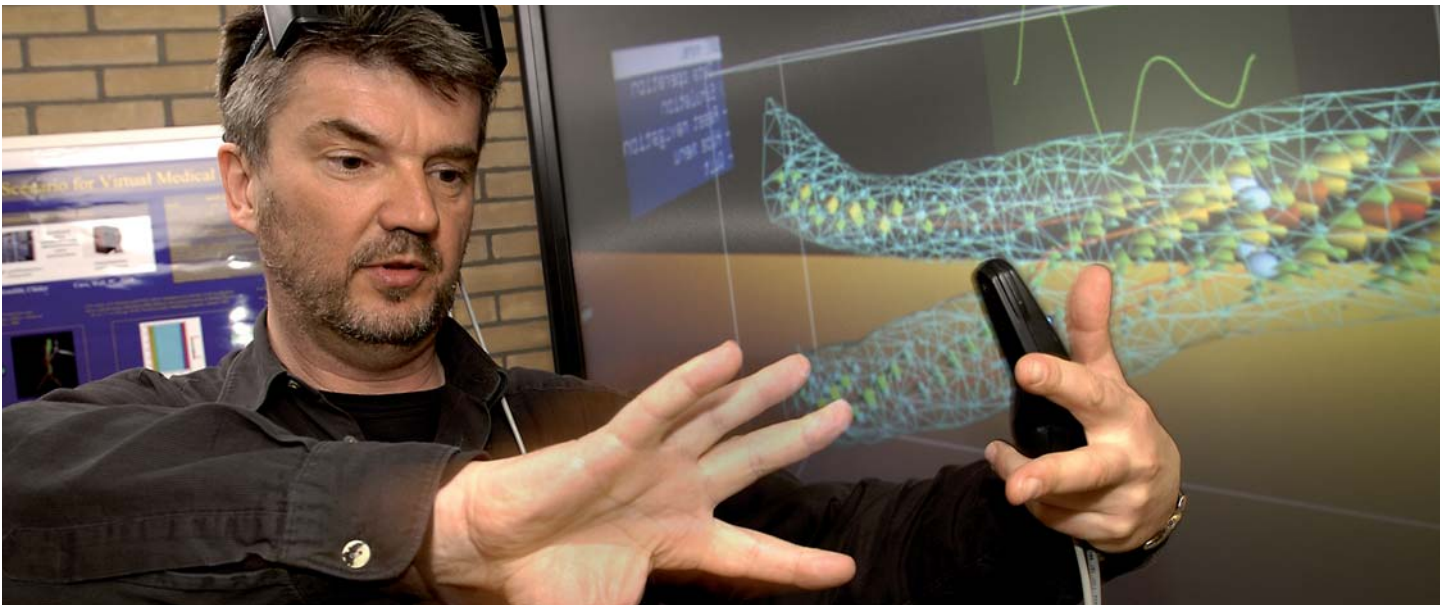




### Medical Business Park AMC

AMC complex already houses scientific institutes such as the Netherlands Institute for Neuroscience (NIN) and the medical department of the Royal Tropical Institute.

In order to accommodate more biomedical institutes and companies on the campus, AMC is currently building its Medical Business Park, 100,000 m<sup>2</sup> of space for laboratories and offices, plus an incubator for start-ups. In the past seven years, eleven biomedical spin-off companies have been founded based on inventions from the AMC, all located on the AMC campus. Together with the planned Medical Business Park, the concentration of expertise makes the AMC a highly effective hospital and provides a breeding ground for fruitful scientific collaboration and business.



### Other Facilities

Several institutions offer additional facilities. Here are some examples:

**Sanquin** offers the following facilities in the form of turn-key services:

- Viral validation studies and safety testing of biologicals
- CSO for the development of biopharmaceuticals (GMP)
- Immuno-reagents and biomaterials for research and diagnostics
- DNA-banking and cell banking

The **Swammerdam Institute** of Life Sciences provides support for activities including:

- Mass spectrometry
- Advanced microscopy
- Micro-array technology
- Bio-informatics
- Electrophysiology in brain research

**SARA** offers:

- Processing capacity: national supercomputer, national processing cluster and grid facilities
- Data storage and back-up facilities (disk and/or tape)
- Visualisation and virtual reality, including the CAVE™ and Tiled Panel Displays
- Networking, including the management of the academic SURFnet-network, Optical Private Networks, the location of the Amsterdam Internet Exchange (AMS-IX) en NetherLight, the optical internet exchange for research networks
- Co-location and commercial ICT services: housing and hosting

Every knowledge institution has its own portfolio of facilities that can accelerate research and business.

Naturally, companies in the region also offer a wide range of services that support life sciences development.

**Amsterdam Life Sciences:**  
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