Experience from a serial entrepreneur – from academic research to business development

Professor Mathias Uhlen Science for Life Laboratory (KTH and KI) Stockholm, Sweden

#### Short bio – Mathias Uhlen



- Professor at the Royal Institute of Technology and the Karolinska Institutet
- Professor Danish Technical University DTU (2010 to 2020)
- Board member Novozymes (Denmark) sinch 2008
- 750 publications with over 70,000 citations
- Founding Director of Science for Life Laboratory (national infrastructure)
- The Director of the Human Protein Atlas consortium
- Member of the <u>National Academy of Engineering (NAE)</u> in USA
- Member of the <u>Royal Swedish Academy of Science (KVA)</u>
- Member of the <u>Swedish Academy of Engineering Science (IVA)</u>
- Member of the European Molecular Biology Organization (EMBO).
- President of the <u>European Federation of Biotechnology</u>

## Swedish economy depends on innovation

> 50% of GDP is export



Forestry/Paper



Mining/Metal/Machinery



Trade



**Transport/Vehicles** 

Sweden:

137 billion in R&D



Aeoroplanes/Weapons



Pharma/Biotech





Environment/CleanTech

3.4% av GDP



#### Trade balance of Sweden



**Biobased products important for the economy of Sweden** 

Source: SCB (2018)

## Sweden –a unicorn factory in life science



Sold for 20 billion USD (2019)

## Scientific revolution in Medicine

#### Scientific Breakthroughs in Medicine

(select examples)



mRNA Technology e.g., vaccines



Cell & Gene Therapy e.g., gene editing



Precision Molecules e.g., protein degraders



Multispecific Biologics e.g., bi-specific



Systems Immunology e.g., JAK inhibitors



Artificial Intelligence e.g., imaging, modality design

#### A national infrastructure for life science (KTH main responsible)

- Technology evolving rapidly
- Big data



- Started in 2010
- 1 500 researchers
- More than 2000 projects in 2020



Founding Director: Mathias Uhlen (2010-2015)



## Human Protein Atlas: 20-year journey



2009

2910 17

16.

Biomarker discovery is pathology

18 Therapeutic antibodies and Affibedies

Knowledge-based pertail

proteins in cells, tissues and organs.

💑 HPA

34 The Metabolic Atlas

35 The fight against the nevel coronavirus

2028

2028



#### **Protein Atlas launch articles**





# Precision medicine



- Right treatment to right patient
- More targeted treatment with less side-effects
- Better diagnostic methods for analysis of health and disease:

- 1. Early detection
- 2. Stratification of patients
- 3. Monitor of treatment



#### "Next generation" precision medicine



Most comprehensive longitudanal "omics" analysis ever done Tebani et al (2020) Nature Communication Zhong et al (2020) Genome Medicine Zhong et al (2021) Pedriatic Research Zhong et al (2021) Nature Communication Building an international core resource to explore human biology and disease





- One of the most visited biological databases in the world
- More than 700 "in-house" publications (peer-reviewed)
- Cited in more than 10 publications every day

- More than 20 patent families
- 9 biotech companies started from the program
- Five human clinical trials on-going



## Mapping of human building-blocks

Initiative	Funding
Allen Brain Atlas (USA)	Paul Allen (Microsoft)
Human Cell Atlas (US and Europe)	Chan-Zuckerberg (Facebook)
Human Proteome Project (HUPO)	National
UniProt, Ensembl, Expression Atlas (UK)	EBI
GTEx (USA)	NIH
FANTOM (Japan)	RIKEN
Human Protein Atlas (Sweden)	Wallenberg Foundation

#### **Experience of innovation**

- 80 patents (families)
- 26 start-ups (5 publicly traded)
- Member of the board for public companies:
  - Sweden: Bure, Skandigen, Prevas, Biotage, Skanditek, Alligator
  - Denmark: Novozymes
  - Norway: Nordiag
  - England: Amersham

#### **Experience of licensing**

- 43 patents have been licensed to companies
- Only 3 have been commercial success
- Total export income to Sweden: more than 1,5 billion USD





MabSelectSure - New affinity matrix for purification of antibodies (Cytiva, Uppsala)

Patent from KTH

#### Involved in 26 start-ups

Start-ups from KTH

Start-up	MU role	Start	Description	]
		year		Dublichy trodad
1. MU Bioteknik	Founder	1989	Royalty from various innovations	
2. InsuDev Therapeutics	Co-founder	1993	Insulin factories	1
3. Creative Peptides	Co-founder	1994	Late complications of diabetes	1
4. Pyrosequencing/Biotage	Co-founder	1995	Next generation sequencing. IPO in 2000.	NASDAQ (mid cap)
5. Magnetic Biosolutions/ Nordiag	Co-founder	1996	Robotics for lab. Sold to Nordiag (public) and later Diasorin	1
6. Affibody Medical	Co-founder	1998	Next generation biopharmaceuticals	1
7. Visual Bioinformatics	Co-founder	1998	Bioinformatics software.	1
8. Woodheads	Co-founder	2000	Holding company of SweTree. 48 researchers.	1
9. SweTree Technologies	Co-founder	2001	Next generation plant breeding	1
10. Olink	Investor	2003	Next generation antibody assays.	NASDAQ (New York
11. Atlas Antibodies	Co-founder	2006	50,000 products. >98% export. >100 million SEK turn-over	1
12. Atlasab Intressenter	Co-founder	2006	Holding company Atlas antibodies. 125 co-founders.	1
13. Atlas Therapeutics/Alligator	Co-founder	2010	Therapeutic antibodies. IPO in 2015.	NASDAQ (small cap
14. Immunovia	Investor	2010	Diagnostics pancreatic cancer. IPO in 2018	NASDAQ (mid cap)
15. Abclon (South Korea)	Co-founder	2010	Therapeutic antibodies. IPO in 2017	
16. InnSpire	Investor	2011	AI-based IT-solutions for hotels.	
17. Argrow	Co-founder	2012	Growth promoting agent forestry.	1
18. Antibodypedia	Co-founder	2013	Portal for antibodies. Extensive content of 4 million entires.	1
19. MIMIR	Investor	2016	Investments in various companies (buy-outs).	1
20. ScandiBio Therapeutics	Co-founder	2017	AI-based drugs for metabolic disease. Clinical trails on-going.	5 companies
21. ScandiEdge Therapeutics	Co-founder	2017	Medicinal chemistry liver diseases.	publicly traded -
22 INSSEN (South Korea)	Co-founder	2018	Therapeutic antibodies.	market can more
23. Amylonix	Co-founder	2018	Next generation biologicals for neuro diseases (Alzheimer)	than 4 hillion USD
24. ProteomEdge	Co-founder	2019	Protein daignostics	
25. Mindforce	Investor	2020	App applications for health care	]
26. A05 Diagnostics	Co-founder	2020	Corona Diagnostics	1

NASDAQ (New York)

NASDAQ (small cap) NASDAQ (mid cap) COSDAQ (S. Korea)

#### Co-founder of 20 start-ups

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## Biotage (Pyrosequencing)



1991	Research project started at KTH
1993	First proof-of-principle publication from KTH. Patents filed.
1997	Company founded. Venture capital: Health Cap. CEO: Eugen Steiner
1998	Science article from KTH. New sequencing principle.
1999	Expansion of company (2nd round VC). First instrument launched.
2000	IPO (Stockholm O-list) - 70 persons. 100 MUSD cash.
2003	Acquisition of Personal Chemistry (Sweden) and Biotage (US).
2006	Roche starts selling 454 sequencer based on Pyrosequencing technology
2008	330 FTEs and 490 MSEK in turn-over (2007).
2009	Pyrosequencing technology sold to Qiagen and Roche.
2021	Extremely successful company. Market cap: 1,6 billion USD

## **Atlas Antibodies**





# TATLAS ANTIBODIES

2006	Company started by KTH researchers (n=110)
2007	10 FTEs. Sales of reagents through internet. Start filing biomarker patents
2008	Deal with Sigma. A new patent family filed every six weeks.
2009	Profitable (all years thereafter). 15 FTEs.
2010	Therapeutics spin-out, including a company in Korea
2011	20 FTEs. More than 5000 different customers in 60 countries
2012	Profitable. 98% export. Gasell (DI) and 33-company (Ny Teknik)
2020	Extremely profitable. More than 10 MUSD in annual sales.
2021	Investor majority owner. Market cap more than 300 million USD



## **A05 Diagnostics**

March 2020	Funding from Wallenberg to start COVID testing at Karolinska
April	Plane hired from SAS to bring in 6 tons of reagents from China
Мау	IT-integration with hospital journal systems completed
June to Nov	More than 600,000 test done at KI lab (academic setting)
November	Start-up company A05 with 17 founders from KTH and KI
December 2020	Tests started in A05. 100 employees by the end of month
Jan. to August 2021	Open 7 days a week. More than one million test.
Jan to August	Best in class turn around time (in Sweden)
Summary	More than 1,5 million test done (A05 and academic lab together).

Floor A05 Karolinska Institutet

campus



2010- 2016	Research at KTH in systems biology (AI) with clinical collaborations (Karolinska and Sahlgrenska)
2015	Mixture of four natural products established for improving mitochondrial (metabolic) dysfunction
2016	Patent filed on "Combined Metabolic Activators"
2017	Company founded (three researchers)
2018	VC funding (for clinical studies)
2019	Phase 1 completed. Phase 2 on NAFLD (Turkey)
2020	Phase 2 on Alzheimer s Disease (85 patients) completed
2021	Phase 3 on COVID-19 patients (300 + 300 patients)
2022	Plan for clinical trials in EU (pending VC funding)





Advance Science (July 2021)



## Amylonix

1993	Research at KTH started for "next generation" biological drugs (Affibody)	
1998	Affibody company founded. CEO: Steiner. Now 100 employees.	1
2008	First generation binder to Amyloid– $\beta$ at KTH.	1
2015	Third generation binders at KTH. Successful in mouse model (NYU)	1
2018	Company (Amylonix) founded by researchers at KTH and NYU	7
2020	Strategic collaboration with Affibody company (equity in return for patent).	٦
2020	The worlds largest recombinant binder libraries. New platform established	
2021	New binders for beta-amyloid, tau, synuclein and transferin receptor	1
2022	Prepare for human clinical trials (and VC funding)	1



Affibody - Betaamyloid structure -PNAS (2008)



Prof.

Stefan

Ståhl,

KTH



Prof.

Thomas

Wisniewsk

i (NYU)



Tau

 $\alpha$ -synuclein

TDP-43



Several sub-nM binders

nM binders

nM binders

Selections ongoing



Tri-functional binders

- So magical formula each journey is unique
- Start-ups is a roller-coaster-ride
- Try to be "lean" (cost effective) as long as possible
- So venture funding without a clear milestone-driven plan
- The Founder dilution problem have realistic business plans
- Use soft funding if possible, but avoid bureaucratic organizations
- Sense of urgency" (management and board)
- Gim to be number one in a niche (avoid being second best)

