DEVELOPMENT

This volume collects essays from prominent intellectuals and public figures based on talks given at the 2015 Darwin College Lectures on the theme of 'development'. The writers are world-renowned experts in such diverse fields as architecture, astronomy, biology, climate science, economy, psychology, sports, and technology. *Development* includes contributions from developmental biologist and Nobel laureate John B. Gurdon, Olympic gold medallist Katherine Grainger, astronomer and cosmologist Richard Ellis, developmental psychologist Bruce Hood, former Met Office Chief Scientist Julia Slingo, architect Michael Pawlyn, development economist Ha-Joon Chang, and serial entrepreneur Hermann Hauser. While their perspectives and interpretations of development vary widely, their essays are linked by a common desire to describe and understand how things change, usually in the direction of ever-increasing complexity.

Written with the lay reader in mind, this interdisciplinary book is a must-read for anybody interested in the mechanisms underlying the changes we see in the world around us.

TORSTEN KRUDE is a University Senior Lecturer in Cell Biology at the University of Cambridge, and a Fellow at Darwin College. His research on the regulation of DNA replication in human cells has been widely published in leading international journals. In 2012 he received the prestigious Pilkington Prize for excellence in teaching by the University of Cambridge. He oversees the Darwin College Lecture Series and is also responsible for the development of the College Gardens.

SARA T. BAKER joined the Faculty of Education at the University of Cambridge in 2011. She performs basic research on cognitive development in the pre-school years, when children learn about a constantly changing world, and translates this research into educational contexts. Her projects have been funded by the Newton Trust, the ESRC, and the LEGO Foundation. She is a Deputy Dean at Darwin College and a member of the College Council.

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Development

Mechanisms of Change

Edited by *Torsten Krude* and *Sara T. Baker*

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Notes on Contributors

John Gurdon Professor Sir John Bertrand Gurdon FRS is a developmental biologist, whose work has pioneered nuclear transfer and reprogramming, and led to the first cloning of a vertebrate organism.

John Gurdon was judged at school to be wholly unsuited to science, having come bottom in a class of 250 in Biology. However, he was able to take up science at Oxford University, where he also did a PhD. His work led to the concept that an egg has the ability to rejuvenate the nucleus of an adult cell, and hence to the current prospect of replacing aged and diseased cells in humans with new cells derived from other body cells such as skin. In mid-career he moved to Cambridge, where he still works in the University, in a major research institute that has been named in his honour, The Gurdon Institute. He is an Honorary Fellow of Christ Church, Oxford, and of Magdalene and Churchill Colleges in Cambridge. He served as Master of Magdalene College, Cambridge, from 1995–2002. He has received a number of awards, including the Copley Medal of the Royal Society (2003), the Lasker Award for Basic Medical Research (2009), and the Nobel Prize for Physiology or Medicine (2012).

Katherine Grainger Dame Katherine Grainger DBE is Britain's most successful international female rower and most-decorated female Olympian.

Originally from Glasgow, Katherine Grainger studied at Edinburgh University, where she took up the sport in 1993. Her international rowing career began in 1997, and since that time she has won six world championships and four Olympic silver medals (Sydney, Athens, Beijing, and Rio). In 2012 she won the Olympic gold medal with Anna Watkins in the double scull. Katherine Grainger is the only British female athlete from any sport to have won medals in five consecutive Olympic Games. She was awarded an MBE in 2006, a CBE for services to rowing in 2012, and a DBE for services to sport and charity in 2017. She obtained an Honours LLB from Edinburgh

University, an MPhil in Medical Law and Medical Ethics from Glasgow University, and a PhD in the Law of Homicide at King's College, London. In 2015, she became Chancellor of Oxford Brookes University. Alongside her studies, she wrote her autobiography *Dreams Do Come True*, which was published in June 2013.

Richard Ellis Professor Richard Salisbury Ellis CBE FRS is an astronomer and has charted the earliest period of cosmic history, when the first galaxies emerged.

A Welshman by birth, Richard Ellis was an undergraduate at University College London, and gained his PhD at Oxford. He became a professor of astronomy at the University of Durham in 1985. He was appointed the Plumian Professor at Cambridge in 1993, and served as Director of the Institute of Astronomy from 1994 to 1999. He then became the Steele Professor of Astronomy at the California Institute of Technology in Pasadena. Since 2015, he is Professor of Astrophysics at University College London. He has published widely on topics in observational cosmology and galaxy evolution. Within both the UK and the USA he has led discussions for new observational facilities, the most recent example being the Thirty Meter Telescope atop Mauna Kea on the island of Hawaii. Richard Ellis is a Fellow of the Royal Society and was awarded the Gruber Cosmology Prize for his part in the discovery of the accelerating Universe (2007), the Carl Sagan Memorial Prize (2017), and the Gold Medal of the Royal Astronomical Society (2011).

Bruce Hood Professor Bruce MacFarlane Hood is an experimental psychologist who researches early child development and specialises in the development of the mind.

Bruce Hood is Canadian-born, but moved to Scotland, where he was an undergraduate and obtained an MPhil at the University of Dundee. He then obtained his PhD from Cambridge and worked at MIT and Harvard before returning to the UK. Bruce Hood is currently the Professor of Developmental Psychology in Society at the University of Bristol, where he has worked for the past 16 years. He is the Director of the Bristol Cognitive Development Centre that researches early child development, and has published three popular science books on the development of the mind. In 2011, he presented the Royal Institution Christmas Lectures, 'Meet Your Brain', and received the Public Engagement and Media Awards from The British Psychological Society in 2013. He is a Fellow of the Association for Psychological Science, the Royal Society of Biology, and the Royal Institution of Great Britain.

Julia Slingo Professor Dame Julia Mary Slingo DBE FRS is a meteorologist and climate scientist.

Julia Slingo obtained her BSc and PhD at the University of Bristol and subsequently worked for the Met Office, the European Centre for Medium-Range Weather Forecasts in Reading, and the National Center for Atmospheric Research in the USA. She returned to the UK and became the Director of Climate Research in the NERC's National Centre for Atmospheric Science at the University of Reading. She became the first female Professor of Meteorology in the UK. In 2006, Julia Slingo founded the Walker Institute for Climate System Research at Reading, aimed at addressing the cross-disciplinary challenges of climate change and its impacts. She became the Met Office Chief Scientist in 2009, where she led a team on a portfolio of research that underpins weather forecasting, climate prediction, and climate change projections. Since joining the Met Office she has sought to integrate the UK community in weather and climate research to ensure that the UK receives maximum benefit from its science investments. She was awarded an OBE in 2008 for services to environmental and climate science and a DBE for services to weather and climate science in 2014.

Michael Pawlyn Michael Pawlyn is a London-based architect who has been described as a pioneer of biomimicry. He established the company Exploration Architecture to work on biomimetic architecture and the development of sustainable design.

After graduating from University College London and the University of Bath with a BSc and a BArch, respectively, Michael Pawlyn worked with Grimshaw Architects for 10 years and was central to the team that radically reinvented horticultural architecture for the Eden Project. He was responsible for leading the design of the Warm Temperate and Humid Tropics Biomes and the subsequent phases that included proposals for a third Biome for plants from dry tropical regions. He established the company Exploration Architecture in 2007 to focus exclusively on biomimicry, and in 2008 the company was short-listed for the Young Architect of the Year Award and the internationally renowned Buckminster Fuller Challenge. He is a Founding Partner of the Sahara Forest Project – a company established to deliver concrete initiatives for restorative growth. Michael Pawlyn has lectured widely on the subject of sustainable design in the UK and abroad, and delivered talks at the Royal Society of Arts, at Google's annual Zeitgeist conference and became one of only a small handful of architects to have a talk posted on TED.com in 2011. In the same year, his book *Biomimicry in Architecture* was published by the Royal Institute of British Architects.

Ha-Joon Chang Dr Ha-Joon Chang is an institutional economist who specialises in Development Economics.

Ha-Joon Chang graduated from the Department of Economics at Seoul National University in his native South Korea and subsequently moved to Cambridge, where he obtained his PhD in 1991. He currently teaches economics at the University of Cambridge and is a Reader in the Political Economy of Development. In addition to numerous journal articles and book chapters, he has published 15 authored books (four co-authored) and 10 edited books, including *The Political Economy of Industrial Policy*, *Kicking Away the Ladder*, *Bad Samaritans*, *23 Things They Don't Tell You about Capitalism*, and *Economics: The User's Guide*. He has developed a critique of neo-liberal capitalism particularly in developing countries, and his writings remain accessible to the general public. His work has been translated and published in 36 languages and 39 countries. He is the winner of the Gunnar Myrdal Prize in 2003 and the Wassily Leontief Prize in 2005.

Hermann Hauser Dr Hermann Maria Hauser KBE FRS is a serial entrepreneur and co-founder of Amadeus Capital Partners.

Hermann Hauser obtained a Masters degree at Vienna University in his native Austria before moving to Cambridge, where he obtained a PhD in Physics. He has wide experience in developing and financing companies in the information technology sector. He co-founded a number of high-tech companies, including Acorn Computers (which spun out ARM), E-trade UK, Virata, and Cambridge Network. Subsequently he became Vice President of Research at Olivetti. During his tenure at Olivetti, he established a global network of research laboratories. Since leaving Olivetti, he has founded over 20 technology companies. In 1997, he co-founded Amadeus Capital Partners. At Amadeus he invested in CSR, Solexa, Icera, Xmos, and Cambridge Broadband. Hermann Hauser is a Fellow of the Royal Society, the Institute of Physics, and the Royal Academy of Engineering. He is an Honorary Fellow of Hughes Hall and King's College, Cambridge. In 2001, he was awarded an Honorary CBE for 'innovative service to the UK enterprise sector'. In 2004 he was made a member of the Government's Council for Science and Technology and in 2013 he was made a Distinguished Fellow of BCS, the Chartered Institute for IT. In 2015 he was awarded a KBE for services to engineering and industry.

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