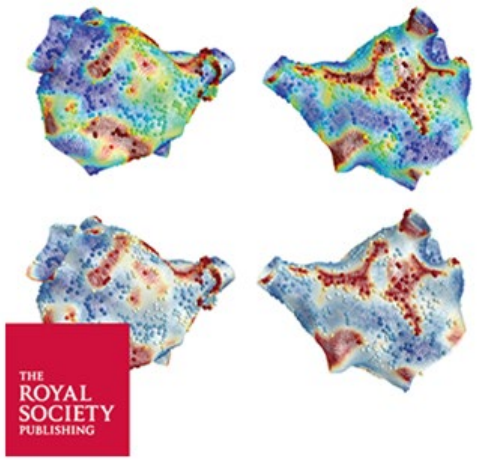
INSIGNEO Institute for *in silico* Medicine | The University Of Sheffield. | Sheffield Teaching Hospitals NHS Foundation Trust

Insigneo Newsletter - June 2020

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.

Special issue of the Philosophical Transactions of the Royal Society: 'Uncertainty quantification in cardiac and cardiovascular modelling and simulation'



Richard Clayton, Professor of Computational Physiology at the University of Sheffield and Insigneo Director of Training, has guest edited a special issue of the prestigious Philosophical Transactions of the Royal Society (the world's longest running science journal) on the theme of 'Uncertainty quantification in cardiac and cardiovascular modelling and simulation'.

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Insigneo Summer Research Programme 2020

We are pleased to announce that the Insigneo Summer Research Programme 2020, which is taking place remotely this year, is fully subscribed with over 100 applications received.

Insigneo will host 13 summer placements for University of Sheffield undergraduates to undertake a research project within the Institute on a topic related to *in silico* medicine.

Read more

New MSc in Bioengineering

Bioengineering at Sheffield is pleased to be launching a new Masters degree for September 2020. The MSc Bioengineering degree is a unique interdisciplinary offering combining *in silico* medicine, biomaterials, experimental analysis and

regulatory aspects.

Delivered by lecturers from internationally-recognised research groups including: the Insigneo Institute for *in silico* Medicine, POLARIS (Pulmonary, Lung and Respiratory Imaging Sheffield), Sheffield Biomaterials and Bioengineering, and Bioengineering and Health Technologies, exposing students to the most relevant research in the field and welcoming them to a community of academic professionals.

The course offers a personalised, project-centred approach allowing students to undertake a dissertation project of their interest and choose options to support this research.

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Insigneo PhD student, Michail Mamalakis, takes part in EU COVID-19 Hackathon

Insigneo PhD student Michail Mamalakis has taken part in two Covid-19 hackathons as part of a team of researchers from the universities of Brighton, Bristol, Glasgow, Lincoln, Oxford and Sheffield. The team has developed Quantum Computer AI to predict Covid-19 from standard blood tests two weeks earlier than current tests. This could increase testing capacity and reduce the need for large scale lockdowns by spotting new waves and outbreaks before they develop, and allowing localised lockdown and social isolation.

Read more

Save the date - BioMedEng21

BioMedEng21

The UK's largest gathering of Biomedical Engineers, Medical Engineers and Bioengineers

Following the decision to cancel the 2020 BioMedEng conference due to the coronavirus pandemic, we are pleased to confirm that the BioMedEng21 conference will take place at the University of Sheffield from 6 – 7 September 2021. Please save this date in your diaries and keep up to date with further announcements by checking the conference website and following on social media.

Online BioMedEng charity launch
We can also confirm that the BioMedEng Scientific Committee will be running an online BioMedEng charity launch on 14 September 2020. More details will be announced later on.

We look forward to welcoming you to Sheffield in September 2021

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VPH2020 conference goes online

We are looking forward to the 2020 VPH conference which will now be held online (in the context of the COVID-19 pandemic) with a special day on modelling and simulations for COVID-related applications on August 24th, followed by satellite

workshops on August 25th, before the conference on August 26th – 28th 2020.

The VPH conference offers a platform to present research related to the Virtual Physiological Human and more broadly to Computational Systems Biomedicine, as well as applications in clinical settings, underpinning the move towards predictive personalised medicine.

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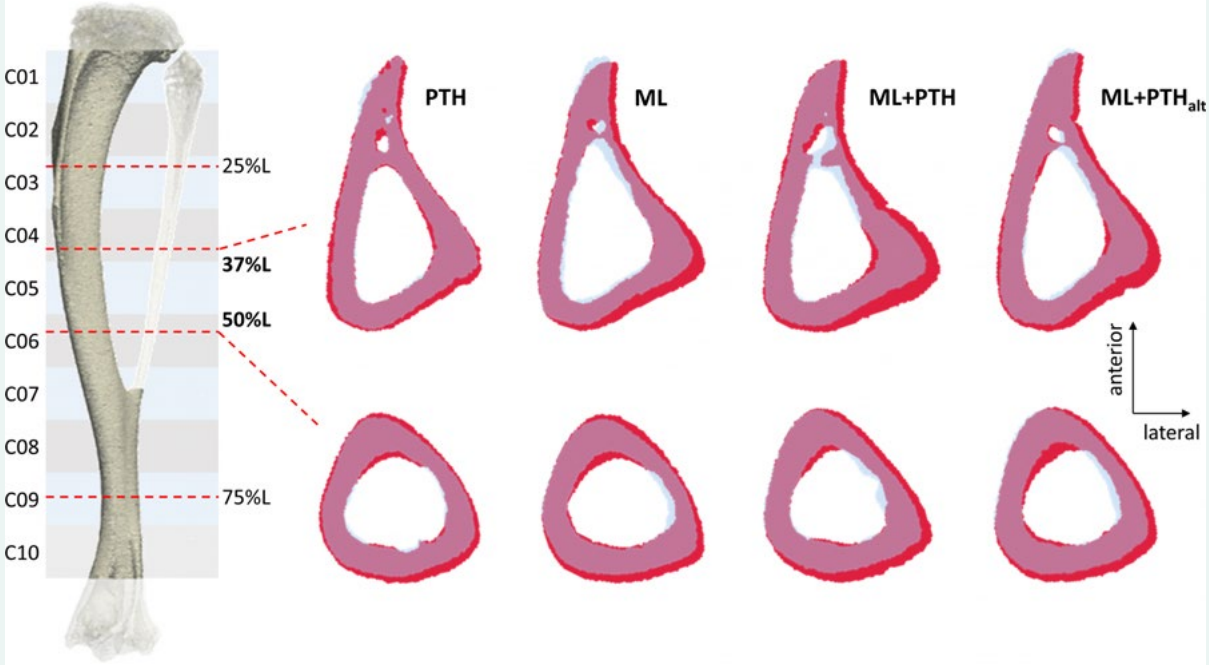
Recent research papers

PTH(1–34) treatment and/or mechanical loading have different osteogenic effects on the trabecular and cortical bone in the ovariectomized C57BL/6 mouse

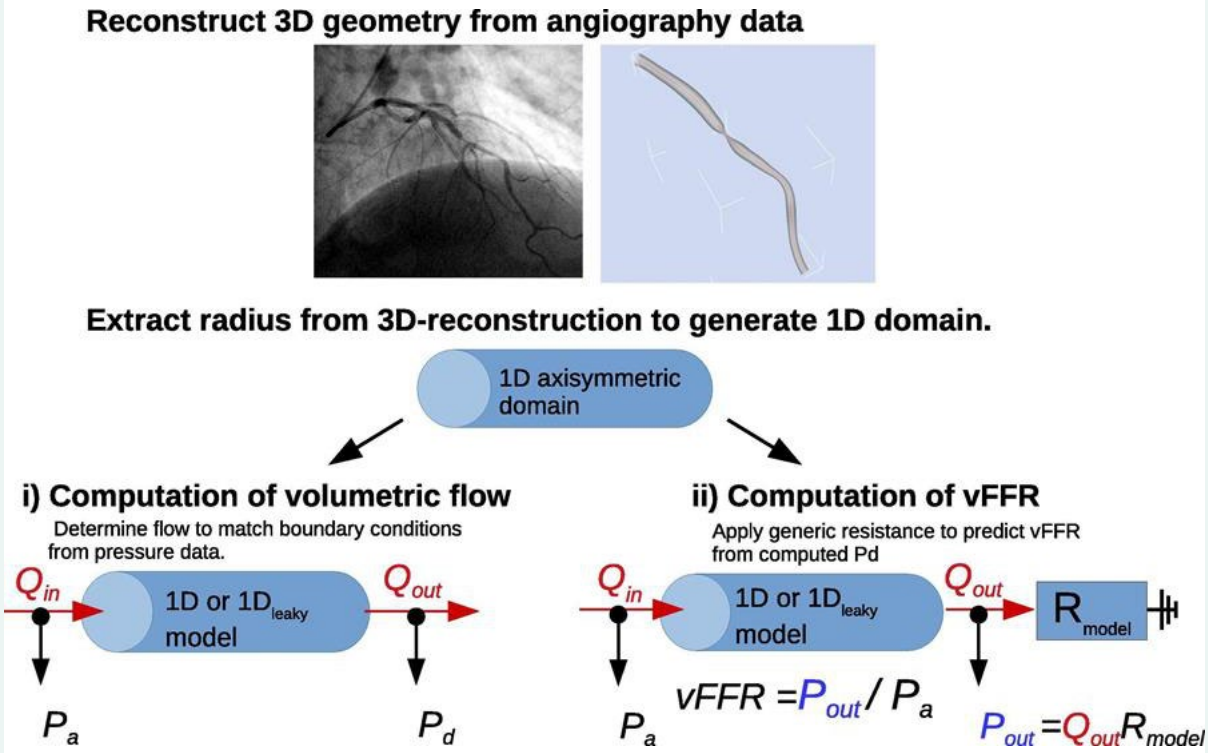


This EPSRC and NC3Rs funded study from Roberts et al quantified the individual and combined longitudinal effects of PTH(1–34) and loading on the bone morphometric and densitometric properties in ovariectomised mice. The study showed that combined treatment had increased, albeit highly region-dependent, benefits to cortical bone that were largest in midshaft regions subjected to higher strains under compressive loads. Whereas combined treatment may limit benefits of loading on the trabecular bone.

Read more

Effect of side branch flow upon physiological indices in

coronary artery disease

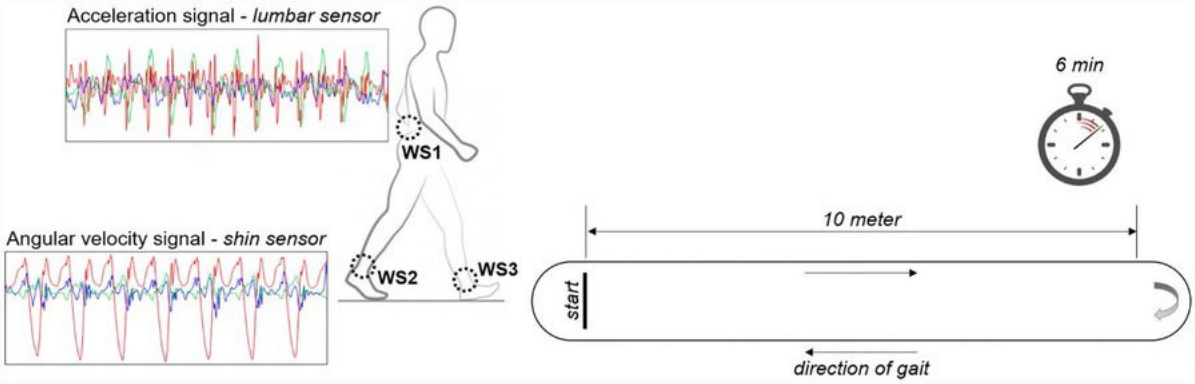


The accuracy of computational models of FFR depends on the anatomical and physiological assumptions which are made during the computational process. This study tested the assumption that coronary physiology can be accurately predicted using computational models that neglect side-branches. The addition of a leakage term had no significant effect on the predictive accuracy of vFFR despite significant differences in the estimated volumetric flow rate. The insensitivity of accuracy of predicted vFFR to differences in predicted flow may reflect the fact that FFR is a ratio whereas absolute measures of flow will be directly affected. The increasing adoption of computed physiological indices may require better understanding of the significance of both relative and absolute measures of coronary artery function.

This is the first paper to come out of our ongoing collaboration with the Norwegian University of Science and Technology.

Read more

Wearable sensors can reliably quantify gait alterations associated with disability in people with progressive multiple sclerosis in a clinical setting



Angelini and colleagues identified reliable gait-based biomarkers using wearable sensors. These may allow clinicians to quantify clinically relevant gait alterations in Multiple Sclerosis patients during regular clinical visits.

Read more

PRIMAGE project: predictive *in silico* multiscale analytics to support childhood cancer personalised evaluation empowered by imaging biomarkers

PRIMAGE
Medical imaging
Artificial intelligence
Childhood cancer research

This article was chosen to be featured in the latest edition of Highlights from ESR Journals!

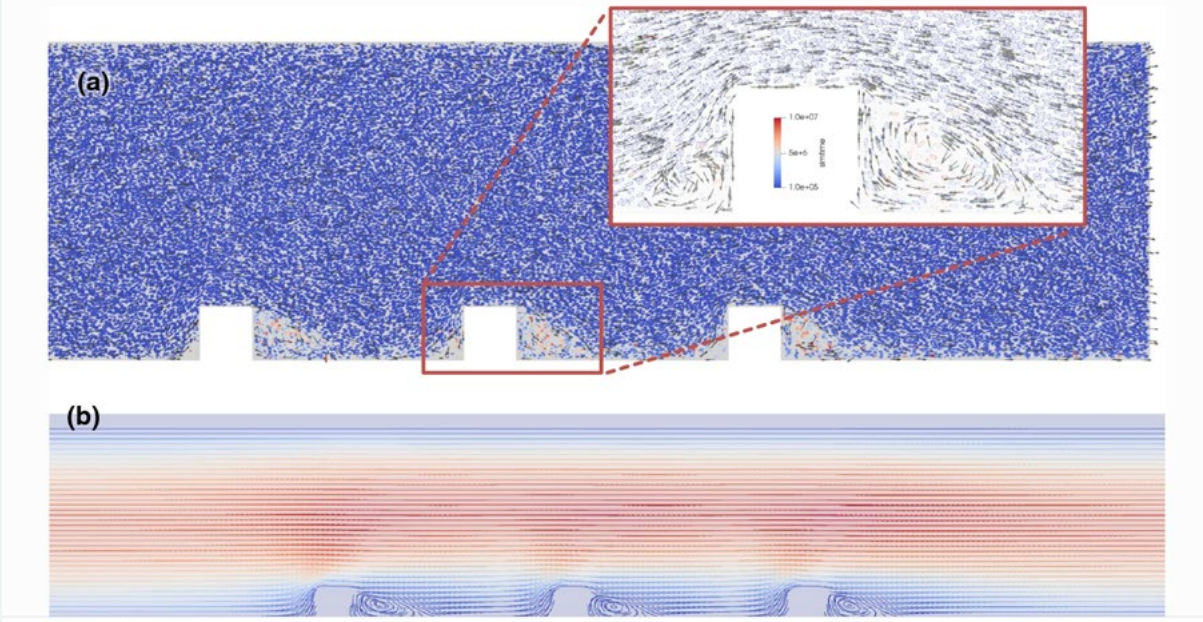
Key points:

- An open-cloud platform for decision support in neuroblastoma and diffuse intrinsic pontine glioma is being developed.
- A decision support system guided by imaging and paediatric oncology experts under a user-centric approach will be developed.
- The platform will validate imaging biomarkers (computed tomography, magnetic resonance, positron emission tomography, 131I-meta-iodobenzylguanidine imaging) and integrated data.

The system will develop diagnostic multiscale models to predict disease progression.

Read more

A particle-based model for endothelial cell migration under flow conditions



Endothelial cells (ECs) play a major role in the healing process following angioplasty to inhibit excessive neointima (scar tissue). This makes the process of EC healing after injury, in particular EC migration in a stented vessel, important for recovery of normal vessel function. This study presents a novel particle-based model of EC migration and validates it against *in vitro* experimental data.

Read more

Inadequacy of Protein Intake in Older UK Adults

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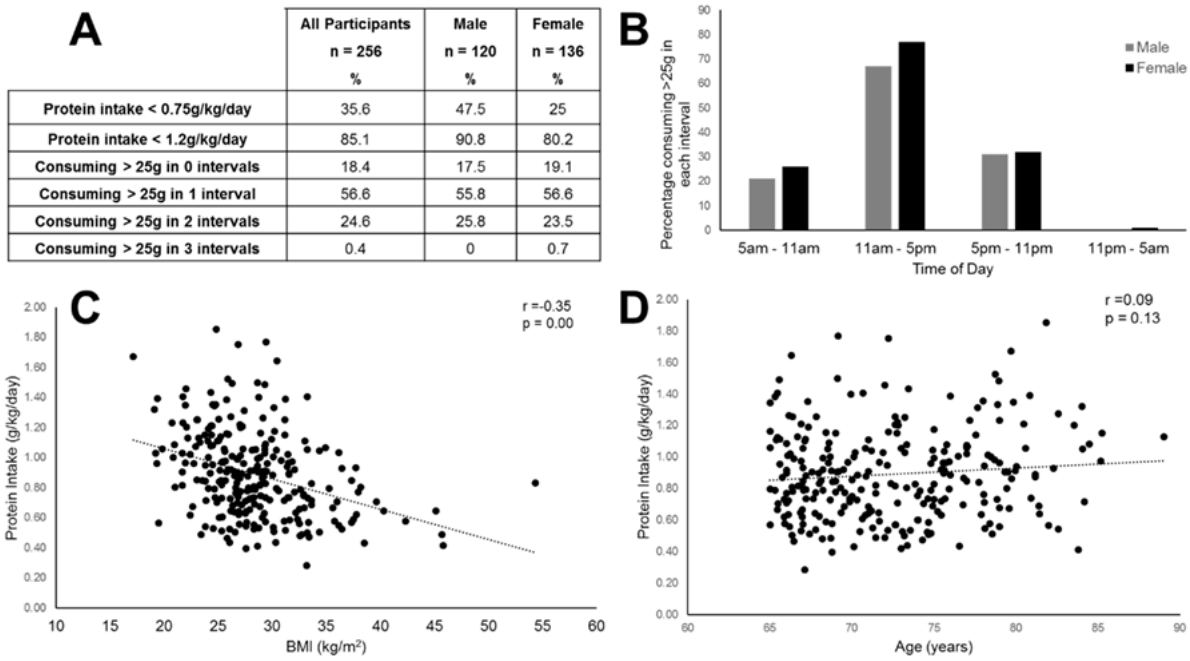
	All Participants n = 256 %	Male n = 120 %	Female n = 136 %
Protein intake < 0.75g/kg/day	35.6	47.5	25
Protein intake < 1.2g/kg/day	85.1	90.8	80.2
Consuming > 25g in 0 intervals	18.4	17.5	19.1
Consuming > 25g in 1 interval	56.6	55.8	56.6
Consuming > 25g in 2 intervals	24.6	25.8	23.5
Consuming > 25g in 3 intervals	0.4	0	0.7



This study assessed the diets of older adults in South Yorkshire and found that more than half of older adults studied aren't consuming enough protein to reach national recommendations.

Protein is particularly important for delaying frailty and maintaining muscle mass and function. Only one of out of the 256 participants ate the recommended 25-30 grams of protein at each of three daily meals.

Researchers hope results will lead simple strategies to help cancer patients stay resilient by preventing muscle wastage during treatments.

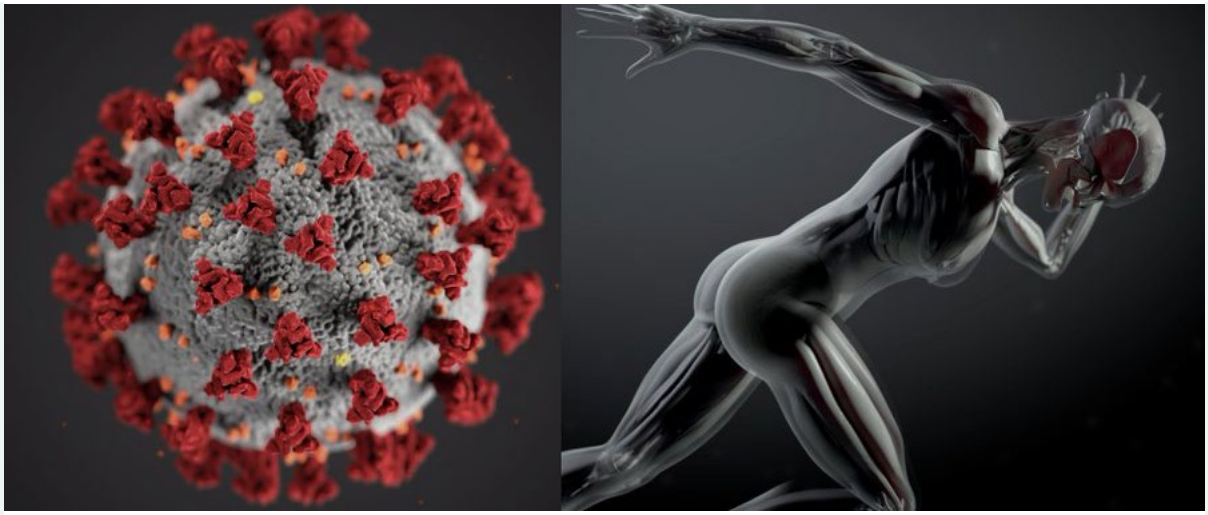
Read more

How *in silico* fights Coronavirus

The *in silico* community is joining forces taking advantage of *in silico* technologies to accelerate the identification of vaccines and treatments to rapidly respond to the coronavirus crisis. *In Silico* World have brought together a page of initiatives of the from the *In Silico* community. If you would like to find out more and contribute click the button below to visit their website.

Read more

CompBioMed and Coronavirus



CompBioMed is active in a vast international consortium across Europe and USA working on urgent coronavirus research. Heading CompBioMed's efforts in this collaboration is Prof Peter Coveney and the Centre for Computational Science (CCS) at University College London (UCL), together with Leibniz Rechenzentrum (LRZ) and Gauss Centre for Supercomputing (GCS) Director Prof Dieter Kranzlmüller.

Read more

Stem for Girls event

Thank you to Zianab Altai, Kirsty Scott and Lorenza Angelini for inspiring Year 9-11 students with Insigneo's research activities at the STEM for Girls event which took place at the Octagon on 11 March 2020. Over the course of the day the event welcomed around 400 visitors to the University from Sheffield City Region and further afield. Pictured is Zainab at our stand with motion capture and FEM video .

Insigneo Seminar: unravelling the interplay of structural & material properties of biological soft tissues using Mechanistic Modelling

Our final Insigneo Seminar before the Coronavirus lockdown was from Dr Georges Limbert from the University of Southampton and the University of Cape Town on 5 March 2020.

Georges presented some of the modelling approaches his research team have been designing to gain a mechanistic understanding of the interplay between material and structural properties of the skin, and ultimately, to exploit this knowledge for a variety of clinical and industrial applications.

See below for details of our upcoming online seminar.

Guest Lectures, Conferences & Seminars

Insigneo Events

1 July 2020
Insigneo Seminar: Mechanobiology of the nucleus and the impact of DNA damage

Other events

26 August 2020
VPH2020

7 September 2020
International Winter School on *In Silico* Trials, Bologna

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"):

Wearable sensors can reliably quantify gait alterations associated with disability in people with progressive multiple sclerosis in a clinical setting (Journal of Neurology) L. Angelini, W. Hodgkinson, C. Smith, J. Moorman Dodd, B. Sharrack, C. Mazzà, D. Paling

Gaussian process manifold interpolation for probabilistic atrial activation maps and uncertain conduction velocity (Philosophical transactions. Series A, Mathematical, physical, and engineering sciences) S. Coveney, C. Corrado, C.H. Roney, D. O'Hare, S. E. Williams, M. D. O'Neill, S. A. Niederer, R. H. Clayton, J. E. Oakley, R. D. Wilkinson

Predicting left ventricular contractile function via Gaussian process emulation in aortic-banded rats (Philosophical transactions. Series A, Mathematical, physical, and engineering sciences) S. Longobardi, A. Lewalle, S. Coveney, I. Sjaastad, E. K. S. Espe, W. E. Louch, C. J. Musante, A. Sher, S. A. Niederer

An audit of uncertainty in multi-scale cardiac electrophysiology models (Philosophical transactions. Series A, Mathematical, physical, and engineering sciences) R. H. Clayton, Y. Aboelkassem, C.D. Cantwell, C. Corrado, T. Delhaas, W. Huberts, C. L. Lei, H. Ni, A. V. Panfilov, C. Roney, R. W. dos Santos

Homeobox B9 integrates bone morphogenic protein 4 with inflammation at atheroprone sites (Cardiovascular Research) C. Souilhol, I. Gauci, S. Feng, B. Tardajos Ayllon, M. Mahmoud, L. Canham, M. Fragiadaki, J. Serbanovic-Canic, V. Ridger, P. C. Evans

Performance Investigation of Integrated Model of Quarter Car Semi-Active Seat Suspension with Human Model (Applied Sciences (Switzerland)) S. Jain, S. Saboo, C. I. Pruncu, D. R. Unune

BNP/NT-proBNP in pulmonary arterial hypertension: time for point-of-care testing? (European respiratory review : an official journal of the European Respiratory Society) R. A. Lewis, C. Durrington, R. Condliffe, D. G. Kiely

Sensitivity and Uncertainty Analysis of Two Human Atrial Cardiac Cell Models Using Gaussian Process Emulators (Frontiers in Physiology) S. Coveney, R. H. Clayton

Editorial: Pulmonary Hypertension: Mechanisms and Management, History and Future (Frontiers in Medicine) A. A. R. Thompson, M. R. Wilkins, J. M. Wild, D. G. Kiely1, A. Lawrie

A new approach to comprehensively evaluate the morphological properties of the human femoral head: example of application to osteoarthritic joint (Scientific Reports) M. Ryan, L. Barnett, J. Rochester, J. M. Wilkinson, E. Dall'Ara

A novel algorithm to predict bone changes in the mouse tibia properties under physiological conditions (Biomechanics and Modeling in Mechanobiology) V. S. Cheong, A. Campos Marin, D. Lacroix, E. Dall'Ara

Changes in scaffold porosity during bone tissue engineering in perfusion bioreactors considerably affect cellular mechanical stimulation for mineralization (Bone Reports) F. Zhao, D. Lacroix, K. Ito, B. van Rietbergen, S. Hofmann

PRIMAGE project: predictive in silico multiscale analytics to support childhood cancer personalised evaluation empowered by imaging biomarkers (European Radiology Experimental) L. Martí-Bonmatí, Á. Alberich-Bayarri, R. Ladenstein, I. Blanquer, J. D. Segrelles, L. Cerdá-Alberich, P. Gkontra, B. Hero, J. M. García-Aznar, D. Keim, W. Jentner, K. Seymour, A. Jiménez-Pastor, I. González-Valverde, B. Martínez de las Heras, S. Essiaf, D. Walker, M. Rochette, M. Bubak, J. Mestres, M. Viceconti, G. Martí-Besa, A. Cañete, P. Richmond, K. Y. Wertheim, T. Gubala, M. Kasztelnik, J. Meizner, P. Nowakowski, S. Gilpérez, A. Suárez, M. Aznar, G. Restante, E. Neri

A clinically aligned experimental approach for quantitative characterization of patient-specific cardiovascular models (AIP Advances) A. P. Narata, F. Silva de Moura, F. Patat, A. Marzo, I. Larrabide, J.-M. Gregoire, C. Perrault, C. A. Sennoga, and A. Bouakaz

A particle-based model for endothelial cell migration under flow conditions (Biomechanics and Modeling in Mechanobiology) P. S. Zun, A. J. Narracott, P. C. Evans, B. J. M. van Rooij, A. G. Hoekstra

Preliminary modeling of effective positioning of Arabin cerclage pessary in women at high risk of preterm birth (Ultrasound in Obstetrics and Gynecology) A. S. Barbone, X. Li, B. Arabin, Y. Kira, J. C. Jani, M. M. Cannie

Revealing hidden information in osteoblast's mechanotransduction through

analysis of time patterns of critical events (BMC Bioinformatics) G. Ascolani, T. M. Skerry, D. Lacroix, E. Dall'Ara, A. Shuaib

Effect of size and location of simulated lytic lesions on the structural properties of human vertebral bodies, a micro-finite element study (Bone Reports) M. C. Costa, L. B. Bresani Campello, M. Ryan, J. Rochester, M. Viceconti, E. Dall'Ara

Angiography-Derived Fractional Flow Reserve: More or Less Physiology? (Journal of the American Heart Association) P. D. Morris, N. Curzen, J. P. Gunn

Inadequacy of protein intake in older UK adults (Geriatrics (Switzerland)) S. Morris, J. D. Cater, M. A. Green, A. M. Johnstone, J. M. Brunstrom, E. J. Stevenson, E. A. Williams, B. M. Corfe

Performance comparison of dry, flood and vegetable oil based minimum quantity lubrication environments during CNC milling of Aluminium 6061 (Materials Today: Proceedings) A. Shukla, A. Kotwani, D. R.Unune

Boosting the Osteogenic and Angiogenic Performance of Multiscale Porous Polycaprolactone Scaffolds by in Vitro Generated Extracellular Matrix Decoration (ACS Applied Materials and Interfaces) B. Aldemir Dikici, G. C. Reilly, F. Claeyssens

Shear stress rosettes capture the complex flow physics in diseased arteries (Journal of Biomechanics) C. Vamsi Krishnaa, V. Chandran Sujab, P. N. Watton, J. H. Arakeria, N. Gundiaha

Effect of side branch flow upon physiological indices in coronary artery disease (Journal of Biomechanics) R. C. Gosling, J. Sturdy, P. D. Morris, F. E. Fossan, L. R. Hellevik, P. Lawford, D. R. Hose, J. Gunn

From cell to multi-crypt: Agent-based models of the human colon suggests novel processes of Field cancerisation (Journal of Computational Science) T. A. Ingham-Dempster, R. Rosser, B. M. Corfe, D. C.Walker

Comparison of the anabolic effects of reported osteogenic compounds on human mesenchymal progenitor-derived osteoblasts (Bioengineering) R. Owen, H. Bahmaee, F. Claeyssens, G. C. Reilly

Double-Kissing Nanocrush for Bifurcation Lesions: Development, Bioengineering, Fluid Dynamics, and Initial Clinical Testing (Canadian Journal of Cardiology) P. D.Morris, R. Gosling, A. Rothman, J. Iqbal, C. Chiastra, M. Colombo, F. Migliavacca, A. Banning, J. P. Gunn

Neutrophil microvesicles drive atherosclerosis by delivering miR-155 to

atheroprone endothelium (Nature Communications) I. Gomez, B. Ward, C. Souilhol, C. Recarti, M. Ariaans, J. Johnston, A. Burnett, M. Mahmoud, L. A. Luong, L. West, M. Long, S. Parry, R. Woods, C. Hulston, B. Benedikter, C. Niespolo, R. Bazaz, S. Francis, E. Kiss-Toth, M. van Zandvoort, A. Schober, P. Hellewell, P. C. Evans, V. Ridger

Quantifying atrial anatomy uncertainty from clinical data and its impact on electro-physiology simulation predictions (Medical Image Analysis) C. Corrado, O. Razeghi, C. Roney, S. Coveney, S. Williams, I. Sim, M. O'Neill, R. Wilkinson, J. Oakley, R. H. Clayton, S. Niederer

Subject-specific simulation for non-invasive assessment of aortic coarctation: Towards a translational approach (Medical Engineering and Physics) M. Mercuri, K. Wustmann, H. vonTengg-Koblig, C. Göksu, D. R. Hose, A. Narracott

Identification of cardiac magnetic resonance imaging thresholds for risk stratification in pulmonary arterial hypertension (American Journal of Respiratory and Critical Care Medicine) R. A. Lewis, C. S. Johns, M. Cogliano, D.Capener, E. Tubman, C. A. Elliot, A. Charalampopoulos, I. Sabroe, A. A. Roger Thompson, C. G. Billings, N. Hamilton, K. Baster, P. J. Laud, P. M. Hickey, J. Middleton, I. J. Armstrong, J. A. Hurdman, A. Lawrie, A. M. K. Rothman, J. M. Wild, R. Condliffe, A. J. Swift, D. G. Kiely

Fucoidan Inhibition of Osteosarcoma Cells is Species and Molecular Weight Dependent (Marine drugs) D. Gupta, M. Silva, K. Radziun, D. C. Martinez, C. J. Hill, J. Marshall,V. Hearnden, M. A. Puertas-Mejia, G. C. Reilly

Characterizing Cross□Linking Within Polymeric Biomaterials in the SEM by Secondary Electron Hyperspectral Imaging (Macromolecular Rapid Communications) N. Farr, S. Pashneh□Tala, N. Stehling, F. Claeyssens, N. Green C. Rodenburg

Assessment of the Angiogenic Potential of 2-Deoxy-D-Ribose Using a Novel in vitro 3D Dynamic Model in Comparison With Established in vitro Assays (Frontiers in Bioengineering and Biotechnology) S. Dikici, B. Aldemir Dikici, S. I. Bhaloo, M. Balcells, E. R. Edelman, S. MacNeil, G. C. Reilly, C. Sherborne, F. Claeyssens

Effect of Vitamin D supplementation on irritable bowel syndrome symptom severity and quality of life (Proceedings of the Nutrition Society) C. E. Williams, E. A. Williams, B. M. Corfe

Credibility of in Silico Trial Technologies-A Theoretical Framing (IEEE Journal of Biomedical and Health Informatics) M. Viceconti, M. A Juarez, C. Curreli, M. Pennisi, G. Russo, F. Pappalardo

The effect of strontium and silicon substituted hydroxyapatite electrochemical coatings on bone ingrowth and osseointegration of selective laser sintered porous metal implants (PLoS ONE) A. Mumith, V. San Cheong, P. Fromme, M. J. Coathup, G. W. Blunn

An extended discrete element method for the estimation of contact pressure at the ankle joint during stance phase (Proceedings of the Institution of Mechanical Engineers, Part H: Journal of Engineering in Medicine) I. Benemerito, L. Modenese, E. Montefiori, C. Mazzà, M. Viceconti, D. Lacroix, L. Guo

Influence of cardiac autonomic neuropathy on cardiac repolarisation during incremental adrenaline infusion in type 1 diabetes (Diabetologia) A. Bernjak, E. Chow, E. J. Robinson, J. Freeman, J. L. B. Marques, I. A. Macdonald, P. J. Sheridan, S. R. Heller

Postnatal pelvic floor muscle stiffness measured by vaginal elastometry in women with obstetric anal sphincter injury: a pilot study (International Urogynecology Journal) D.O. C. Anumba, S. Gillespie, S. Jha, S. Abdi, J. Kruger, A. Taberner, P. M. F. Nielsen, X. Li

Combined porogen leaching and emulsion templating to produce bone tissue engineering scaffolds (International Journal of Bioprinting) R. Owen, C. Sherborne, R. Evans, G. C. Reilly, FClaeyssens,

Diagnostic accuracy of CT pulmonary angiography in suspected pulmonary hypertension (European Radiology) A. J. Swift, K.Dwivedi, C. Johns, P. Garg, M. Chin, B. J. Currie, A.M. K. Rothman, D. Capener, Y. Shahin, C. A. Elliot, T. Charalampopolous, I. Sabroe, S. Rajaram, C. Hill, J. M. Wild, R. Condliffe, D. G. Kiely

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