

Insigneo Newsletter - September 2021

Welcome to our monthly Insigneo newsletter!

Our monthly e-newsletter keeps you up to date with events, funding, success stories and information. We hope you will find it useful! If you would like to add information and/or events to this newsletter please email: news@insigneo.org (the newsletter will be issued during the 2nd week of the month, excluding January and August). Please ensure that you submit news and events with a minimum of one week's notice.

Insigneo General Assembly - save the date!

INSIGNEO
Institute for *in silico* Medicine

General Assembly

The 2021 Insigneo General Assembly will take place virtually on **7 October 2021 from 3 - 4pm**. Insigneo members please check you calendars for your invitation. Further details to follow.

Insigneo Institute hosts BioMedEng21 conference at the University of Sheffield



BioMedEng21, the UK's largest gathering of Biomedical Engineers, Medical Engineers and Bioengineers was hosted by the Insigneo Institute and the Department of Materials Science and Engineering on 6th – 7th September 2021 in the Diamond Building.

The hybrid conference, chaired by Professor Gwendolen Reilly, brought together over 300 attendees, with 175 delegates travelling to Sheffield to meet in person and 135 joining the conference online. The in-person event witnessed a joyful but cautious return to face-to-face networking, sharing and discussing research, and sparking new ideas. Meanwhile, the hybrid format allowed international speakers from the USA, Uganda, and France, who were not able to travel to the UK, to livestream their talks into the Diamond Building for online and in person delegates.

[Read more](#)

Welcome!

New members

We would like to introduce Dr Lin Cao who has joined the Insigneo Institute recently:



Dr Lin Cao

Department of Automatic Control and
Systems Engineering

Lecturer (Assistant Professor)

Dr. Lin Cao received his Ph.D. degree in Mechanical Engineering in 2015 from the University of Saskatchewan, Canada, with research on compliant robotic systems and soft robotics. He was a visiting scholar in the Interactive Mechanisms and Mechatronics lab, Delft University of Technology, the Netherlands, in 2013. He joined the medical robotics research group at Nanyang Technological University, Singapore, as a Research Fellow and a team leader in 2016. In June 2021, Dr. Cao joined the University of Sheffield as a Lecturer in Medical Robotics.

Dr. Cao's main research interests include flexible endoscopic surgical robots, soft robots, and compliant robotic systems. Collaborating with clinicians and industrial collaborators, he strives to develop flexible/soft robotics technologies that enable medical diagnosis and treatment with minimal invasiveness. These technologies are rigorously developed and tested, in both in-vivo animal trials and human trials, with the ultimate goal of making a real difference for the healthcare of patients.

Dr. Cao is interested in both theoretical and applied research, ranging from modeling the friction in medical tools to developing robots that remove cancer tumors or repair perforations in the digestive tract. His theoretical work on the design theory of compliant robotic systems was featured by ASME Journal of Mechanical design; an applied work on the flexible endoscopic robotic suturing system was a finalist of the "Surgical Robot Challenge" at Imperial College London, and he also won the 'Best Presentation Award' on the Congress of European Association for Endoscopic Surgery at the Amazing Technologies session. In Jan. 2021, he was nominated and invited to attend the Global Young Scientists Summit in Singapore. He also holds a few intellectual properties.

[Full profile](#)

Spinner Fellows present posters at the Tissue & Cell Engineering Society (TCES) 2021 virtual conference



Serum-free Osteogenic Differentiation of a Mesenchymal Stem Cell Line

J. Rodrigues¹, D. Sylla¹, G. Kelly¹, E. Clayson¹

¹Sheffield Hallam University, Sheffield, Yorkshire, England

Background

- One main source of variability in cell culture can be the media used, generally supplemented with animal serum.
- Serum-free alternatives mitigate variability but for Mesenchymal Stem Cells (MSC) it can be difficult to find a good serum free alternative.
- This work aims to compare a commercially available serum-free media to different serum-containing media, for the osteogenic differentiation of an immortalized MSC cell line.

Methods

- hTERT-MSC Y201 cell line (1) cultured for 21 days in 3 different media (Table 1) following 3 supplementation profiles (Table 2). Cells were analysed at day 7, 14 and 21. Fig. 1 details culturing conditions.
- Cells analysed by optical microscopy and cell metabolic activity measured by Resazurin reduction assay.

Results

- Y201 metabolic activity in CD1 following conditions O and H is comparable to results in BM3 and CD1, regardless of supplementation profile (Fig. 2).
- Optical microscopy suggests Y201 cells mineralize faster in CD1, following condition O and supplementation profile OM2. Fig. 3 illustrates results for all three media following condition O at day 21.

Discussion and Conclusions

- Current results suggest CD1 outperforms BM3 and H2M for the mineralization of Y201. Regardless of media, condition O (1 media change/week) following supplementation profile OM2 seems to provide the best results.
- Overall, it is shown that serum-free media can be an effective alternative to serum-containing media for the osteogenic differentiation of hTERT-MSC Y201.

Acknowledgements

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No 76012

References

[1] S. James, et al., Stem Cell Reports 4(3) (2015) 1004-1015.

Sheffield Teaching Hospitals NHS Foundation Trust

EXPANSION OF HUMAN MESENCHYMAL STEM CELLS UNDER SERUM-FREE CONDITIONS

D. Sylla¹, J. Rodrigues¹, G. Kelly¹, E. Clayson¹

¹Sheffield Hallam University, Sheffield, Yorkshire, England

Background

- The lack of uniformity in sera compositions leads to variable and inconsistent in-vitro cell behaviour by altering overall cell metabolism.
- Serum-free media can provide a more consistent performance and avoid masking of biological tests.
- In this project we aim to test cell expansion with serum and serum-free media to analyse optimal conditions for fast cell expansion.

Methods

- An immortalized human mesenchymal stem cell line (hTERT-MSC Y201) [1] was seeded in a density of 4000 cells/cm².
- Well-plates were non-coated or coated with different substrates.
- Media changes varied in different groups.
- Cells were analysed with light microscopy and metabolic resazurin reduction assay on day 1, day 3 and day 7.

Media Composition

Media	Composition
BM3	DMEM (GIBCO) + 10% FBS (GIBCO)
CD1	StemMACS™ MSC Expansion Media K15 X1, human (Miltenyi biotech), serum-free and xeno-free
H2M	Human Mesenchymal-XF Expansion Medium (Merck), human-serum

Substrates

Substrates	Media Changes
NS	No media change
FS	Partial media change
GS	Full media change

Results

- All media provided high cell metabolism.
- CD1 had the highest cell metabolism in all media types and showed the best results when coated with Fibronectin or gelatin and without any media changes.

Discussion and Conclusions

- Results show that the use of CD1 has the best results when used together with a coating and not treated with any media changes.
- Serum free media is an overall good candidate for cell expansion.

Acknowledgements

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No 76012

References

[1] S. James, et al., Stem Cell Reports 4(3) (2015) 1004-1015.

Sheffield Teaching Hospitals NHS Foundation Trust



Spinner Fellows, Denata Sylla and José Rodrigues attended the Tissue & Cell Engineering Society (TCES 2021) Virtual Conference, on Tuesday and Wednesday, 6th and 7th July. They presented virtual posters on their research work developing a protocol or Standard Operating Procedure (SOP) to optimise the expansion and osteogenic differentiation of human Mesenchymal stem cells and thus reduce the variability of their in vitro experiments.

[Read more](#)

Spinner Fellows outreach video.



In this video Spinner Fellows introduce the motivation and background of their

research and the Spinner project which is developing and applying biomaterials, biomechanics and *in silico* modelling for spine surgery.

Watch

STriTuVaD: how augmented clinical trials are accelerating a vaccine for tuberculosis



Tuberculosis is an endemic infectious disease that affects many of the world's poorest populations. By using the latest techniques in mathematical modelling, augmented clinical trials could help researchers develop an affordable vaccine.

Clinical trials are needed to ensure medical treatments available to the public are effective and safe, but it is a lengthy and expensive process. It can take up to ten years and cost around \$1.3 billion to bring a new drug to market.

Researchers at the University of Sheffield are trying to find another way – through augmented clinical trials. This is where computer simulations are used alongside physical trials to reduce the amount of time spent testing treatments, the number of patients involved and, ultimately, the cost.

This work is a major pillar of STriTuVaD, a consortium coordinated by the pharmaceutical company Etna Biotech and focussed on developing vaccines for tuberculosis. The project includes collaborators from across Europe, including the University of Sheffield, where the principal investigator is Insigneo member Dr Miguel Juárez from the School of Mathematics and Statistics.

Read more

Biotechnology and Biological Sciences Research Council (BBSRC) award for Dr Alexander Fletcher

Congratulations to Insigneo member Dr Alexander Fletcher from the School of Mathematics and Statistics (SoMaS) who has been awarded £413,182 for the project '**Chaste: developing sustainable software for computational biology**', from the Biotechnology and Biological Sciences Research Council (BBSRC). Alongside experimental studies, computational modelling plays an increasing role in helping to understand biological processes ranging from embryonic development to tumour growth. Yet computational models and methods are often not re-used effectively and suffer from a lack of reproducibility. The open-source software library Chaste (Cancer, Heart and Soft Tissue Environment) has been developed to overcome these problems. This five-year project, supporting Research Software Engineers at the Universities of Sheffield, Nottingham and Oxford, will fulfil Chaste's potential for the benefit of the UK biology research community. Researchers will enable a richer variety of computational models to be simulated, make use of the latest advances in computing and hardware, and introduce new ways that users can interact and interface with the software without expert programming knowledge.

Guest Lectures, Conferences & Seminars

Insigneo events

7 October 2021

Insigneo General Assembly



Insigneo Seminar: Mechanical & rheological properties of self-organized cellular assemblies: Insights from particle-based simulations.

Bart Smeets - Assistant Professor
BIOSYST-MeBioS, KU Leuven

Friday 8 October 2021,
15:00 - 16:00

8 October 2021

[Insigneo Seminar: Mechanical and rheological properties of self-organized cellular assemblies: Insights from particle-based simulations](#)

19 November 2021

Insigneo Seminar: Ara Nazarian, Associate Professor of Orthopaedic Surgery,
Harvard Medical School

Other events

6 October 2021

[CompBioMed E-seminar #18: High Performance Containers](#)

21 - 22 September 2021

[KKIO 2021 - prime software engineering conference](#)

22 - 25 November

[Klaster LifeScience Kraków \(KLSK\) Life Science Open Space 2021](#)

For a full list of upcoming events visit: <http://insigneo.org/events/>

Publications

Research output affiliated to Insigneo in Scopus (please ensure papers are affiliated to the Insigneo Institute by including the words "Insigneo Institute for *in silico* Medicine"):

A combined modelling and experimental study of heat shock factor

SUMOylation in response to heat shock (Journal of Theoretical Biology) M.

Zhanga, A. Zhao, C. Guo, L. Guo

A method for gait events detection based on low spatial resolution pressure

insoles data (Journal of Biomechanics) F. Salis, S. Bertuletti, T. Bonci, U. Della

Croce, C. Mazzà, A. Cereatti

MA-SOCRATIS: An automatic pipeline for robust segmentation of the left

ventricle and scar (Computerized Medical Imaging and Graphics) M. Mamalakis,

P. Garg, T. Nelson, J. Lee, J. M. Wild, R. H. Clayton

A proposal for a linear calculation of gait asymmetry (Symmetry) L. M. A. van

Gelder, L. Angelini, E. E. Buckley, C. Mazzà

Tibial cartilage, subchondral bone plate and trabecular bone

microarchitecture in varus- and valgus-osteoarthritis versus controls (Journal

of Orthopaedic Research) S. Rapagna, B. C. Roberts, L. B. Solomon, K. J.

Reynolds, D. Thewlis, E. Perilli

Consensus based framework for digital mobility monitoring (PLoS ONE) F.

Kluge, S. Del Din, A. Cereatti, H. Gaßner, C. Hansen, J. L. Helbostad, J. Klucken, A. Küderle, A. Müller, L. Rochester, M. Ullrich, B. M. Eskofier, C. Mazzà

[A multi-approach and multi-scale platform to model CD4+ T cells responding to infections](#) (PLoS Computational Biology) K. Y. Wertheim, B. L. Puniya, A. La Fleur, R. Shah, M. Barberis, T. Helikar

[Protective treatments against endothelial glycocalyx degradation in surgery: A systematic review and meta-analysis](#) (Applied Sciences (Switzerland)) H. Q. R. B. Khan, G. C. Reilly

[Scientific and regulatory evaluation of mechanistic in silico drug and disease models in drug development: Building model credibility](#) (CPT: Pharmacometrics and Systems Pharmacology) F. T. Musuamba, I. Skottheim Rusten, R. Lesage, G. Russo, R. Bursi, L. Emili, G. Wangorsch, E. Manolis, K. E. Karlsson, A. Kulesza, E. Courcelles, J.-P. Boissel, C. F. Rousseau, E. M. Voisin, R. Alessandrello, N. Curado, E. Dall'ara, B. Rodriguez, F. Pappalardo, L. Geris

[Bayesian Calibration of Electrophysiology Models Using Restitution Curve Emulators](#) (Frontiers in Physiology) S. Coveney, C. Corrado, J. E. Oakley, R. D. Wilkinson, S.A. Niederer, R. H. Clayton

[Automatic methods of hoof-on and -off detection in horses using wearable inertial sensors during walk and trot on asphalt, sand and grass](#) (PLoS ONE) E. V. Briggs, C. Mazzà

[Investigation of Coatings, Corrosion and Wear Characteristics of Machined Biomaterials through Hydroxyapatite Mixed-EDM Process: A Review](#) (Materials) M. Al-Amin, A. M. Abdul-Rani, M. Danish, S. Rubaiee, A. B. Mahfouz, H. M. Thompson, S. Ali, D. R. Unune, M. H. Sulaiman

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