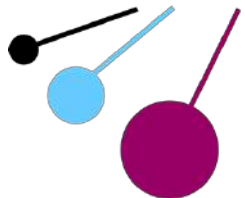


The Grand Tour:

European Life Science Innovation Hubs

February 2019
MUNICH

Gregory Qushair



Alésia
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Executive summary:

The Munich Life Sciences ecosystem

Strengths:

- An Applied R&D, IP and SME powerhouse
- *Attitude*: locals are refreshingly humble about themselves and their sector, relatively easy to contact and open to discussion
- R&D: Bio- & Medical Imaging · Diabetes & Metabolism · Immunology & Immunology · Oncology · Medical Devices & Software · Neuroscience & Neurology · Omics · Scientific Tools & Instruments · Stem Cells
- Excellent universities and Applied R&D centers; elite IP organizations; one of Europe's top Biotech clusters and one of its top regional Biotech agencies; and one of Germany's best teaching hospitals
- Numerous CROs & CDMOs covering the full spectrum of services: Drug Discovery, Preclinical Development, Clinical Development, and Formulation & Manufacturing
- 20+ years of Public Policy support at the Munich, Bavarian, German and EU levels
- Robust and growing VC community, albeit with some room for improvement
- Strong Engineering and ICT sectors facilitate development of Medical Devices, R&D Instruments and STEM Software
- Traditional fabric of Bavarian SMEs (*Mittelstand*) provides ample opportunities for local Manufacturing (Instrumentation, Devices, Disposables, etc.)
- *Quality not quantity*: fewer start-ups than in some other European hubs, but of very high quality, thanks to carefully built scientific, medical and business rationale
- Many local start-ups and SMEs have been acquired by large foreign companies
- Munich the city: lauded for superb quality of life and connectivity, year after year

Weaknesses:

- Public R&D centers could be leaner and more agile, especially with Tech Transfer
- Few Big Pharma R&D centers, Business Development sites or accelerators
- Low *per-capita* number of clinical trials (despite high *total* numbers for Germany)
- Somewhat behind in AI-based businesses and projects, especially in Drug Discovery
- Lack of diversity in upper management
- Clarity, brevity and availability of English communications needs improvement
- Munich can be expensive for employers (salaries, office space) and employees (rent)



Introduction

The Grand Tour and Munich

February 2019

About the Grand Tour

The concept is simple: I'm traveling to different European cities that are Life Sciences Innovation hubs to interview local experts, attend events, network my brains out and report on my findings, while adding anecdotes, statistics and a few personal opinions. My Grand Tour reports are not massive tomes of Financial Analytics and Business Forecasting, like you'd get from a Big Consulting firm: I'm looking to capture the human face of Innovation in these cities and hear first-hand from patient advocates, clinicians, researchers, entrepreneurs, investors, IP lawyers and others about what is working and what is not, at different points in each ecosystem. Although I'm emphasizing start-ups and SMEs in Early-Stage Drug Discovery – because that is what's nearest and dearest to me – I'll also be exploring other domains, like Med Tech and Clinical Care. I hope that you find my Grand Tour reports useful, whether you are a foreigner looking to collaborate, invest, or set up in these cities, or a professional already working in them.

Fourth stop: Munich

Admirably, Munich embodies a long-term focus on market-driven Life Sciences excellence without flashy marketing, excessive public lifelines for failing companies, or empty start-up hype. Over the past 2 decades, the Bavarian capital has produced world-class research in areas like Bio-Imaging, Medical Devices and Immuno-Oncology, and importantly, has consistently transformed its R&D results into viable businesses, thanks to IP expertise, Tech Transfer prowess, Engineering knowhow and increasing VC money. Add to that, an arsenal of CROs and CDMOs, plus Bavaria's historic *Mittelstand* – SMEs manufacturing everything from hand tools to silicon wafers to eye lasers – and you've got a recipe for success! Yet even in the pragmatic, productive, punctual and polite "City of Monks", the Life Sciences sector is not perfect. Join me in Munich to learn more... *Lass uns gehen!*

About Alésia Consulting and Gregory Qushair

Alésia Consulting

Recognizing that Life Science researchers in Europe often need help at the interface of R&D and Business, I started Alésia Consulting in 2017. I help academics, start-ups and SMEs to define their R&D and early IP Strategy, understand their Competition, develop their Business, forge Strategic Alliances and communicate their findings, especially in Early-Stage Drug Discovery. I also review Biotech and Med Tech start-ups for investors. My mixed background and international network (see next page) enable me to cover diverse R&D areas and bridge distinct stakeholders.

To learn more about my work, the Munich Life Sciences ecosystem or opportunities for sponsoring future Grand Tour reports, contact me:

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Gregory Qushair

I was born and raised in Orange County, California (1975) and earned BS degrees in Biological Sciences and in Chemistry at the **University of California, Irvine** (1993). There, I began my research career as an undergrad, in Bioinorganic Chemistry (group of **Dr. Patrick Farmer**). I then worked as a Drug Discovery chemist in the Boston (**ArQule**), Barcelona (**U. Barcelona / Barcelona Science Park**; group of **Dr. Fernando Albericio**) and San Francisco (**ChemoCentryx**) areas. In 2004, I launched a Scientific Communications service called **SciLingua**, in Barcelona, working mainly with academic researchers in Biology, Chemistry and Clinical Medicine. I also did a stint at the **Catalan Institute for Nanoscience & Nanotechnology (ICN2)**. I moved to Toulouse, France, in 2014, to join **InvivoGen**, where I did Project Analysis, Patent Strategy, Scientific Due Diligence and Scientific Communications for their Immunotherapy projects and for their core business of Life Sciences Reagents. In 2017, I started **Alésia Consulting** (see previous page). That same year, I earned my Masters in Molecular Oncology through the **Spanish National Cancer Research Center (CNIO)** and **CEB** in Madrid, Spain. I work in four languages (English, French, Catalan and Spanish) and currently divide my time among European Life Sciences hubs. I look forward to meeting you!

LinkedIn: www.linkedin.com/in/gregory-qushair/



The man with a plan for Munich

Interview with **Dr. Peter Hanns Zobel**, PhD
CEO

IZB (Innovation and Start-Up Center for Biotechnology)

www.izb-online.de/en

*It's impossible to discuss Life Sciences Innovation in Munich without mentioning its first and largest cluster, the **IZB** (see p. 69) and it's impossible to discuss the IZB without mentioning its CEO and conceptual architect, **Dr. Peter Hanns Zobel**. In the mid-1990's, with a PhD in Business Administration and years of consulting experience at the interface of Finance and Technology for the **Fraunhofer Society**, Peter set out his vision for a Munich Life Sciences cluster to the Bavarian government. And the rest, as they say, is history. Although we had spoken by phone and e-mail in the past, this was the first time that we met in person. Peter exudes warmth and conviviality: despite his VIP status in Munich, he treated me like a peer. We met in his office at the IZB's Martinsried campus, where he gave me an informative presentation on the IZB. I'm indebted to the IZB's Head of Public Relations, **Susanne Simon**, for her help.*

GQ: Congratulations on all your success at the IZB over these past 23 years. I truly think that the IZB is unique within Europe, in terms of both the density and the quality of its companies.

PZ: Thank you! I like to say that the IZB is just a *box*: what's really important, is the *companies inside that box*. Today, we are at 100% occupancy, hosting 60 start-up companies across 26,000 m² of space on two campuses. And since 1995, we've hosted over 200 companies. But we didn't build the IZB *overnight*: instead, we started with one small space and *strategically grew in phases*. Our first building was only 900 m²!

GQ: Where do you see the IZB today on the European and global levels?

PZ: We consider ourselves among the top clusters in Europe, together with places like Zurich, Copenhagen or Cambridge (UK). Where exactly do we rank? Well, that depends on what criteria you are using: *Is it the total number of*

companies? The volume of financing or deals done by those companies? The amount of lab and office space? So, depending on the criteria, we're probably in the top three. Internationally, we're not quite on the level of Boston, but we're not so far off, either! For example, from 2015 to 2018, IZB companies did a total of €3.75 billion in financing, licensing and stock deals, which is not too bad. We saw **Pieris** do deals with **Roche**, **Astra-Zeneca** and **Servier**; **Rigontec** and **Exosome Diagnostics** each be acquired (by **Merck Sharp & Dome** and by **Bio-Techne**, respectively: see p. 55); **4SC** do a deal with **Maruho**... In January of this year, **Preomics** (see p. 46) raised €3.3 million in Series A and **4Gene** raised 7-digit seed financing. Plus, the IZB offers certain benefits due to our location: for example, the salaries and rents in Boston or San Francisco are quite high, about *four times higher* than in Martinsried.

GQ: You mention Boston and San Francisco... I was reading **Bruce Booth's** 2017 *Forbes* article about the dominance of those hubs¹. Comparing Munich to those cities, is there a cultural element to its growth potential?

1. www.forbes.com/sites/brucebooth/2017/03/21/inescapable-gravity-of-biotechs-key-clusters-the-great-consolidation-of-talent-capital-returns/#6d7aadge52e9

PZ: In Germany, it's very hard to find money to finance a Biotech company. In the US, there's more money and they're *not afraid of failure*. In Europe, *the fear of failure is a big problem*. Americans sell ideas, but Europeans are less secure and are more critical of their ideas. So, there's more growth in the USA. We've already lost a few people to Boston.

GQ: I often hear from start-up founders, lawyers, investors and Tech Transfer professionals around Europe that negotiations with public R&D centers are very complicated: IP rights, royalties, equity stakes, *etcetera*. Given that the IZB partners with public centers like **LMU** and the **Max Planck Institute**, as well as with start-ups and SMEs, how can you remain neutral when disputes arise? And



what role, if any, can you play in smoothing out those negotiations?

PZ: In Munich, we have highly professional organizations such as **Max Planck Innovation**, with people like **Axel Ullrich**, who founded five companies, as well as **Bayerische Patentallianz (Bavarian Patent Alliance)**, which helps scientists with patent drafting. If a start-up came to me and said that they have an IP problem, then I would tell them, *“You need to solve that problem, because if you don’t, you won’t have a future.”* If the issue is with Max Planck, then I would send them to the Max Planck Innovation office; if the problem is with a university, then I’d send them to Bayerische Patentallianz; and if it was between individuals, then I would help to make those people aware of the issue. Obviously, I cannot get involved directly, but I can at least help bring people together, including lawyers. We’ve had situations like that, where I’ve arranged friendly meetings and the participants were able to work out their differences over a coffee. To be honest, we’ve never had a problem.

GQ: I’m asking Munich experts about this mixed blessing of acquisitions of local companies (see p. 55) by larger, typically foreign firms: on one hand, it validates the scientific and business quality of those companies and provides a nice return for investors, but on the other, it may prevent those companies from attaining critical mass and may even lead to them abandoning Munich. Are those acquisitions inevitable? Realistically, how many SMEs can remain independent, as **MorphoSys** has done? Should they even try to do so?

PZ: So yes, as you say, there are companies like MorphoSys and **Medigene** that have tried to build a Pharma company out of a small Biotech and have been successful. But others have tried and failed. It takes several years and they can’t find the money or the people to grow. Then, a big company comes along and pays a lot of money to acquire them, so the founders and investors are

happy. What I don’t like to see is that most of those acquired companies are leaving to Boston or somewhere else. In terms of local employment, for every company with 100 employees that you lose, you need ten start-ups with ten employees each to replace that. One easy way to keep companies inside Germany would be to establish tax credits, like those in France².

2. *Crédit d’impôt recherche (CIR)*; see: www.tresor.economie.gouv.fr/Ressources/File/409099)

GQ: Munich is lauded for the quality of its Life Sciences sector. Which areas still need improvement?

PZ: There are two areas: *money* and *lab space*. The problem is that money is flowing *out of* Germany: Germans are not investing in Biotech, they might prefer something with a shorter life-cycle, like apps. Some traditional high-worth individuals don’t want to invest in Biotech or if they do, they might prefer to invest in companies elsewhere. Concerning lab space, there are just not enough construction companies building labs here.

GQ: Over the past few years, we’ve seen many Big Pharma companies opening accelerators and incubators around the world, including in Europe. **Amgen** and **Bayer** each have centers in Berlin; **Johnson&Johnson Innovation** opened a **JLABS** in Belgium; **Pfizer** launched its center in Paris last year... and each of these operates distinctly in terms of IP rights, equity stakes, *etcetera*. What role could a Big Pharma-sponsored accelerator or incubator have in Munich and especially, here at the IZB? What might be some of the challenges there?

PZ: I’ve talked to three global Pharma companies about having a hub here at the IZB, as I have not yet been successful in doubling the size of our campus. I would like to have them as neighbors. I don’t like the model where that host company gets “first look” and first IP rights at the start-up. That’s very bad!

Small companies need to be able to stand up to large companies that propose abusive contracts. I remember a meeting once where a Big Pharma company asked for some very unfair contractual terms from a tiny start-up. And the start-up founder stood up and said, *“There’s no way that I’ll work with you because you obviously don’t respect me as a partner.”* I really admired that, especially because that start-up was facing an uncertain future.

GQ: Looking to the near future, what are your plans for the IZB?

PZ: I’d love to double the size of the IZB, but if I’m going to be the person to lead that, it needs to happen in, let’s say, the next 2 to 3 years. I’m 54 now, so I can’t wait a decade to start a project like that: I’ve been doing 60-to-70-hour weeks for the past 20 years, and I don’t think that I’ll be able to do that in 10 years, so I’m getting impatient! What we’d like to do is to build new offices and labs for Big Pharma R&D groups and to establish residency for more VC firms here, at least part-time, so that they could be here a couple of days a week networking. I’m very proud of the fact that we have two daycare centers (**Biokids**) on site to make life easier for our professionals with children. Women especially have it tough, juggling family and work responsibilities, and they often bear the burden of taking care of seniors, as well. So, something I’d love to do one day is to build a short-term care site for seniors, and not just for people working at the IZB or Max Planck, but for the whole community.

GQ: Thank you.

PZ: Thank you for the interview and see you tomorrow, at the **Biotech Press Lounge** (see p. 35)!



Revving up Munich's start-ups

Interview with:

Dr. Petra Burgstaller, PhD

Senior Manager, Start-ups & Funding

Christina Enke-Stolle, MS, MBA

Senior Manager, Start-ups & Funding

Bio^M

www.bio-m.org/en/

I was introduced to **Christina Enke-Stolle** and **Dr. Petra Burgstaller** by their colleague, **Bio^M's** Communications Manager, **Georg Kääb**. It's tempting to describe Christina and Petra as a "dynamic duo", given their symmetric approach to teamwork and their complementary backgrounds: Christina, in Biology, Investments and Biz Dev; and Petra, in Biochemistry, Drug Discovery and Project Management. Having each helped to launch and grow Munich's Life Science start-ups for around a decade at Bio^M they have witnessed the City mature through phases that many other European hubs have yet to experience. We met on a sunny morning at the Bio^M HQ, on IZB's Martinsried campus.

GO: Christina and Petra, tell me about your respective roles at Bio^M.

CE-S: We coach founders and founders-to-be on their business concepts and we introduce them to different specialists, mentors and other relevant network contacts. We review pre-seed grant applications, pitch decks and business plans and we give advice on funding programs and on financing. We do job-sharing, so our tasks are *identical*. Since 2011, we've built a kind of *virtual incubator* for Life Science founders (**Bio^M for BioEntrepreneurs**). It includes a pre-seed grant program (**m⁴ Award**), a mentoring program (**Mentor Circle**), events for founders (**BioEntrepreneur Lounge**, **BioEntrepreneurship Summit**) and investors (**BioAngels**), and intense training formats for founders (**Pitch Doctor**, **Boot Camp**). So, we accompany start-ups from lab to market.

PB: We have another colleague in start-up support, **Angelika Leppert**, who joined in 2015. She has a background in Corporate Finance, is a certified coach and is responsible for our Boot Camps and investor events. It's really rewarding getting to help start-up founders to create a business from their R&D.

GO: I'm so impressed with the quality of the start-ups here in Munich. Tell me



Photo: Christina Enke-Stolle (L) and Petra Burgstaller (R)

more about Bio^M's Boot Camp and the steps that you take to ensure, early on, that start-up founders have a solid business model that is market-driven. I see many start-ups with poor business models in other European cities...

PB: The Bootcamp is a 4-week training program that is really dedicated to validating the business model or a chosen medical indication. We connect the founders as early as possible with a lot of Key Opinion Leaders, potential customers, mentors and other stakeholders in our extended network. This year's edition is in conjunction with the **University of Oxford**.

CE-S: In our Mentor Circle, we provide a confidential setting for start-ups and experts to meet. We handle the arrangements, like the CDAs and do the matchmaking.

PB: Regarding your observation of poor business models *elsewhere*, that's something that we *already* went through in Munich back in the mid-1990's to the early 2000's, when there were a lot of companies and a lot of money. The cluster is much more mature now. People have learned their lessons.

CE-S: Also, the seed investors are more professional now. In the past, it was *different*. There were a lot of VCs popping up and they *didn't have a clue*. On one hand, we now have seed investors that look at more-mature projects. On the other hand, there are VCs like **Forbion** that look closely at academic projects, at the science, and actively build a company out of that R&D, which means putting together the team, *etcetera*.

GO: The Munich area features several areas of Life Sciences excellence of varying levels of market maturity. I've seen interesting thematic initiatives here, like Bio^M's Immuno-Oncology industry program, **ImmPact Bavaria**. How important is it for you strategically to emphasize core areas of expertise and what steps do you take in that sense?

CE-S: There are two sides here. *On one hand*, we have thematic groups, where we bring together people from the same R&D area that might not already know each other, like *companies* and *academics*. *On the other hand*, it's also important for us to emphasize core areas of excellence to *promote the cluster* and *attract big players*. The **Leading-Edge Cluster Competition**, which the Munich cluster won with a strategic shift towards Personalized Medicine in 2010, provided us with €40 million in public funding from the federal government and helped us a lot to establish new R&D collaborations.

PB: Right now, we're working on a new network, called "Tools of Science", which came directly from suggestions from local companies. We always listen

to what companies have to say, but we're also somewhat independent.

CE-S: That's part of Bio^M's character, to be *open-minded* to new ideas.

GO: That's great, because Scientific Tools & Instruments is an area that I emphasize in this report. So, given Munich's privileged position in terms of the number, scale, diversity and quality of its CROs and CDMOs (**BSL, Definiens, Evotec, Eurofins, IQVIA...**), those companies *should* offer ample testing ground for local start-ups to develop new Life Sciences reagents, instruments, devices or software. What challenges and opportunities do you see there?

CE-S: That's a very good question and we agree: *that could make absolute sense*. We do have close contacts with CROs. So far, though, we have not seen any use cases of close collaborations - at least with early start-ups.

PB: However, we have had many discussions between different CROs and start-up founders.

CE-S: One of the hurdles was *money*. The CROs don't want to do it for free, but the start-ups don't have money.

PB: The CROs are also *very selective* in their projects, like a VC firm would be, at least in the case of non-fee-for-service-models.

GO: There is some lively debate about the need, efficacy and sustainability of public funding instruments and fiscal benefits for start-ups and young SMEs. How are German funding instruments such as **High-Tech Gründerfonds (HTGF)**, which reminds me somewhat of France's **BPI**, and the **GO-Bio fund** from the **Federal Ministry of Education and Research (BMBF)**, helping here?

How can one avoid using public funds as *life-support for failed companies*?

CE-S: The HTGF has become the most important seed investor in Germany and in the Life Sciences. For start-ups in Bavaria, the HTGF can team up with **Bayern Kapital** to provide even larger funding amounts. GO-Bio is a federal pre-seed grant program. In fact, 15 of 58 GO-Bio projects were from Bavaria. Examples of successfully formed companies include **Corimmun, Chromotek, iThera Medical, imeVax, Ethris** and **Dynamic Biosensors**. Regarding the use of public funds as life support for failed companies: yes, we *have* seen such "grant-based business models", but rather as an exception.

PB: There have been some really great public programs in Germany, like BMBF's **KMU-innovativ** ("Innovative SME") program. However, BMBF is currently changing their programs, so they may shift from Biotech to Health Science. There are some great pre-seed programs at the German level, like **VIP+**, which is **BMBF's** Technology Validation program; **EXIST**, which in the past wasn't really suitable for Drug Discovery but now provides a larger budget; and **GO-Bio**. And at the Bavarian level, there is the m4 Award, which we created to support promising projects with spin-off potential.

GO: Munich has witnessed many high-profile acquisitions of its Biotech and Med Tech start-ups and SMEs (see p. 55). This reflects their quality and is *good news for founders and investors*, but also corroborates *frustration around Europe that local gems are destined to get grabbed up by large foreign firms*. How important is it for Munich's start-ups and SMEs to attain the critical mass to remain *independent*?

CE-S: That's a *very good question*! Indeed, it should be our *goal* as a cluster organization that our SMEs gain critical mass and grow to be less prone to get

snatched away by large foreign firms. For the future, we probably need a balance between companies that have the potential and ability to grow to heavyweights and also, nice M&A stories that render the cluster attractive for investors and Big Pharma and other large industry players.

PB: The past few years, the financing situation was not great, so there were a lot of M&A's. Maybe we'll see IPOs start up again in the future.

CE-S: There's also a question of *leadership*: some founders might not want to grow more, as they might fear losing control and autonomy over their "baby".

GO: Given the plethora of local homegrown talent, does Bio^M endeavor to attract foreign entrepreneurs and start-ups to Munich? And on that note, how important is it for Bio^M that the Life Sciences sector be diverse?

CE-S: There are specialized organizations like **Invest in Bavaria** that work to attract foreign companies and professionals and we are working closely with them. And yes, diversity is *important for us and* I agree that it's a *great value*. For example, we see nice diversity in working closely together with **EIT Health** in our boot camps, which are also attended by European start-ups.

PB: The academic scene is getting a *lot* more international, too. It wasn't like that when we were students!

CE-S: With regard to gender diversity, *there could be more women in the higher executive positions and as founders*. I think you need to have a critical mass of female role models to encourage other women. We have had a hard time finding *enough* women for some of our activities, like for the jury for the m⁴ award. For some women, such activities may not be a priority.

GO: Which areas of Munich's Life Sciences ecosystem still need improvement?

CE-S: As you mentioned earlier, our cluster really needs to open up to new technologies, like *Artificial Intelligence* and to foster *cross-sectorial collaboration*. However, at Bio^M, we don't have subject experts in house. Another weak spot is that Munich doesn't have many *Pharma R&D centers*. Most Pharma companies have sales or Clinical Development offices here, but not really R&D.

GO: What's in store for Bio^M in 2019?

CE-S: We're really excited about our upcoming BioEntrepreneurship Summit¹, which is scheduled for October 15th & 16th. It's a 2-day program where we bring together diverse stakeholders in Life Sciences entrepreneurship, around *170 people*, including students, scientists, VCs and Pharma companies. That's also where we award the annual winners of the m⁴ Award². We've had great partners, like **Johnson&Johnson**, last year, and this year, **Roche** and **Sanofi**.

1. www.bioentrepreneurshipsummit.org

2. www.bio-m.org/veranstaltungen/detail/m4-award-elab.html

Fostering patient-centric Innovation

Interview with **Dr. Katharina Ladewig**

Director

EIT Health - Germany

www.eithealth.eu/clc-germany

*I was kindly introduced to **Dr. Katharina Ladewig**, director of **EIT Health - Germany**, by her colleague, Communications Lead **Bettina Maria Blees**, who also provided invaluable assistance in arranging and supplementing this phone interview. Before taking the helm at EIT Health's division for German-speaking countries just over 1 year ago, Katharina led the UK & Ireland division for 2 ½ years, after having spent a decade in Australia and Germany researching Nanomaterials for Life Science applications. I was impressed with Katharina's openness, commitment to addressing real Health & Healthcare needs, and pragmatism: she and her team are uniting disparate Innovation stakeholders along the value chain and across European borders to benefit patients and the general public.*

GO: Describe EIT Health - Germany's mission and history, and your work there.

KL: EIT Health was founded in 2015 through a call by the **European Institute of Innovation and Technology (EIT)** to create a pan-European entity to address Healthcare *challenges* and *opportunities*. There is a lot of fragmentation in the Healthcare system, which faces an ageing population and a rise in chronic diseases. On the other side, there is amazing new Innovation and technology. All these new opportunities need to be *connected*. EIT Health has six regional nodes: *UK/Ireland, France, Spain, Benelux, Scandinavia* and, for the DACH region (Germany, Austria and Switzerland), *EIT - Health Germany*. It's a great example of how the EU puts taxpayer money to good use to improve the life of citizens. The EIT organizations from different sectors (Health, Food, Climate, Energy) all work together in partnership, pooling resources to address the big challenges that Europe is facing today. My role as director at EIT Health - Germany is to drive Healthcare Innovation in the DACH region, working mainly from my office on the **Roche** campus in Mannheim. My team and I endeavor to ensure that our partners come together and that Innovation remains relevant to the health of European citizens.



GO: I've learned that working with multiple European countries can introduce cultural, political and socioeconomic variables into the Innovation process. Does EIT Health apply one Innovation model across all sixteen of its European member countries? I mean, do you have a *standardized* vision of the lab-to-market process that you apply to everywhere?

KL: No. We're not a *VC firm* or a *classical investment agency*, so we don't apply a single Innovation model; *we try to stimulate Innovation in any way, shape or form that it can take*. We do that in *many ways*, like workshops, networking, match-making and industry partnerships. We encourage *cross-border collaborations*, so *all* of our programs have a *cross-border element*. We bring start-ups together with big corporate partners, technology experts or mentors. Healthcare Innovation can be lots of things: it can be a *product* or a *service* but also *Organizational Innovation*, in terms of *changing the way we do Healthcare*. The latter is especially interesting to us because it doesn't always get support from traditional investment sources and does not necessarily generate profit, but it *does* help efficiency. For instance, we look at how medical and frontline Healthcare staff use their time, so we're interested in maximizing their efficiency. That's a good way to spend European public money and it's not something that traditional VC does.

GO: How does EIT Health - Germany ensure that patients' needs are considered as early as possible in the development of new drugs, diagnostics, devices or Digital Health tools? Do you work with Patient Advocacy groups?

KL: We tackle that in a lot of ways. Last week we just had our annual **EIT Health Matchmaking** event, in Berlin, where participants looked to establish joint solutions to meet patient needs. There, we worked with Patient & Public Involvement Adviser, **Ania Henley (Imperial College)**, who advised SMEs on Best Practices in Innovation. We do that by design: working with patients and

the public. We also ask specific questions about the project proposals that we receive: *Were patients involved in defining the needs that you're trying to address or in developing the solution that you are proposing?* We recently held an event in Munich called **Protect Ur Life**, a sort of *Healthcare fair* for the general public, where people could receive information on their cardiovascular and bone Health. And we brought together different Health partners to deliver that information. So, we did a partnership with **Amgen**, who's done an *amazing* job of linking together cardiovascular and osteoporosis information. There were doctors on hand to provide advice to patients that had just received data on their cardiovascular health. There was an elderly woman there that got some Health data and said, *"This is great. I'm going to take this information to my GP and discuss this!"*. From an EIT Health perspective, that's a great outcome! That's a patient becoming a real *actor* in their health, and taking *ownership* of their health. We've done similar events in Zurich, Grenoble and Barcelona, and the response has been overwhelming!

GQ: The DACH region has several dynamic Life Sciences hubs of varying sizes and degrees of maturity: *Munich, Berlin, Heidelberg, Vienna, Lausanne, Zurich, Basel...* How does EIT Health - Germany balance its European and regional objectives with the local aspirations of city Life Science agencies?

KL: We are a *collaborative* network. Those agencies don't work with us to *compete*: they work with us to *collaborate*. So, everyone brings their own element to the table. We share Best Practices. It's really not about *competition*, but about *sharing*. The **InnoStars** program is a great example: it's a program for the former Eastern-Bloc countries, where they might not yet have all the possibilities to do Innovation yet. So, we help with *capacity-building*. People come ask us *how to set up an incubator*, for example. We help connect those who are just beginning with those who already have that experience.

GQ: Much of today's Life Sciences Innovation economy is *decentralized*. For initiatives like EIT Health - Germany's Accelerator, how important are physical spaces and geographic proximity for the stakeholders involved? Can you describe your collaborations or vision for collaboration with Big Pharma-sponsored incubators or accelerators in DACH hubs?

KL: I think that for *Healthcare* - not *Drug Development*, but for patients and clinicians in *day-to-day care* - you really need to be *close* to them. Of course, Digital Technology enables communication for partners in different areas and we use those technologies all the time. We encourage people to come visit our sites and we offer free, dedicated office spaces for participants in our entrepreneurial programs. We've also offered virtual training, like MOOCs, which we will be repeating in 2019. As for Pharma accelerators and incubators, **Johnson&Johnson's Innovation's JLABS** is part of the **Bridgehead** program. **Amgen**, with its Tech Hub in Berlin, and **Bayer**, with its incubator Berlin, are both heavily involved in EIT Health. And at EIT Health Germany, we're leading a new program in 2019, **Start-ups Meet Pharma**, where we match start-ups with Pharma partners that they've identified. We're confident that will be great!

GQ: Can you describe EIT Health's links to the Munich ecosystem?

KL: We already have partners in Munich, like **BioM**, who is a founding partner of EIT Health and is running many programs for us, like one on Bio-Entrepreneurship, where they brought companies to Munich to train them in Market Access, introduce them to Business Angels, *etcetera*. The **Technical University of Munich (TUM)** is also one of our founding partners and they are *very, very active* in almost *everything* that we do! Especially in Clinical Innovation, through their **Rechts der Isar Hospital** and in building start-ups - almost *one per day*! They have an incubator for start-ups in *Digital Health*.

Companies like **Climedo**, **Mecuris**, **PreOmics** and **Tubulis** all came from the incredibly active start-up scene in and around Munich. We've helped many of these companies through our non-dilutive funding, seed funding and training opportunities. *Another* of our Munich partners, one with a very niche interest, is the **German Center for Diabetes Research (DZD)**. So overall, I see a lot of Digital Health and Biotech in Munich.

GQ: I've been reading about **WE Health**, your recent program for female entrepreneurs. As a German woman in a high-ranking executive position in the Life Sciences sector, can you offer your perspective on the need for such programs in Germany and elsewhere in Europe?

KL: These programs are needed to help women build networks. That's what **WE Health** does best: *it connects women to each other and to the stakeholders that they need to succeed*. Women have climbed *some* ladders, but where I think that they still need assistance is in *building those networks*. Men have been better at that and maybe have had an advantage there historically. There are still relatively few women in executive positions and they can often be quite lonely, so these programs can help those women to avoid feeling out of place.

GQ: Any parting thoughts on Munich?

KL: We're excited to hear about Munich's latest innovations in your report! We'd like to encourage those researchers, entrepreneurs and companies to check out EIT Health's programs, like **Head Start**, for start-ups, or **European Health Catapult**, for more-established SMEs. And for start-ups seeking strategic partnerships with our Pharma partners, we highly recommend the **Start-Ups Meet Pharma** program, which is *now open for applications*. Moreover, we have the network to help companies grow their business and can help them with Technical Expertise. That's where we *really* create value.

Accelerating Antibiotics

Interview with **Christian Riemann**, MSc

Co-founder

Bacteriobator

www.bacteriobator.com

Par for the course in Munich, **Bacteriobator** co-founder **Christian Riemann** very quickly responded to my contact message via their website, and very openly agreed to an interview. Together with co-founder and CSO **Dr. Christoph Kapfer**, and their partners, they're employing a unique approach to identifying, developing, and investing in the most promising R&D and entrepreneurial projects in Antibiotic Therapeutics and Diagnostics, beyond Drug Discovery. Per his suggestion, we met at the café **Literaturhaus München**, which hosts Literature events and Arts exhibits and boasts a tempting array of desserts.

GQ: Christian, what are Bacteriobator's mission, objectives and operations?

CR: Bacteriobator is an accelerator for *medical antimicrobial technologies*. However, we are not your typical accelerator, where start-ups get coaching for 3 months at a physical site and then leave. Our model is *permanent*, in that we want to define the ecosystem so that *nobody exits*. Our mission is *Tech Scouting and Investing*, and our objectives are *Validation* and *De-risking* of early-stage projects. Before investing in a project, we check *the team, their business plan, their IP...* When we *do* start investing, we operate like a VC or Private Equity firm. We mainly explore *Diagnostics, Materials* and *Components*, as those have similar risk profiles, so *we don't really do new medicines*. Our work is based on peer-to-peer validation of basic science. Scientists don't understand the financial strategy behind their science, or capital markets. So we provide that expertise as well. We work mainly in Europe and the UK, with an emphasis on the *DACH* region (Germany, Austria and Switzerland). We're a listed member of **Deutsche Börse**, on the **German Stock Exchange**, in the pre-IPO section.

GQ: Can you explain the work that you and Christoph each do, given your distinct backgrounds?



CR: Christoph and I are partners and have quite interchangeable roles. I am a *technologist* by training: I earned a Masters in Technology Management in the UK and worked there for 8 years, plus 1 year in Lyon, France, doing Corporate M&A in the Life Sciences sector. Christoph is a pure scientist with a PhD in Neurobiology from the **Max Planck Institute of Neurobiology (MPIN)**, here in Munich, and a background in Scientific Consulting. We work directly with researchers and give them “homework”: basically, *questions that they need to answer and tasks to do to help us in decision-making*. Christoph has learned a lot about Business Finance, and I’ve learned a lot about the science. However, when things get really detailed at the science level, then he handles it.

GQ: Tell me a bit about the origins of Bacteriobator.

CR: It was founded in 2017 by post-docs from Max Planck, with help from the **Robert Koch Institute (RKI)** and **Boehringer Ingelheim**. Christoph joined later and became our CSO.

GQ: Can you describe some of the projects that you’ve worked on recently?

CR: Sure, I can give you two examples. We’ve worked on a *fast and precise system for Bacterial Diagnostics*. We’re also helping to develop an *anti-microbial substance* that could be used alone or with classical antibiotics, to reduce dosing of them and/or to reduce use of cortisone.

GQ: What are your thoughts on the failure of Big Pharma to deal with the global crisis of antibiotics resistance?

CR: By definition, this is a *systemic crisis*, not a *Big Pharma problem*. It is related to Health in general: *Antibiotics prescriptions, hospital care, Antibiotics use in foods...* We need infrastructure for that. When you look at mobile phone net-

works or motorways, those are public infrastructures that *everyone* uses. So for Antibiotics, we need a similar *systemic* approach. That means having *written contracts* that involve government, companies, NGOs, public-private partnerships, *etcetera*. For instance, the government could award funding to companies with the best proposals, like it has for 5G networks. There are specific ways to link public and private incentives, like “pre-epidemic” financing. And there are *trade-offs*... maybe Agro companies use Antibiotics because they *want to provide cheap food*, like meat, to *feed poorer people*. But then you have questions of sustainability of mass-production of those food products, and suddenly, *a population dealing with antibiotic resistance issues that they didn't face before*. So we *have to* look at those trade-offs.

GQ: Scientists now have a broad arsenal of Antibiotics strategies: *Small Organic Molecules, Biologics, Phage Therapy, Microbiome Modulation*... Where do you see the greatest therapeutic potential in these and other modalities?

CR: There is no clear Drug Development pipeline right now. The only *short-term* promise is in *Targeted Evolution of existing Antibiotics*. With Biologics, I think there is just not enough known yet in a *clinical* setting. Phage Therapy *could be* interesting, but there are *regulatory questions* there, when you start injecting humans with phages. In terms of direct modulation of the Microbiome to reduce infection rates, I think that is an interesting idea, but the field is still young, so it's *too early* for commercialization. We need antibiotics that are more focused and better targeted. And that will require a better understanding of the life-cycle and infectious properties of the bacteria in question. Other approaches include *making bacteria more prone to being killed by the immune system, destruction of biofilms, interfering with cell communication*... We need to *rethink* how we deal with bacterial infection. The first line of defense

does not need to be *Antibiotics*, but could be *Antiseptics*, which we've seen in Scandinavia. You use *what* you need *where* you need it.

GQ: How might the recent stream of discoveries on the Microbiome influence the field of Antibiotics, including the use of traditional drugs?

CR: There is a lot that can be done in *Precision Diagnostics*: for example, by using Deep Sequencing to determine the actual *disease-causing* bacteria. That could involve Artificial Intelligence (AI) or Machine Learning, which we'll be discussing later. You need a personalized approach to Diagnostics. I think we should *reconsider the use of broad-spectrum antibiotics*, in order to preserve the natural Microbiome. We really need new Antibiotics with *minimal toxicity*.

GQ: So much of today's Life Sciences sector is *decentralized*. Bacteriobator is a great example of that, with you in *Munich*, Christoph traveling around the DACH region, and your partners *around Europe and the UK*. So, how important are Innovation hubs or clusters with geographically-linked physical spaces?

CR: There's always a balance between *local critical mass* and *working abroad* to avoid “Not Invented Here” Syndrome or being blind to external Innovation.

GQ: I'm interested in AI for Drug Discovery and work with clients in this space. Where do you see AI applications in Antibiotics Therapeutics or Diagnostics?

CR: There are many, such as Machine Learning analysis of highly dimensional data to support therapeutic decisions for specific indications, like sepsis. There are Chemoinformatics applications in Drug Discovery. Also, it would be great to compile and analyze a database on failed clinical trials, to establish criteria for success. Another area is building Probability Models to study and predict bacterial mutations: their *location, type, frequency, etcetera*.

Training tomorrow's IP experts

Interview with **Matthias Fink**, LL.M.

Administrative Director

**Munich Intellectual Property Law Center
(MIPLC)**

www.miplc.de

I only learned of the **MIPLC's** existence 2 months before my Munich trip, and as soon as I reached out to Administrative Director **Matthias Fink**, he cordially agreed to an interview and made an extra effort to adapt to my tight schedule. Matthias introduced me to the MIPLC's fascinating teaching and research model, which ensures that students of diverse backgrounds, including STEM professionals, leave with the theoretical and practical bases to excel at distinct IP careers. A lawyer by training, Matthias gave me invaluable insight into Bavaria's modern history and its famous Knowledge Economy. After the interview in his office, nestled behind the **Residenz Museum**, he graciously showed me MIPLC's facilities, explaining how the design reflects their teaching philosophy, and then gave me a tour of the adjacent headquarters of the **Max Planck Institute**, one of MIPLC's founding partners. He even explained the history behind some of the neighboring historic gems, such as the **Cultural Project Marstall**, a contemporary theater housed in former royal stables.

GO: Matthias, what are the mission, objectives and activities of the MIPLC and who are the main stakeholders?

MF: The MIPLC has two pillars. *Firstly*, we do research with the Max Planck Institute. *Secondly*, we offer a 1-year Masters of Law degree in IP and Competition Law. The MIPLC was formed in 2003 – so we just celebrated our 15th anniversary last year – by the **Max Planck Institute for Innovation and Competition (MPIIC)**, who had noticed that many great lawyers were being trained at the universities, but with little emphasis on IP or copyright law. At the same time, Max Planck needed more people with IP skills, so they founded the MIPLC. We teach every subject from both the European *and* the US perspectives: so, European *and* American patent law, European *and* American copyright law, *etcetera*. We also offer a *glimpse* of Asian IP laws. Besides the MPIIC, the other partners are the **Technical University of Munich (TUM)**, **The**



George Washington University, in Washington DC – who have been teaching IP since the 19th century! – and the **University of Augsburg**. The MIPLC is run by a Project Board with one representative of each of the four founding partners. Program Director **Seth Ericsson**, and the two Administrative Directors, **Margit Hinkel** and I, are responsible for day-to-day operations.

GO: Tell me more about the MIPLC's students, teachers and teaching methods, and the balance between theoretical and practical training, and between IP Strategy and Prosecution.

MF: We have a small and an extremely diverse student body: we deliberately only take in about 36 students a year, and they represent around 20 nationalities. *About 40% have a technical background*, in Biology, Chemistry, Physics, Medicine or Engineering; *the other 60% are lawyers*. The first thing

that sets us apart from traditional academic programs is our *network nature*: rather than have a *standing faculty*, we fly in diverse IP experts to come teach for 2 weeks at a time. We ask ourselves: *Who could teach such-and-such subject?* And we look at experts from Germany and abroad, including **Oxford**, **Cambridge** or **Stanford**. Our curriculum includes an optional 2-month internship. Students can opt for an internship at an IP law firm, in the IP department of a large multinational corporation or at an international institution. Another unique aspect is our office arrangements: *we selectively divide the students into small groups of complementary cultural and professional backgrounds*, and give each group a shared office. That ensures a lot of rich *discussions* and *exchanges*. Some times when I arrive in the morning, I see that a scientist has written a formula on the whiteboard to explain science to a lawyer colleague! Our training includes IP Strategy, Valuation and Prosecution, so we're looking at the *entire life-cycle* of an IP asset. We run activities like a licensing game, in which the students do mock negotiations.

GO: What is your professional background? And what is your role as one of the two Administrative Directors here at the MIPLC?

MF: I studied law in Germany and in Lyon, France. My tasks here include legal and financial aspects, and counseling students on internships and the job market. I help students with things like writing their CV, doing role-playing activities like mock job interviews, and with connecting them to employers. We take a lot of pride in Career Development here!

GO: Can you describe some of the recent research projects at the MIPLC?

MF: We're very active in the **European Intellectual Property Institutes Network (EIPIN)**, which includes four other European IP schools (see:

www.eipin.org). Through the **European Commission's Horizon 2020 (H2020)** program, EIPIN has received funding to train fifteen PhD students – three at each of the five EIPIN schools – to *understand the Valley of Death*, in order to *better prepare companies to get from lab to market*. So each student spends 36 months writing a PhD thesis, interning at different corporations or industry associations and completing many IP-related training courses. From the MIPLC side, the PhD program is being directed by **Prof. Dr. Josef Drexl**, one of the Directors of the MPIIC.

GQ: Munich seems to be a dream location for IP expertise, especially in Technical fields: you have here the **European Patent Office (EPO)** HQ, the **German Federal Patent Court (BPatG)**, the **German Patent & Trademark Office (DPMA)** and several top-tier IP firms like **Boehmert & Boehmert**, **Eisenführ Speiser**, **Michalski Hüttermann**... How does the MIPLC collaborate with these prestigious organizations?

MF: Yes, Munich is called the “IP Capital of Europe”. We have many big-name firms with a specialized focus on geographic regions, which is good for our graduates. I often get calls from companies and IP authorities, including the EPO, asking us if we have any graduates with a particular skill set, cultural background or language ability. That’s important right now for German companies doing business in China, Japan or South Korea. A specific example is that the EIPIN member institutions recently started a training program with the EPO and the **EUIPO**, called “Pan-European Seal”, to train MIPLC graduates, among others, in their various departments.

GQ: How did Munich get to be such a powerhouse of IP and Technology?

MF: After World War 2, Bavaria was basically an agricultural backwater that was

transformed into an IP-driven, Tech-driven hub. *It's true!* Not many people know that. We were *far* from the coasts, *far* from the coal and steel industries of the Ruhr valley, up north... So people asked: *What can we do here?* Over 40 to 50 years, different governments created a fertile soil to attract High Tech companies, by building several new universities and technical schools all around Bavaria. In Munich, you have the long-standing universities of TUM and **LMU**, plus *R&D strength*, plus that *IP expertise* we talked about, plus *foreign talent*, because people *like* coming to Munich... So the Munich area is to Germany, what California is to the USA! Today we are reaping the rewards of our parents’ and grandparents’ decisions.

GQ: I am very interested in AI applications for Drug Discovery IP: *for example, to analyze prior art*. Is the MIPLC interested in AI? If so, how do you incorporate it into your research or teaching?

MF: We certainly do have an interest in AI. Every year, we review our curriculum to ensure that it is relevant. So, we’ve introduced a course on “Big Data and the Law”, taught by **Prof. Dr. Matthias Leistner** (LMU). We recognize that students need information on Big Data and IP. We host a lecture series and lately, several of the talks have dealt with AI. Also, many of our over 400 alumni around the world come back to give talks at our annual alumni conference, and recently, many of those talks have been on AI.

GQ: Given the strength of the Life Sciences sector here in Munich, the expertise and network of the MIPLC and all the focus on AI, there seems to me an obvious window of opportunity for some type of local consortium in that area. Is that something that MIPLC would be open to? Or maybe just co-hosting related events with local organizations like **Bio^M** or **IZB**?

MF: We’re always open to exploring proposals and we receive many sug-

-gestions from *all around the world*. We always look closely to ensure that the proposal is consistent with our mission. So in theory, that's something that we could at least *consider*, but I can't *promise* anything!

GQ: What do students need to apply to your program?

MF: There are three main requirements: a *Bachelor's degree*; a *TOEFL score of 85 or higher, for non-native English speakers*; and *at least 1 year of professional experience*. I'd like to add that the MIPLC is part of a **German Academic Exchange Service (DAAD)** scholarship program for students from developing countries doing post-graduate courses in Germany. Recent winners came from places like *Afghanistan, Bolivia, Ghana* and *Nigeria*.



Putting numbers to industry promises

Interview with **Dr. Joachim Greuel**, PhD, MBA
Managing Director, Co-Founder

Bioscience Valuation

www.bioscience-valuation.com

I was introduced to **Dr. Joachim Greuel**, Managing Director and Co-Founder of **Bioscience Valuation**, a couple years ago through his colleague, **Dr. Thomas Zürcher**, who also heads the R&D division of **PROALT**, in Madrid. Joachim has that rare combination of both breadth and depth of expertise, thanks to a multifaceted career trajectory that spans four countries: a PhD in Physiology from the **Max Planck Institute for Brain Research** and several years leading a Drug Discovery team at **Bayer**, both in Germany; an MBA from **Wharton**, in the USA; teaching Pharmacoeconomics at **IE Business School** in Madrid; consulting and investment experience at **Andersen** and **New Medical Technologies**, respectively, in Switzerland... Our interview, in a bar on Munich's Sonnenstraße, was as stimulating as it was educational!

GQ: Joachim, can you explain Bioscience Valuation to my readers who might not be familiar with your company?

JG: Perhaps I should start with the *history*, because that's important to understand the rest. After my PhD and my time at Bayer, I went to Wharton for my MBA, and ended up specializing in *Finance and Healthcare*. Finally, I came back to Germany wanting to bring two worlds together: *Business Ventures* and *Science*. I spent some time working at a VC investment fund in Basel and ultimately created Bioscience Valuation in 2000, knowing that there was a need for *valuation services*. The key was having that *double expertise*.

GQ: Who are your clients and what services do you offer?

JG: We have three types of clients: *Biotech*, *Big Pharma* and *investors*. For *Biotech* companies, we mainly help them to *prepare for funding*, by doing pre-money valuation, and to *prepare for licensing*, for which we spend a lot of time approaching partners or investors, doing term-sheets and supporting negotia-



tions. For *Big Pharma*, we mainly do *in-licensing* and *portfolio management*, for which we can provide an objective view. And for *investors*, we can help them to decide *whether they should make an investment* and to determine *how much they should spend*. The idea is to take away the *guesswork*. By area, about 80% of our clients are in *Therapeutics*, about 5% in *Medical Devices*, and the rest in areas such as *Diagnostics* and *Animal Health*. Roughly 35% of our clients are *German*, with the rest coming from various countries: *the USA, the UK, Switzerland, Spain, China...*

GQ: Certain investors can be extremely arbitrary in their valuations of Life Science companies and assets, especially in seed and Series A, basically working in “accepted” ranges that loosely parallel past “guidepost” deals. *Your thoughts?*

JG: It’s *true* that arbitrary valuations are common. Value is driven *mainly* by *sales potential* and *chance of success*. For therapeutics, you have to design your Target Product Profile based on *real medical needs*. That means looking at Efficacy, Safety, Formulation and Price, and doing a probabilistic analysis of your program. We provide *Evidence-Based Valuations*, meaning that all our assumptions are backed by *credible sources*. At Bioscience Valuation, for every input that we use, we provide a *reference*. That helps our clients *tremendously*, because they can defend the valuation. It’s important to have a good starting point. With good preparation, you can win *millions of dollars* when negotiating with a potential partner!

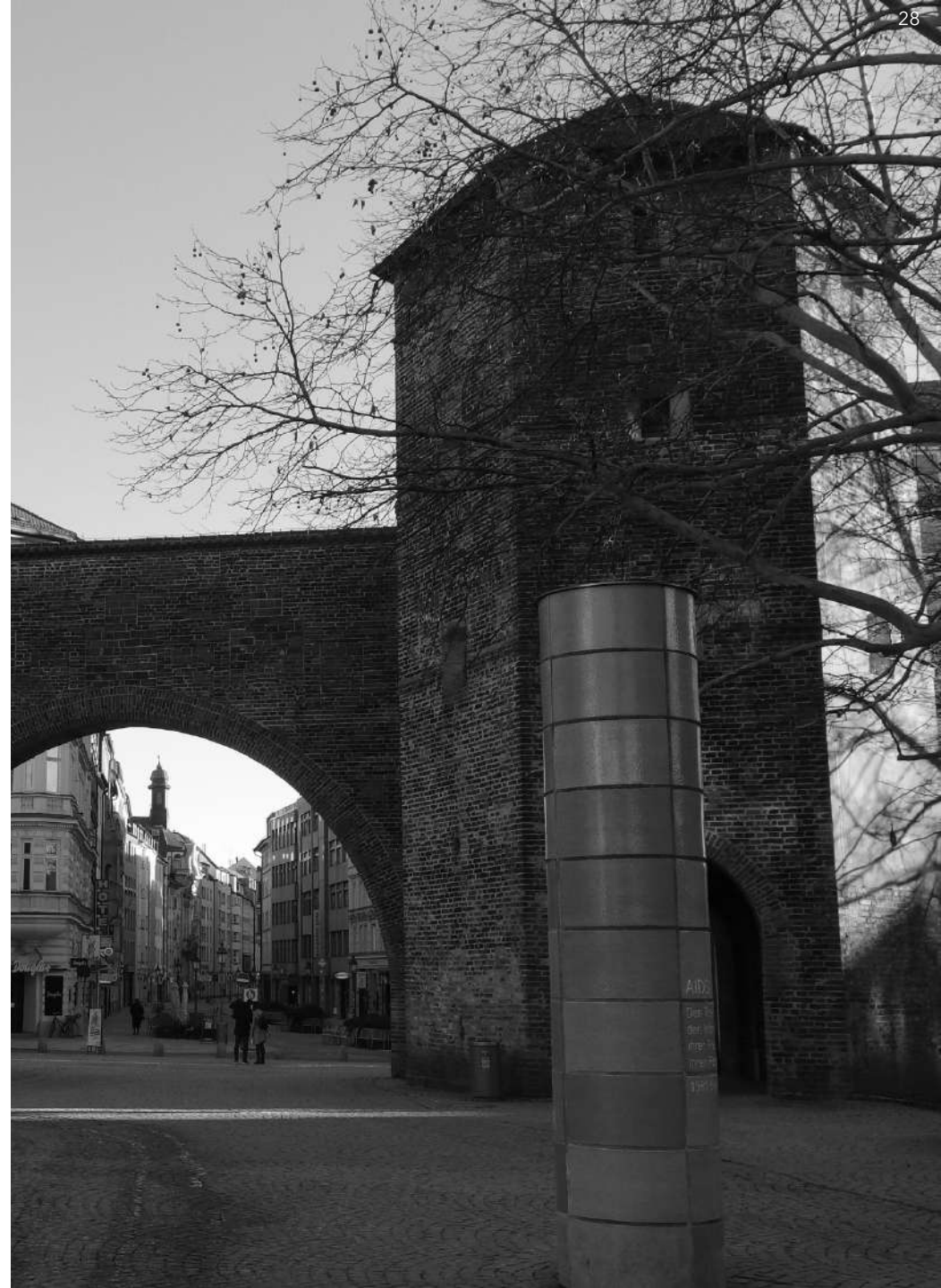
GQ: In our sector, there’s always a lot of criticism about the lack of alignment among profitability for investors, R&D success for companies and the real needs of patients. What can be done to better harmonize those factors?

JG: Given that the failure rate in Drug Discovery is so *high*, we all have the same goal: *to enhance the probability of success*. At Bioscience Valuation, we believe that at least *one-third* of clinical trial failures are related to factors unrelated to the chemical entity itself: factors like Study Power, *Indication Selection, Choice of Endpoint, Biomarker Use*... I remember a company that had great Phase 2 data on an antibody, but their Phase 3 failed because of a tiny statistical fluke related to cohort size. They underpowered that study because they didn't have enough money for a larger patient group. Besides, when you can stratify patients based on *real-world evidence information* and *biomarkers*, then you can *really* improve the outcome of clinical trials.

GQ: Another subject that has come under fire lately is the purported failure of Precision Medicine to live up to its promises¹. Given your expertise in the field, where do you stand on that issue?

1. See, for example: www.jci.org/articles/view/126119

JG: Personalized or Precision Medicine has been a *very good development*. We understand *a lot more* about diseases than before. *Oncology* is the hottest therapeutic area right now, and Personalized Medicine for Oncology has been a *quantum leap*: the knowledge gain has been *huge*! Of course, sequencing the human genome was just one small step. We still need to understand how those genes work and to account for Epigenetics, Proteomics, Post-Translational Modifications... If you can combine Omics data with *other* types of data, such as *real-word insights*, then you can *really* make serious progress.



The Munich VC corner:

Part 1

Interview with **Dr. Fei Tian**, MD, PhD

Principal

Vesalius Biocapital

www.vesaliusbiocapital.com

I first contacted **Fei Tian** through LinkedIn. After cordial emails and a Skype chat, we met in person at **Vesalius Biocapital's** Munich office, located at **IZB**. A native of northern China, Fei trained as a medical doctor in Shanghai, then did a PhD at **LMU**, ultimately leaving both the lab and hospital behind to work in VC. I was as impressed with Fei's credentials as I was with her multicultural perspective, warmth and openness. She taught me about some of the unique investment challenges and opportunities in Munich's Life Sciences ecosystem.

GQ: Fei, could you give me an introduction to Vesalius Biocapital?

FT: Vesalius is highly *decentralized*. We have two Managing Partners in Brussels, two Venture Partners in Munich, with whom I share an office, an IP Expert and our Financial and Corporate Controlling team in Luxembourg, a Venture Partner in Paris and a Venture Partner in Boston. *Over 300 companies contact us per year*. About 10% of those 300 companies are companies that have *previously* contacted us. We have a Deal Flow of about 1%: so, we do *three or four deals* per year during the investment period. We attend a *lot* of conferences and reach out to R&D teams or IP offices.

GQ: Tell me about your role there.

FT: I mainly do *Deal-Flow Management*. We have a large database of information on companies and projects, which I manage. So the *majority* of my time, I'm doing Deal Analysis and preliminary Due Diligence. I'm becoming more involved in Portfolio Management, too; I'd eventually like to join the boards of companies. I *also* help with tasks like fundraising, finding investors in Asia and things like that. We all have specializations based on our backgrounds and previous experiences, but of course, none of us is as *specialized* as the scientists themselves. For example, I may work more in Oncology. Sometimes, we use external experts. For Digital Health, which we're seeing more of in



Vesalius Fund III, we need IT experts to analyze software architecture.

GQ: Tell me more about Vesalius Fund III and the investment strategy for it.

FT: For Fund III, we're benefitting from our long-term involvement in the ecosystem. So that means *more-mature* Drug Discovery projects: ones that are clinical ready or even in Phase 1 or 2. We'll also invest in *Medical Technology*, *Diagnostics* and *Digital Health*. However, we're still enthusiastic about meeting and helping *early-stage founders* to help them form their companies and make them VC-ready for the future.

GQ: What do you feel are the Munich ecosystem's strengths and weaknesses?

FT: There are very strong scientific centers and high-quality hospitals to enable development and to recruit experts that would like to live and work in Munich. The location itself is *very convenient*: the airport is very convenient, you can fly to China, to the USA... The ecosystem for Life Sciences here is *very mature*. You find VCs from *all over Europe* investing here. There's *a lot* of public funding at different levels: German, Bavarian, *etcetera*. Munich is *a bit expensive* for cost-of-living. So, a lot of start-ups prefer to *move somewhere cheaper*, like *Berlin*, where salaries and office space are cheaper.

GQ: How effective are German public funding & financing instruments for start-ups and SMEs, such as **Go-Bio**? Are there the same fears here, as in other European countries, like France, of public monies being used to keep failed companies on life support?

FT: Quality and efficacy of public funding is not just a *German or French issue*, but rather a *European issue*. I agree with you that many companies have

maintained funding by getting one small grant after another. And nobody is asking: *What is the time limit or assessment process to limit that funding?* Most of the time they can't exclude based on the *quality* of the work, but they have to use *hard criteria* like the *age* of the company, the *milestones*, the *revenue*... One strategy is that public funds can work as *co-investors* with VC funds, which is something that we've done with **Coparion** as well as with other public funds. So, the question is: *What is the right balance between over-incubating projects and really focusing on the high-performing ones?*

GQ: Many of Munich's start-ups and SMEs have been acquired by large foreign firms (see p. 55), which is a sign of their quality and is good news for their investors. However, many Europeans are frustrated that their best companies always get acquired or leave. How realistic is it for established SMEs in Munich to try and stay independent, like **MorphoSys** has done?

FT: This is an issue that we've heard from other VC colleagues: *that European VCs tend to sell too early and that they could do a better job of taking companies to a more mature stage.* I hope that things change. Back in 2007, there was the financial crisis, and companies had a hard time finding investments, while investors were looking for 5-year exits. Now we're seeing larger investments *come back*, so start-ups can *get €40 or 50 million at a preclinical stage* to develop their assets further. And established companies can find funding to even go *as far as Phase 3.* We find that when companies have to worry about bridge funding, they waste a lot of time, maybe *half a year*, during which they're *not spending money and not developing their assets.*

GQ: One of the start-ups in Vesalius' Fund III is **Mecuris**, which does Computer-Aided Design and 3D-Printing of orthoses and prostheses and is based here in Munich. Tell me about your decision to invest in them.

FT: First, they have a *real medical product* that serves an *unmet medical need.* Secondly, they have a *highly-automated production process.* We looked at *several 3D-printing processes*, and we think that they have *one of the best*, in terms of *logistics.* One of the big issues for Medical Devices is how to adopt *high-tech solutions*, rather than just *paper and pencil*, for design and manufacturing. I think Mecuris has done a really good job at that. We appreciate that. The team is *very young* and has *evolved a lot.* They are making a *real social impact.*

GQ: Do you foresee that, over the next 5 to 10 years, Chinese Life Sciences companies and investors will play a bigger role here in Munich: whether that means setting up local operations, investing in start-ups or even acquiring companies?

FT: Yes, I *think so.* And I *hope so*, as well. But it *won't* be as fast as some people say in the media: that there will suddenly be *thousands* of Chinese investors coming. However, European companies should take into consideration that they might *eventually* work with Chinese investors. Many Chinese investors are *very strategic*: for example, they might want to have a potential deal for *licensing for the Chinese market*, or a *licensing deal to bring the European technology to China.* And that's *not always welcome from the European side*, from investors who are mainly *finance-driven.* Their (Chinese investors') concern is not the *exit itself*, but rather the *technology.* Years ago, it was easier for Chinese investors to have large amounts of euros for M&A deals; but in recent years, the foreign currency control in China has become much stricter, so Chinese Pharma companies and investors are more restricted.

The Munich VC corner:

Part 2

Interview with **Christian B. Jung**, PhD

Principal

Wellington Partners

www.wellington-partners.com

*Dr. Christian B. Jung, Principal at **Wellington Partners**, one of Munich's most well-known VC firms, was introduced to me by Managing Partner **Dr. Regina Hodits**, through a mutual acquaintance at a Big Pharma Innovation center. A Luxembourg native, Christian came to Munich to attend university. He began his VC career as a Masters-level intern back in 2005, and then earned a PhD in Molecular Cardiology at **TUM**. Before joining Wellington, he worked at **High-Tech Gründerfonds** (see p. 69) and **Atlas Ventures** and has served on the boards of start-ups like **TRiCares**, **Rigontec** (see p. 55) and **Amal Therapeutics**. In another prime example of the openness of Munich Life Science professionals, Christian not only happily agreed to an interview, but also arranged for us to have breakfast at **Brasserie Tresznjewski**, a Munich institution. We conversed about everything from Cancer Immunotherapy targets to start-up business models to transport connections.*

GO: Christian, can you briefly outline Wellington Partners' investment philosophy and strategy?

CJ: Our mandate is to invest in solutions for *life-threatening* or *severely-debilitating* diseases for which *few or no treatment options* exist. In order for us to invest, there needs to be a *super-strong medical need*, *credible management* and a *clear path to approval*. We look for investments in which the value proposition is *automatically differentiated*. For example, when we invested in (Philadelphia-based) **Carisma Therapeutics**, part of that decision was taken on the grounds that they are the only CAR-macrophage company out there, so you don't have to explain to the buy-side *how* this company is different. Wellington Partners' current fund, *Fund V*, is currently holding commitments of *€209 million*, making it *Germany's largest Healthcare investment fund*. It's a *reasonably-sized* fund that gives us the *freedom* to make the investments that we want in the current market environment.



GQ: Regina told me that you know the Munich Life Sciences ecosystem quite well. What do you perceive as its strengths and weaknesses?

CJ: I'll begin in a *German* context. If you want to open a company or subsidiary in Germany, then I'd say your first thought should be to do it in *Munich*. There are major VC's here such as **Forbion** and **Wellington**. And the **IZB** is an incubator of a quality that is *unique* in Germany. **Peter Zobel** (see p. 7) is *amazing!* What he accomplished there is *nothing short of amazing!* There are other factors, too. You have a well-connected airport, nice surroundings, an attractive city... all of which are key for hiring people here. You have super R&D groups here at **Max Planck, Helmholtz**... In terms of the *downsides*, only a *very few* Pharma and Med Tech companies have senior business developers located in Munich: it's *not like in Boston*, where you can easily meet people for lunch. The interaction between Tech Transfer, scientific groups and the VC

VC community could be further improved, although I would say that this is not really a *Munich problem*, but a *continental Europe problem*: Tech Transfer is just being done *differently* than in the *US*. We counter that by entertaining strong direct relations to the academic groups and by co-organizing local events that allow start-ups to pitch to the VC community.

GQ: I'm often shocked at the hiring decisions that I see at public Tech Transfer Offices in certain European countries. I see 27-year-olds finish their Life Sciences PhD, and then get hired into senior positions, when they've *never even worked in industry!*

CJ: Because those are the *only people* those centers can hire. Public-sector institutions *can't pay professionals anything close to what the private sector pays*, which is one of the factors that is making it hard for them to recruit senior people into the Tech Transfer offices.

GQ: I've heard frustrations from certain professionals in Munich that the local VC firms do not invest sufficiently in *homegrown* Life Science companies. Is there a *problem here* with VC "loyalty" to Munich and Germany?

CJ: First and foremost, we're bound to *return with profit* the money that our investors have entrusted us with. We're not a *political organization*. So, *although* we have a mission to help foster the Munich and German ecosystem, we *can't* finance a Munich-based company that's the *third-best* in its field. Our factors are *Scientific Quality, Team Quality* and *Medical Need*. Having said that, we can happily offer certain *extra services* to German companies that we might not offer to foreign ones, like *advising them on how to develop their projects to a stage that is investable* or *brokering contacts that could be useful for them* in their further development.

GQ: Another complaint I hear from researchers and start-up founders here is that German investors are *too conservative*. Given the different risk levels between, say, Therapeutics and Scientific Tools & Instruments, do you think the latter might provide a more *comfortable* entry point for risk-adverse investors to support the Life Sciences ecosystem? Maybe they *won't* get a 30X return on a lab instrument, like they might for a therapeutic molecule, but the risk would be *lower* and the life-cycle, *shorter*.

CJ: It's common to *underestimate risk* and go for potential "*safe bets*", but there's *always* risk involved in investing, although there might be different risks associated with different industries. I'm not so sure that the levels are *that* different. Those Instrument or Tool companies have always been *hard to align with the VC business model*: they often want to *grow organically, increase their sales...* and then, *sell on a sales multiple*. That's not the kind of investment that VC's look for. As an illustration: the market is not willing to pay a premium because you've made a syringe that's 10% sharper or a bandage that's 10% stickier. No patient has every *died* because their syringe wasn't *sharp enough* or because their bandage was not *sticky enough* - that strong medical need is often just *missing*! So, unless those companies are not doing something *truly disruptive that will transform the way medicine is being practiced*, I just don't see the rationale to invest as a VC. A good alternative for such companies that have tangible revenues could be to finance the continued organic growth though bank loans.

GQ: Something I've been asking everyone here about, is the importance of *geographic proximity* for Life Sciences Innovation, given that so much of our sector is now *decentralized*, with Virtual Biotechs and the like.

CJ: Some things should be local; others don't matter. For example, for *services*

like lawyers or CROs, it really *doesn't matter* where they're located. A patent attorney should at least *visit the company once in a while*, though. For young Biotechs, I believe it's *crucial* to have the core team in one location so that they can have frequent physical meetings to align on progress and issues. I just don't think that the decentralized model works in the very early stages of a project if internal R&D efforts are involved. Also, having VCs nearby is helpful, as time is *critical* to VCs, too. That makes it easier to meet informally at your lab, or over coffee or lunch.

GQ: Any Munich start-ups that you happen to like?

CJ: Check out **TRiCares**, **Kumovis** and **iOmix** (see p. 57 for all three).

GQ: Thank you and thanks for breakfast.

CJ: Thank you!

All eyes on Martinsried:

Biotech Press Lounge at the IZB

21 February 2019

I was fortunate enough to reserve a space for **IZB's** latest Biotech Press Lounge event, its first for 2019. The unique format of this series provides attendees with crucial networking opportunities within the Munich Life Sciences ecosystem, while guest speakers give brief, informal presentations (no PowerPoint slides!) on their work in R&D, business or investing. This edition was opened by IZB CEO **Dr. Peter Hanns Zobel** (see p. 7), moderated by local journalist **Eva Müller** (Manager magazine) and featured three guest speakers:

Dr. Hubert Birner, Managing Partner at **TVM Capital**, one of Munich's most well-known VC firms, sought to give an update on TVM, to "get people excited about VC" and to tell us what was "keeping him up at night". He explained that TVM has is now taking on much more early-stage risk, including single-asset companies and investments in which TVM is the sole investor. He said that their portfolio of twelve early-stage molecules was progressing well. He affirmed that TVM still explores more-mature opportunities: companies with 3 to 4 years until a "massive exit", "little or no technology risk" and a "massive value proposition". He mentioned that TVM is now also looking at Diagnostics and is partnering with **Qiagen**. Despite the strong American market of the past couple years, Dr. Birner shared his reservations about the US, citing the effects of the recent government shutdown on certain IPOs around Christmas 2018, and alluded to the threat of possible American government intervention as foreigners increasingly invest in US Biotech, a sensitive sector. He also warned that "more and more money is going to fewer and fewer companies", and mentioned two problems in Life Sciences: heavily-funded companies facing exit pressure, and underfunded companies facing survival pressure. He described a troubling trend of VCs taking fewer risks, and that there was "a massive concentration of money" among a few VC groups. He was also concerned about the paucity of Business Angel and Seed funding in Europe and shared his negative outlook for the next 5 years. Lastly, although he

described Brexit as a “big mistake” that made him “very sad”, he was confident in the UK’s ability to “keep its Biotech sector intact”.

Dr. Phil L'Huillier, VP of Business Development for Europe & Middle East at **Merck Sharpe & Dohme’s (MSD)** new **Innovation Hub**, in London, summarized MSD’s evolution from a New Jersey-based Pharma company focused on small-molecule drugs, to a less centralized company with an agnostic approach to therapeutic modality. He quoted an impressive figure: about 20% of MSD’s \$20 billion in revenues go back into R&D. He outlined MSD’s six core areas (Oncology, Immunology, Infectious Diseases & Vaccines, Cardiovascular & Metabolism, Neurology and Microbiome) and emphasized MSD’s desire to collaborate with smaller companies. He stressed the value of their acquisition of former IZB company **Rigontec** in 2017 (see p. 55), underscoring the relevance of RIG-I and Innate Immunity to MSD’s I/O strategy. He said that “*You don’t do Innovation by a shopping list*”, but instead need to look at novel targets, novel mechanisms and defining therapeutic needs. As hubs of Neurology, he listed Paris, Scandinavia, the UK and Munich. However, he explained that MSD did not need to focus on traditional hubs, but could “go all over Europe”. For instance, his team had attended **BioSpain** in 2018 “*and saw some interesting science in the south of Spain*”. Interestingly, he told us that when MSD was considering sites for its new Innovation Hub, they had narrowed it down to London and Munich before choosing the former. Another recurring theme in his talk was that of shifting away from a classical “*disease focus*” towards a better understanding of Cellular Biology, in areas like Neurodegeneration, ER Stress, *etcetera*, which includes collaborating in those areas. Since he had mentioned Neurodegenerative diseases, I asked him when he thought we might begin to see therapies based on modulation of autophagy and/or the proteasome. He replied that it was still too early, as the underlying biology of those phenomena are still not well understood.



Dr. Phil L'Huillier (Merck Sharpe & Dohme)

Prof. Ali Ertürk, Group Leader at the **Institute for Stroke and Dementia Research (ISD)** at **LMU**,

opened up his talk by asking the audience how many people believed humans could eventually live to the age of 200 years! He described his research group at being at the crossroads of “Imaging, Artificial Intelligence, Nanotechnology and Engineering” and that his team asks “How can we accelerate science to benefit humanity?” ... “We’ve done so much in the past 2 years. Things that we previously thought were science fiction, we’re now doing”, he affirmed. Prof. Ertürk’s team has developed technology for Whole-Body Imaging of (sacrificed) animals and tissue samples at the sub-cellular level, based on generating numerous transparent slides, which he compared to “converting milk into water”. Thus, they marry the utility of traditional Whole-Body Imaging techniques like Magnetic Resonance, which are limited in their resolution, to high-resolution techniques such as Electron Microscopy, which “cannot be scaled to a whole organism”. He joked that visitors to his lab “freak out when they see invisible mice or human brains”. Prof. Ertürk described a couple applications of his technology. The first was Whole-Body Imaging of animal models of cancer. His group has collaborated with cancer biologists to characterize “every cancer cell inside a mouse’s body”, to identify the most pernicious cells underpinning metastases – those few cells that tend to be treatment-resistant and immune-resistant. They’ve studied the size of metastases as well as the efficacy of therapeutic antibodies at a single-cell-targeting level. Alluding to the dire need for organ donors, he introduced the second application: creating subcellular “blueprints” of organs to enable 3D-Bioprinting of organs or of hybrid systems merging engineered kidneys with dialysis machines, as a way to improve upon nature. To Eva Müller’s question on when such organs might appear in the clinic, he responded that functional kidney parts could be bioprinted within 5 years. **Note:** Prof. Ertürk’s work on Imaging of human brains to visualize neuronal structures was featured on the cover of the February 2019 issue of *Nature Neurology* (issue **33**(2)).



Dr. Peter Hanns Zobel (IZB; L) and Gregory Qushair (Alésia Consulting; R)

"Proteomics around the Clock"

Prof. Maria "Charo" Robles, PhD

Head, Systems Chronobiology Lab

Institute of Medical Psychology, LMU

*Interdisciplinary Lecture Series at the
International Max Planck Research School for
Molecular & Cellular Life Sciences (IMPRS-LS)*

Max Planck Institute of Biochemistry (MPIB)

21 February 2019

*There was no way I was going to spend a week in Munich, touring some of its finest R&D centers, without attending at least one academic seminar. And I was spoiled for choice: there were dozens of lectures, workshops and conferences going on while I was there. I chose "Proteomics around the Clock", by **Prof. Maria "Charo" Robles**, who leads the Systems Chronobiology Lab at **LMU**. A native of León, Spain, Prof. Robles warmly agreed to let me sit in among the chattering grads students. She gave a crystal-clear talk designed for non-specialists to grasp the crux of her work and the big issues in her field. Note: the lecture host from **MPIB** informed us that photos were not permitted.*

Prof. Robles' seminar comprised two parts:

In *Part 1*, she gave us a quick overview of circadian rhythms, pointing out examples of time-synched maxima and minima in human physiology: *for example, that we tend to show maximum alertness around 10 a.m., greatest coordination around 1 p.m. and our highest body temperature, around 7 p.m.* She explained the roles of *critical transcription factors* like BMAL1 and CLOCK in temporal maintenance of gene expression. I learned that 25% of the genome is regulated by the circadian clock! She also illustrated how ambient light entering our retinas reaches the brain to modulate the suprachiasmatic nucleus, the circadian "master clock". Turning to her team's work, Dr. Robles recounted how they developed a luciferase reporter for use in mice, which they used to *record circadian rhythms in samples of healthy murine liver tissue*, based on activity of the *Bmal1* promoter. Using Quantitative Mass Spectrometry (MS)-based Proteomics, they determined that more than 6% of liver proteins cycle throughout the day. They identified a temporal gap between the mRNA transcripts and the proteins, with the former peaking about 6 hours before the latter. They ultimately identified two main signaling pathways for circadian control of metabolism. Dr. Robles emphasized that the

functional consequences of these patterns are not yet well understood, but she did mention that temporal gaps between *protein peaks* and *metabolic function* may be somewhat attributed to *post-translational control of metabolism*.

In *Part 2*, Dr. Robles focused on circadian rhythms in the brain and their relationship to phosphorylation of proteins involved in *light/dark* (for mice: *sleep/wake*) cycles. She showed us a nice diagram of the *kinase signaling hubs* in the *synaptoneurosome*. Crucially, when her team *deprived healthy mice of sleep*, throwing the animals' circadian clocks off, they observed concomitant *impairment of synaptic activity*, as reflected in a *dysfunctional proteome*. Before concluding her talk, she mentioned other projects that her team is working on, including a collaboration with **Prof. Dieter Saur (TUM)**, as part of the **SFB1321** consortium on pancreatic cancer and the circadian clock. When I asked Dr. Robles about *comparing circadian-linked Omics data between healthy and diseased tissue*, and the implications of circadian control of metabolism for issues like *drug dosing*, she affirmed although these were "hot topics", their clinical utility was currently limited by the lack of knowledge on how mRNA levels, protein levels and protein function are actually related.

To learn more about Dr. Robles and her team's work, see the following:

Group website:

www.imp.med.uni-muenchen.de/research/systems-chronobiology-robles/index.html

Publications and projects cited in her lecture:

1. <https://journals.plos.org/plosgenetics/article?id=10.1371/journal.pgen.1004047>
2. [www.cell.com/cell-metabolism/pdf/S1550-4131\(16\)30535-6.pdf](http://www.cell.com/cell-metabolism/pdf/S1550-4131(16)30535-6.pdf)
3. www.sfb1321.med.tum.de/en

SME profile:

CellTool

www.celltool.de

Founded:

2008

Full-time staff:

4

Business:

Benchtop instruments for label-free cell analysis and sorting

Approach:

Raman Spectroscopy-based microscopes equipped with simultaneous Optical Trapping functionality

Scientific
Tools &
Instruments
Special

Visiting **CellTool's** headquarters in Tutzing, by the shores of Lake Starnberg (around 40 minutes south of Munich by train), was a real treat. Not only did CEO, CSO and co-founder **Dr. Karin Schütze** and Lab/Scientific Sales Manager **Dr. Hesham Yosef** provide me with a thorough, informative introduction to CellTool's innovative technology for analysis of living cells, they also demoed one of their BioRam® instruments for me, while co-founder (and Karin's husband) **Raimund Schütze** assembled another instrument on his workbench. You really have to see the Optical Trapping function in action to believe it: I stared incredulously at the computer screen as Hesham "picked up" a single live bacterial cell and held it in place, only to drop it back into the crowd of swimming cells a few micrometers below. CellTool embodies that typically Munich mix of scientific expertise and entrepreneurial spirit.

GQ: Let's talk about CellTool, its history and especially, your BioRam® instrument. I'm really intrigued by your approach and honestly, I had no idea that you could apply Raman Spectroscopy to living cells!

KS: My husband Raimund and I are *serial entrepreneurs* in Instrumentation. We sold our previous company, **P.A.L.M. Micro Laser Technologies** to **Carl Zeiss** back in 2004. Fascinated by the power of photons that allow non-contact micro-dissection and manipulation, we looked for a *new* technology to explore for cell characterization. We reflected on the fact that standard techniques for analyzing living cells require *labels*: either monoclonal antibodies and fluorescence labels, for FACS, or magnetic beads, in the case of MACS. Also, they typically require large volumes of cells. So we wanted to create a technology for *label-free analysis of living cells*, and one that would require *small cell volumes*. We initially explored various techniques, things like *Holography*, and finally settled on *Raman Spectroscopy*. People asked us: "How can you use Raman to do cell analysis? Raman is well-known for pure compound analysis but cells have million of molecules in permanent turnover!".



Dr. Karin Schütze (L) and Dr. Hesham Yosef (R)

However, *Raman is fast, label-free and very sensitive*. The first thing we needed was a set-up to detect Raman photons, so my husband invented one! He has a background as a goldsmith and studied Optics and Electronics, so he is *quite good at building high-precision tools!*

GQ: What exactly can you do with a BioRam® instrument?

KS: There are so *many* applications... You can use it to *distinguish between healthy and infected cells*; you can do *Quality Control on batches of Cellular Therapies like CAR-T cells*; you can use it for *Drug Screening*; you can test *cell media*... Our instrument can perform all of those tasks with *less than 100 cells*, unlike traditional methods, which require thousands of cells. We recently applied for a patent to measure *transfection levels of genetically engineered cell lines*, to quantify the number that are *really* transfected.

GQ: Who are some of your customers and collaborators?

KS: We began with *academic collaborators*. Our mission was to really *make people aware* of Raman-based products for cellular applications. They include the **University of Würzburg**, the **Karolinska Institute**, the **Paul-Erlich Institute**, the **German Red Cross Blood Donation Service**, the **German Center for Cancer Research (DKFZ)** and many more. We often publish papers and conference posters with our partners (*note: see below*). In terms of sales, we recently began distributing our instrument in China, Japan and the USA.

GQ: What are some R&D projects that you've worked on?

KS: We were partner in the **EU FP7** Health project **IDEA**, on identification, homing and monitoring of therapeutic cells for Regenerative Medicine. We've worked on QC analysis of skin grafts in collaboration with the **University**

Children's Hospital Zurich and got funding from the **German Federal Ministry of Education and Research (BMBF)**, through their **KMU-innovativ** ("Innovative SME") program, to develop Raman-based QC of blood products¹. We've published a paper with academics from Germany and Austria, on use of BioRam® to analyze 3D cell cultures². And we've collaborated on the **Horizon 2020 (H2020)** project **TargetAMD**, on Age-related Macula Degeneration³.

1. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6198779/>

2. https://docs.wixstatic.com/ugd/10bc71_a2aaca94b10428a96b6f9e4506c2c2d.pdf

3. www.targetamd.eu

GQ: Coming from a Drug Discovery Chemistry background, I know how important *standardized values* are for characterization: *NMR shifts, Pka values, logP values...* Do you foresee that scientists will eventually compile a *database of standardized Raman values* for living cells, based on *cell type, cell-cycle phase* or whatever?

KS: Yes, we think that that will *eventually* happen. But it will take time, because it will require Raman Spectroscopy to become *generalized* among cell biologists and physicians. And of course, there are many parameters to consider.

GQ: Given recent *advances in single-cell analysis*, the fact that you're exploring the *utility of Raman Spectroscopy for characterization of tumor cells*, and the duration of the BioRam® analysis, which you explained was *about 30 minutes*, do you think that Oncology surgeons could eventually use your instrument to obtain *in situ* diagnostic information on patient biopsies in the operating room?

KS: Yes, that's *definitely* something that we're exploring.

GQ: What are your objectives for Cell Tool for the next 6 to 12 months?

KS: Around April, a *spectroscopist* will be joining our team to support manufacturing. In May, we're planning on *moving to new, larger facilities* just a few minutes away, where we'll be setting up our *Lab Services* again. And around September, we'll be *setting up our Sales & Marketing* and *Finance departments*, which are presently managed part-time by our two daughters, **Mayke** and **Kim**! An important goal for us is that we're *looking for €2 to 5 million to finance our growth and expansion*.

GQ: Can you share your view on the Munich and its Life Sciences scene?

KS: Munich is a *really nice* city. There are some *great labs*, like the Laser Research Lab at the **University Hospital Großhadern (KUM-LMU)**. **Bio^M** is very active and we've had many good meetings with many good networking opportunities. They recently have started a new networking group, "Tools for Life" Sciences. Companies like (Cell Microscopy & Assays SME) **Ibidi** and (laser manufacturer) **TOPTICA Photonics** are there... There is a lot of *database expertise*, which is something that *we're interested* in acquiring. However, the *office space* in Munich is *very expensive* for start-ups. On a personal note, another reason that my husband and I have stayed in Tutzing, is that we like being closer to the lake and the mountains!

SME profile:



Nanion

www.nanion.de/en

Founded:

2002

Full-time staff:

100

Business:

Benchtop instruments for High-Throughput Screening of ion channels in Drug Discovery

Approach:

Proprietary technologies for automated patch-clamp assays, other whole-cell assays (protein transporters) and lipid bilayer measurements

Just when I thought I couldn't be any more impressed with Munich's stellar Life Science professionals, I met **Dr. Niels Fertig**, CEO and founder of **Nanion**, one of Munich's instrument SME success stories. Just a few days before my publication deadline, I contacted Nanion at the suggestion of **BioM**, hoping that I could miraculously schedule a last-minute interview to complete my Tools & Instruments special. Within minutes of receiving my email – and despite having a crazy schedule, including an upcoming international flight – Niels graciously agreed to a phone interview for that very afternoon. With over two decades in the Bavarian capital, Niels is another Munich Life Sciences veteran with a wealth of experience. He gave me a crash-course on Ion Channel Biology, CRO business models, and financing challenges for instrument companies.

GQ: Niels, could you give my readers an introduction to Nanion?

NF: Basically, Nanion provides *instruments to accelerate Drug Discovery*. Our core technology is *automated patch clamp* (automated electrophysiology) to measure *cells and ion channels in those cells*. Our instruments are used in Drug Discovery, Drug Safety and R&D efforts, mainly for phenotypic assays. About *two-thirds of our clients are Biotech/Pharma companies and CROs*; the rest are academic groups. There's a lot of advanced R&D being done with our instruments, including for *high-throughput* applications. I know it sounds cliché, but we are a very *Innovation-driven company*: we're always collaborating with academic and company partners to develop new technologies.

GQ: Tell me about your team.

NF: We have about 100 employees, 80 of whom are here in Munich, including around *30 PhD-level experts in Electrophysiology*. In fact, we've looked around and realized that we have one of the greatest densities of Electrophysiology experts *anywhere in the world!* To keep that team stimulated, we make sure to engage them with exciting R&D projects. Since we're such a "nerdy" team, with



Photo courtesy of Nanion

all our scientists, we maintain really good relationships with the top universities. The academics always have ideas and always push us to do more. Some of those projects *really do turn into something great* for our products.

GO: Can you give a brief history of Nanion and the driving force behind it?

NF: Sure. I did my PhD at **LMU** and started the company half a year before I finished my thesis, in 2002. *What was the idea behind automated patch-clamping?* Well, at that time, researchers had to deal with highly manual, highly delicate work that involved a lot of careful pipetting: *on a good day, you might patch ten cells per day.* With our device, you automate the whole process and run assays in parallel. We started out with a small benchtop machine and have been growing since then; we now have 384-well plate standard format machines, so we can do very high throughput patch-clamp and do up to two modules in a single liquid handler: so, 768 wells in parallel, which is the *fastest*

system on the market! Over the years we've spread out to look at other areas, like instruments for *transporter proteins, cardiac stem cells* and *other structures*.

GO: What was the funding and financing environment like at the beginning?

NF: We had seed financing in the beginning, as VC money has a *bit scarce* back then. That was just after the Biotech bubble and no one was investing in early-stage companies at the time. So we skipped that, which turned out to benefit us. Instead of first launching an automated patch-clamp *robot*, we had to focus on something *small*, so we developed a small patch-clamp *device*. *We broke even in our second year.* We did a management buyout in 2009, so we bought back our shares from our investors. So, we're *totally private*: I'm not only CEO but also *majority shareholder*. That enables us to be *highly independent* and *highly agile* when it comes to decision-making, so we don't have to deal with a lot of people. Also, going back to our collaborative projects, we've always found national or EU funding to do pretty cool stuff!

GO: I've heard from people here in Munich and also from clients of mine that VC's don't like to invest in Instruments, Tools, Reagents or Services, because those purportedly don't scale and don't provide the returns of Therapeutics or Diagnostics. So I've been having a lot of discussions with people about *Low Risk/Low Return* versus *High Risk/High Return*. What are your thoughts on that?

NF: I share your view that Instrument companies *can be* lower risk and lower return, and that there is also a lot of the view that VCs prefer Drugs or Diagnostics that *"scale like crazy"*. *There isn't a "Yes or No" answer.* It depends on the strategic goals and setting of a VC fund. There are a few funds that *focus* on Instrumentation. Not every VC is the same; there is a *spectrum* of VCs. *I would not underestimate the value* that you can generate in Instrumentation businesses. I know a number that have been scaling nicely... easily 10X plus! It may be *more rare*, but it's *not completely uncommon*. Nanion has been scaling

quite nicely. But, looking at it from the vantage point of company management, if you can go with little or no VC money, that has its advantages, too.

GQ: Can you share an important *milestone* in Nanion's history?

NF: Probably in 2013, when we introduced the *SynchroPatch 384PE*, our flagship product for 384-well screening. It represents our fourth generation of patch-clamp instruments. It has been a *huge* growth promoter for us. The past 2 years, we've been growing *tremendously* thanks to 384 patch-clamping.

GQ: I'll be honest, I'm a bit rusty on the topic of Ion Channels and Drug Discovery. Back in the 1990's there was a bit of a trend in Ion Channel-Modulation for Pain and other areas, using compounds from snake or scorpion venom and related analogs. Where are the hot areas now?

NF: So, about 20 years ago, ion channels were very underexploited drug targets. There were no *direct* methods for screening of ion channels: only *indirect* approaches like fluorescence binding methods or clumsy manual patch clamp measurements, which were not amenable to HTS. So we've seen a renaissance of ion channel drug targets driven by development of those second- and third-generation patch-clamp instruments, *especially* the ones based on 384-well plates, which are HTS compatible. As you say, *Pain* is one therapeutic area: for example, **Genentech** and **Xenon** have a *great* Drug Discovery program there targeting **Nav 1.7**; there's a lot of work in the *CNS* field, in *Psychiatry applications* such as GABA receptor modulators. **Vertex Pharmaceuticals** is really strong there, like for Cystic Fibrosis. So, there are a number of fields involving ion channels. They have the nice feature that you can really induce *subtle* effects: rather than just that *activation or deactivation* of traditional targets, you can have really *fine-tuned* effects through *use-dependence, state-dependence* and *other phenomena*.

GQ: Both **Charles River** and **WuXi AppTec** have acquired Nanion SynchroPatch 384PE instruments. Given Munich's many CROs, do you think such companies could provide fertile ground for developing *new* instruments?

NF: So, *two things* to that. In reality, if you go to a CRO and you want to co-develop technology, the CRO will tell you that their budgets are tight, so they'll *only* engage in something a *client asks them to*. They're *very reluctant* to test anything early stage or any prototype, if they don't *already* have a client asking for that service, which is fair enough. CROs are a *very important* for us. They do *a lot* of ion channel work with our instruments. In fact, *we probably own about 75% of the ion-channel screening CRO market worldwide*. If you have something new, *then they'd like to have a client attached to it*. They'd like to turn a *project* into *business*. But in the early days, *around 2005 or 2006*, we *did* have a government-funded project with a CRO partner and a Biotech partner, where we developed the second generation of our device. The motivation for the CRO was knowing that there would *eventually be end-users for the devices*.

GQ: What direction is Nanion heading in, *R&D-wise*?

NF: One area is in *stem cells*. We work with numerous stem-cell providers and academic groups in *cardiac, neuronal* and *hepatic* stem cells. Another field that we've become involved in over the past few years is *Optogenetics combined with Electrophysiology*. We have a number of partners in Europe and the US, including in Munich. That includes **Prof. Duirk Traunerowner**, who had a group at LMU but is now in New York, and **Dr. Martin Sumser**, who comes from his group. They develop photo-active compounds and ion channels. We also work on *optogenetically-modified stem cells*, where you can nicely stimulate cardiac cells optogenetically to trigger highly rhythmic beating, and then measure ion-channel potentials and contractility using our devices.

Start-up profile:

Scientific
Tools &
Instruments
Special

PreOmics

<https://preomics.com>

Founded:

2016

Full-time staff:

11

Business:

Tools for Mass Spectrometry (MS)-based
Proteomics

Approach:

Proprietary technology adapted from in-
StageTip (iST) method for sample processing

I met **PreOmics'** CEO and co-founder **Dr. Garwin Pichler** by email and he kindly agreed to an interview. **Garwin**, co-founder and Managing Director **Dr. Nils Kulak**, and their team are a perfect illustration of Munich's local talent in *Scientific Tools & Instruments*, combining technical prowess in Proteomics with clearly defined market needs. A proud ambassador of **IZB**, where PreOmics' HQ is located, Garwin amiably gave me a tour of the premises, including the expansive terrace of the G2B Faculty Club building, where the unusually spring-like weather offered a clear view of the Alps. We chatted about everything from Peptidomics to Boston winters. And he taught me a German word: Föhn, the warm, dry wind that travels off the mountains.

GQ: Garwin, can you give my readers an introduction to PreOmics?

GP: Let's start with the *technology*. We have developed very complete, simplified and efficient tools for *protein analysis*. We're focusing on Mass Spectrometry, which is *unbiased*, in that you can analyze multiple proteins at a time, unlike methods such as ELISA, which are for analyzing only a *single protein*. Protein analysis typically has three steps: *Sample Preparation*, the *Analysis* itself, and *Bioinformatics* on the data. We're focusing on *Sample Preparation*. We realized that normal protocols are very time-consuming and complicated: *mixing, adding reagents, preparing fresh buffers...* So, we have a *streamlined process* based on a patented buffer that incorporates multiple steps. Basically, we've shortened the process from around *48 hours* down to *10 minutes*. And we have patented peptide clean-up steps to remove lipids and salts, like for tissue and body-fluid analysis. Our main customers are Biopharma companies. They really value gaining all that *time and efficiency* without any loss of quality. Most of our customers are in the USA, so we have a warehouse there and will be expanding operations there. We get a lot of feedback from customers on development of new technologies.



Photo courtesy of PreOmics

GQ: Tell me about PreOmics' history and your relationship to **Prof. Dr. Matthias Mann** at the **Max Planck Institute of Biochemistry (MCIB)**.

GP: Nils was a PhD student in Matthias' lab. And he was disappointed with the existing protocols for protein samples. So, around 2013, he applied for a Bavarian grant – the **m4 grant** from **BioM** – to fund development and commercialization of a protocol. That grant provided €500,000 of funding to start work in 2014, based on results that were eventually published in *Nature Methods*¹. We founded the company in January of 2016, with a product already ready for the market. By 2017, we had received great support from business angels and just recently, we've raised €3.3 million in a second financing round. Matthias is *really supportive* of business. We often meet over a nice meal to discuss our work. He was a *great network* and *reputation*. I'd also like to say that we're really proud of our board, which includes highly experienced people

such as **Dr. Andreas Jenne**, who co-founded **Kinaxo** (see p. 55); serial entrepreneur **Martin Spitznagel**; and **Dr. Ulrich Shriek**, who spent 20 years as head of Business Development at **Qiagen**.

1. www.nature.com/articles/nmeth.2834

GQ: What are your thoughts on applying AI to Omics data, like for fragment analysis or structural predictions?

GP: That's definitely interesting from a scientific perspective, especially for Biomarker Discovery, but PreOmics is not interested in working in that space *right now*. That's more something that our clients would do with their data.

GQ: How amenable are MS-based Proteomics workflows to automation and to upstream or downstream combination with complementary analytical techniques? And how does PreOmics approach the challenges of automation and of High-Throughput Screening?

GP: It was *very important* for us to develop reagents and protocols that would be amenable to automation and to High-Throughput Screening. And talking to other companies, we know that those issues are important. In fact, in December, we published an application note with **Agilent** on automated analysis of plasma samples². Combining techniques for Automated Proteomics is complex: for example, when you start talking about Automated LC/MS, then things get *tricky*. Eventually, it would be nice to have a *fully-automated workflow for LC and MS injection and analysis*.

2. www.agilent.com/cs/library/applications/application-protein-sample-preparation-preomics-bravo-proteomics-5994-0306en-agilent.pdf

GQ: Switching now to the Munich Life Sciences ecosystem... Where do you see its strengths and weaknesses?

GP: For us as a young start-up, IZB has been so helpful, so perhaps I'll focus on Martinsried first. There is a very dense network of companies of different levels of maturity. You can always meet people and call people to discuss anything: *marketing, setting up business in the USA, etcetera*. To hire scientists, you have the **Max Planck Institute** and **LMU** right here. And you can easily bring in people from other parts of Germany, because they would like to live in the Munich area. Well, perhaps I am a bit biased, because I've spent my whole life here! What are the *negatives*? Well, the *salaries here are very high* and very competitive within Europe. Of course, Munich is in no way comparable to Boston or San Francisco in terms of *scale, size, Series A funding*... We often visit Boston and it's so impressive, with all the companies there! Also, people here are more conservative in terms of *early adaptation of new technologies*. I think the Americans are quite good at that.

GQ: Getting back to PreOmics... What are your objectives for the next 6 to 12 months?

GP: Our main goals for this year are to explore *Automation*, work on applications for *Antibody Drug Development*, and expand our *presence in the USA*.



Start-up profile:

PharmaTrace

www.pharmatrace.io

Founded:

2017

Full-time staff:

11

Business:

Blockchain-based ecosystem for sharing of Healthcare and Pharma data

Approach:

Pay-and-earn model for safe and encrypted sharing of data for Clinical Trials, Drug Development, Supply Chain and other areas

Thanks to the **IZB Biotech Press Lounge** (see p. 35), I met many new faces from Munich's Life Sciences community, such as **PharmaTrace** CEO & Founder, and Morocco native, **Dr. Issame Outaleb**, who agreed to an interview for the next day! With expertise in R&D (he holds a PhD in Immunology), Healthcare consulting and Blockchain (he previously launched a cryptocurrency start-up), he and his versatile team are laying the foundations for a new Blockchain-based platform for Healthcare and Pharma data. Issame is another great example of the cosmopolitan face of Munich's vibrant start-up scene: he's as comfortable discussing Big Pharma projects in English, as he is, debating Data Sharing models in French or cracking jokes in Arabic. He treated me to a much-needed "coffee and cake break", just hours before my flight back to Toulouse.

GQ: Issame, can you summarize PharmaTrace's business and origins?

IO: At PharmaTrace, we'd like to create the biggest ecosystem of Healthcare players – *Pharma companies, government agencies, pharmacies, suppliers* – all to support our patients, through a trusted platform based on Blockchain. We'd like to provide *tools to make life easier*, like tools for Clinical Trials Data or gaining a deeper understanding of Patient Data. The idea is to be able to use this data *immediately* for things like *Predictive Analysis* based on AI and ML. I launched PharmaTrace in mid-2017, inspired by own needs – hence Pharma needs – as a Biotech/Pharma consultant. I noticed that there were problems with *data trust*, things like *GDPR¹ compliance*, and the veracity of data sources. This lack of data transparency causes *huge* problems for business. Another advantage of our system is that it enables companies to access data for far *cheaper* than they are currently paying.

1. GDPR: General Data Protection Regulation 2016/679 is an EU regulation on data protection

GQ: Describe your team and your teamwork philosophy.



I've assembled a team of eleven people from a diverse array of backgrounds. It took me about a *year* to put the team together. To generate Innovation, you need people from different backgrounds: *artists, scientists, marketing people, programmers...* So we have a range of talents, from a German Physics post-doc at **LMU Hospital (KUM-LMU)**, who works with physicians on heart-failure devices; Deep Learning specialists; and an American filmmaker working with Exponential Tech teams at **Singularity University**, who is currently based in Budapest. Our Chief Marketing Officer recently moved here from New York City. Everyone contributes ideas and I make sure that the team always communicates their concerns. It's a "*no shame, no blame*" approach.

GQ: What are some of the projects that you've worked on lately?

IO: We will run a pilot with a Big Pharma company on *Predictive Analytics to better understand where to focus efforts*: basically, looking at parameters like frequency and timing of *severe respiratory issues*. We've also done a project in the area of *Supply Chain*, on Tracing, Tracking and Cost-Reduction. For a different Pharma company, we're developing an Auditing system for their Financial Operations. You know, those companies can struggle a lot at the end of every year! And right now, we're working on an R&D project in *Clinical Trials*, exploring patient enrollment and smart contracts. We recently published the first White Paper on the interplay between AI & Blockchain for Healthcare² and why Blockchain should be deployed as a data and ecosystem backbone.

2. www.healthcareshapers.com/why-to-deploy-blockchain-as-a-data-and-ecosystem-backbone/

GQ: How do you ensure the quality of the data shared among members?

IO: The ecosystem should be carried by the *players themselves*, who pay a fee to access via *nodes*. Each player contributes data, so you *pay to request data* and *earn to supply data*.

GO: What is your financing situation like right now?

IO: We're getting questions from investors. Honestly, we don't need *funding* as much as we need *partners*.

GO: You've now been in Munich for several years. What do you see as the strongest and weakest points of the Life Sciences scene here and the city itself?

IO: Starting with the *strengths*, there is *solid infrastructure for start-ups* and *Innovation* in general, like the facilities. It is an *international city* that attracts *good stakeholders*. There are *big funds* in Munich and they're *willing to invest*. You have a *great, Innovation-focused talent pool* from all the universities, which leads to *many start-up founders*. In terms of *weaknesses*, Life Sciences are still promoted here in a *traditional way* and information is *difficult to access*. Another thing is, they don't have that Boston mentality, like "*Let's go!*", where you figure things out *as you go along*. Here in Munich, it's more like, "*Convince me twice and maybe we can have a meeting.*". You can have the best idea in the world but if you don't have any *momentum*, it's *pointless*.

GO: What are your plans for PharmaTrace for the next 6 to 12 months?

IO: We're focusing on finishing our case studies as proof-of-concept ASAP. We're also reaching out to governments and corporations. Our platform is now ready to go!



Start-up profile:

Sci-Illustrate

www.sci-illustrate.com

Founded:

2018

Full-time staff:

1

Business:

Visual Communications for the Life Sciences sector

Approach:

Digital and paper services including Technical Illustration, Animations, Videos, Web Design and Brand Identity

Scientist, multilingual globe-trotter and **Sci-Illustrate** founder **Dr. Radhika Patnala** and I met via LinkedIn and, following a lovely Skype chat in which we traded stories from the many countries in which we've each lived and worked, arranged to meet over coffee and pastries at Munich's famed **Schmalznudel - Cafe Frischhut**. Radhika has passionately combined her R&D background in Neurobiology, her love of all things visual and a familial entrepreneurial spirit to launch a highly focused Visual Communications agency. She made an extra effort to help me meet other Life Sciences experts in Munich, and was more than understanding when I arrived late to our meeting due to a delayed train!

GO: Radhika, it's great to *finally* meet you in person! Can you describe Sci-Illustrate, your team and your clients to my readers?

RP: Sci-Illustrate is a *creative agency* specifically for the *Life Sciences & Biotech* sector. My team is formed of scientists and designers, each with their own expertise. My clients are mainly Biotech or Healthcare companies looking for assistance with *Branding, Visual Scientific Communications* and *scientifically-informed Design*. That ranges from *Scientific Illustrations* and *Presentations* on the technical side, to *Brand Identity* and *Scientific Communications* on the Strategy, Business Development and Marketing spectrum.

GO: What drove you to launch Sci-Illustrate?

RP: I founded Sci-Illustrate because I felt that there was a need for a service provider who could bring scientific and Design expertise to the table and effectively cater to the multiple Design and marketing needs of life science and Biotech companies. My Neurobiology research had a lot of *Microscopy*, and that really cultivated my appreciation for the *beauty* in living systems. My love for Science, the strong visual aspect of my research, and my experience and skills with Design and Art, triggered me to explore Design as something more



than just a hobby. Also, because both of my parents are entrepreneurs, I'd always had it in me to find a problem of my *own* that I can strive to solve with my skills. Sci-Illustrate really represents those three factors coming together in sweet harmony: *the Science, the visual communication made possible through Art and Design, and running my own business.*

GO: What are some of the projects that you've worked on recently?

RP: We currently assist an Immunology company in California with Design and Scientific Consulting for their presentation deck, and are also supporting them with their Brand Strategy and Brand Identity. We have done some Science-inspired illustrations for (local reagents SME) **siTOOLS Biotech**, for their website and potential Marketing materials. Together with the start-up **Trials 24** (see p. 57), we designed a logo for an R&D collaboration between **TUM** and **Peking University**. And last year, we were commissioned to design a poster and identity system for a seminar series at the **Sidney Kimmel Comprehensive Cancer Center** at **Johns Hopkins School of Medicine**. I'm excited about the traction we have generated through our latest illustration series, *Women in Science*¹, which highlights pioneering women scientists.

1. www.sci-illustrate.com/stories#womeninscience-sci-illustrate

GO: One of my best friends is an artist in his mid-50's that always bemoans the lack of traditional media in today's *all-digital* world and complains that younger illustrators, spoiled by modern software, lack *fundamental skills*, like *perspective*. Do you agree? And do you see a role for *hand-drawn or painted* technical illustrations in Science and Medicine?

RP: Yes, I agree with him. *Of course*, I see a role for those skills. In fact, traditional media were instrumental in informing how I perceive the world

visually and how I could create something beautiful that could be shared with others. Traditional media like watercolors or pencil really help one *translate thoughts into something real, something tangible*. Also, much of the pleasure in Visual Communication lies in *creating*.

GQ: What are your impressions of the Munich Life Sciences ecosystem?

RP: Munich is a very *vibrant* place and, as a scientist, it's *exactly* where I want to be, in the company of people who *value science* and in an ecosystem which *nurtures it*. There's a high density of world-class Biotech Research institutions in one place. The German language-based corporate culture can be a bit difficult for foreigners, especially when compared to countries like Singapore or the USA. It is something I am getting comfortable with, as my German gets better.

GQ: What do you think of the quality of Visual Communications here in Munich, in the public and private sectors: *websites, print, etcetera...* ?

RP: I'm *quite impressed* by it, especially the *Print Media*. It's *good* and *functional*, and *definitely better* than in other parts of the industry. They're really good at the *Scientific Communications* and *Outreach* level, and it pleases me to know how much importance it is given. I've seen that at the Open Days at the **Max Planck Institute**. One area where local companies could improve upon is in their *Global Digital Marketing strategy* and *streamlining their brand presence*.

GQ: Your life's trajectory has taken you from *India* to *Australia* to *Singapore* to, very recently, *Germany*. Can you share some of your experiences having lived, studied and worked in such distinct cultures?

RP: Going from India to Australia was a *really stark transition*, because I moved from a culture motivated by competition to a more laidback, do-it-for-the-love-of-it culture. I want to mention that India and my *alma matter*, **GITAM University**, gave me the best educational and scientific foundation that I could have asked for; my academic transition to the research landscape in Australia was very smooth. In Australia, I was able to apply all that I learnt before, in the world-class research environment at **ANU**. Singapore was *amazing!* It is a *beautiful city* and it is so *resourceful!* On a personal note, living in Singapore taught me the power of *inter-cultural collaborations*. My time at **NUS** was some of the most *intellectually stimulating* of my life: it gave me my *love for Neuroscience*, and I am very thankful to everyone who contributed to it. Now, I'm *excited to explore Munich* and discover all the potential it might hold for my *professional and personal goals*.

GQ: What's in store for Sci-Illustrate?

RP: Over the last year, we have really grown in terms of our capabilities and the range of services we can provide our clients. This year, I look forward to working with more local clients here in Munich and to better understanding their Design needs so that I can tailor our services to assist them.

Up for grabs:

Noteworthy acquisitions of Munich Life Science companies (2011 - 2018)

The quality of Munich's start-ups and SMEs is reflected in the many acquisitions of them over the past decade by larger (mainly foreign) firms. Here are ten representative examples, spanning Small-Molecule Drug Discovery, Cellular Therapies, Medical Imaging Software, Ophthalmologic Lasers and more...

Acquisition	Acquired by	Date	Upfront	Milestones
Exosome Diagnostics ¹	Bio-Techne (USA)	Aug 2018	\$250 M	\$325 M
Invendo Medical ²	Ambu (Denmark)	Oct 2017	\$115 M	\$70 M (plus \$40 M in earn-out over 4 years)
Rigontec ³	Merck Sharpe & Dome (USA)	Sep 2017	\$137 M	\$416 M
TomTec Imaging Systems ⁴	Philips (The Netherlands)	Jul 2017	Undisclosed	
CRELUX ⁵	WuXi AppTec (China)	April 2016	Undisclosed	
Stage Cell Therapeutics ⁶	Juno Therapeutics (USA)	May 2015	\$81 M (\$59 M in cash + \$22 M in Juno stock)	\$152 M
Definiens ⁷	Medimmune (USA)*	Nov 2014	\$150 M	Undisclosed (but possible)
Technolas Perfect Vision ⁸	Bausch + Lomb (USA)	Jan 2013	Undisclosed (reports of "up to €450 M" total)	
Micromet ⁹	Amgen (USA)	Jan 2012	\$1.15 B total (\$11 per share in cash)	
Kinaxo ¹⁰	Evotec (Germany)	Feb 2011	\$12 M (\$3.6 M in cash + shares)	Up to \$4 M

B: billion; M: million; *Medimmune is a subsidiary of AstraZeneca (UK) and was so at the time.

References

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3. www.fiercebiotech.com/biotech/merck-looking-to-build-cancer-success-buys-io-biotech-rigontec
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Munich's Life Sciences start-ups:

What are they working on?

■ Biotech: Tools

■ Biotech: Human Tx

■ Biotech: Industrial

■ Med Tech: Devices

■ Biotech: Animal Tx

■ Med Tech: Data & Software

Dust Biosolutions

Solidification of dust via microbiologically induced calcite precipitation
<http://dustbiosolutions.com>

mk2 Biotechnologies

Peptide R&D and production

www.mk2.bio

Adivo

MorphoSys spin-off developing therapeutic antibodies for dogs and other pets

<https://adivo.vet>

IRUBIS

Silicon crystals for Attenuated Total Reflection Infrared (ATR-IR) Spectroscopy of fluids and solids

<https://irubis.com>

PreOmics*

Protocols and tools, including sample-preparation kits, for Mass Spectrometry-based Proteomics applications

* See p. 46

<https://preomics.com>

Breath Tx

Drug-aerosol therapeutics for orphan pulmonary diseases

<https://breath-therapeutics.com>

iOmx Tx

First-in-class cancer therapeutics based on novel immune checkpoint modulators

<https://iomx.com>

Gotham Tx*

Small-molecule drugs that target the Epi-transcriptomics machinery.

*HQ in New York City

www.gothamtx.com

Secarna

Proprietary Drug Discovery platform (LNAPLUS™) for next-generation Antisense Oligonucleotide Therapies

<https://secarna.com/>

Thermosome

Intravascular drug release technology for treatment of solid tumors and other therapeutic applications

<http://www.thermosome.com>

Tubulis®

Proprietary protein-drug conjugation technology to prevent early release of cytotoxic drugs in Antibody-Drug Conjugates (ADCs)

<https://tubulis.com/>

Kumovis

3D-Printing systems for medical applications, ranging from prototyping to personalized human implants

www.kumovis.com

Mecuris

Computer-Aided Design and 3D-Printing of custom orthoses and prostheses

<https://mecuris.com>

Medineering

Robotic solutions for minimally-invasive surgery

www.medineering.de

Munevo

Smart glasses and application to control electric wheelchairs

https://munevo.com_en

TerraPlasma Medical

Hand-held disinfection device using cold atmospheric plasma

www.terraplasma-medical.com

TRiCares

Catheter-based valve replacement system for minimally invasive treatment of tricuspid valve regurgitation

www.tricare.de

Climedo

Software for Intelligent Searching and Collaborative Management of medical data (patient records, images, R&D, E-lab notebook)

www.climedo.de

Cunesoft

Machine Learning-based software for Regulatory Compliance

<https://cunesoft.com>

PharmaTrace

Blockchain-based ecosystem for protected sharing of Health data among diverse stakeholders

www.pharmatrace.io

Smart Reporting

Software for Structured Reporting of Radiology data via specific templates (cardiac CT, etc.)
www.smart-radiology.com

Trials24

"Online patient recruitment as a service: effective, transparent, compliant. We recruit patients and healthy volunteers for your clinical trial."

<https://trials24.com/>

News from Munich:

2018 to 2019

Discoveries, R&D accords, start-ups, M&As,
VC financing and more...

- Bio- & Medical Imaging
- Diabetes & Metabolism
- Immunology & Immuno-Oncology
- Medical Devices & Software
- Neuroscience & Neurology
- Omics
- Scientific Tools & Instruments
- Stem Cells

Bio- & Medical Imaging

Dr. Ali Etürk (KUM-LMU, Graduate School of Neuroscience [GSN-LMU] and SyNergy) and co-workers at KUM-LMU, TMU and U. Heidelberg describe DeepMACT workflow for whole-body imaging of metastases and antibody-targeting in mice, based on combination of vDISCO single-cell fluorescence imaging and Deep Learning algorithms for counting and characterization of metastases, in *bioRxiv* (Feb 2019); At **Society for Neuroscience** meeting (San Diego, USA), Dr. Etürk reveals vDISCO method for creating rigid, transparent mouse models for single-cell Neuroimaging and related applications (Nov 2018).

Prof. Dr. Daniel Razansky (Institute for Biological and Medical Imaging [IBMI] at Helmholtz Zentrum München, and TUM) and colleagues from TUM, LMU and George Washington University, devise Optoacoustic Imaging method for high-speed, highly detailed 4D characterization of isolated beating mouse heart, as outlined in *Scientific Reports* (Sep 2018).

Computer scientist **Dr. Kuangyu Shi** (TUM) and co-workers from TUM, Fudan University, Klinikum Bayreuth and UCLA School of Medicine devise four-layer Convolutional Neural Network (CNN) for Deep Learning on ¹⁸F-Fluorodeoxyglucose Positron Emission Tomography (¹⁸F-FDG PET) images to enable differential diagnosis of idiopathic Parkinson's Disease from related syndromes (Multiple System Atrophy and Progressive Supranuclear Palsy), in *Journal of Nuclear Medicine* (May 2018).

Reporting in *Cell Metabolism*, **Dr. Vasilis Ntziachristos** (TUM, Helmholtz Zentrum München and co-founder, iThera) and colleagues from TUM and EPFL describe use of Multi-Spectral Optoacoustic Tomography (MSOT) for non-invasive hemoglobin-based monitoring of metabolism in brown adipose tissue (Mar 2018).

Diabetes & Metabolism

The groups of **Dr. Matthias Tschöp** (Institute of Diabetes and Obesity [IDO] at Helmholtz Zentrum München, DZD and TUM) and **Dr. Claudia Doege** (Columbia University) report that loss of the transcription factor Tbx3 in hypothalamic neurons leads to weight gain and to alterations in neuronal plasticity, in *Nature Metabolism* (Jan 2019).


Prof. Dr. Anette-Gabriele Ziegler (TUM), **Prof Dr. Ezio Bonifacio** (Technical University of Dresden) and colleagues from TUM, Helmholtz Zentrum München and Technical University of Dresden publish patent application (WO 2019 002364 A1) disclosing method to determine risk of Type 1 Diabetes based on Genetic Risk Score (Jan 2019).

An Australo-German team led by **Dr. Ana Messias** (Institute of Structural Biology at Helmholtz Zentrum München), including researchers from Helmholtz Zentrum München, DZD, Leibniz Universität Hannover, Monash University, Peter MacCallum Cancer Centre and TUM, and using switchSENSE® technology from Munich's **Dynamic Biosensors**, identifies the mechanism of action of celastrol, a traditional Chinese medicine that induces weight-loss: modulation of the hypothalamus via direct negative inhibition of protein tyrosine phosphatase (PTP) 1B (PTP1B) and T-cell PTP (TCPTP), as published in *Journal of Medicinal Chemistry* (Sep 2018).

A Franco-German team co-led by **Dr. Thomas Clavel** (Institute for Food and Health [ZIEL] at TUM; University Hospital of RWTH Aachen) and **Dr. Patricia Lepage** (Micalis Institute, INRA, AgroParisTech, University Paris-Saclay) reports on the interplay between gut microbiota, dietary fats and metabolic consequences in mice, in *Microbiome* (Aug 2018).



Immunology and Immuno-Oncology

An aerial photograph of a city, likely Munich, Germany, with a prominent clock tower in the foreground. The image is overlaid with a semi-transparent green filter. The clock tower has a large clock face and a cross on top. The city buildings are visible in the background, with a mix of traditional European architecture and modern structures.

Medigene gains additional IP protection on its dendritic cell (DC) vaccine platform, upon granting of European patent previously licensed from **Helmholtz Zentrum München** (Jan 2019); also licenses from Helmholtz Zentrum München, a chimeric co-stimulatory receptor (4-1BB/PD-1 fusion protein) to explore with the company's modified T-cells as a Cancer Immunotherapy combination (Jan 2019); publishes topline interim data on Phase 1/2 trial on its DC vaccine for acute myeloid leukemia (AML), showing treatment was well-tolerated and did not induce any serious adverse effects (Dec 2018); signs licensing agreement with **Leiden University Medical Center (LUMC)**; The Netherlands) for use of HA-1-specific T cell receptor (TCR) as a targeted immunotherapy for cancer (Dec 2018); and announces inclusion in German **SDAX** stock listing (Jun 2018).

Immunic announces joint venture with **Vital Therapies** (San Diego) in Inflammation and Autoimmunity, based on Immunic's preclinical and clinical pipeline (Jan 2019); gains in-licensing option from **Daichi Sankyo** on compounds ("IMU-856") against undisclosed targets in ulcerative colitis and Crohn's disease (Nov 2018); announces enrollment of first patient in CALDOSE-1 Phase 2b trial on IMU-838, a small-molecule inhibitor of dihydroorotate dehydrogenase (DHODH), for treatment of ulcerative colitis (Apr 2018).

MorphoSys recruits **David Trexler** (ex-**Merck KGaA**) to head US operations (Feb 2019); reports encouraging results from L-Mind Phase 2 trial on combination of its anti-CD19 mAb MOR208 with lenalidomide for treatment of patients with relapsed or refractory diffuse large B cell lymphoma (DLBCL) who are ineligible for high-dose chemotherapy (HDC) or autologous stem cell transplantation (ASCT) (Dec 2018); announces that licensee **Janssen** will begin Phase 2 trial

(NOVA) on Gesulkumab, an anti-IL-23 mAb discovered using MorphoSys's HuCal technology, for hidradenitis suppurativa (Nov 2018); signs partnering agreement on its anti-c5ar antibody MOR210 with **I-Mab Biopharma** (Shanghai) (Nov 2018); announces, jointly with **Galapagos**, initiation of Phase 1 clinical trial on subcutaneous formulation of its anti-IL-17C antibody MOR106.

Amgen Munich granted US patent (US 10,047,159 B2) on bispecific antibodies targeting CD3 and prostate-specific membrane antigen (PMSA) (Aug 2018).

Prof. Dr. Peter Duedell, **Prof. Dr. Max Schnurr** and associates from the **Center for Integrated Protein Science Munich (CIPSM)** and **Division of Clinical Pharmacology** at **KUM-LMU** affirm in *Scientific Reports* that a non-PD-1 nuclear antigen released by dying cells cross-reacts with anti-PD-1 antibodies, as observed in murine immune and tumor cells that do not express PD-1 (Jun 2018).

Prof. Dr. Jürgen Ruland (Institute for Clinical Chemistry & Pathobiochemistry and TranslaTUM at TUM; DKTK - Heidelberg and DZIF - Munich) and **Dr. Maïke Buchner** (same except for DZIF), with colleagues from TUM, **U. Freiburg**, **U. Bonn**, the **Max Planck Institute of Immunobiology and Epigenetics** (Freiburg) and **University Hospital Erlangen**, discover critical role of transcription factor Foxp1 in regulation and survival of mature B cell subsets and suggest possible role of Foxp1 malfunction in lymphoma, as reported in *PNAS* (Mar 2018).

Prof. Dr. Sebastian Kobold (LMU) and colleagues from LMU, **Roche Innovation Center** (Zurich & Penzberg), **U. Zurich** and **DZD - Munich** present synthetic antigen receptor (SAR) T cells conditionally activated by mesothelin-targeting bispecific antibodies to induce specific tumor-cell lysis in mesothelin-expressing pancreatic cancer cell lines and related xenograft model, at the **5th Immunotherapy of Cancer Conference**, in Berlin (Mar 2018).



Medical Devices, Data & Software

iThera Medical hosts kick-off meeting for European consortium EUPHORIA (Enhancing Ultrasound and PHOtoacoustics for Recognition of Intestinal Abnormalities) with partners **IMASONIC** (ultrasonic transducers; France) **RayFos** (software; UK), **University Hospital Erlangen** and **Pintail** (Project Management; Ireland) in Munich (Feb 2019); and receives €2.3 million in “Fast Track to Innovation” funding for EUPHORIA, to enhance the sensitivity and effectiveness of Multispectral Optoacoustic Tomography (MSOT) at detecting and managing Inflammatory Bowel Disease (IBD), and accelerate the transition from clinical R&D to diagnostics use of MSOT, through **Horizon 2020 (H2020)** (Jan 2019).

Definiens® announces agreement with **Covance (LabCorp**® group) on Digital Pathology for Precision Medicine in Oncology and Immuno-Oncology, focusing on multiplex immunohistochemistry (IHC) and *in situ* hybridization (ISH) applications in early-stage clinical R&D, including applications of Definiens® Tissue Phenomics® technology (Oct 2018).

TerraPlasma CEO **Dr. Julia Zimmerman** announced as speaker for upcoming **Hello Tomorrow Global Summit** (Paris, March 2019), will discuss applications of Cold Plasma in diverse scientific fields (Jan 2019); TerraPlasma wins SME Instrument Phase 1 funding for development of hand-held, battery-operated device for wound care, through **H2020** (Jun 2018).

Cardiology device start-up **TRiCares** closes €22 million Series B round to finance development of transcatheter-based tricuspid valve replacement system to enable non-surgical treatment of tricuspid regurgitation (Jun 2018).

Brainlab granted US patent (US 9907622 B2) on dual-display system for Image-Guided Surgery.



Neuroscience & Neurology

Prof. Dr. Franz-Ulrich Hartl, Director of **Max Planck Institute of Biochemistry** and member of **SyNergy**, wins 2019 Paul Ehrlich and Ludwig Darmstaedter Prize, together with **Prof. Arthur Horwich** (**Yale Medical School & Howard Hughes Medical Institute**) (Jan 2019); and biochemist **Dr. Dorothee Dormann** (**LMU & SyNergy**) (Jan 2019) wins Young Researchers version of the award.

Prof. Dr. Martin Dichgans, Director of **Institute for Stroke and Dementia Research (ISD)** at **LMU**, and colleagues from several German and Swiss institutions publish clinical study supporting use of serum neuronal light chain (neurofilament light polypeptide) as biomarker for Neuroaxonal Injury Ischemic Stroke, in *Neurology* (Oct 2018); and co-supervises massive GWAS study (520,000 individuals) by large international consortium (several hundred authors; >180 affiliations), on genetic loci associated with stroke risk and subtypes, published in *Nature Genetics* (Sep 2018).

Prof. Dr. Klaus T. Wanner (**Center for Drug Research** at **LMU**) and colleagues from the **Max Planck Institute of Psychiatry** in Munich describe a new class of photo-switchable GABA-uptake inhibitors (mGAT1 subtype inhibitors), based on a nipecotic acid scaffold, which demonstrate enhanced potency upon photo-induced shift from (*E*) to (*Z*) forms, in *Journal of Medicinal Chemistry* (Jun 2018).

Prof. Dr. Michael Ewers (**ISD** at **LMU**) and colleagues from multiple centers in Australia, Germany, Portugal, South Korea, the UK and the USA publish study employing cross-sectional resting-state functional MRI (fMRI) and cerebrospinal fluid levels of tau (as disease-stage proxy) to demonstrate that greater left frontal hub connectivity correlates with lesser cognitive impairment in early stages of autosomal-dominant or sporadic Alzheimer's Disease, in *Brain* (Apr 2018).



Omics

Prof. Dr. Fabien Theis (Institute of Computational Biology [ICB] at Helmholtz Zentrum München, TUM) and colleagues from TUM devise artificial neural network, the Deep Count Autoencoder (DCA), for removing noise from single-cell RNA sequencing data, as reported in *Nature Communications* (Jan 2019).

Dr. Roman Hornung (LMU) and **Dr. Marvin N. Wright** (Leibniz Institute for Prevention Research and Epidemiology [BIPS] and U. Copenhagen) describe new method, Block Forest, which outperforms traditional Random Forest methods for analyzing blocks of multi-omics and clinical data, in *LMU Department of Statistics, Technical Report #219* (Dec 2018).

Team led by **Prof. Dr. Thomas Klopstock** (KUM-LMU) does Proteomics analysis on thin samples of single muscle fibers isolated by Laser Capture Microdissection (LCM) from biopsies of patients with Chronic Progressive External Ophthalmoplegia, identifies compensatory mechanisms used by energy-depleted and stressed muscle tissue in mitochondrial disorders, in *bioRxiv* (Sep 2018).

Dr. Thomas Grünewald (Institute of Pathology at LMU; DKTK - Munich and DKFZ - Heidelberg) and colleagues from LMU, DKTK - Munich, DKFZ - Heidelberg, **Jena U. Hospital, Fukushima Medical U. School of Medicine, Biocenter - Würzburg**, and **University Clinic of Würzburg**, report use of Functional Genomics to identify high levels of high adenosine monophosphate deaminase 2 (AMPD2) as prognostic biomarker for poor outcome in Undifferentiated Pleomorphic Sarcomas (UPS), in *Int'l J Cancer* (Sep 2018)

Prof. Dr. Axel Imhof (BCM at LMU) and colleagues contribute chapter on use of MS-based Proteomics to track histone demethylation status throughout the cell cycle, to the book *Histone Variants* (Aug 2018).



Scientific Tools & Instruments

NanoTemper launches Dianthus, its new instrument for measuring biophysical interactions in solution at sensitivities from millimolar to picomolar Kd, at up to 10,000 compounds per day for Drug Screening, at **Society for Laboratory Automation and Screening (SLAS2019)**, in Washington DC (Feb 2019).

GNA Biosolutions announces collaboration with **Boehringer Ingelheim** in Veterinary Diagnostics (Feb 2019); wins **American Association of Clinical Chemistry's (AACCC's)** inaugural Disruptive Technology Award (Jul 2018).

Prof. Dr. Paolo Lugli, Chair of Nanoelectronics at **TUM**, and co-workers granted US Patent (US 10145838 B2) on device for impedance measurements and/or visual analysis of biological samples such as cells and cell components in solution, based on partially transparent electrodes fabricated from materials such as carbon nanotubes or graphene oxide (Dec 2018).

TUM team of **Prof. Dr. Steffen Glaser**, **Dr. Franz Schilling** and colleagues granted European patent (EP 3 058 375 B1) on pH Biosensors based on C¹³-chemical shifts, and their applications in Magnetic Resonance and Magnetic Spectroscopy, including for *in vitro* and *in vivo* assays (Dec 2018).

mRNA therapeutics firm **Ethris** granted European patent (EP 3 112 469 B1) on use of specific untranslated regions (UTRs) to enhance translation of target RNA sequences, including for *in vitro* applications in living cells (Nov 2018).

CellTool (see p. 40), wins top Health Technology Award at **Sino-EU Innovation Week of Health Technology (SIWHT) 2018**, in China (Nov 2018).



Stem Cells

Prof. Dr. Heiko Lickert (Helmholtz Zentrum München), his post-doc **Dr. Pallavi Mahadalkar** and **Sebastian Knöbel (Milteny Biotech)** publish patent application (WIPO 2018 229179 A1) on enrichment of specific subsets of pancreatic cells from pluripotent stem cells, induced pluripotent stem cells or embryonic stem cells, based chiefly on selective induction of the markers CD51 and C177 (Dec 2018).

Prof. Dr. Heiko Hermeking and co-workers (**Institute of Pathology at LMU, DKTK - Munich** and **DKFZ - Heidelberg**), including from the **Institute of Pathology at Charité - Universitätsmedizin** (Berlin), correlate activity of transcription factor Ap4 to formation of adenomas and to regulation of intestinal and colonic stem cells, and Paneth cells, in *Nature Communications* (Sep 2018).

The team of **Dr. Christina Scheel (Helmholtz Zentrum München)** publishes patent application (US 2018 0155686 A1) on method to isolate, culture and differentiate breast stem cells and to form multicellular breast organoids from the resultant cells (Jun 2018).

Prof. Dr. Marion Subklewe (KUM-LMU, Gene Center at LMU, DKTK - Heidelberg, DKFZ - Heidelberg) and colleagues, including researchers from **Memorial Sloan Kettering Cancer Center**, propose combinatorial targeting of stem-cell marker couples (CD33/TIM3 or CLL1/TIM3) in Acute Myeloid Leukemia (AML), in *Leukemia* (Jun 2018).

A team from **KUM-LMU** and **Klinikum rechts der Isar/DHM/TUM**, led by **Dr. Markus Krane**, presents results of *Transcriptome Analysis* on *in vitro*-differentiated induced pluripotent stem (iPS) cells from Hypoplastic Left Heart Syndrome patients vs. healthy controls, at the 47th Annual Meeting of the **German Society for Thoracic and Cardiovascular Surgery**, in Leipzig (Feb 2018).



Mini-directory:

The Munich Life

Sciences

ecosystem

Are you new to Munich or looking to expand your existing local network?

This mini-directory includes all the Munich-based organizations cited in this report as well as many others. It is nowhere near exhaustive, but should at least get you started. If you need a hand meeting people in and around Munich, feel free to contact me.

Viel Glück! / Fui gligg! / Good luck!

Patient Advocacy

- Bavarian Cancer Society
- Patvocates Network

Universities and R&D Centers

- Biomedical Center Munich (BCM) at LMU
- Center for Digital Technology and Management (CDTM)
- Fraunhofer Institutes
- German Cancer Consortium (DKTK) - Munich site
- German Center for Diabetes Research (DZD)
- German Center for Infection Research (DZIF) - Munich site
- German Heart Center Munich (DHM)
- German Research Center for Environmental Health (Helmholtz Zentrum München)
- Institute for Stroke and Dementia Research
- Leica Bioimaging Center at BMC-LUM
- Ludwig-Maximilians-Universität (LMU)
- Max Planck Institutes:
 - Biochemistry
 - Neurobiology
 - Plasma Physics
 - Psychiatry
- Munich Center for Machine Learning (MCML)
- Munich IP Law Ctr. (MILPC)
- Munich University of Applied Sciences (MUAS)
- SNSB IT Center
- Technical University of

- Munich (TUM)
- Universität der Bundeswehr München Weihenstephan-Triesdorf
- University of Applied Sciences

Business Schools

- EU Business School
- IESE - U. Navarra
- Munich Business School

Hospitals & Clinical Care

- Benedictus Hospital - Feldafing
- BG Unfallklinik Murnau
- Internal Medicine Clinic (FIM)
- Ludwig-Maximilians-Universität Hospital (KUM-LMU)
- Martha-Maria Hospital
- München Klinik (MüK)
- Munich-Bogenhausen Surgical Clinic
- Munich Comprehensive Cancer Center (MCCC)
- Neuwittelsbach Hospital
- Rechts der Isar Hospital
- Rinecker Proton Therapy Center

Business & Entrepreneurial Support

- Bio Deutschland
- BioM
- IBB Netzwerk
- Invest in Bavaria
- Munich Startup

TTOs, Incubators, Consortia & Clusters

- Bacteriobator
- German Accelerator

- ImmPact Bavaria
- Innovation & Start-Up Center for Biotechnology (IZB)
- LMU Entrepreneurship Center
- Munich Technology Center (MTZ)
- Strascheg Center for Entrepreneurship at MUAS
- Startup Creasphere
- Tech Founders
- UnternehmerTUM (TUM Center for Innovation & Business Creation)

Business Angels & VC

- BayBG
- Bayern Kapital
- Forbion Capital Partners
- Life Sciences Partners (LSP)
- MIG Verwaltungs
- MPM Capital
- TVM Capital
- Vesalius Biocapital
- Wellington Partners

Consulting

- Alésia Consulting
- Anteris
- ARS3 Pharma Management
- Biopharma Excellence

Intellectual Property

- Boehmert & Boehmert
- Eisenführ Speiser
- European Patent Office
- German Federal Patent Court (BPatG)
- German Patent & Trademark Office (DPMA)
- Michalski Hüttermann

START-UPS**Biotech**

- Adivo
- Breath Therapeutics
- Connexome
- Dust Biosolutions
- iOmx Therapeutics
- Gotham Therapeutics
- mk2 Biotechnologies
- PreOmics
- Secarna
- Thermosome
- Tubulis

Med Tech

- Climedio
- CLINARIS
- Cunesoft
- Irasun
- Kumovis
- Mecuris
- Medineering
- Munevo
- seiratherm
- Smart Reporting
- Terraplasma Medical
- Trials24
- TRiCares

SMEs**Biotech**

- 4SC
- advanceCOR
- AmVac
- BioNTech - Small Molecules
- Formycon
- ImevaX
- Immunic
- Isarna Therapeutics
- MAB Discovery
- Medigene
- Neovii Biotech
- Origenis
- Pieris
- SIRION Biotech
- Therawis

Industrial Biotech

- 4Gene
- AMSilk

Life Sci Reagents

- Biontex
- ibidi®
- PELO Biotech
- Silantes
- siTOOLS

Life Sci Tools & Instruments

- 2mag
- CellTool
- ChromoTek
- Dynamic Biosensors
- Ethris
- GNA Biosolutions
- Implen
- Inveox
- IRUBIS
- Nanion
- NanoTemper
- SpheroTec

Med Tech: Devices & Instruments

- Baxter
- Carl Zeiss Meditec
- Custo Med
- GE Global Research Europe
- GE Healthcare
- iThera
- PULSION Medical Systems (Maquet Getinge Group)
- SurgicEye

Med Tech: Data & Software

- Biomax Informatics
- Brainlab
- Certara
- ibidi®
- Infochem
- microDimensions
- TOMTEC Imaging Systems (Philips)

- Amgen Research
- Apcech Biopharma
- Bavarian Nordic
- Celgene
- Daiichi Sankyo Europe
- Denk Pharma
- GSK Consumer Healthcare
- Hikma Germany
- Klinge Pharma
- MorphoSys
- Roche Diagnostics
- Roche Innovation Center
- Santen

CROs**Drug Discovery & Preclinical Development**

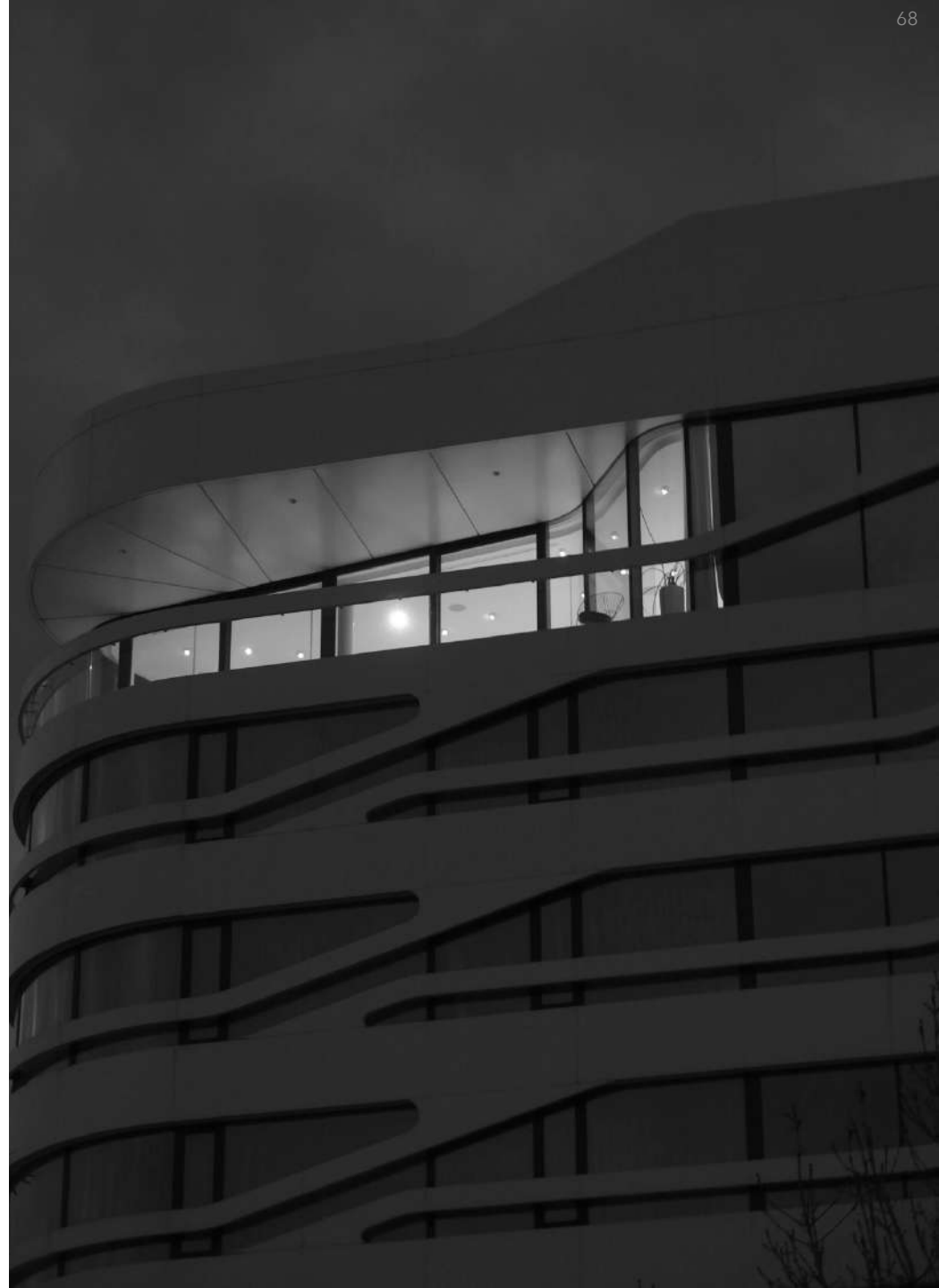
- Aurigon
- Bicol
- BSL Bioservice
- CRELUX (WuXi AppTec)
- Eurofins Genomics
- Evotec Munich
- IMGM Laboratories
- Intana Bioscience
- Oncolead
- Proteros
- SYNLAB International

Clinical Discovery, Development & Regulatory

- Covance
- Definiens®
- FGK Clinical Research
- Inamed
- IQVIA
- Medpace Germany
- OPIS Germany

Formulation & Manufacturing

- Apcech Biopharma
- Cinfa Biotech
- Corden Pharma
- Coriolis Pharma
- GenPlus
- Leukocare Biotechnology
- ProJect Pharmaceuticals

BIOPHARMA & PHARMA

Learning the lingo: BioM, IZB, BMBF, HTGF

If you're interested in the Life Sciences ecosystem in Munich, greater Bavaria or elsewhere in Germany, then you should get to know these organizations.

Bio^M

Founded in 1996, **Bio^M** is a regional development agency tasked with growing the Life Sciences economy in Munich and greater Bavaria, with an emphasis on Biotech start-ups and SMEs. Bio^M runs an array of coaching & training programs, funding & financing initiatives and industry activities, including networking events.

www.bio-m.org/en

See also: "Revving up Munich's start-ups" (p. 11)

IZB

As Munich's first and largest Biotech cluster, the **Innovation and Startup Center for Biotechnology (IZB)**, in German), founded in 1995, spans two campuses (Martinsried and Weihenstephan). It currently hosts 60 Biotech start-ups and SMEs. The IZB offers various technical and administrative services to its tenants, plus access to two daycare centers, two restaurants, conference rooms and a Faculty Club. The Martinsried campus also features a hotel. The IZB organizes numerous networking and business events in conjunction with **LMU**, the **Max Planck Institute**, **TUM** and other academic and industry partners.

www.izb-online.de/en

See also: "The man with a plan for Munich" (p. 7)

BMBF

The **German Federal Ministry of Education and Research (BMBF)**, in German) makes policy on national Research, Higher Education and Technology strategies – including the new High-Tech Strategy, "Innovations for Germany" – fosters national and international industry clusters, and advises on hiring of skilled foreign workers. It funds Innovation through initiatives such as "Research Campus – Public-Private Partnership for Innovation" and various pre-seed programs.

www.bmbf.de/en

HTGF

High-Tech Gründerfonds (HTGF) is a German public-private venture capital firm and Germany's largest pre-seed investor. Since its inception in 2005, HTGF has invested nearly €900 million over 530 investments, with 102 exits. Headquartered in Bonn, it hosts a yearly High-Tech Partnering conference there.

<https://high-tech-gruenderfonds.de/en/>



In numbers:

Munich and Germany

Universities - Munich

QS World University Rankings (2018) - Overall, Top 200¹

- 64th - Technical University of Munich (TUM)
- 66th - Ludwig-Maximilians-Universität (LMU)

QS World University Rankings (2018) - Life Sciences & Medicine, Top 200²

- 43rd - Ludwig-Maximilians-Universität (LMU)
- 85th - Technical University of Munich (TUM)

U-Multirank University Rankings (2016) - Biology, Top 293³

- 43rd - Ludwig-Maximilians-Universität (LMU)
- 63rd - Technical University of Munich (TUM)

U.S. News & World Report, Molecular Biology & Genetics, Top 200²²

- 30th - Ludwig-Maximilians-Universität (LMU); listed as "University of Munich"
- 54th - Technical University of Munich (TUM)

Thomson Reuters "Top 100 Innovative European Universities" (2018)⁴

- 6th - Technical University of Munich (TUM)
- 8th - Ludwig-Maximilians-Universität (LMU); listed as "University of Munich"

Bloomberg-Businessweek (2017) - Business Schools, Top 31 outside USA⁵

- None



Hospitals & Healthcare - Munich

Operation Karriere - Top 10 German Teaching Hospitals (2018)⁶

- Ludwig-Maximilians-Universität Hospital (KUM-LMU)*: 4th

* Listed as "Klinikum der Universität München"

Das F.A.Z.-Institut und Faktenkontor - Top 100 German Hospitals (2018)⁷

- Benedictus Hospital - Feldafin: 3rd
- BG Unfallklinik Murnau: 12th
- Neuwittelsbach Hospital (Fachklinik für Innere Medizin): 23rd
- Munich-Bogenhausen Surgical Clinic: 35th
- Martha-Maria Hospital: 97th

GBD 2015 Healthcare Access & Quality Index, 1990-2015, World's Top 195 countries⁸

- Germany: 20th

For comparison: **Switzerland** (3rd), **Spain** (8th), **France** (15th) and **UK** (30th)

Clinical trials - Munich & Germany

Clinical Trials: Munich vs. Paris (Jan 2019)^{23,24}

- Total number of trials^a: **Munich:** 1,112 **Paris:** 3,535
- Per 10,000 inhabitants^{b,c}: **Munich:** 2.1 **Paris:** 2.5

a. Planned, recruiting or active trials within 80 km radius²⁴; b. Based on estimated population within 80 km radius²⁵; c. Reference values for other cities: **Barcelona** = 3.8; **Lausanne** = 3.3; Trial values and population data for all cities were updated in Jan 2019.

AllTrials - Clinical Trials Transparency Index, World's Top 46 Drug Companies (2015)⁹

German companies:

- 7th: Boehringer Ingelheim
- 11th: Bayer
- 14th: Merck KGaA

Research funding & output - Germany

ERC, Country Rankings for Starting Grants (2017), Number of Grantees^{10,11}

- 4th among Top 12 European countries (per capita) for Life Sciences
- Total number of ERC Life Sciences Starting Grants: 32 (eight in Munich)²

Nature, World Life Science Institutions (2017)¹²

German R&D centers in Top 100, Overall (non-normalized data)

- Max Planck Society: 3rd
- University of Freiburg: 86th
- Helmholtz Association: 26th
- Leibniz Association: 92nd
- LMU: 50th
- European Molecular Biology Laboratory (EMBL): 97th
- Heidelberg University: 63rd

German companies in Top 50, Industry (non-normalized data)

- Bayer: 14th
- Merck KGaA: 33rd
- Boehringer Ingelheim: 18th

Innovation - Germany and Munich

ATKearney, Global Innovative Cities Ranking, Top 25 cities¹³

- Not ranked in top 25 (32nd)

WIPO, Global Innovation Index (2017)¹⁴

Innovation - Overall, 127 countries Top 100 regional clusters -

- Germany: 9th
- Munich: 20th

CNS (Collaborating for Novel Solutions) Summit Pharma Index, Global Innovation Index (2018)¹⁵

German Pharma companies in Top 40, overall

- Bayer: 8th
- Merck KGaA: 18th
- Boehringer Ingelheim: 12th





Quality of life - Munich

Mercer, World Quality of Living Ranking - Overall, Top 231 cities¹⁶

- In 2014: 4th
- In 2016: 4th
- In 2018: 3rd

Teleport, World Quality of Life Rankings - Overall, Top 266 cities¹⁷

Where Munich ranks HIGHEST:

- 8th for Outdoors
- 10th for Travel Connectivity
- 11th for Education
- 18th for Commute
- 24th for Business Freedom
- 24th for Venture Capital

- 25th for Safety
- 31st for Healthcare
- 40th for Startups
- 45th for Tolerance

Where Munich ranks LOWEST:

- 219th for Housing

Gender equality - Germany

WEF, The Global Gender Gap Report (2017) - Overall, Top 144 countries¹⁸

- 12th

Where Germany ranks HIGHEST:

- 10th for Political Empowerment
- 43rd for Economic Participation & Opportunity

Where Germany ranks LOWEST:

- 70th for Health & Survival
- 98th for Educational Attainment

Business & start-ups - Munich

City Lab, World's Most Economically Powerful Cities (2015), Top 25¹⁹

Inc.com, Europe's 10 Best Cities for startups (2018)²⁰

ASGARD/Roland Berger, Global AI startups (2018), Top 20 hubs²¹

- Not rated in any of the above three lists

ATOMICO, European Tech hubs by capital invested (2017), Top 20 hubs²⁵

- Munich: 10th

References

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4. www.reuters.com/article/us-emea-reuters-ranking-innovative-unive/reuters-top-100-europes-most-innovative-universities-2018-idUSKBN1HW0B4
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7. www.faz-institut.de/wp-content/uploads/sites/13/2018/06/F.A.Z.-Verlagsspezial_ASV_Deutschlands_Beste_Krankenhäuser_F.A.Z.-Institut-Faktenkontor_20180628.pdf
8. [www.thelancet.com/journals/lancet/article/PIIS0140-6736\(17\)30818-8/fulltext#seccestitle160](http://www.thelancet.com/journals/lancet/article/PIIS0140-6736(17)30818-8/fulltext#seccestitle160)
9. <http://policyaudit.alltrials.net/>
10. <https://erc.europa.eu/news/erc-2017-starting-grants-results>
11. Calculated using country population rankings obtained via Google search, January 2019
12. www.natureindex.com/annual-tables/2017/institution/all/life-sciences
13. www.atkearney.com/documents/20152/1136372/2018+Global+Cities+Report.pdf/21839da3-223b-8cec-a8d2-408285d4bb7c
14. www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2017.pdf
15. <http://cnssummit.org/InnovationIndex.aspx>
16. https://en.wikipedia.org/wiki/Mercer_Quality_of_Living_Survey
17. <https://teleport.org/cities/munich>
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Further reading

External reports and articles

For more info about the Life Sciences sector in Munich, Bavaria or Germany:

Biotech in Bavaria - 20 years of Innovation (2017)

Bio^M

www.bio-m.org/fileadmin/Webdata/Uploads/Zahlen_und_Fakten/Downloads/2016-17_Bavarian_Biotech_Report.pdf

Life Sciences in the Munich Metropolitan Region (2014 to 2019)

Munich Metropolitan Region

www.metropolregion-muenchen.eu/en/the-munich-metropolitan-region/business-location/key-sectors-and-clusters/life-sciences/

Munich as a Business Location (2018)

Department of Labor & Economic Development, City of Munich

www.wirtschaft-muenchen.de/publikationen/pdfs/en_factsandfigures_2018.pdf

German Biotech Startup Report (2017)

Labiotech, Euronext and BIO Deutschland

<https://labiotech.eu/sponsored/launch-german-biotech-startup-report/>

Research in Germany - Land of Ideas

German Federal Ministry of Education and Research (BMBF)

www.research-in-germany.org/en

Germany and Health: Germany's Health system and role in Global Health (2017)

The Lancet

www.thelancet.com/series/germany

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How this report was made

Munich

“Munich” is used here to indicate both the City itself and its surrounding area of an approx. 80-km radius.

Interviews

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Photographs

All interviewees consented to have their photo shown. All photos were taken by **Gregory Qushair (Alésia Consulting)**, unless otherwise noted. A lack of photo for any phone interviewees simply indicates that no photo was available at the time of publication.

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The Grand Tour: European Life Science Innovation Hubs

2018 - 2019

