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Kalium Health: monitoring chronic kidney disease anywhere, anytime

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Abstract: Blood potassium concentration normally oscillates between 3.5 to 5.0mM. Abnormally low or high levels of potassium due to renal or cardiac disorders are particularly dangerous and can end up being fatal. Despite the relevance of closely monitoring electrolytes levels, patients currently rely on going to the hospital to obtain a reading which causes delays in acting upon the measurement results. Thus Kalium Health has been working towards offering an accessible home test alternative for patients to be able to question their own health accurately and in real time. They are currently developing fast and low-cost potassium electrodes relying on finger-prick blood by patients themselves. Kalium Health development has been driven hand in hand with patients from the very start and this puts the company in a unique position to revolutionize the everyday life of millions of patients.

Keywords: Potassium, Monitoring, Sensors, Patient-driven, Cambridge

1. Who is Kalium Health?

Kalium Health's vision is to empower people to manage their health and well-being by having access to personal health information in real time from anywhere. Their core expertise is the rapid measurement of electrolytes concentration, which is extremely relevant in the management of diseases such as heart conditions and chronic kidney disease (CKD). Indeed, in the case of advanced CKD, patients require dialysis to replace the filtering function of the kidneys [1]. However, between treatments, the levels of certain waste products and ions such as potassium can rise significantly to life-threatening levels. Unfortunately, current care protocols make it difficult for patients to track their vital signs as it relies on venous blood draw at the hospital followed by laboratory analyses. This can lead to delays in adapted treatment and increases the risk for patients. With 10% of the population in the UK suffering from chronic kidney disease [2], such a delay increases hospital admissions and thus healthcare costs. Therefore, Kalium Health is building on an extensive clinical experience combined with an

expertise on medical sensors to develop their first product enabling patients to monitor their potassium levels directly from home at all times. From the very early start, the company has placed patients at the heart of all their technological development to ensure they make meaningful advances for disease management.

2. How did it start

The idea of fast and easy monitoring of electrolytes by individuals themselves sparked in 2018 when potassium deficient patients asked Fiona Karet, Professor of Nephrology at the University of Cambridge and Consultant in Renal Medicine at Addenbrooke's Hospital why an equivalent of the diabetic patients' glucometer did not yet exist for them. Seeing the demand coming from patients themselves and the potential for such a technology to be a game-changer in clinical treatment pathways, Prof. Karet leveraged her Cambridge scientific network. She called upon Dr. Tanya Hutter, a medical sensor expert with more than 7 years of experience in the field and inventor of multiple patents to see whether she could find a way to easily design a miniature potassium sensor. With their shared passion to improve patients' experience, Prof. Karet and Dr. Hutter decided to embark on the journey to develop a proof of concept electrolyte sensing platform and secured funding from Kidney Research UK, Addenbrooke's Charitable Trust and Addenbrooke's Kidney Patients' Association to do so. They aimed to make this tool easy to use, fast and clinically accurate. After one year of trying out different methods, they successfully developed a low-cost working prototype relying on finger-prick blood on a single-use test strip.

To gain insights into the commercial potential of this new technology, the scientific pair outsourced the task to i-Teams, a Cambridge-based program bringing together a multi-disciplinary team of students with an industry mentor. The team's goal is then to assess the commercial viability of new technologies. In the scope of this project, the students evaluated the market potential by reaching out to clinicians but more importantly by reaching out to patients. The survey they launched over social media went viral with more than 300 answers and highlighted the critical need for such an innovation to be made rapidly available in Europe but also in the USA. The success encountered during i-Teams did however not stop there. Indeed Tom Collins, the i-Teams industry mentor and experienced consultant in medical technology development, felt so enthusiastic about the project and its mission that he got involved after the program ended and became Kalium Health CEO.

With the recruitment later on of Dr. Liz Norgett as chief scientific officer bringing her knowledge about potassium disorder and surface sensing chemistry, the company was all set up to start raising funds and making a positive impact for patients.

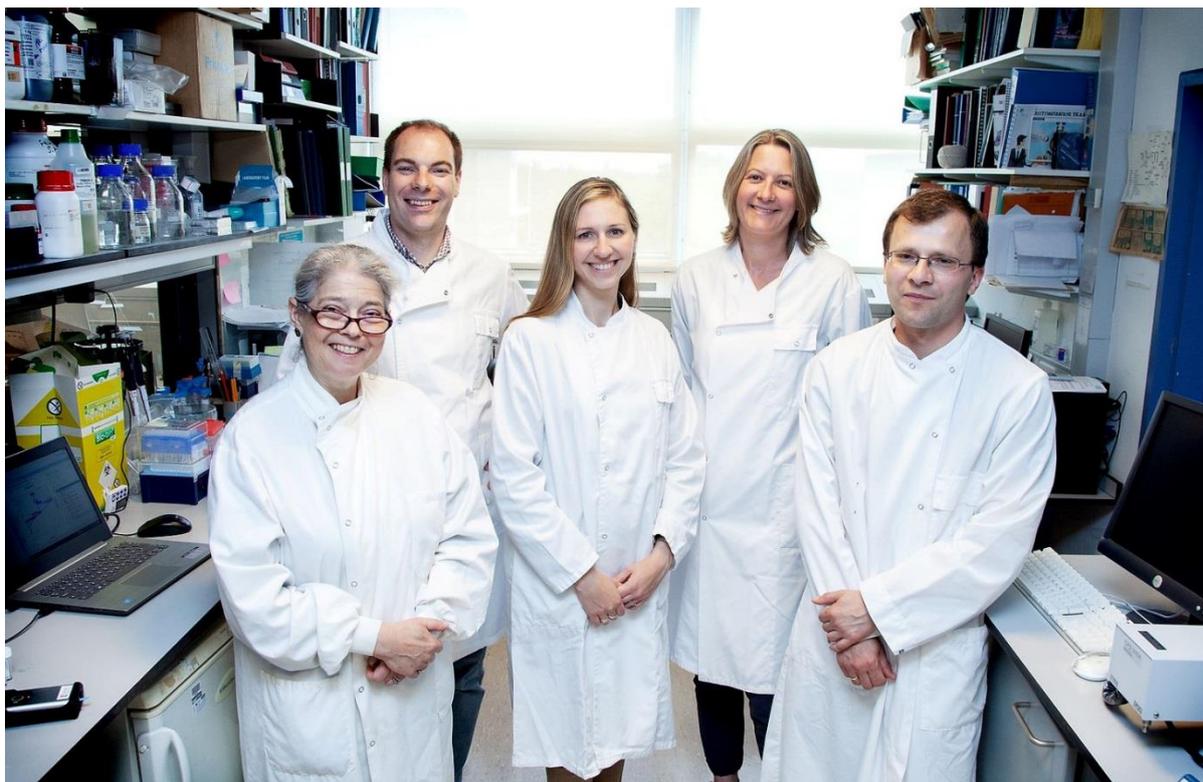


Figure 1. The Kalium Health team in their Cambridge laboratory. From L-R: Professor Fiona Karet, Chief Medical Officer; Tom Collings, Chief Executive Officer, Dr Tanya Hutter, Chief Technology Officer; Dr Liz Norgett, Chief Scientific Officer; Dr Greg Orłowski, Lead Electrochemist. Photo: Melanie Yenerski, CUH Media Studio.

3. The journey so far

The Cambridge ecosystem is known worldwide to be a major biotech cluster and the team at Kalium Health brilliantly made use of what this ecosystem has to offer. Indeed, the first milestone on their way to deliver ground-breaking monitoring solutions was to be named the best healthcare start up in the inaugural AstraZeneca Start-up Science competition. This victory came with valuable mentoring from AZ experts such as David Weston, Laura Fergusson and VP of operations Shaun Grady. Keeping up its momentum, the team secured funding and lab space at the Babraham research park by receiving one of the first prizes during the Accelerate@Babraham competition. The prize money enabled them to explore IP protection of their technology while the lab space allowed them to scale up their processes and recruit interns to work on the scientific development of the electrodes. Building the company even further, Kalium Health grew thanks to the mentoring provided at Accelerate Cambridge, the world-renowned accelerator run by the Entrepreneurship Centre at the University of Cambridge. All of these milestones combined led the Cambridge Independent Science and Technology Award to name Kalium the “One to Watch” start-up of 2018. With this prize came professional IP advice from Appleyard Lees which worked with the scientific team to patent their method of improving the performance of potassium sensing electrodes. Further progress was enabled by the 2019 £25,000 Armourers and Brasiers venture prize, a prestigious award supporting the commercialisation of materials science research.

By early 2020, Kalium's team successfully raised a £950k seed round with participations from Cambridge Enterprise, Kidney Research UK, Cambridge Angels and Martlet Capital, the investment arm of Marshall Cambridge group. This investment allowed the company to embed itself in the Biomedical Campus at Addenbrooke's hospital by settling at the Cambridge Institute for Medical Research. All these achievements will allow Kalium to accelerate its product development and to deliver its vision of launching a medically-approved low-cost miniaturized potassium sensor within the next four years, transforming the lives of thousands of patients around the world.

4. Looking to the future

By working alongside patients, Kalium Health has been thriving to build meaningful and accessible life-changing products. They are tirelessly working towards their vision of empowering people to manage their health and well-being by enabling them to interrogate in real time their health information. Following their first successful fundraising, they plan to raise a series A round which would be used to explore sensing of other electrolytes. Kalium holds great promises to become a leader at empowering underserved patient populations to monitor and track their own health.

References

[1] Facts About High Potassium in Patients with Kidney Disease. National Kidney Foundation, Jul. 2019, www.kidney.org/atoz/content/hyperkalemia/facts/.

[2] Chronic Kidney Disease (CKD), Kidney Care UK, Jan. 2021, <https://www.kidneycareuk.org/about-kidney-health/order-or-download-booklets/>.

The company



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Marion Perrin is a Wellcome Trust scholar and a final year PhD student at the Wellcome/ MRC Stem Cell Institute. Her research aims at understanding how humans start from a unique cell, the embryo to being a fully functional being with millions of specialized cells. She focuses on the first few steps of life where cells take decisions laying out the whole-body organisation plan with the hope that the knowledge generated will lead to improvements in stem cell therapies. In parallel, Marion founded The Adjustables, a start-up in the fashion space designing more sustainable garments for infants and toddlers following completion of EnterpriseTech Star at the Cambridge Judge Business School,



Marion holds a BSc and an MSc in Biology from the Ecole Normale superieure of Lyon, France, an engineering degree from the Ecole des Mines of Paris, France and an MPhil in Stem Cell Biology from the University of Cambridge, UK. In line with her entrepreneurial mindset, she also worked as an analyst in the venture capital firm Kurma partners before starting her PhD where she evaluated investment opportunities in biotech. She is the current Gonville and Caius MCR President and a co-founder of WATT, a non-for-profit organisation promoting women in STEM.