

## Results of Competition: Biomedical Catalyst 2019 Round 1: Feasibility and Primer Awards

Competition Code: 1901\_BMC\_R1\_2019\_FS

Total available funding is £1,022,349

Note: These proposals have succeeded in the assessment stage of this competition. All are subject to grant offer and conditions being met.

| Participant organisation names | Project title   | Proposed project costs | Proposed project grant |
|--------------------------------|---|------------------------|------------------------|
| PLASTICELL LIMITED             | Pre-clinical development of a hematopoietic stem cell therapy product | £297,263               | £208,084               |
| ANTHONY NOLAN                  |   | £131,743               | £131,743               |
| The Francis Crick Institute    |   | £165,204               | £165,204               |

Note: you can see all Innovate UK-funded projects here: <https://www.gov.uk/government/publications/innovate-uk-funded-projects>

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## Project description - provided by applicants

Many patients with blood disorders, such as cancers, can usually be treated by receiving a bone marrow transplant from another person. Usually this donor has to be a blood relation or have a compatible tissue type to ensure the transplant is not rejected. However, finding such a match is not always possible. For some years now, parents have been donating the blood found in the umbilical cord of their new-born babies. Just as with bone marrow, this 'cord blood' contains stem cells which are capable of reconstituting the entire blood and immune system of a transplant recipient. Furthermore, complete matching is not required, so cord blood cells can be used to treat patients that can't find exact matches, lowering the risk of tissue rejection. Unfortunately, the number of cells in each cord blood unit is limited and too small to treat most adults, therefore methods to expand the number of these cells in the laboratory are highly desirable. Plasticell has developed and patented formulations which, in preliminary *\_in vitro\_* studies, allow the stem cells in the cord blood units to be multiplied by around 500-fold without affecting their properties. The company has further developed manufacturing methods in which these cells can be expanded ready for clinical use. The resulting cells have been tested *\_in vitro\_* in the laboratory and in preliminary *\_in vivo\_* transplantation using immune-deficient mouse models. Nevertheless, to ensure the cells are useful to patients we must carry out more extensive *\_in vivo\_* analyses. In this project, we will test the cells ability to reconstitute the entire blood system when injected into immune-deficient mice and also aim to develop innovative solutions to ensure the stem cell product we are developing can be made and delivered to the patients that need it in a format that is safe, effective, user-friendly and affordable.

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| BRAINTRAIN2020 LIMITED         | Multiple physiological inputs to optimise real-time biofeedback through artificial intelligence to improve sleep in insomniacs | £183,000               | £128,100               |
| Sheffield Hallam University    |  | £51,340                | £51,340                |

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The amount we sleep has been increasingly recognised as having an important impact on our health and well-being. Over recent years we have become increasingly aware of the effects that sleep has on both our physical and mental health. Even one bad night's sleep or late night can affect a person's mood, alertness and memory. The long-term effect of poor sleep can cause a range of life-threatening conditions such as cardiovascular disease, obesity and depression. Sleep deprivation was recently identified by Centers for Disease Control and Prevention as a global epidemic.

The economic costs of poor sleep are huge and lead to a staggering annual productivity loss; US \$411bn, Japan \$138bn, Germany \$60bn and UK \$50bn. Unsurprisingly, the sleep aid market is global, demanding and growing, and expected to hit \$101.9bn by 2023 with 6.5% CARG (RAND Europe, 2016).

Our mission is to rid the world of addictive sleeping tablets and provide a good night's sleep for everyone, improving health and well-being.

SleepCogni has identified an urgent clinical need for a solution that aids diagnostics, provides treatment and monitors adherence. The SleepCogni system provides an innovative technological solution to this problem. SleepCogni has developed and patented a wearable and bedside device designed to be used within a subject's home, which will provide support to sleep clinicians, through longitudinal data, enabling a fully informed diagnosis. It can also deliver a treatment for insomnia using light, sound and tactile cues personalised through a biofeedback system.

We now seek to optimise SleepCogni's capability of treating insomnia using SleepCogni's patented active biofeedback which is personalised through our artificial intelligence capabilities using the 20 physiological, behavioural and environmental sensors on the SleepCogni devices. We are working with leading experts in social psychology at Sheffield Hallam University to achieve our goal.

SleepCogni is entering a market where current treatment methods come at a substantial cost. Sleep lab testing costs between \$1300 to \$5000 - for one night. Sleep treatment equipment such as Continuous Positive Airway Pressure (CPAP), machines for sleep apnoea, typically cost \$700 to \$4000. Through exports and local manufacturing SleepCogni would make a significant impact on the UK economy.

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| SOMNUS SCIENTIFIC LIMITED         | Real-Time Blood Propofol Monitoring | £212,707               | £148,895               |
| University of the West of England |                                     | £188,983               | £188,983               |

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## Project description - provided by applicants

Propofol is an intravenous drug used to induce general anaesthesia (unconsciousness or drug induced sleep). It can also be administered by continuous infusion to keep the patient asleep and has substantial benefits for patients compared with the use of anaesthetic gases. These benefits include a carefully controlled, smooth induction of anaesthesia and a rapid, high quality recovery with a very low incidence of nausea. Propofol has less impact on memory, especially in susceptible patients. Patients who have cancer and are anaesthetised with propofol are more likely to be alive 5 years later than those given gaseous anaesthesia. Emerging laboratory evidence is helping to explain this.

There are benefits to the anaesthetist too. Some patients cannot be anaesthetised with a gas whilst equipment or environmental concerns prevent its use in others. The anaesthetist has no worries about the patient awakening during a difficult instrumentation of the airway (during which a gas cannot be delivered).

Propofol infusions are also used extensively to sedate patients (make them calm and sleepy but still responsive) such as those in intensive care units.

During gaseous anaesthesia the gas can be measured in the patient's breath, this shows that it is being delivered to the patient as well offering a measurement of how much is in their system. During intravenous anaesthesia it would be ideal if the amount of propofol in the blood could be monitored and displayed continuously. Such a 'real-time' monitor does not currently exist. Blood propofol concentrations can be measured by sending samples to a laboratory but the delay means that this does not meet the anaesthetist's need for immediate and continuous information.

A real-time blood propofol monitor would increase patient safety by:

- \\* Providing evidence that the drug is being delivered to the patient (and thus a rapid indication of an accidentally disconnected infusion line).
- \\* Indicating how deeply the patient is anaesthetized or sedated
- \\* Refining the dosing calculations built into anaesthetic infusion pumps
- \\* Moving toward personalised anaesthesia by adjusting drug doses to individual patients

This application is being made to support the development of a functioning prototype real-time blood propofol measuring system that works in a laboratory. Required milestones include the invention of a sensor that detects propofol at clinically relevant concentrations, integrating it into a recovery system for use in blood, and linking it to a data display. Further work will be required to produce a clinically useful monitor.

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