

COUNTING CELLS

An inside look into the world of Oculyze

Business startup statistics prove that starting a business is not an easy thing to do; 90 percent of all startups fail in the first year. So the foundation of getting it right lies in three key pillars or cornerstones. Are you able to make it? Are you able to sell it? Are you able to sustain it? However, one important quality that is often overlooked is the vision and passion one brings to an enterprise. This is what makes the above three pillars work together like a well-oiled machine. Oculyze GmbH is one such venture, which now in their third year of operations, has overcome major hurdles on its road towards setting up a successful and innovative company.

Dr. Katja Schulze is the co-founder and Chief Science Officer of Oculyze, the world's premier platform for mobile image analysis based out of Brandenburg in Germany. Its cloud based image analysis software transforms ordinary mobile devices into powerful tools delivering accurate and reproducible results in seconds.

Early on at the beginning of her academic career, Dr. Schulze took part in a wide ranging interdisciplinary study, focusing on biotechnology, computer science and microsystems. This laid the foundation towards further exploration within the field, especially with regards to the development of both hardware and software, crucial to the makeup of the company she would co-found in the future.

Her Master's thesis, titled "Detection of Potato Spindle Tuber Viroids – Molecular Biology and Business Administration Aspects," observed not just standard molecular biological methods, but also leaned towards a more economic outlook within the scientific field, namely the usability and business benefits of the subject. Here, she reflected a sound business acumen that would prove integral to the success of Oculyze as a business venture.

When working on her PhD subject, "Automatic classification and viability analysis of Phytoplankton," Dr. Schulze quickly realized a crucial problem that existed in the time consuming nature of sample collection and analysis within the field. Her work as a scientific associate with the PlanktoVision

project constitutes the fundamental research results of which Oculyze is based upon.

Seeing a practical and commercial need for the development of automated image analysis and recognition, Dr. Schulze began to develop the core idea for a business solution that could provide this innovative technology to a wide range of enterprises and established industries thereby doing away with traditional, relatively expensive and time consuming methodologies that were then in existence.

The first device

Towards the end of 2015, Dr. Schulze began working on her first prototype of the device. This would be the manifestation of the tool that brewers and breweries use worldwide today, enabling them to create consistent beer. The research available at that time was limited and theoretical in nature. The idea to integrate optics with a smart phone was something that still needed further development.

However, undeterred by the complications that were involved, Dr. Schulze began to research how to bring about her ideas into being. She started to experiment with a 3D printer to create the casing of the device, and through trial and error coupled with a lot of patience, she finally managed to perfect it in a record 3 months. The idea was not just to integrate the two together but also make it compact, simple, portable and be able to

scale up production at some point of time in the future. In February 2016, Dr. Schulze filed her first patent application for the hardware software system. It was during this time that Dr. Schulze began working together with Dr. Ulrich Tillich and Kilian Moser who would later on become her co-founders at Oculyze. Dr. Tillich had completed his BSc and MSc in Biosystems Technology and Bioinformatics, while also holding a PhD in Molecular Biology. Consequently, he provided the necessary technological, software and back end expertise, while Kilian looked more towards the specific business and financial feasibility of launching such a product and creating a successful start-up.

Accuracy of the Oculyze device and its comparison to standard forms of image recognition

With the development of the device completed, there was a need for an external validation of the technology. This was a market in which other forms of yeast analysis were still very popular, especially the use of manual microscopy and other automated systems.

In order to show the brewery industry and the world at large that their product could achieve highly accurate results and also stand as the best yeast counting option on the market, the three co-founders contacted the prestigious Ver- suchs- und Lehranstalt für Brauerei

(Research and Teaching Institute for Brewing – VLB) in Berlin and engaged with them to write a validity report.

The VLB was founded in 1883 by the German brewing and malting industry. It provides research, training, education and other associated services for the brewing industry. The VLB also operates as an educational institution for brewers. Its research into the process of brewing is vast and backed up by years of scientific knowledge. Its presence in the verification of Oculyze's technology was to be integral to the wide popularity that Oculyze enjoys today.

Oculyze's mobile integrated device and method of analysis was compared to the standard practices where brewers use either a Thoma chamber alongside a microscope or another automated yet expensive device. After a series of rigorous tests which included three strains of yeast in different batches, Oculyze's device was found to have very closely comparable results to the microscopic Thoma chamber method. However, while a microscope requires trained staff and expensive equipment, Oculyze's device was easily accessible and operable by even a brewer novice. Its speed was also highlighted as a pertinent factor within the VLB report, and Oculyze's device was recognized for its ability to save brewer's valuable time and money. This research and validation helped Oculyze's first product evolve from not simply an exciting technological experiment, but towards a fully validated and industry trusted analytical device.

Equipped with a vision to provide automated image analysis for anyone anywhere and backed by her skilled expertise within the fields of biotechnology and informatics along with image recognition, Dr. Schulze alongside her two like-minded co-founders Dr. Tillich and Kilian jointly co-founded Oculyze in October 2015. The mission was clear from day one to be the world's premier platform and go-to brand for mobile quantitative image analysis.

As a first application of their technology, the team decided to call its first product the Oculyze BB (better brewing), a hardware software combination that allowed breweries to determine concentration and viability of their yeast in less than

one minute. The Oculyze BB was significantly faster and cheaper than competing products at that time and drastically reduced repitching costs by thousands of euros per year, whilst ensuring the same consistent taste and quality in beer. Oculyze has since won a multitude of awards and recognition for its innovative approach towards simplifying the process of microscopic image analysis.

Today, with close to 80 craft breweries already using Oculyze BB across 17 countries around the world, Oculyze is working on future applications which are in various

stages of development, ranging from agricultural monitoring to a point-of-care diagnostic tool. In addition, Oculyze has ambitious plans for the last quarter of 2018, with a planned launch of its next generation device for brewers called Oculyze BB 2.0. The company promises that the new upgraded device comes equipped with several new features and includes a new device design as well.

The product is due to be launched at BrauBeviale 2018 held from the 13th to the 15th of November in Nuremberg – Germany.

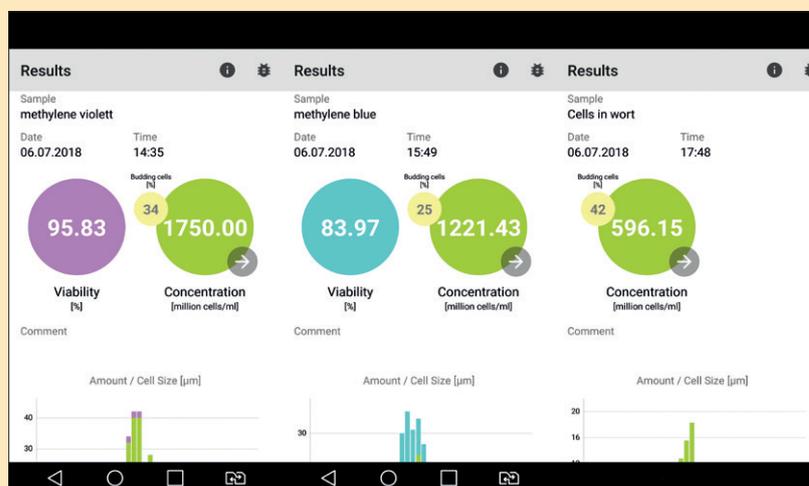
A basic overview of how a brewer can use the Oculyze BB in the process of yeast analysis is as follows:

Before measurement, the yeast sample may have to be diluted in order to reach the device's optimal measurement range. In order to determine the viability of the yeast, it must be stained with methylene blue or methylene violet. Next, the brewer will need to load the sample chamber.

A Pasteur pipette may be used to collect a small amount of the sample which is then injected into one of the chamber's openings. The sample will naturally be pulled into the slide via capillary force. This filled chamber should then rest for one minute so that the yeast settles.

After completing the sample preparation, the hand held microscope is attached to the smartphone. The chamber is now placed within the microscope and the Oculyze mobile app can be turned on. By interacting with the interface, the user can check the yeast viability and the concentration. The user then takes a series of five photographs of the sample and enters other information to be saved into the application.

After recording these with specific details the analysis results are returned to the brewer with accurate information regarding the viability and concentration of the yeast. All data is automatically saved in the cloud for future reference.



Screenshot of measurements taken by the Oculyze App

To learn more about the motivation behind Oculyze, BREWING AND BEVERAGE INDUSTRY INTERNATIONAL spoke to founder and Chief Science Officer Dr. Katja Schulze.

BREWING AND BEVERAGE INDUSTRY INTERNATIONAL:

When did you realize you wanted to start your own business and why?

Dr. Katja Schulze: Being an academic and having completed my PhD, research was second nature to me and it was something that I loved doing. However, the opportunities to pursue that into a career were restricted. In Germany you either become a professor or have temporary teaching contracts that don't provide much stability. Additionally, I realized that I could also apply for a regular job within the image analysis industry, as my skill set was at the right level. However, the opportunity to create something innovative and that I could call my own was too great an opportunity to miss. To make a massive impact on the future of the industry was what I wanted. It was an easy decision in the end.

BBII: *What inspired you to take on such a difficult task?*

Dr. Schulze: I come from a family where everyone was given the opportunity to achieve her best. I was taught to think freely and always be creative in how I approached challenges in my life. Right from



Founder and Chief Science Officer of Oculyze: Dr. Katja Schulze

childhood up till university, I spent a lot of time in sports and other activities that required a certain level of mental and physical fitness and training. This instilled certain values and disciplines in me that kept me going when times were tough. The women in my family have also always been inspiring. They taught me how to be strong in my resolve and to work hard towards achieving my goals.

BBII: *What do you do to stay encouraged or motivated?*

Dr. Schulze: I think as one grows older, the virtues of patience and self-belief just grow stronger. I have always been a self-motivated person. Perhaps because I know what my end goals are, and I always work towards them. Anything that might get in the way, I try and see as a learning and an experience. I know what my end goals is and I work towards it and consider everything that comes in between

as a learning and put it down to experience gained.

BBII: *What advice would you give to young people who want to develop a start-up or their own business? Or have an idea and don't know what to do?*

Dr. Schulze: My advice would be to make sure you have something unique and innovative that you can offer or make, sell for a certain price and then sustain the same process. You have to be certain that this is something you are passionate about and want to do since it's something you will be dedicating a big portion of your life towards. If you are convinced that this is what you want, then you are already further down the road than so many other people. I would also advise them to find a likeminded person right at the beginning that they could talk to and exchange ideas with since it will help them get a better grasp on the situation and be realistic about expectations and setting up goals and objectives. When you discuss your ideas with someone who understands and challenges you, it helps bring out the best in you.

BBII: *Dr. Schulze, thank you for speaking with us!* □

Gordon Andrade

Head of Marketing and Communications at Oculyze

The Oculyze BB Process

Oculyze offers a modular service-based platform that can be tailored towards individual customer requirements. The customer has a choice between a singular service or a combination of several services together. The three main components of the service on offer include the custom developed hardware for image capture, image recognition software and the Oculyze App and cloud platform. Oculyze BB is a turnkey solution where the customer utilizes the hardware and entire Oculyze software stack.

The Oculyze hardware consists of a microscope, that can be used without specialized expertise. A combination of an optical module, a corresponding smartphone and automated image analysis, enables different cell counting approaches. The optical module enables a 400x magnification with a high resolution of samples. The user can then record and analyze microscopic images with the associated smartphone automatically. Data management and storage is carried out in the cloud and available from any internet connected device. The captured images are transmitted via a mobile network to the server and results appear on the screen within seconds. The whole system is faster and cheaper than other automated solutions.

Two of the most important factors determining the taste and quality of beer are the concentration and viability of brewing yeast. The concentration of the yeast cells is calculated by counting, whilst the viability is determined by differentiating between dead and living cells with an appropriate staining solution (methylene blue or violet). An accurate separation of clumped cells and the identification of budding occurrences make the results very precise. With the results, the customer has the option to use the integrated yeast pitch calculator that can directly determine the ideal pitch rate. To have a long-term overview of results, the user can also review all findings through a web application: that allows for generating customized reports, viewing historical data, tracking yeast over time and increasing statistical accuracy by creating averages of different measurements.