SHORT HISTORIES OF SOME OF THE MOST SUCCESSFUL STEM BASED COMPANIES TO HAVE BEEN STARTED IN THE UK OVER THE LAST 40 YEARS

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Company	Origins and Financing	Current Status
Dyson Consumer durables and other products	It took 14 years for James Dyson to bring his first Dyson Dual Cyclone vacuum cleaner to market. Funding was scarce and very few believed in his idea of applying cyclone technology to a vacuum cleaner, removing the need for a bag. Development, which began in 1978, was initially undertaken on a part time basis. The first stages of the project were funded by his invention of the Ballbarrow. Later, financial backing came from his late mentor, Jeremy Fry, who owned an engineering company, Rotork, which he had worked for. It was Rotork which first licensed Dyson's bagless vacuum cleaner invention, paying him an up-front fee to get it into production. Only 500 units of the resulting *Cyclon* were sold, but it paved the way for further licensing deals with larger companies in the US and Japan before Dyson started producing his own, branded product. Besides revenues from these deals, he was also supported by a bank loan. The first Dyson Dual cyclone vacuum cleaner was sold in 1993. Dyson never raised venture capital and the company remains privately owned and very independent. In 2015, Dyson saw its turnover reach £1.7bn, up 26% from 2014. Profits grew 19%. Each week Dyson invest £7m in research and development, employing 9,000 people in 75 markets.	Private company Employees in 2015 7,000 worldwide Revenues £1.7 billion Profits before tax £448m (25%) R&D £206m (12%)

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Arm Holdings Semi-conductor design licensing	The development of Arm's semi-conductor technology was funded first by its parent Acorn Computers as a first lead customer and later by Apple as a second lead customer for its Newton project. Acorn computer's first funding came from an associated company's consulting revenues, but its success was built on a contract from the BBC in 1981 to supply home computers for a new computer literacy TV series. Customers bought by mail order and their up-front payments and a bank loan provided finance. Acorn did not need to raise venture capital. Employee numbers peaked at 500. Arm started in 1983 as an internal project within Acorn computers to develop a reduced instruction set chip for use in future computer models. The design looked to pioneering work in the US, particularly at the University of Berkeley. However, in the early 1980s, there were significant uncertainties surrounded the RISC concept, and it was uncertain if it would have a commercial future. It was spun off as a separate company in 1990 with equity funding from Apple, its second customer, and LSI Logic, and listed on the London Stock Exchange and NASDAQ in 1998. It never raised venture capital.	Sold to Softbank Group Corporation in 2016 Employees at time of acquisition: – 4227 globally – 1695 in UK Previous year's revenues £968m Exports £939m (98%) Profit before tax £415m (43%) R&D expenditure £278m (29%)
Renishaw plc Measurement, motion control, healthcare,	While an engineer at Rolls Royce, David McMurty invented a new kind of probe to solve a quality control challenge in the manufacture of the Concorde Olympus engine. With a colleague John Deer, he set up Renishaw on a part time basis to manufacture and sell the resulting product to other companies. By 1979 they were both working full time for the company. Renishaw was admitted to the London Unlisted Securities Market in 1983 and the LSE the	Listed on London Stock Exchange Founders own 53% of the company.

[1] Against the Odds, James Dyson 1997 and company information

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spectroscopy and manufacturing technology.	following year. Renishaw never raised venture capital. Today it is active in a wide range of advanced technology products.	Employees in 2016: 2486 worldwide Revenues £437m Profit before tax: £80m (18%) Exports: £413m (95%) R&D; £72m (17%)
Oxford Instruments Nanotechnology tools, industrial products and services	As a Senior Research Officer at the Clarendon Laboratory at Oxford University, Martin Woods was responsible for developing and servicing high field magnets for the lab's research in low temperature physics. In 1959 he set up a part-time business with his wife Audrey to design and later supply similar magnets to the dozen or so other potential customers in universities around the world. Oxford Instruments' breakthrough came with major advances in superconducting materials announced in 1961, opening up a new, fast growing research market which in turn paved the way for NMR and MRI. In 1971 it developed the magnet for a powerful new NMR spectrometer for Oxford University's Enzyme Group, funded by the Science Research Council. And in 1978 it received a contract from EMI to provide the magnet for a whole body MRI scanned funded by the Department of Health and Social Security. Apart from a modest personal investment, Oxford Instruments early development was funded by customer contracts. By the time it employed 80 people though it needed additional capital and sold 20% of the business to ICFC (later 3i), allowing the founders to retain entrepreneurial control[2]. Oxford Instruments was listed on the LSE in 1983.	Listed on London Stock Exchange Employees in 2016 :2077 worldwide Revenues £361.6 Profit before tax £37.0m (10%) Exports: £329m (91%) R&D £29m (8%)

[2] Magnetic Venture, The Story of Oxford Instruments, Audrey Wood, OUP, 2001

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Domino Printing Sciences Coding and printing equipment for food, beverages and other products	A Cambridge Consultants project to develop envelope franking technology for the Post Office led on to a very large contract from ICI to develop ink jet printing for textiles. This proved too difficult technically and ICI sold the IP back to CCL. The EU date labelling directive provided the opportunity for a much simpler application and Domino Printing Sciences was set up using the ICI funded technology by Graeme Minto, one of CCL' s printing technology engineers, in 1978. Several other successful digital printing technology companies have been spun out of CCL, including Xaar, Inca Digital, Elmjet and Linx	Acquired by Brother Industries Ltd in 2015 Employees in 2014: 2345 worldwide Revenues £350m Profit before tax £57m (16%) Exports £326m (93%) R&D £18m (5%)
Cambridge Silicon Radio	Fabless semiconductor company, Cambridge Silicon Radio span out from Cambridge Consultants in 1999 to develop a Bluetooth chips for the newly released Bluetooth 1.0 standard. CCL had had a long history of designing special purpose semiconductors. Much of CCL's early work was for the MOD and in the early 1970s 70% of revenues came for MOD and other UK government departments. During the 90s the semiconductor team had done pioneering work in wireless CMOS technology, developing chips for Ericcson and other customers. This, and the experienced team of CCL engineers who started the company, enabled CSR to develop a single chip solution and beat a large number of other start-ups to become the world's dominant Bluetooth supplier. $10 million of start-up venture capital was raised to fund the business in this competitive and fast growing market. It raised further rounds of funding before listing on the LSE in 2004. In 2012, part of the business was sold to Samsung, taking with it 310 employees. In 2015, the remainder of the business was acquired by Qualcomm	Now owned by Qualcomm. Employees in 2014: 2108 Revenues $775m Profit before tax $97m (13%) Exports $746m (96%) R&D $241m (31%)

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Autonomy	Mike Lynch set up Cambridge Neurodynamics at the age of 26 with Richard Gaunt to take advantage of his research on signal processing and adaptive pattern recognition. He was unable to raise venture capital. The Neurodynamics business model was to find "people who needed things, say we could do it, work very hard for a few weeks to make what they needed and deliver it". With the exception of a £2000 loan, repaid in six months, the company was entirely self-financing from operating cash flow[3]. An early piece of work was a finger print matching system for the police force. An identity photo product for the police and text processing for the intelligence community followed. By 1996, Neurodynamics was selling a variety of software products and the business was split into four separate entities with the help of funding from Apax. Autonomy was listed on EASDAQ in 1998 and listings on the LSE and NASDAQ followed raising $124m. It was acquired by Hewlett Packard in 2011	Owned by Hewlett Packard Employees in 2010: 2700 worldwide Revenues $870m Profit Before Tax $377m (43%) Exports $773m est.(89%) R&D $135m (16%)
Cambridge Antibody Technology Phage display based drug discovery and development	CAT is the UK's most successful biotechnology company. It was founded in 1990 by David Chiswell with redundancy money from Amersham International, together with Greg Winter from the MRC Cambridge Laboratory of Molecular Biology. An additional £750k of equity funding came from a small Australian company with which Winter had contacts, but Chiswell tried unsuccessfully for 6 months to raise venture capital. Development work was initially undertaken in borrowed space at the LMB and by the end of the year the team had both an article in Nature and a patent on phage display as a new way of making antibodies, the breakthrough platform technology on which the company's success was based.	Part of Astra Zeneca's Medimmune business employing over 600 people in its Cambridge R&D facility.

[3] Exploding the Myths of UK Innovation Policy, David Connell and Jocelyn Probert, Centre for Business Research, University of Cambridge, 2010

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	The next three years were funded mainly from development, first with Pharmacia to develop and assemble kits for the research market , and later for BASF on drug discovery. Deals with Genentech, Pfizer, Lilly and other pharma companies followed, each bringing a mixture of up-front payments and and consulting fees, milestone payments and royalties. A £3m equity investment from a US investment bank in 1993 together with cash from the pharma deals enabled CAT to start developing its own drug IP from 1995. Two years later it listed on the LSE, raising £41m to continue this direction of travel. It was acquired by AstraZeneca in 2006 and is part of its Medimmune business, responsible for 50% of AstraZeneca's drug pipeline. CAT employed around 300 people at the time of the acquisition and was loss making. [4]	
AVEVA Engineering design and information management software	The Cambridge CAD Centre was set up by the then government in 1967, to exploit the research undertaken at the university's Mathematical Laboratory. By the early 70's it employed around 100 people and was essentially pursuing a "Catapult" like model. In 1973 a team led by Dick Newell conceived the idea of software to design plant layouts and sold a project to Dutch chemicals multinational, Akzo, and Isopipe, a Nottingham based plant design consultancy as lead customers. Their £90k fees were later followed by £300k of government funding before the resulting product, PDMS (Plant Design Management System) was ready to launch 4 years later. It was used for the world's first major 3D plant design project (a sugar refinery in the Philippines) completed by Isopipe in 1979. The CAD Centre was privatised through ICL, went through a management buyout and was listed on the LSE in 1996.	Listed on London Stock Exchange Employees in 2016 – over 1700 Revenues £204m Profit before tax £29m (14%) Exports £183m (90%) R&D £32m (16%)

[4] Exploding op cit and David Chiswell

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	Today, the successor to PDMS continues to drive the growth of Aveva, Cambridge's largest software company. Dick Newell left the CAD Centre in the 70's to found two other successful companies: Cambridge Interactive Systems and Smallworld, both grown without venture capital using the soft start up model and customer contracts to help create standard products.	