

Curriculum Vitae: Leroy (Lee) Cronin FRSE

Regius Professor of Chemistry, School of Chemistry, University of Glasgow, Glasgow, G12 8QQ, UK

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Researcher ID: <http://www.researcherid.com/rid/B-7752-2008>



Personal details:

Name: Leroy (Lee) Cronin
Date of Birth: 1st June 1973 (aged 43)

Education:

1994 - 1997 University of York
1991 - 1994 University of York

Qualifications:

BSc (1994): First Class Honours, Pure Chemistry (York University)
DPhil (1997): Inorganic Chemistry (York University)

Awards, Recognition, Fellowships, & Highlights:

2016 Feature Profile in Chemistry World "Searching for Complexity" <http://tinyurl.com/zdzvc2d>
2015 RSC Tilden Prize
2015 European Research Council Advanced Grant (2015-2020)
2015 Spin out company Listed on the AIM stock exchange CroninGroupPLC (raising ca. £6 M)
2015 1st Annual Pearlman Lecture at the Weizmann Institute of Science
2015 Solvay Lecture at the University of Belgium
2014 RISE Award (1 of the UK's top 10 Inspiring Sciences and Engineers)
2014 UK Science Council One of the top 100 UK practising Sciences
2014 EPSRC Programme Grant on Digital Synthesis (2014-2019)
2013 RSE/BP Hutton Prize
2012 RSC Corday Morgan Medal and Prize
2012 81st Henry Lecture at the Philosophical Society of Washington
2012 Visiting Professor, UPMC - University Pierre and Marie Curie, France
2011 RSC Bob Hay Lectureship
2011 Speaker and opening lecture at TEDGlobal2011 in Edinburgh
2010 Invited Lecturer, 3^{ème} cycle de Chimie, Switzerland
2009 Royal Society-Wolfson Research Merit Award
2009 Elected to the Royal Society of Edinburgh
2008 Morino Foundation Prize
2007 Philip Leverhulme Prize (£70,000)
2006 Finalist and winner (silver medal) of the Young European Chemists Award
2005 EPSRC Advanced Fellowship
1999 Alexander von Humboldt Research Fellowship
1998 Monbusho-JSPS Fellowship
1996 ICI Scientists Scholarship

Employment History:

2015 - Founding Scientific Director, CroninGroup PLC – listed on AIM since Sept 2015
2013 - Regius Chair of Chemistry (appointed by HM Queen Elizabeth II) Established in 1817
2009 - 2013 Gardiner Chair of Chemistry, Glasgow University
2006 - 2011 EPSRC Advanced Research Fellowship, Glasgow University
2006 - 2009 Professor of Chemistry, Glasgow University

2005 - 2006	Reader in Chemistry, Glasgow University
2002 - 2005	Lecturer in Chemistry, Glasgow University
2000 - 2002	Lecturer in Chemistry, Birmingham University
1999 - 2000	Alexander von Humboldt Research Fellowship
1997 - 1999	Research Fellow, University of Edinburgh

Current Research Interests: Complex Chemical Systems

Lee Cronin is the Regius Professor of Chemistry in the School of Chemistry at the University of Glasgow. The focus of Cronin's work is understanding and controlling self-assembly and self-organisation in Chemistry to develop functional molecular and nano-molecular chemical systems; linking architectural design with function and recently engineering system-level functions (e.g. coupled catalytic self-assembly, emergence of inorganic materials and fabrication of inorganic cells that allow complex cooperative behaviours). Much of this work is converging on exploring the assembly and engineering of emergent chemical systems. One target is the development of 'inorganic biology' i.e. a biological system beyond the naturally occurring 'organic biology' found on planet earth. Not only does this have ramifications for the origin of life on earth, elsewhere in the universe, the realisation of a living system assembled from the bottom up would also lead to a range of new technologies. To achieve his aims, Cronin and his group regularly collaborate with Physical, Theoretical, Organic, Materials, and Biological Chemists as well as Scientists in Chemical and Electrical Engineering, Physics and Medicine. The expertise in the Cronin group is unique bringing together chemists, chemical engineers, reaction modelling, complex system modelling, evolutionary theory, synthetic biology, robotics and AI.

Cronin is also developing several new 'reaction-formats' for chemical reactions as well as applications in catalysis, energy, and coatings. These include flow reactors for evolvable chemistry, 3D-printing 'reactionware' for the democratisation of chemistry e.g. synthesis of drugs important for the developing world (e.g. anti-malaria) as well as counterfeit drug sensors. Within Glasgow Solar Fuels, Cronin and colleagues are investigating a solar fuel cell that effectively produces a liquid fuel suitable for transport use. In 2009 he was elected to Fellowship of the Royal Society of Edinburgh and between 2006 and 2011 he was an EPSRC Advanced Research Fellow. Cronin has published over 290 papers that have amassed >10,000 citations in the world's leading scientific journals and has given over 200 invited talks. He has over 120 national and international collaborators and has active research exchanges with Beijing University of Chemical Technology, Arizona State, Emory, Hokkaido University, Tokyo University, University of Aachen, North East Normal University, and Northwestern. LC has recent / active industrial collaborations with BP (catalyst discovery, acidic materials, understanding present catalysts), Samsung (nano- materials discovery), FujiFilm (new pigments), QinetiQ (Inorganic Energy), Oxford Diffraction (Ultra Large Molecules by Crystallography), Unilever (Inorganic additives for personal care products).

Research Examples/Highlights:

- 2016 Quantifying the origins of life on a planetary scale (PNAS)
- 2016 Sizing of clusters in solution using ion mobility mass spec (JACS)
- 2016 Solution discovery of Pd₇₂ nanoring (ACIE)
- 2015 Programmable peptide synthesis (Nat Comm)
- 2015 Trapping Reactive Phosphorous Atoms in Cluster Cages (ACIE)
- 2015 New method of Hybrid Inorganic-Peptide Synthesis (JACS)
- 2014 Robotically mediated chemical evolution (Nature Comm.)
- 2014 Polyoxometalate-based flash memory devices and new types of memory device (Nature)
- 2014 Decoupled catalytic hydrogen evolution from an electron-coupled-proton-buffer (Science)
- 2013 New types of cluster-based electron transfer reagents (ACIE)
- 2013 Combined 3D printed and robotically organised synthetic system (Chem. Sci.)
- 2012 Self-assembly of the largest macrocycle ever, {W₂₀₀Co₈O₆₆₀}, within a network reactor (ACIE)
- 2012 3D printing of chemical reactions and reactors with the development of 'reactionware' (Nature Chem)
- 2012 Engineering of a chemically powered nanoscale cluster oscillator (JACS)
- 2011 Inorganic Chemical Cells potential towards Inorganic Biology (ACIE)

- 2011 Pioneered the development of Variable Temperature Mass Spectrometry (Nature Chem)
- 2010 Trapping the transient in the assembly of molybdenum blue (Science)
- 2010 Assembly of Zeolitic structures using molecular oxide synthons (Nature Chem)
- 2009 Emergent Tubular Architectures and Networks (Nature Chem)
- 2009 Molecular Metal Oxide Field Effect Transistor (Nature Nano)
- 2008 Confined Electron Transfer Reactions in Molecular Cages (ACIE)
- 2007 Observing molecular self-assembly with mass spectrometry (ACIE)
- 2006 Control of molecular self-assembly by symmetry transfer (JACS)

Strategic Roles within the University of Glasgow:

- 2015- New Glasgow Chemistry Estates Plan
- 2014- Chemistry Strategic Plan
- 2013- Chair of the Research Committee
- 2012 - Director of WestCHEM (Joint Strathclyde Glasgow Research School in Chemistry)
- 2011 - Reorganisation of the Research School for critical mass / interdisciplinary challenges
- 2010 - Chair of the Professorial Search Committee in Chemistry
- 2010 - Co-director of Glasgow Solar Fuels
- 2010 - Development of Glasgow Solar Fuels
- 2009 - Research Director School of Chemistry
- 2009 - Author the 'Chemistry-Plan' for strategic investment of ca. £8 M in Chemistry
- 2008 - College Library and Research Information Committee Member
- 2007 - Member of Departmental Research Strategy Committee

Selected Active Research Grants Grants listed below with FEC value. Total value of research portfolio >£13M.

2016	EPSRC (EP/P00153X/1) Advanced Mass Spectrometry Kit for Controlling Chemical Robots and Exploring Complex Chemical Systems	£989,800
2015	ERC (670467) SMART-POM: Artificial-Intelligence Driven Discovery and Synthesis of Polyoxometalate Clusters	£2,439,992
2014	BBSRC (BB/M011267/1) Plug'n Play Photosynthetic for Rubisco Independent Fuels	£444,430
2014	EPSRC (EP/L023652/1) Programme Grant: Programmable 'Digital' Synthesis for Discovery and Scale-up of Molecules, Clusters and Nanomaterials	£3,993,970
2014	EC FP7 EVOBLISS	£672,548
2013	EC FP7 EVOPROG	£925,671
2013	EPSRC (EP/K023004/1) Hydrogen Production using a Proton Electron Buffer	£475,175
2013	EPSRC (EP/K038885/1) Synthetic Biology applications to Water Supply and Remediation	£930,778
2013	EC FP7 (318671) MICREAGENTS	£535,369
2012	EPSRC (EP/J015156/1) Platform Grant: Programmable Molecular Metal Oxides (PMMOs) - From Fundamentals to Application	£1,792,462

Current Active Collaborators

Alexei Lapkin (Cambridge), Alfonso Jaramillo (Warwick), Dave Deamer (UCSC), Bruno Pignataro (Palermo), Caleb Scharf (Columbia), Carles Bo (ICIQ), Emmanuel Cadot (Versailles), Eric McInnes (Manchester), Fraser Stoddart (Northwestern), George Church (Harvard), Gonen Ashkenasy (Ben Gurion), Jonathan Reid (Bristol), Yufei Song (BUCT), Martin Hancz (Trento), Perdita Barran (Manchester), Quan-Feng Dong (Xiamen), Piet Hut (IAS), Ronny Neumann (Weizmann), Sijbren Otto (Groningen), Tianbo Liu (Akron), Tomoki Ogoshi (Kanazawa), Tomoyuki Akutagawa (Tohoku), Victor de Lorenzo (Madrid), John McCaskill (Bochum), Yifeng Wang (Shandong), Sara Walker (Arizona), Anna Proust (UMPC), Richard Winpenny (Manchester), Ryo Tsunashima (Yamaguchi), Hiroki Oshio (Tsukuba), Joseph Poblet (Tarragona), Miles Padgett (Glasgow), Richard Cogdell (Glasgow), Douglas Paul

(Glasgow), David Cumming (Glasgow), Mike Barrett (Glasgow), Bill Sloan (Glasgow), Justin Hargreaves (Glasgow) Vihar Georgiev (Glasgow), Jon Cooper (Glasgow), Nikolaj Gadegaard (Glasgow), Steve Neale (Glasgow).

Current Research Group at University of Glasgow:

4 Senior Researchers, 25 Post-Doctoral Researchers, 21 PhD Students, 3 Technicians, 4 Project Students, 1 Graduate Interns, 2 Administration Staff.

Personnel Output From Research Group:

21 Postdoctoral fellows all in full time employment; 25 are Associate / Assistant Professors / Team leaders
50 Doctorates (all within 4 years), 1 Masters by research

Current and Previous Group Members:

(a) **Senior researchers:**

Current (year joined): Dr. De-Liang Long (2002), Dr. Geoff Cooper (2002), Dr. Haralampos Miras (2006), Dr. Laia Vilà Nadal (2011).

(b) **Postdoctoral associates:**

Current (year joined): Dr. Ross Winter (2009); Dr. Phil Kitson (2009); Dr. Jennifer S Mathieson (2011); Dr. Andrew Surman (2012); Dr. Weimin Xuan (2012); Dr. Soichiro Tsuda (2012); Dr. Alon Henson (2014); Dr. Guillaume Marie (2015); Dr. Jia Jia Chen (2015); Dr. Piotr Gromski (2015); Dr. Rebecca MacLeod (2015); Dr. Vincenza Dragone (2015); Dr. Jonathan Grizou (2015); Dr. Jaroslaw Granda (2015); Dr. Jan Szymanski (2016); Dr. Sergey Zaleskiy (2016); Dr. Edward Brightman (2016); Dr. Yousef Abul-Haija (2016); Dr. Ralph Sigerson (2016); Dr. Nancy Watfa (2016); Dr. Qi Zheng (2016); Dr. James Taylor (2016); Dr. Juan Manuel Parrilla Gutierrez (2016); Dr Jean-Patrick Francoia (2017); Dr Abhishek Sharma (2017).

Past: Dr. Leanne Bloor (Masters Degree at University of Strathclyde, Group Member 2012-2016); Dr Gerardo Camarasa (University of Glasgow, Lectureship, Group Member 2015-2016), Dr Salah Sharabi (University of Strathclyde, Group Member 2013-2016), Dr. Mohamed Hezwani (University of Glasgow, Group Member 2013-2016), Dr. Andrew MacDonnell (EPSRC, Group Member 2015-2015); Dr. Stefan Glatzel (Joined CroninGroup PLC, Group Member 2013-2016), Dr. Anna Andreou (Joined CroninGroup PLC, Group Member 2014-2016); Dr. Christoph Busche (Own Fellowship at the University of Glasgow, Group Member 2010-2015), Dr. Ommid Anamimoghadam (Northwestern University, Group Member (2013-2015), Dr. Michael Lee (Moved to the USA, 2014-2015), Dr. Greig Chisholm (Peak Scientific, 2012-2015), Dr. Jamie Cameron (University of Tsukuba, Group Member 2010-2015); Dr. Marie Hutin (Emmerson, Group Member 2010-2015), Dr. Vladislav Kulikov (A.T. Kearney, Germany, Group Member 2013-2015), Dr. Trevor Hinkley (Goldman Sachs, Group Member 2012-2014), Dr. Victor Sans Sangorin (University of Nottingham, Group Member 2011-2014), Dr. Roy McBurney (University of Strathclyde, Group Member 2012-2014), Dr. Mali Husby Rosnes (University of Bergen, Group Member 2007-2013), Dr. Mark Symes (University of Glasgow, Group Member 2010-2013), Dr. Yohei Takashima (Kyoto University, Group Member 2010-2013), Dr. Jingli Xie (Group Member 2011-2013), Dr. Johannes Thiel (Group Member 2011-2012), Dr. Yasutaka Suzuki (Yamaguchi University, Japan, Group Member 2011-2012), Dr. Ross Forgan (University of Glasgow, Group Member 2011-2012), Dr. Jun Yan (Centralsouth University, China, Group Member 2010-2012), Dr. Scott Mitchell (University of Zaragoza, Spain, Group Member 2010-2011), Dr. Liz Wilson (Erlangen University, Germany, Group Member 2009-2010), Dr. Craig Richmond (ICIQ, Spain, Group Member 2008-2011), Dr. Chris Ritchie (University of Melbourne, Australia, Group Member 2008-2009), Dr. Sumit Khanra (IISER Kolkata, India, Group Member 2008-2009), Dr. Carsten Streb (Erlangen University, Germany, Group Member 2008-2009), Dr. Pradeep C. Parameswaran (IIT Mandi, India, Group Member 2006-2010), Dr. Yufei Song (BUCT China, Group Member 2005-2008), Dr. Eric Burkholder (Panalytical, USA, Group Member 2005-2006), Dr. Alexis Parenty (Pfizer UK, Group

Member 2004-2008), Dr. Jesús M de la Fuente (Aragon Nanoscience Institute, Group Member 2004-2006)

(c) **Graduate students:**

PhD Candidates. Current (year joined): Robert Pow (2017); Alastair Murray (2016); Daniel Salley (2016); Stephanie Colon (2016); Naomi Johnson (2015); Dario Caramelli (2015); Edward Lee (50% University of Edinburgh, 2015); Stuart Marshall (Part Time, 2015); Sebastian Steiner (2015); Vasilios Duros (2014); Niall Kirkaldy (2014); Laurie Points (2014); David Doran (2014); Irene Suarez Marina (2013); Mari Yoshida (2013), Lewis MacDonald (2013), Sergio Martin Marti (2013), Lorna Christie (2013), Jamie Purcell (2013), Merce Martin (2012), Zied Hosni (2012)

Graduate Interns: Graham Keenan.

Past: James Taylor (2012-2016), Juan Manuel Parrilla Gutierrez (2012-2016), Luzian Porwol (2010-2016), Marc Rodriguez (2012-2016), Qi Zheng (2012-1016), Charikleia Sartzi (2011-2016), Phil Robbins (2011-2016), Hannah Stepto (2011-2015), Caihong Zhan (2011-2015), Vincenza Dragone (2011-2015), Andrew Macdonell (2010-2015), Carine Yvon (2010-2014), Rachel Scullion (2010-2014), Jamie Cameron (2010-2014), Hongying Zang (2010-2014), Andreu Ruiz (2010-2014), Ross Winter (2010-2014), Benjamin Rausch (2011-2014), Antoine Boulay (2009-2013), Pedro Molina Sanchez (2009-2013), Thomas Boyd (2009-2013), Jing Gao (2009-2012), Mali Husby Rosnes (2008-2011), David Gabb (2008-2011), Neus Corella Ochoa (2008-2011), Claire Lydon (2008-2011), Roslyn Eadie (2008-2011), Feng Xu (2008-2011), Jennifer S Mathieson (2007-2011), Johannes Thiel (2007-2011), Jun Yan (2007-2010), Thomas McGlone (2007-2010), Chris Flemming (2006-2009), Jacky Johnston (2006-2011), Scott Mitchell (2006-2010), Liz Wilson (2006-2009), Damiano Portinari (2005-2010), Phil Kitson (2005-2009), Craig Richmond (2005-2009), Nicola McMillan (2005-2009), Graham Newton (2005-2008), Carsten Streb (2005-2008), Chris Ritchie (2004-2008), Kevin Guthrie (2003-2008), Louise Smith (2003-2006), Hamera Abbas (2003-2006), Geoff Cooper (2002-2005), Alex Pickering (2001-2004), John Fielden (2001-2004), Alexis Parenty (2001-2004), Georg Seeber (2000-2003).

(d) **CroninGroup PLC:**

Dr Stefan Glatzel (2016); Dr Anna Andreou (2016); Paul Duddy (2016); Francis Jamieson (2016); Steve Coles (2016); Jillian Martin (2016).

Membership of External Committees & Advisory Boards (2008-):

2016- Royal Society Innovation Award Committee Member

2016- DFF Review Panel, Copenhagen, Denmark

2015- Science Advisory Board of the Center for Sustainable Materials Chemistry (CSMC), Oregon, USA.

2015- City University of New York Nanotechnology Institute, NY, USA.

2014- Beijing University of Chemical Technology International Soft Matter Centre

2013- Editor, Inorganic Chemistry Frontiers (joint RSC – Peking University new journal)

2013-5 Director of WestCHEM

2012- External reviewer for the Fundamental Centre for Living Technology (FLinT) at the University of Southern Denmark

2012- Management Group member of COST Action CM1203 PoCheMoN

2011- Member of the Advisory Committee to North East Normal University – Metal Oxide Science

2011-2 Nano Advisor “Working safely with Nanomaterials” on the definition of “Nanomaterials”

2011-4 Mentor – EPSRC ‘Inspire’ Workshop for Young Researchers

2011-2 Advisor to the European Project EVOBODY: ‘Embodied Artificial Evolution’

2011 Member of the Non-Conventional Computation Conference Special Topics Committee

2010-3 Deputy Director of WestCHEM, the Glasgow & Strathclyde Universities joint Chemistry Research School

2010- Editorial Advisory Board of CrystEngComm

2010-5 Member of the ScotCHEM Board
2010-3 Member of the Royal Society of Edinburgh Earth Sciences and Chemistry Selection Committee
2010 Conference Chair 'Solar Fuels'
2010 Conference Chair, Emerging Chirality
2009- Editorial Advisory Board for Chemical Communications
2009- Advisory Board for International Conference on Polyoxometalates
2008 Management Board of Innovative Catalysis
2008-11 Chair of Emergent the EPSRC 'emergeNet' network on complexity and emergence

Selected Invited Presentations from 2008 from a full list of over 325; selected international invites listed here

2016 Keynote Speaker, ICC42, Brest, July
Plenary Speaker, FMOCS, Newcastle, July
UK-Japan Solar Fuels Symposium, Tokyo, June
GRC Biointerfaces, Les Doublets, June
Keynote Speaker, World Biomaterials Congress, Montreal, May
Tilden Prize Lecture, Bristol University March
Oxford Chemistry, Chemical Biology Department, February

2015 Plenary Speaker, Modelling Origins of Life, Carnegie Institute, Washington, Nov
Keynote Speaker, Advanced Functional Materials, Stony Brook, June
Invited Lecture, AbSciCon, Chicago, June
Swiss Nanoscience Institute Invited Lecture, Basel, May
1st Pearlman Lecture, Weizmann Institute of Science, April
Plenary speaker, Annual Chemical Society Meeting, University College Dublin, April
Solvay Colloquium, University of Brussels, February
Earth Life Systems Institute (plenary speaker), Tokyo, January

2014 Plenary speaker, Faraday Discussion (closing speaker), Xiamen, October
Invited speaker, UK-Japan meeting on coordination chemistry, Tokyo, Sept
Distinguished visitor and creativity lecturer, Hong Baptist University, August
Keynote lecture, ALIFE, New York, July.
Invited speaker, Beilstein Symposium, Near Munich, Germany, May
Plenary lecturer, CSIRO annual meeting, Melbourne, Australia, May
Invited speaker, McBain Meeting, Cambridge, January
Keynote speaker, ISCP, Tokyo, January

2013 Keynote speaker, ACIN, July, Namur, Belgium
Invited speaker, ECAL, September, Sicily
Plenary speaker, International conference on photosynthesis, St Louis, July,
Keynote speaker, Sloan-Kettering Memorial Centre Expo, May, New York, USA.
Invited speaker, MRS special symposium on bio-inspired materials, San Francisco, May.

2012 Keynote speaker, ICC, Valencia, Spain, September
Invited speaker, GRC on Crystal Engineering, New Hampshire, USA, June
Symposium Speaker, Inorganic Chemistry, ETH-Zurich, Switzerland, May
81st Henry Lecture, Philosophical Society of Washington, USA, May
Invited speaker, Beilstein Symposium, Near Munich, Germany, May
Invited Speaker, Inorganic Chemistry, The University of Zurich, April
Invited Speaker, NASA Conference on Alternative Biology

2011 Center for Functional Nanostructures, Bad Herrenalb, Germany, September
Polyoxometalate conference, NENU, Changchun, China, August
8th National Meeting of Inorganic Chemistry, Harbin, China, August
Molecular Nanoscience Meeting, Patras, Greece, June
Solar Fuels Conference, Denmark, April

- Departmental Seminar, University of Barcelona, Barcelona, Spain, March
 Lecture on Inorganic Biology, Tokyo University, Tokyo, March
 Technical University, Berlin, Jan
- 2010 11th Conference on Solid State Chemistry joint with the 2nd Dalton Transactions International Symposium, Shanghai and Hong Kong, November
 3^{ème} cycle de Chimie, Switzerland (Geneva, Bern, Basel, Neuchâtel), October
 3rd Euchems, Nurenberg, Germany, August
 Frontiers in Metal Oxide Science, Jerusalem, Israel, July
 Non-conventional computing, Tokyo, June
 Invited lecture at the University of Tokyo, March
 Department of Chemistry Invited Lecture, Universität Kaiserslautern, January
- 2009 ESF Conference on Systems Chemistry, October
 2nd IRUN Symposium on Nanotechnology, October
 International Polyoxometalate Meeting, Bremen, Germany
 Department of Chemistry, Northwestern University, Evanston, Chicago, USA
 International Conference of Bio-inorganic Chemistry 14, Nagoya, Japan
 Université Pierre et Marie Curie, Paris, France
 International Symposium on Macrocyclic & Supramolecular Chemistry, Maastricht
- 2008 Morino Foundation Lectures, Kyoto, Tokyo and Hokkaido Universities, Japan
 EPFL, Lausanne, Switzerland
 Werner Chemical Society, Trinity College Dublin, Ireland
 University of Amsterdam, Amsterdam, The Netherlands
 Hong Kong University of Science and Technology, Hong Kong, China
 Indian Chemical Society Meeting, Bangalore, India

Science Advocacy and Media Engagement:

Within Science and Society, at a political and international level, Cronin is an advocate for Science and Engineering and is deeply committed to inspiring the public, especially young people. To achieve this he has helped develop kinetic-art exhibits that aim to explore self-assembly in the nano-world (EPSRC giants of the infinitesimal), developed a range of chemistry experiments for the Birmingham Science Museum 'thinktank', has appeared in a BBC documentary on Photosynthesis (series title; botany a blooming history), gave the Royal Society of Chemistry Edinburgh Christmas Lectures, and regularly gives public lectures and school events every year both in the UK and at Science super-schools in Japan. He also tries to explain new ideas and concepts to the public even when there are still new as with the development of 'living' inorganic systems (Inorganic Biology) which was the subject of a TED talk given at TEDGlobal 2011 in Edinburgh; this is now on the web (see: http://www.ted.com/talks/lee_cronin_making_matter_come_alive.html) and has been viewed over 370,000 times on the web in just 5 months. His work has captured the imagination of many people with over 50 articles in the press, on the web, blogs, at TEDGlobal, in Newscientist etc. Cronin has been interviewed using a variety of media including TV, web shows (<http://twit.tv/show/dr-kikis-science-hour/115>), the Observer (<http://www.guardian.co.uk/technology/2011/aug/28/aliens-iron-evolution-lee-cronin>), and several radio programs. In press Cronin has written several general for the non-specialist including essays and also published an article in the prestigious architecture Journal, Architecture and Design (AD). Finally it is worth pointing out that Cronin has been active in discussing issues regarding energy, sustainability and climate change as part of the Glasgow funded initiative, Glasgow Solar Fuels (<http://www.glasgowsolarfuels.com>), where he is actively engage not only in fundamental research with the grand aim of generating fuels from carbon dioxide, but also engaging the public discussing issues relating to lifestyle change, land use, and energy security. For example on the 6th of February BBC Scotland came to Glasgow to film Cronin's latest water splitting breakthrough which produces an intermediate 'reduced' fuel rather than hydrogen. This media coverage was covered on Newsnight Scotland in February 2012 with a discussion live on air; it is also cover on the BBC webpages (<http://www.bbc.co.uk/news/uk-scotland-glasgow-west-16939564>). Cronin was also involved in a discussion

about Solar-Fuels on Radio 4 on the BBC's Material World on the 22nd February (available on iplayer: http://www.bbc.co.uk/iplayer/episode/b01c7sn9/Material_World_23_02_2012/).

20 'Selected' References – Cronin

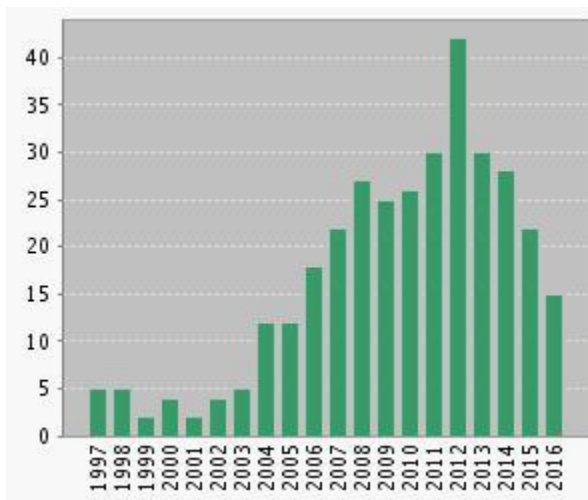
1. *Restraining symmetry in the formation of small polyoxomolybdates: Building blocks of unprecedented topology resulting from "shrink-wrapping" [H₂Mo₁₆O₅₂]¹⁰⁻-type clusters* D.-L. Long, P. Kögerler, L. J. Farrugia, L. Cronin *Angew. Chem. Int. Ed.* **42**, 4180–4183 (2003).
2. *Unveiling the transient template in the self-assembly of a molecular oxide nanowheel* H. N. Miras, G. J. T. Cooper, D.-L. Long, H. Bögge, A. Müller, C. Streb, L. Cronin *Science* **327**, 72–74 (2010).
3. *Decoupling hydrogen and oxygen evolution during electrolytic water splitting using an electron-coupled-proton buffer* M. D. Symes, L. Cronin *Nature Chem.* **5**, 403–409 (2013).
4. *A bio-inspired, small molecule electron-coupled-proton buffer for decoupling the half-reactions of electrolytic water splitting* B. Rausch, M. D. Symes, L. Cronin *J. Am. Chem. Soc.* **135**, 13656–13659 (2013).
5. *Decoupled catalytic hydrogen evolution from a molecular metal oxide redox mediator in water splitting* B. Rausch, M. D. Symes, G. Chisholm, L. Cronin *Science* **345**, 1326–1330 (2014).
6. *Design and fabrication of memory devices based on nanoscale polyoxometalate clusters* C. Busche, L. Vila-Nadal, J. Yan, H. N. Miras, D.-L. Long, V. P. Georgiev, A. Asenov, R. H. Pedersen, N. Gadegaard, M. M. Mirza, D. J. Paul, J. M. Poblet, L. Cronin *Nature* **515**, 545–549 (2014).
7. *Integrated 3D-printed reactionware for chemical synthesis and analysis* M. D. Symes, P. J. Kitson, J. Yan, C. J. Richmond, G. J. T. Cooper, R. W. Bowman, T. Vilbrandt, L. Cronin *Nature Chem.* **4**, 349–354 (2012).
8. *Combining 3D printing and liquid handling to produce user-friendly reactionware for chemical synthesis and purification* P. J. Kitson, M. D. Symes, V. Dragone, L. Cronin *Chem. Sci.* **4**, 3099–3103 (2013).
9. *3D Printed High-Throughput Hydrothermal Reactionware for Discovery, Optimization, and Scale-Up* P. J. Kitson, R. J. Marshall, D. Long, R. S. Forgan, L. Cronin *Angew. Chem. Int. Ed.* **53**, 12723–12728 (2014).
10. *Assembly of a Gigantic Polyoxometalate Cluster {W₂₀₀Co₈O₆₆₀} in a Networked Reactor System* A. R. de la Oliva, V. Sans, H. N. Miras, J. Yan, H. Zang, C. J. Richmond, D.-L. Long, L. Cronin *Angew. Chem. Int. Ed.* **51**, 12759–12762 (2012).
11. *A flow-system array for the discovery and scale up of inorganic clusters* C. J. Richmond, H. N. Miras, A. R. de la Oliva, H. Y. Zang, V. Sans, L. Paramonov, C. Makatsoris, R. Inglis, E. K. Brechin, D.-L. Long, L. Cronin *Nature Chem.* **4**, 1038–1044 (2012).
12. *Discovery of gigantic molecular nanostructures using a flow reaction array as a search engine* H.-Y. Zang, A. R. de la Oliva, H. N. Miras, D.-L. Long, R. T. McBurney, L. Cronin *Nat. Commun.* **5**, 3715 (2014).
13. *Evolution of oil droplets in a chemorobotic platform* J. M. P. Gutierrez, T. Hinkley, J. W. Taylor, K. Yanev, L. Cronin *Nat. Commun.* **5**, 5571 (2014).
14. *Confined electron-transfer reactions within a molecular metal oxide "Trojan horse"* D.-L. Long, H. Abbas, P. Kögerler, L. Cronin *Angew. Chem. Int. Ed.* **44**, 3415–3419 (2005).
15. *Reversible electron-transfer reactions within a nanoscale metal oxide cage mediated by metallic substrates* C. Fleming, D.-L. Long, N. Mcmillan, J. Johnston, N. Bovet, V. Dhanak, N. Gadegaard, P. Kögerler, L. Cronin, M. Kadodwala *Nature Nanotech.* **3**, 229–233 (2008).
16. *Probing the self-assembly of inorganic cluster architectures in solution with cryospray mass spectrometry: Growth of polyoxomolybdate clusters and polymers mediated by silver(I) ions* E. F. Wilson, H. Abbas, B. J. Duncombe, C. Streb, D.-L. Long, L. Cronin *J. Am. Chem. Soc.* **130**, 13876–13884 (2008).
17. *Observation of Fe(v)=O using variable temperature mass spectrometry and its enzyme-like C-H and C=C oxidation reactions* I. Prat, J. S. Mathieson, M. Güell, X. Ribas, J. M. Luis, L. Cronin, M. Costas *Nature Chem.* **3**, 788–793 (2011).
18. *Spontaneous assembly and real-time growth of micrometre-scale tubular structures from polyoxometalate-based inorganic solids* C. Ritchie, G. J. T. Cooper, Y.-F. Song, C. Streb, H. B. Yin, A. D. C. Parenty, D. A. MacLaren, L. Cronin *Nature Chem.* **1**, 47–52 (2009).

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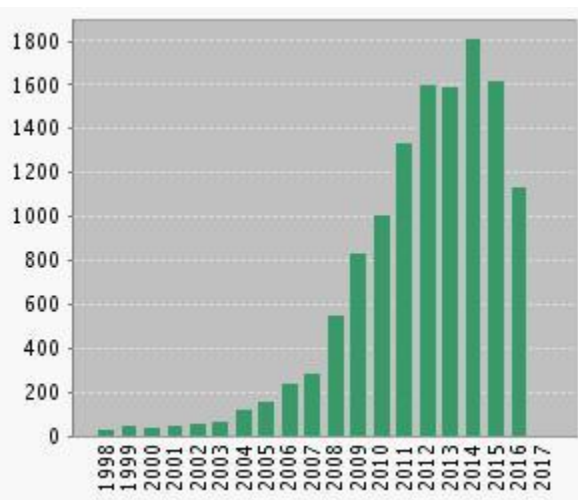
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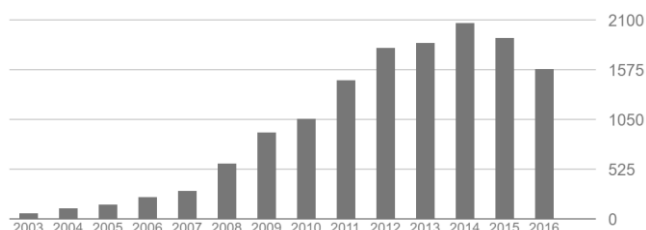
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Grants and contracts (listed as 100% FEC):

Current Grants: Selected from a list of grants worth more than ca. £ 13.0 M with Cronin as PI (only the Funding in the Cronin Lab is Shown)

Project Title	Start Date	End Date	Funder Code	Amount
SMART-POM	31/10/2015	30/10/2020	670467	€2,464,532

Programmable 'Digital' Synthesis for Discovery and Scale-up of Molecules, Clusters and Nanomaterials	31/10/2014	30/10/2019	EP/L023652/1	£3,666,598
Synthetic Biology applications to Water Supply and Remediation	01/10/2013	30/09/2018	EP/K038885/1	£5,191,661
EVOBLISS	01/02/2014	31/01/2018	611640	€609,000
Programmable Molecular Metal Oxides (PMMOs) - From Fundamentals to Application	31/12/2012	30/12/2017	EP/J015156/1	£1,732,456
Plug'n Play Photosynthetic for Rubisco Independent Fuels	30/11/2014	29/11/2017	BB/M011267/1	£444,430
The Multi-Corder: Poly-Sensor Technology	13/05/2013	31/10/2017	EP/K021966/1	£3,009,066
Cronin 3D Spin-out	01/10/2012	31/03/2017	EPSRC (Cronin, Prof Leroy) IAA	£676,000
EVOPROG	01/10/2013	30/09/2016	610730	€815,000
Energy and the Physical Sciences: Hydrogen Production using a Proton Electron Buffer	30/09/2013	29/09/2016	EP/K023004/1	£475,175
PROMISE: Programmable RedOx Materials for Inorganic Sustainable Energy	07/10/2013	06/10/2015	SC-ENTER (Cronin, Prof Leroy)	£751,959
Innovative Manufacturing Research Centre for Continuous Manufacturing and Crystallisation (CMAC)	01/10/2011	30/09/2015	EP/I033459/	£425,255
Microscale Chemically Reactive Electronic Agents	01/09/2012	31/08/2015	318671	£535,369
A Digital DNA Nano Writer (DNA NanoFab)	28/02/2014	27/08/2015	EP/L015668/1	£242,576
International Collaboration in Chemistry - Modular microtubular architectures for photo-driven water splitting	01/05/2012	30/04/2015	EP/J00135X/1	£399,025
RSE BP Hutton Prize	01/03/2014	28/02/2015	ROY_SOC_ED (Cronin, Prof Leroy)	£10,000

Total current grant funding in PI-lab (not all listed):

£13,240,596.00

Selected Previous Grants with Cronin as PI (only the Funding in the Cronin Lab is Shown):

IAA-EPSRC: Low Power FLASH Memory, 2014	£42,002
Evolutionary / optimisation of formulation processes using flow systems, 2013-2014	£100,000
Bio-inspired Oxygen Evolving Light Driven Catalysts, EUROCORE, EuroSolarFuels, 2011-2014	£287,421
Plug'n Play Photosynthesis for RuBisCO independent fuels. BBSRC-NSF, 2011-2014	£391,790
Molecular-Metal-Oxide-Nanoelectronics – Achieving the Molecular Limit, L. Cronin (PI) EPSRC, (EP/H024107), 2010-2014	£4,458,843
Crystallization under flow. Spirit Horizon, 4 other partners, 2009-2014	£458,021
"The CHELL": Approach to Minimal Life, 4 partners, EPSRC, (EP/G026130) 2009-2013	£466,562

Artificial Photosynthesis: Solar Fuels, EPSRC, EP/F047851, 3 partners, 2009-2013	£563,068
Inorganic Energy, Royal Society-Wolfson Laboratory Refurbishment, 2011-2013	£200,000
POMHydcat Hydrogenase Catalysts; EU-MC IOF, 2011-2013	£186,264
NewQDS - New Frontiers in Quantum Dots; EU-MC, 2010-2013	£195,558
Bridging the Gap in Self Assembly of POMs, EPSRC, EP/F030509, 2008-2011	£369,648
Nanoscale Metal Oxides for Responsive Systems, EPSRC, EP/F022921, 3 partners 2008-2011	£357,663
Unilever Research PLC, 2008-2011	£30,000
Directed Reconfigurable Nanomachines, EPSRC, EP/F009410, 2008-2011	£205,294
Spirit Studentship with FujiFilm, 2009-2011	£45,000
Self-Assembly of Nanoscale Polyoxometalates, EPSRC Fellowship, EP/C542819, 2006-2011	£261,614
Understanding acidic polyoxometalate solids, BP, 2006-2009	£65,000
Philip Leverhulme Prize, 2007-2011	£70,000
SMT Therapeutics towards a pre-clinical package, Scottish Enterprise POC, 2005-2007	£200,000
Breaking the Mould: Fundamental new in-situ Switchable Polyoxometalate Cluster-based Acylation Catalysts, GR/S87072/01, 2005-2008	£268,880
Molecular Metal Oxides for Process Intensification, EPSRC, EP/D000513/1, 2005-2007	£62,489
Consortium of Excellence in Advanced Sensors and Their Applications, EPSRC, EP/F012519/1, 2007-2009	£22,832
Chemical Craftwork: Realising the Concept of the Artificial chemical cell with Vesicles EP/D021847/1, 2005-2009	£93,403
Evolvable CHELLware, EPSRC, EP/D023327/1, 2005-2009	£77,658
Molecular Hostages as Novel Switching Systems, Leverhulme Trust, 2002-2005	£98,000
Trapping Fundamentally New Types of Polyoxometalate Cluster Using A Shrink-Wrapping Approach, EPSRC, GR/T17205/01, 2005-2008	£196,567
Understanding and Controlling the Self Assembly of Nanoscale Polyoxometalate Clusters EPSRC, EP/C542827/1, 2006-2009	£231,768
Systematic Design of Complexes For Recognition & Binding To Dna as Probes & Therapeutic Agents, EPSRC, GR/R14323/01, 2001-2004	£62,549