

Curriculum Vitae: Professor Simon M. Cragg

Institute of Marine Sciences
School of Biological Sciences
University of Portsmouth
Ferry Road
Portsmouth PO4 9LY, UK

simon.cragg@port.ac.uk

<https://www.port.ac.uk/about-us/structure-and-governance/our-people/our-staff/simon-cragg>

1. Career and training

2014 to date: Professor of Marine Zoology, University of Portsmouth, Band 2 Professor since 2017

2009 to 2014: Reader in Zoology, University of Portsmouth

1997 to 2009: Principal Lecturer, University of Portsmouth

1990 to 1996: Principal Lecturer, Reader then Professor of Wood Science, Buckinghamshire College

1986 to 1990: Research Fellow, University of Portsmouth

1977 to 1985: Scientific Officer Class 2, 3 then 5, becoming Officer in Charge and Assistant Secretary (Utilisation), Department of Forests, Papua New Guinea

1972 to 1976: SRC studentship in NERC Unit of Marine Invertebrate Biology, Marine Science Laboratories, University of Wales, Bangor, PhD awarded 1976

1969 to 1972: BSc (Hons) Zoology with Marine Zoology, Bangor 1972

2. Research

I am an invertebrate zoologist specialising in wood-boring bivalves and crustaceans, focusing on their unusual wood digestion processes, on the role of larvae in their life history strategies, on their role in carbon fluxes in mangrove ecosystems and on methods of controlling them.

2.1. *Development of research interests*

From a sound background in marine biology obtained in the Menai Bridge Marine Laboratories, Anglesey, UK, under strong intellectual leaderships of two fellows of the Royal Society – professors Crisp and Fogg, I developed an enduring interest in the larvae of marine bivalves, which generated papers that continue to be cited. I then took up a position as a scientific civil servant in Papua New Guinea, initially working on wood boring bivalves, but broadening my research into mangrove forests where I found that the borers were acting as ecosystem engineers, an idea that I was able to follow up much later through my research students at Portsmouth. This position also introduced me to wood science, which has guided my current focus on wood degradation for biofuels. My borer research benefitted from mentoring by Ruth Turner of Harvard University, a pioneer in the field. I became involved in the activities of the International Research Group on Wood

Protection (IRG-WP), through which I interacted with and was funded by commercial interests in wood protection. This gave me a well-developed perspective on the major economic losses caused by borers. I also noted increasing concerns about the impact of wood protection methods on the marine environment, which I addressed by winning funding and coordinating a six institution collaborative EU project that assessed these environmental impacts.

2.2. Recent and ongoing research

Currently I focus on the digestion process in marine wood borers, viewing it as a source of enzymes and other wood break down mechanisms that can be exploited in the generation of biofuels from waste materials. Initially, with an excellent PhD student, I substantially extended the understanding of the anatomy of the digestive tract of the crustacean wood-borer *Limnoria* then, with the help of Leverhulme funding, sequenced the first cellulose-degrading enzyme to be reported for this animal. To exploit this discovery, I followed up an enquiry from the University of York and proposed that together we focused on *Limnoria* as our experimental organism. The resulting research was funded by BBSRC, allowing me to build a team with a sufficient range of expertise to tackle our multidisciplinary project. The team consisted of two academics with complementary expertise (Guille, McGeehan), a postdoctoral fellow, a technician and up to five postgraduate researchers. Together with the team at York, we revealed a rich, novel, digestive-enzyme suite and, crucially through the expertise of Matt Guille, demonstrated that the animal itself generates the enzymes. This was published in a joint paper in PNAS (King et al., 2010).

One of these enzymes from glycosyl hydrolase family 7 (GH7) was produced in collaboration with a commercial partner, Novozymes. To respond to the opportunity presented by the availability of the protein, I made a major modification to the Portsmouth work programme which was implemented thanks to the expertise of John McGeehan. The Portsmouth team crystallized and then resolved the high resolution structure of the protein using the Diamond Light Facility. With additional modeling expertise from the USA National Renewable Energy Lab (NREL), we discovered highly unusual and useful properties of this enzyme which were published in a second PNAS paper (Kern et al. 2013). The interest of NREL in our experimental animal prompted me to intensive efforts to progress with the *Limnoria* genome. Support from the University Research Development Fund enabled me to leverage funding for genome sequencing from NREL and to obtain crucial bioinformatics support from The Genome Analysis Centre (TGAC) and thus set up the *Limnoria* Genome Project. Much of the genome has now been sequenced and a first output from this study has been to define the mitochondrial genome of *Limnoria* (Lloyd et al., 2015) which gives a valuable key to the phylogenetic position of the Limnoriidae which are an isolated group within the Isopoda.

I have used our insights into digestive system function in this major pest to inform our investigations of non-biocidal, environmentally-benign methods of controlling borers. We are applying high-sensitivity screening tests developed at Portsmouth (Borges et al., 2008, 2009), which have radically reduced the time required to generate results. Through a network of contacts we have assessed borer activity around the world (Cragg et al., 2009; Cookson et al., 2012) and developed predictions for changes in the level of borer hazard

(Borges et al., 2014). This work has detected the invasion of a Caribbean wood-boring bivalve into the eastern Mediterranean (Shipway et al., 2014).

3. Publications

3.1. Refereed articles

- Trégarot E., Caillaud A., Cornet C. C., Taureau F., Catry T., Cragg S. M., Failler P. (2020) Mangrove ecological services at the forefront of coastal change in the French Overseas Territories. *Science of the Total Environment*.
- Dahdouh-Guebas F, Ajonina GN, Amir AA, Andradi-Brown DA, Aziz I, Balke T, Barbier EB, Cannicci S, Cragg SM, Cunha-Lignon M, Curnick DJ, Duarte CM, Duke NC, Endsor C, Fratini S, Feller IC, Fromard F, Hugé J, Huxham M, Kairo JG, Kajita T, Kathiresan K, Koedam N, Lee SY, Lin H-J, Mackenzie JR, Mangora MM, Marchand C, Meziane T, Minchinton TE, Pettorelli N, Polanía J, Polgar G, Poti M, Primavera J, Quarto A, Rog SM, Satyanarayana B, Schaeffer-Novelli Y, Spalding M, Van der Stocken T, Wodehouse D, Yong JWH, Zimmer M and Friess DA (2020) Public Perceptions of Mangrove Forests Matter for Their Conservation. *Front. Mar. Sci.* 7:603651.
- Newton, A., Icely, J., Cristina, S., Perillo, G., R. Turner, R. Eugene, Ahsan, D., **Cragg, S. M.**, Yongmin Luo, Chen Lu, Yuan Li, Haibo Zhang, Ramachandran Ramesh, Forbes D., Solidoro, C., Béjaoui, B., Shu Gao, Pastres, R., Kelsey, H., Taillie, D., Nhan, N. H., Brito, A., de Lima, R., Kuenzer, C. (2020) Anthropogenic pressures on coastal wetlands. *Frontiers in Ecology and Evolution* 8:144, 1-29.
- Hendy I. W.**, Burt O., Clough S., Young L., **Cragg S. M.** (2020) The mosquitofish, *Gambusia affinis* avoids thermal stress by moving from open water to the shade of the mangrove *Rhizophora mangle*. *Marine Ecology Progress Series* 637: 103-116.
- Cragg, S. M.**, Friess, D. A., Gillis, L. G., Trevathan-Tackett, S. M., Terrett, O. M., Watts, J. E. M., Distel, D. L. & Dupree, P. (2020) Vascular plants are globally significant contributors to marine carbon fluxes and sinks. *Annual Review of Marine Science* 12: 469-497.
- Treu, A., Zimmer, K., Brischke, C., Larnøy, E., Gobakken, L. R., Aloui, F., **Cragg, S. M.**, Flæte, P-O, Humar, M., Westin, M., Borges, L., Williams, J. (2019) Durability and protection of timber structures in marine environments in Europe: an overview. *BioResources* 14 (4): pages to be assigned.
- Howarth, A., Simms, C., Kerai, N., Allen, O., Mihajluk, K., Madureira, P. A., Sokratous, G., **Cragg, S. M.**, Lee, S. Y., Morley, A. D., Keyoumars, A., Cox, P. A., Pilkington, G. J. & Hill, R. (2019). DIVERSet JAG compounds inhibit topoisomerase II and are effective against adult and pediatric high-grade gliomas. *Translational Oncology* 12 (10) 1375-1385.
- Simões, M. C.R., **Cragg, S. M.**, Barbu, E., De Sousa, F. B. (2019) The potential of electrospun poly(methyl methacrylate)/polycaprolactone core–sheath fibers for drug delivery applications. *Journal of Materials Science* 54 (7) 5712-5725.
- Besser, K., **Malyon G. P.**, Eborall, W. S., da Cunha, G. P., Filgueiras, J. G., Dowle, A., **Cruz Garcia, L.**, Page, S. J., Dupree, R. Kern, M., Gomez, L., Yi Li, Elias, L., Sabbadin, F. Mohamad, S. E., Pesante, G., Steele-King, C., Ribeiro de Azevedo, E. Polikarpov, I., Dupree, P., **Cragg, S. M.**, Bruce, N. C. & McQueen-Mason, S. J. (2018) Hemocyanin facilitates lignocellulose digestion by wood-boring marine crustaceans. *Nature Communications* 9, 5125.
- Beeston, M. A.**, **Cragg, S. M.**, Linse, K. (2018) Hydrological features above a Southern Ocean seamount inhibit larval dispersal and promote speciation: evidence from the bathyal mytilid *Dacrydium alleni* sp. nov. (Mytilidae: Bivalvia). *Polar Biology* 41(7) 1493-1504.
- Sabbadin, F., Pesante, G., Elias, L., Besser, K., Yi Li, Steele-King, C., Stark, M., Rathbone, D. A., Dowle, A. A., Bates, R., Shipway J. R., **Cragg, S. M.**, Bruce, N. C., McQueen-Mason, S. J. (2018) Uncovering the molecular mechanisms of lignocellulose digestion in shipworms. *Biotechnology for Biofuels* 11:59, 14pp.
- Janus, M., **Cragg, S. M.**, Brischke, C., Meyer-Veltrup, L. and Wehsener, J. (2018) Laboratory screening of thermo-mechanically densified and thermally modified timbers for resistance to the marine borer *Limnoria quadripunctata*. *European Journal of Wood and Wood Products* 76 (1) 393-396.
- Hendy I. W.** & **Cragg, S. M.** (2017) *Rhizophora* prop roots even when damaged prevent wood-boring teredinids from toppling the trees. *Hydrobiologia* 803: 333-344.

- Williams, J. R., Sawyer, G. S., **Cragg, S. M.**, Icely, J. D., Simm, J. Meaden, M., **Borges, L. M. S.** (2017) Evaluating the potential of lesser used timber species for marine construction. Proceedings of the Institute of Civil Engineers - Construction Materials <https://doi.org/10.1680/jcoma.15.00065>
- Ibegbu, D. M., Boussahel, A., Cragg, S. M., Tsibouklis, J. Barbu E.** (2017) Nanoparticles of alkylglyceryl dextran and poly(ethyl cyanoacrylate) for applications in drug delivery: preparation and characterisation. International Journal of Polymeric Materials and Biopolymeric Materials 66 (6): 265-279.
- Shipway, J. R., O'Connor, R. Stein, D., **Cragg, S. M.**, Korshunova, A., Martynov, A., Haga, T., Distel, D. L. (2016) *Zachsia zenkewitschi* (Teredinidae), a rare and unusual seagrass boring bivalve revisited and redescribed. PLoS One 11(5): e0155269.
- Cragg, S. M.**, Beckham, G. T., Bruce, N. C., Bugg, T. D. H., Distel D. L., Dupree, P., **Green Etxabe, A.**, Goodell, B. S., Jellison, J., **McGeehan, J.E.**, McQueen-Mason, S. J., Schnorr, K., Walton, P. H., **Watts, J. E. M.** and Zimmer, M. (2015) Lignocellulose degradation mechanisms across the Tree of Life. Current Opinion in Chemical Biology 29: 108-119.
- Humphreys J., Harris M.,** Herbert, R., Farrell, P., Jensen, A., **Cragg, S. M.** (2015) Introduction, dispersal and naturalization of the Manila clam *Ruditapes philippinarum* in British estuaries, 1980-2010. Journal of the Marine Biological Association 95 (6): 1163-1172.
- Lloyd, R. E., Streeter, S. D.,** Foster, P. G., Huntley, J., Beckham, G. T., Himmel, M. E., **Cragg, S. M.** (2015) The complete mitochondrial genome of *Limnoria quadripunctata* Holthuis (Isopoda: Limnoriidae). Mitochondrial DNA 26(6): 825-826. doi:10.3109/19401736.2013.855912
- Michie, L. A.,** Barnes, R. S. K. and **Cragg, S. M.** (2015) *Uca cryptica* Naderloo, Türkyay & Chen, 2010 (Crustacea: Brachyura: Ocypodidae) is no longer cryptic. Zootaxa 3981 (2): 291-295.
- Klüppel, A., **Cragg, S. M.**, Miltz, H., Mai, C. (2015) Resistance of modified wood to marine borers. International Biodeterioration and Biodegradation 104: 8-14.
- Wurzinger-Mayer A., **Shipway J. R.,** Kristof A., Schwaha T., **Cragg S. M.,** Wanninger A. (2014) Developmental dynamics of myogenesis in the shipworm *Lyrodus pedicellatus* (Mollusca: Bivalvia). Frontiers in Zoology 11(1): 90.
- Borges, L. M. S.,** Merklenbach, L., **Cragg, S. M.** (2014) Biogeography of wood-boring crustaceans (Isopoda: Limnoriidae) established in European coastal waters. PLoS ONE 9(10): e109593. doi:10.1371/journal.pone.0109593.
- Shipway, J. R.,** Borges, L. M. S., Müller J., **Cragg, S. M.** (2014) The broadcast spawning Caribbean shipworm, *Teredothyra dominicensis* (Bivalvia, Teredinidae), has invaded and become established in the eastern Mediterranean Sea. Biological Invasions. 16: 2037-2048.
- Borges, L. M. S.,** Merkelbach, L. M., Sampaio, I., **Cragg, S. M.** (2014) Diversity, environmental requirements and biogeography of bivalve wood-borers (Teredinidae) in European coastal waters. Frontiers in Zoology 11: 13.
- Borges, L. M. S.,** Sivrikaya, H., **Cragg, S. M.** (2014) First records of the warm water shipworm *Teredo bartschi* (Bivalvia, Teredinidae) in Mersin, southern Turkey and in Olhão, Portugal. BioInvasions Records 3: 25-28.
- McGeehan, J. E., Streeter, S. D., Martin R. N. A., Etxabe, A., Malyon, G. P., Cragg, S. M.,** Besser, K., Elias, L., Eborall, W., Bruce, N. C., McQueen-Mason, S. J., Payne, C. M., Beckham, G. T., Himmel, M. E., Schnorr, K. (2013) A novel cellulase for biofuels production: structure of a marine GH7 cellobiohydrolase. Acta Cryst. A69, s333-4.
- Kern, M., **McGeehan, J. E., Streeter, S. D. Martin, R. N. A.,** Besser, K., Elias, L., Eborall, W., **Malyon, G. P.,** Payne, C. M., Himmel, M. E., Schnorr, K., Beckham, G. T., **Cragg, S. M.,** Bruce, N. C. and McQueen-Mason, S. J. (2013) Structural characterization of a unique marine animal family 7 cellobiohydrolase suggests a mechanism of cellulase salt tolerance. Proc. Natl. Acad. Sci. 110: 10189-10194
- Hendy I. W.,** Eme J., Dabruzzi, T. F, Connolly, H. F., **Nembhard, R, Cragg, S. M.** and Bennett, W. A. (2013) Dartfish use teredinid tunnels in fallen mangrove wood as a low-tide refuge. Marine Ecology – Progress Series, 486: 237-245.
- Borges, L. M. S.,** Sivrikaya, H., le Roux, C. A., **Shipway, J. R., Cragg, S. M.,** Costa, F. O. (2012) Investigating the taxonomy and systematics of marine wood borers (Bivalvia: Teredinidae) combining evidence from morphology, DNA barcodes and nuclear locus sequences. Invert. Systemat. 26: 572-582.

- Cookson, L. J., **Cragg, S. M.** & **Hendy, I. W.** (2012) Wood-boring limnoriids (Crustacea, Isopoda) including a new species from mangrove forests of the Tukang Besi Archipelago, Indonesia. *Zootaxa* 3248: 25-34.
- Sivrikaya, H., Hafizoğlu, H., **Borges, L.M.S.**, **Cragg, S.M.**, Carrillo, A., Militz, H. & Mai, C. (2012) Evaluation of wooden materials deteriorated by marine wood boring organisms in the Black Sea. *Maderas: Ciencia y Tecnologia*, 14: 79-90.
- Kientz, B., Thabard, M., **Cragg, S. M.**, Pope, J. & Claire Hellio, C. (2011) A new method for removing microflora from macroalgal surfaces: an important step for natural product discovery. *Botanica Marina* 54: 457-469.
- King, A. J., **Cragg, S. M.**, Li, Y., **Dymond, J.**, **Guille, M. J.**, Bowles, D. J., Neil C. Bruce, N. C., Graham, I. A., McQueen-Mason, S. J. (2010) Molecular insight into lignocellulose digestion by a marine isopod in the absence of gut microbes. *Proc Natl. Acad. Sci.* 107: 5345-5350.
- Karayanni, H., Kormas, K. A., **Cragg, S. M.**, Nicolaidou, A. (2010) Establishment and succession of an epibiotic community on chromated copper arsenate (CCA) treated wood in Mediterranean waters. *Arch. Env. Contam. Toxicol.* 58: 71-78.
- Sivrikaya, H., **Cragg, S. M.** and **Borges, L. M. S.** (2009) Variation in resistance to marine borers in commercial timbers from Turkey, as assessed by marine trial and laboratory screening. *Turk. J. Agric. For.* 33: 569-576.
- Colin, R., Farrell, P. & **Cragg, S. M.** (2009) Confirmation of the identification and establishment of the South American slipper limpet *Crepidatella dilatata* (Lamarck 1822) (Caenogastropoda: Calyptraeidae) in Northern Spain. *Aquatic Invasions* 4 (2): 377-380.
- Cragg, S. M.**, **Jumel, M-C.**, Al-Horani, F. A. and **Hendy, I. W.** (2009) The life history characteristics of the wood-boring bivalve *Teredo bartschi* are suited to the elevated salinity, oligotrophic circulation in the Gulf of Aqaba, Red Sea. *J. Exp. Mar. Biol. Ecol.* 375: 99-105.
- Borges, L. M. S.**, **Cragg, S. M.**, **Busch S.** (2009) A laboratory assay for measuring feeding and mortality of the marine wood-borer *Limnoria* under forced feeding conditions: a basis for a standard test method. *Int. Biodet. Biodeg.* 63: 289-296.
- Papadopoulos, A. N., Duquesnoy, P., **Cragg, S. M.** and Pitman, A. J. (2008) The resistance of wood modified with linear chain carboxylic acid anhydrides to attack by the marine wood borer *Limnoria quadripunctata* Holthius. *Int. Biodet. Biodeg.* 61: 199-202.
- Borges, L. M. S.**, **Cragg, S. M.**, **Bergot, J.**, Williams, J. R., **Shayler, B.** and Sawyer, G. S. (2008) Laboratory screening of tropical hardwoods for natural resistance to the marine borer *Limnoria quadripunctata* with an investigation of the role of leachable and non-leachable factors. *Holzforschung* 62: 99-111.
- Cragg, S. M.**, **Danjon, C.** and Mansfield-Williams, H. (2007) Contribution of hardness to the natural resistance of a range of wood species to attack by the marine borer *Limnoria*. *Holzforschung* 61: 201-206.
- Delgery, C. C.**, **Cragg, S. M.**, **Busch, S.** and **Morgan, E.** (2006) Effects of the epibiotic heterotrich ciliate *Mirofolliculina limnoriae* and of moulting on faecal pellet production by the wood-boring isopods *Limnoria tripunctata* and *L. quadripunctata*. *J. Exp. Mar. Biol. Ecol.* 334: 165-173.
- Rosenbusch, K., **Borges, L. M. S.**, **Cragg, S. M.**, Rapp, A. O. and Pitman, A. J. (2006) A laboratory assessment of the natural durability of the lesser-utilised species *Corynanthe pachyceras* Welw. and *Glyphaea brevis* (Sprengel) Monachino against the marine wood borer *Limnoria quadripunctata* Holthuis. *Int. Biodet. Biodeg.* 57: 71-74.
- Williams, J. R., Sawyer, G. S., **Cragg, S. M.** & Simm, J. (2005) A questionnaire survey to establish the perceptions of UK specifiers concerning the key material attributes of timber for use in marine and fresh water engineering. *J. Inst. Wood. Sci.* 17 (1): 41-50.
- Gouletquer, P., Wolowicz, M., Latala, A., Brown, C. & **Cragg, S.M.** (2004) Application of a micro-respirometric volumetric method to respiratory measurements of larvae of the Pacific oyster *Crassostrea gigas*. *Aquat. Living Resour.* 17: 195-200.
- Brown, C. J., Eaton, R. A., **Cragg, S. M.**, Gouletquer, P., Nicolaidou, A., Bebianno, M. J., Icely, J. D., Daniel, G., Nilsson, T., Pitman, A. J. and Sawyer, G. S. (2003) Assessment of effects of chromated copper arsenate (CCA)-treated timber on non-target benthos by investigation of fouling community development at seven European sites. *Arch. Env. Contam. Toxicol.* 45: 37-47.

- Praël, A., **Cragg, S. M.**, Henderson, S. M. (2001) Behavioural responses of veliger larvae of *Crassostrea gigas* to leachate from wood treated with copper-chrome-arsenic (CCA): a potential bioassay of sublethal environmental effects of contaminants. *J. Shellfish. Res.* 20: 267-273.
- Oevering, P., Matthews, B. J., **Cragg, S. M.** & Pitman, A. J. (2001) Invertebrate biodeterioration of marine timbers above mean sea level along the coastline of England and Wales. *Int. Biodeg. Biodeg.* 47: 175-181.
- Tupper C, Pitman A. J. & **Cragg S. M.** (2000) Copper accumulation in the digestive caecae of *Limnoria quadripunctata* Holthius (Isopoda : Crustacea) tunnelling CCA-treated wood in laboratory cultures. *Holzforschung* 54 (6): 570-576.
- Brown, C. J., Albuquerque, R. M., **Cragg, S. M.** & Eaton, R. A. (2000) Effects of CCA (copper-chrome-arsenic) preservative treatment on the settlement of calcareous fouling organisms on wood at a range of European sites. *Biofouling*, 15: 151-164.
- Cragg, S. M.**, Pitman, A. J. & Henderson, S. M. (1999) Developments in the understanding of the biology of marine wood boring crustaceans and in methods of controlling them. *Int. Biodeg. Biodeg.* 43: 197-205.
- Cragg, S. M.** & Eaton, R. A. (1997) Evaluation of creosote fortified with synthetic pyrethroids as wood preservatives for use in the sea Part 2: Effects on wood-degrading micro-organisms and fouling invertebrates. *Material und Organismen* 31: 197-216.
- Pitman, A. J., **Cragg, S. M.** & Daniel, G. (1997) The attack of greenheart (*Ocotea rodiaei* Mez) and creosote-treated Douglas fir (*Pseudotsuga menziesii* Mirb.) by *Limnoria tripunctata* Menzies. *Material und Organismen* 31: 281-291.
- Cragg, S. M.**, Nicolaidou, A., Bebianno, M. J., Eaton, R. A., Gouletquer, P. and Nilsson, T. (1997) Impact on non-target organisms of anti-marine wood-borer treatments. *Int. Biodeg. Biodeg.* 39: 89.
- Eaton, R. A. & **Cragg, S. M.** (1996) Evaluation of creosote fortified with synthetic pyrethroids as wood preservatives for use in the sea. Part 1: Efficacy against marine wood-boring molluscs and crustaceans. *Material und Organismen* 29: 211-229.
- Sawyer, G. S. & **Cragg, S. M.** (1995) Attack by the wood-boring weevil, *Pselactus spadix* on timbers in the intertidal and splash zones in ports in the U.K. *Material und Organismen* 29:67-79.
- Cragg, S.M.** (1993) Wood break-down in mangrove ecosystems: a review. *PNG J. Agric. For. Fish.* 36: 30-39.
- Daniel, G., **Cragg, S. M.** & Nilsson, T. (1991) *Limnoria lignorum* ingests bacterially and fungally decayed wood. *Holz als Roh und Werkstoff* 49: 489-491.
- Cookson, L.J. & **Cragg, S. M.** (1991) *Limnoria cristata*, a new species of wood-borer (Limnoriidae; Isopoda) from Singapore. *Raffles Bulletin* 39: 87-97.
- Eaton, R. A., Ampong, F., Beesley, J., Bultman, J. D., Cookson, L.J., **Cragg, S.M.**, De Palma, J., Gambetta, A., Henningson, B., Levi, M., Levy, C.R., Nilsson T. and Orlandi, E. (1989) An international collaborative marine trial to investigate the effect of timber substrate on the efficacy of CCA and CCB wood preservatives. *Material und Organismen* 24: 51-79.
- Cragg, S.M.** (1989) The ciliated rim of the velum in larvae of *Pecten maximus* (Bivalvia). *J. Moll. Stud.*, 55: 497-508.
- Cookson, L.J. & **Cragg, S.M.** (1988) Two new species of Limnoriidae (Isopoda) from Papua New Guinea. *J. Nat. Hist.*, 21(6): 1501-1514.
- Cragg, S.M.** (1985) The adductor and retractor muscles of the veliger of *Pecten maximus* (L.) (Bivalvia). *J. Moll. Stud.* 51:276-283.
- Jones D.A., Icely J.D. & **Cragg, S.M.** (1983) Some corallanid isopods associated with wood from Papua New Guinea. *Journal of Natural History* 17: 837-847.
- Cragg, S.M.** (1980) Swimming behaviour of the larvae of *Pecten maximus* (L.) (Bivalvia). *J. Mar. Biol. Ass. U.K.* 551- 564.
- Cragg, S. M.** & Levy, C.R. (1979) Attack by the crustacean *Sphaeroma* on CCA - treated softwood in Papua New Guinean waters. *Int. J. Wood Pres.* 1 (4) 161-168.
- Cragg, S.M.** & Nott, J.A. (1977) The ultrastructure of the statocysts in the pediveliger larvae of *Pecten maximus* (Bivalvia). *J. Exp. Mar. Biol. Ecol.* 27 (1) 23-36

3.2. Contributions to edited volumes

- Cragg, S. M.** (2017) Chapter 7, Test methods for bio-based building materials: sub-section 7.2.3 Marine borers (pp14-22) of section 7.2 Laboratory testing and sub-section 7.3.2 Marine borers (pp38-40) of section 7.3 Field methods. In: Performance of Bio-based Building Materials, Elsevier. <https://doi.org/10.1016/B978-0-08-100982-6.00007-0>
- Cragg, S. M.** (2016) Biology and ecology of scallop larvae. In: Scallops: Biology, Ecology, Aquaculture and Fisheries. Ed. Shumway, S. E. and Parsons, G. J. Elsevier, pp31-83.
- Carter, J. G., Harries, P. J., Malchus, N., Sartori, A. F., Anderson, L. C., Bieler, R. C., Bogan, A. E., Coan, E. V., Cope, J. C. W. Cope, **Cragg, S. M.**, García-March, J. R., Hylleberg, J. Kelley, P., Kleemann, K., Kříž, J., McRoberts, C., Mikkelsen, P. M., Pojeta, J. Jr., Tëmkin, I., Yancey, T., Zieritz, A. (2012) Treatise on Invertebrate Paleontology, Part N, Bivalvia, Revised, Volume 1, Chapter 31: Illustrated Glossary of the Bivalvia. Treatise Online 48:1–209, 327 figs.
- Cragg, S. M. & Hendy, I. W.** (2010) Mangrove forests of the Wakatobi National Park, In: Marine Conservation and Research in the Coral Triangle: the Wakatobi National Park, ed. Clifton J., Unsworth, R. K. F. and Smith D. J., pp67-83, Nova Science Publishers, Hauppauge, NY.
- Cragg, S. M.** (2007) Marine wood boring invertebrates of New Guinea and its surrounding waters. In: The Ecology of Papua, ed. B. M. Beehler & A. J. Marshall. Periplus, Singapore, pp539-563.
- Cragg, S. M.** (2006) Development, physiology, behaviour and ecology of scallop larvae. In: Scallops: Biology, Ecology and Aquaculture, Shumway S.E. & Parsons G. J. (eds) Elsevier, Amsterdam pp45-122.
- Cragg, S. M.** (2003) Marine wood boring arthropods: ecology, functional anatomy and control measures. In Wood Deterioration and Preservation: Advances in our Changing World. Goodell, B., Nicholas, D. D. & Schultz, T. P. (eds), American Chemical Society, Oxford University Press, pp 272-286. (A)
- Cragg, S. M., Brown, C. J., Praël, A. & Eaton, R. A.** (2000) Evaluation of the environmental risk of the use of preservative-treated wood in Langstone Harbour. In: Solent Science – a Review, M. Collins & K. Ansell (eds.) Proceedings in Marine Sciences 1, Elsevier, Amsterdam, pp209-211. (W)
- Cragg, S. M.** (1996) The phylogenetic significance of some anatomical features of bivalve veliger larvae. In: Origin and Evolutionary Radiation of the Mollusca (ed. J. Taylor) Oxford University Press, pp362-371.
- Cragg, S. M.** (1995) Impact on non-target organisms of anti-marine wood-borer treatments. In Marine Sciences and Technologies: 2nd MAST days and Euromar market, Vol. II Luxembourg, Office for Official Publications of the European Communities, pp1227-1236.
- Cragg, S. M. & Crisp, D.J.** (1991) The biology of scallop larvae. In: Biology, Ecology and Aquaculture of Scallops. Shumway S. E. (ed.) Elsevier, Amsterdam, pp75-132.
- Cragg, S.M.** (1988) The wood-boring isopod *Sphaeroma*, a threat to maritime structures in warm waters. In: Biodeterioration 7. D.Houghton, R.N.Smith & H.O.W. Eggins, eds., Elsevier, London, pp727-732. (A)
- Cragg, S. M., Aruga, J.,** (1988) Intertidal and subtidal wood-boring faunas from the Gulf of Papua, Papua New Guinea. In: Advances in Aquatic Biology and Fisheries, St. Josephs Press, Trivandrum, India (N. Balakrishnan Nair Felicitation Volume), pp236-244.
- Cragg, S. M.** (1987) Papua New Guinea. In: Mangroves of Asia and the Pacific: Status and Management. R.Umali *et al*, eds. Natural Resources Management Center and National Mangrove Committee, Ministry of Natural Resources, Manila, pp299-309.
- Cragg, S. M.** (1983) The mangrove ecosystem of the Purari Delta, In: T. Petr. (ed) The Purari - Tropical Environment of a High Rainfall River Basin, pp 295-324. Monographiae Biologicae, Dr. W. Junk, The Hague.
- Cragg, S. M.** (1979) Marine wood borers in the Purari Delta and some adjacent waters. In: Purari River (Wabo) Hydroelectric Scheme Environmental Studies, Vol. 10, ed. T. Petr, Office of Environment & Conservation, Papua New Guinea.
- Cragg, S.M. & Gruffydd, L.I.D.** (1975) The swimming behaviour and the pressure responses of the veliconcha larvae of *Ostrea edulis* (L.). Proc. 9th Europ. Mar. Biol. Symp. pp. 43-57 ed. H. Barnes, Aberdeen University Press.

3.3. Conference contributions

Key note presentations for the following meetings:

Marine borer omics, Linnaeus Centre for Marine Evolutionary Biology (2015)

Mangrove Conservation, IUCN/Zoological Society of London (2013)

Lignocellulose Degradation Mechanisms, Linnean Society (2013)

Molluscan Life Histories, Malacological Society of London (2012)

Annual Meeting, Society of Electron Microscope Technology (2011)

Mangrove Biodiversity, Zoological Society of London (2011)

Annual Meeting, International Research Group on Wood Protection (2010)

Selected published conference contributions listed below.

- Palanti S., Cragg, S. M., Plarre, R. (2020) Resistance against marine borers: About the revision of EN 275 and the attempt for a new laboratory standard for *Limnoria*. International Research Group on Wood Preservation, Document No. IRG/WP 20-20669.
- Treu, A., Zimmer, K., Brischke, C., Larnøy, E., Gobakken, L. R. , Aloui, F., Cragg, S. M., Flæte, P-O, Humar, M., Mats Westin, M. (2018) Hibernation or spring awakening? – The research on wood durability and protection in marine environment. International Research Group on Wood Preservation, Document No. IRG/WP 18-10929.
- Bowen, H., Montibus, M., Kutnik, M., Cragg, S. M. (2017) Novel wood treatments improve resistance to the wood-boring marine isopod *Limnoria quadripunctata*. International Research Group on Wood Preservation, Document No. IRG/WP 17-10899, 12pp.
- Westin, M., Brelid, P. L., Nilsson, T., Rapp, A. O., Dickerson, J. P., Lande, S., Cragg, S. M. (2016) Marine borer resistance of acetylated and furfurylated wood – results from up to 16 years of field exposure. International Research Group on Wood Preservation, Document No. IRG/WP 16-40756, 9pp.
- Slevin, C., Westin, M., Lande, S. and **Cragg, S. M.** (2015) Laboratory and marine trials of resistance of furfurylated wood to marine borers. In: Hughes, M., Raukari, L., Uimonen, T., Militz, H. and Junge, B. (Eds.) The Eighth European Conference on Wood Modification ECWM8 Proceedings 8th European Conference on Wood Modification, Helsinki, pp464-471.
- Jellison, J., Goodell, B., Alfredsen, G., Eastwood, D., Daniel, G., **Cragg, S. M.**, Grace, J. K. (2013) What molecular biology can tell us about the biodegradation of lignocellulose: the utilization of molecular techniques for the detection, identification and enhanced understanding of wood degrading organisms. International Research Group on Wood Preservation, Document No. IRG/WP 13-20528, 9pp.
- Klüppel, A., Militz, H., **Cragg, S. M.** and Mai, C. (2010) Resistance of modified wood to marine borers. In: Hill CAS, Militz H, Andersons B (Eds.) The Fifth European Conference on Wood Modification ECWM5 Proceedings. 5th European Conference on Wood Modification, Riga, pp389-396.
- Williams, J. R., Sawyer, G. S., Malyon, G., **Cragg, S. M.**, Icely, J. D., Simm, J., Meaden, M. (2010) Assessment of the marine borer resistance and abrasion resistance of lesser known hardwood timber species for use in marine construction. International Research Group on Wood Preservation, Document No. IRG/WP 10-10711, 25pp.
- Malyon, G. P., LaBarre, S., Kervarec, N., Carey, P., McGeehan, J., Xie, X., Klueppel, A. and **Cragg, S. M.** (2010) New insights from NMR, FTIR, X-ray diffraction and physical chemistry into digestive processes in the wood-boring marine crustacean *Limnoria quadripunctata*. International Research Group on Wood Preservation, Document No. IRG/WP 10-10732, 16pp.
- Sivrikaya, H., **Cragg, S. M.** and Borges, L. M. S. (2008) Variation of commercial timbers from Turkey in resistance to marine borers as assessed by marine trial and laboratory screening. International Research Group on Wood Preservation, Document No. IRG/WP 08-10668, 11pp
- Borges, L. M. S., **Cragg, S. M.**, van der Zee, M. and Homan, W. J. (2005) Laboratory and field tests of the anti-marine-borer potential of wood modified with dimethyloldihydroxyethyleneurea

- (DMDHEU) and phosphobutane tricarboxylic acid (PBTC). In: Wood modification: processes, properties and commercialization. The Second European Conference on Wood Modification (eds Militz, H. and Hill, C.), Gottingen 2005, pp 198-201.
- Dymond, J., Guille, M. J. & **Cragg, S. M.** (2003) Isolation of a putative endogenous endo- β -1,4-glucanase (cellulase) from the midgut diverticulae of the wood-boring crustacean, *Limnoria quadripunctata*. International Research Group on Wood Preservation, Document No. IRG/WP 03-10494, 12pp.
- Cragg, S. M.** (2001) Mangrove ecology and management for sustainable utilisation and biodiversity maintenance: the relevance of overseas experience and observations to the situation in Sri Lankan mangroves. In: Workshop on Effective Management for Biodiversity Conservation in Sri Lankan Coastal Wetlands: Muthurajawela Marsh, Negombo Lagoon and Chilaw Lagoon (ed. N. Farmer). Report 55, Centre for the Economics and Management of Aquatic Resources, University of Portsmouth, UK, pp21-32.
- Cragg, S. M.**, Brown, C. J., Albuquerque, R. A. & Eaton, R. A. (2001) Rates of emission from CCA-treated wood in the marine environment: measurement, modelling and requirements for further research. In: Proceedings 5th Wood Preservation Symposium "Environment and Wood Preservation", Cannes, Mandelieu, February 2001, International Research Group on Wood Preservation, Document No. IRG/WP 01-50166, 1-15.
- Albuquerque, R. M. & **Cragg, S. M.** (1995) Evaluation of impact of CCA-treated wood on the marine environment. In: Third International Symposium on Wood Preservation: The Challenge, Safety-Environment, Cannes-Mandelieu, France, pp224-236.
- Daniel, G., **Cragg, S.M.** & Nilsson, T. (1991) Ingestion of wood-degrading micro-organisms by *Limnoria lignorum*. International Research Group on Wood Preservation Doc. No. 4169: 1-17.
- Cragg, S.M.** (1990) Poor performance of treated timber in wharfs in Papua New Guinea attributed to details of wharf design. International Research Group on Wood Preservation Doc. No. 4158, 1-13.
- Cragg, S.M.** (1986) The role of wood break-down in mangrove ecosystems. In: Cragg, S.M. & Polunin, N.V.C. (eds.) Mangrove Ecosystem Dynamics: the Proceedings of the Motupore Workshop, UNESCO, New Dehli.
- Cragg, S.M.** & Icely J.D. (1982) An interim report on studies of the tolerance by *Sphaeroma* (Crustacea: Isopoda) of CCA - treated timber. Document No. IRG/WP/491: 26pp. International Research Group of Wood Preservation, Stockholm, Sweden.

3.4. Other outputs

- Cragg, S. M.** (2020) Review of Evolutionary Ecology of Marine Invertebrate Larvae. The Marine Biologist 14 April: 37-38.
- Ebrahim, A., Hobdey, S.E., Podkaminer, K., Taylor II, L.E., Beckham, G.T., Decker, S.R., Himmel, M.E., **Cragg, S.M.**, McGeehan, J.E. (2015) Crystal Structure of a GH7 Family Cellobiohydrolase from *Daphnia pulex*. dataset ID: D_1000205890 and PDB ID: 4XNN.
Patent Application Number 1305487.9 26 March 2013.
- Etxabe, A.G., Elias, L., Kern, M., **Cragg, S.M.** and McQueen-Mason, S.J. (2013) *Chelura terebrans* family 7 cellobiohydrolase (GH7A) mRNA, complete cds. GenBank: KC776193.1
- Etxabe, A., Elias, L., Kern, M., **Cragg, S.** and McQueen-Mason, S. (2013) *Chelura terebrans* family 7 cellobiohydrolase (GH7D) mRNA, complete cds. GenBank: KC776194.1
- McGeehan, J.E., Martin, R.N.A., Streeter, S.D., **Cragg, S.M.**, Guille, M.J., Schnorr, K.M., Kern, M., Bruce, N.C. & McQueen-Mason, S.J. (2012) Crystal Structure of a GH7 Family Cellobiohydrolase from *Limnoria quadripunctata*. Protein Database Submission PDB ID: 4GWA, RCSB ID : RCSB074712.
- Martin, R.N.A., McGeehan, J.E., Streeter, S.D., **Cragg, S.M.**, Guille, M.J., Schnorr, K.M., Kern, M., Bruce, N.C., McQueen-Mason S.J. (2012) Crystal Structure of a GH7 family cellobiohydrolase from *Limnoria quadripunctata* in complex with cellobiose and cellotriose. Protein Database Submission PDB ID: 4HAQ, RCSB ID: RCSB075232.
- Martin, R.N.A., McGeehan, J.E., Streeter, S.D., **Cragg, S.M.**, Guille, M.J., Schnorr, K.M., Kern, M., Bruce, N.C., McQueen-Mason S.J. (2012) Crystal Structure of a GH7 family cellobiohydrolase from

Limnoria quadripunctata in complex with cellobiose. Protein Database Submission PDB ID : 4HAP, RCSB ID : RCSB075231.

Martin, R.N.A., McGeehan, J.E., Streeter, S.D., **Cragg, S.M.**, Guille, M.J., Schnorr, K.M., Kern, M., Bruce, N.C., McQueen-Mason S.J. (2012) Crystal structure of a GH7 family cellobiohydrolase from *Limnoria quadripunctata* in complex with thiocellobiose. Protein Database Submission PDB ID:

CABI, (2012). *Limnoria lignorum* [original text by **S. M. Cragg**]. In: Invasive Species Compendium. Wallingford, UK: CAB International. <http://www.cabi.org/isc>.

Mansergh, R., **Cragg, S. M.** & Ford, A. T. (2011) Parasite biomarkers of amphipod health. Porcupine Natural History Society Newsletter 30: 44.

CABI, (2011). *Limnoria quadripunctata* [original text by **S. M. Cragg**]. In: Invasive Species Compendium. Wallingford, UK: CAB International. <http://www.cabi.org/isc>.

Pattison, N., Wattage, P., **Cragg, S. M.**, Stanton, S., Dossor, P., Strevens, C., Banks, G., Capon, N., Jones, A. (2005) Preliminary study of the commercial potential of oyster beds at Emsworth. Portsmouth Business School e-print 12017, 64pp.

Cragg, S. M. (1982) Coastal resources and the Umboi logging project: an environmental impact study. Office of Forests, Papua New Guinea, 56pp. DOI: 10.13140/RG.2.1.1534.6080.

4. Research Funding

4.1. External sources

About £2.4M of external research funding (listed below) awarded to date. Funds were awarded as PI or research student supervisor, except for the grants from H2020, E3, EU Interreg, the Darwin Initiative and Wellcome Environmental Health, which were lead respectively by Prof John McGeehan, Prof Pierre Failler, Prof. Darek Gorecki, Dr. Prem Wattage and Dr. Rod Eaton. SMC was Co PI and report writer for the Leverhulme and Rohm & Haas grants.

| FUNDING SOURCE | £K | DATES | TOPIC |
|------------------------------------|----------|---------|--|
| NERC Capital | 955.4 | 2021 | Tandem LA-LIB laser ablation analysis |
| NERC/NRF Singapore | 700/720 | 2020-23 | Plastic reduction in SE Asian seas |
| EU H2020 | 858.8 | 2020-24 | Marine coastal ecosystems biodiversity and services |
| E3 UKRI with UoP match funding | 12,000.0 | 2019-24 | Centre for Enzyme Innovation |
| BBSRC Business Interaction Voucher | 8.3 | 2018 | Scoping study for horse bedding valorisation |
| Research Council of Norway | 41.6 | 2017-20 | Evaluation of innovations in furfurylation for marine use |
| BBSRC | 94.9 | 2014-18 | Characterising new lignocellulose mobilising proteins |
| BBSRC | 715.0 | 2014-19 | Marine borer mechanisms of lignocellulose digestion |
| Deutsche Bundesstiftung Umwelt | 3.3 | 2014-15 | Geotextiles as an antiborer protection |
| NREL USA | 16.4 | 2013 | Sequencing of gribble genome |
| Research Council of Norway | 74.0 | 2013-15 | Furfuryl alcohol treatment of wood for marine use |
| Malacological Society | 3.3 | 2012 | Conference: Life History Strategies of Mollusca |
| Mary Rose Trust | 5.0 | 2012-13 | Monitoring borer attack and public engagement |
| BBSRC | 38.1 | 2011-13 | USA partnering: lignocellulose degradation mechanisms |
| Kebony ASA, Norway | 2.7 | 2011 | Evaluation of furfurylated wood |
| Operation Wallacea | 6.9 | 2010-15 | Sympatry in fiddler crabs |
| Malacological Society | 1.5 | 2010 | Mediterranean biogeography of marine wood borers |
| EU Interreg | 27.0 | 2009-11 | Regional high level microscopy facilities |
| BBSRC | 549.7 | 2009-13 | Enzyme discovery in <i>Limnoria</i> for biofuel generation |
| Environment Agency | 7.5 | 2007-8 | Alternatives to greenheart in waterside construction |

| | | | |
|-----------------------------------|-------|-----------|--|
| Greenwich University | 2.0 | 2007-9 | Larval biology of the Manila clam |
| Guyana Forestry Dept. + TRADA | 5.5 | 2007-8 | Resistance of new Guyanan timbers to <i>Limnoria</i> |
| Amaethon | 50.0 | 2007 | Marine borer cellulases |
| Royal Society | 3.5 | 2007 | Turkish wood borers |
| Operation Wallacea | 0.5 | 2007 | Mangrove ecosystem characteristics in Wakatobi |
| Friends of Langstone Harbour | 0.5 | 2006-7 | Manila clam potential in Langstone Harbour |
| Nippon Paints | 5.5 | 2005 | Toxicity of paint to larval barnacles |
| Malacological Society | 1.0 | 2005-6 | Bivalve larval sense organs |
| Leverhulme Foundation | 110.0 | 2005-8 | Mechanisms of <i>Limnoria</i> cellulase expression |
| Fundacao Ciencias e Tecnologias | 12.0 | 2004-5 | European marine borer biogeography |
| Mary Rose Trust | 1.2 | 2004 | Taxonomy of borers at archaeological sites |
| Building Research Establishment | 0.5 | 2004 | A new methods of wood protection for the sea |
| University of French Polynesia | 6.2 | 2003-4 | Taxonomy of Pacific coralline algae |
| Malacological Soc. | 0.5 | 2003 | Larval bivalve sense organs |
| TRADA | 6.2 | 2002-4 | Marine durability of tropical hardwoods |
| EU Marie Curie | 9.4 | 2002-3 | Performance of modified wood in seawater |
| Int. Biodeterioration Soc | 0.2 | 2002 | Epibiota of wood borers |
| SE Hants IoW Educational Trust | 0.9 | 2002 | Anatomy of larval bivalves |
| DfID Darwin Initiative | 147.0 | 2000-1 | Biodiversity in Sri Lankan mangroves |
| Rohm & Haas Inc. | 33.0 | 1997-2000 | Testing of treatments for marine wood protection |
| British Council/ Athens Univ. | 1.5 | 1997-9 | Wood protection methods for aquaculture |
| COST | 0.3 | 1997 | Environmental impact of preservatives |
| EU MAST Programme | 330.0 | 1995-7 | Impact of wood preservatives in the sea |
| HEFCE | 30.0 | 1995-8 | 2 ORS studentships |
| British Council | 0.8 | 1995 | Marine wood borers and microorganisms |
| CSI Laporte Inc. (USA) | 5.0 | 1993-7 | Marine wood preservative efficacy and impact |
| Polytech & Coll Funding Council | 18.0 | 1992-4 | Wood borers, wood and micro organisms |
| Wellcome Environmental Health | 30.0 | 1986-9 | Marine wood borer biology and testing |
| FAO | 8.0 | 1982 | Mangrove ecosystem characteristics in PNG |
| Commonwealth Fund for Tech. Coop. | 5.0 | 1982 | Tolerance of preservatives by the borer <i>Sphaeroma</i> |
| Natl. Pub. Expenditure Plan (PNG) | 2.0 | 1980 | Environmental impact of logging on coastal resources |
| Natl. Pub. Expenditure Plan (PNG) | 2.0 | 1979 | Impacts of the Purari River Project on mangroves |

4.2. *In-kind support*

The output from grant income above has recently been greatly enhanced through access to national facilities representing tens of thousands of pounds worth of in-kind contributions. This has been achieved in close collaboration with Dr. John McGeehan.

| <i>FUNDING SOURCE</i> | <i>DATES</i> | <i>TOPIC</i> |
|------------------------------------|--------------|--|
| Life Sciences Mass Spec Facilities | 2017-8 | Stable isotope signatures of marine wood borers |
| Diamond | 2016-8 | Diffraction of native ferritin and haemocyanin |
| TGAC | 2013 | Assembly of gribble genome |
| National Renewable Energy Lab, USA | 2012-3 | Chimeric enzymes |
| | | Supercomputer access for molecular simulation |
| OPPF | 2012 | Novel approaches to <i>Limnoria</i> protein expression |
| Diamond | 2012 | High resolution solution of GH7 protein structure |

4.3. Internally-handled funds

I have accessed institutionally-managed funds to support new research initiatives and to build up research infrastructure. This has transformed the Electron Microscope Unit (King Henry Building) into an up-to-date facility with capabilities that support researchers from across the Faculty of Science and also in Technology, using refurbishment initiatives, and funds supporting infrastructure (SRIF, RCIF) and knowledge transfer (HEIF). Pump-priming funds have been used to generate initial findings (internal funding mechanisms plus HEIF), while RDF funds have been used to leverage external in-kind support.

| FUNDING SOURCE | £K | DATES | TOPIC |
|-------------------------|------|--------|--|
| Impact development fund | 1.5 | 2019 | Participation in working group for standard EN275 |
| RDF | 75.0 | 2016 | Ultratome and critical point drier for electron microscopy |
| Template H | 24.5 | 2014-5 | Transcriptomics for UoA 7 |
| Template H | 25.0 | 2014-5 | Protein expression system capability (PI J. McGeehan) |
| RDF | 24.5 | 2012-3 | Gribble Genome Project |
| RCIF | 14.0 | 2011 | Maintenance contract for electron microscopes |
| IBBS Pump Priming | 5.0 | 2011 | Demonstration of epigenetics potential of <i>Limnoria</i> |
| HEIF 4 | 10.4 | 2011 | Enhancing analytical potential of EM Unit |
| HEIF 4 | 6.5 | 2009 | X-ray microanalysis and mapping for SEM |
| HEIF 4 | 4.1 | 2008 | Evaluation of potential of borer assay |
| SRIF | 36.0 | 2003 | Replacements for electron microscopes |
| RAE Bursary | 27.5 | 2001-4 | Digestion in <i>Limnoria</i> |
| Buckinghamshire College | 49.5 | 1993-8 | Three studentships on marine borers and wood preservatives |

5. Research training and supervision

5.1. Research degree supervision

Director of studies, completed

| | |
|--------------------|---|
| Laura Michie | PhD pt 2010-2017 Fiddler crab sympatry in Indonesia |
| Ali Ebrahim | MPhil pt 2014-2017 The GH7 enzyme of <i>Daphnia</i> |
| Matt Harris | PhD pt 2006- 2016 after revisions The Manila clam in the Solent |
| Melanie Crockett | MPhil pt 2010- 2014 Wood borers of Barbados |
| Reuben Shipway | PhD pt 2009-2014 Shipworm life histories |
| Amaia Green Etxabe | PhD pt 2008-2013 Wood digestion by the amphipod <i>Chelura</i> |
| Ian Hendy | PhD pt 2006- 2012 Wood borers affect mangrove diversity. |
| Graham Malyon | PhD pt 2008- 2011 Effects of substrate on <i>Limnoria</i> feeding |
| Sam Stanton | PhD pt 2002-2010 Swimming and feeding of bivalve larvae |
| Mark Somerset | PhD pt 1999-2009 (suspended two years) Triazine and bivalves |
| Luisa Borges | PhD pt 2000-2007 Wood borer biogeography and laboratory testing |
| Chloe Delgery | MPhil pt 2002-2005 Epibiota of <i>Limnoria</i> |
| Jo Dymond | PhD ft 2001-2005 Digestive enzymes of <i>Limnoria</i> |
| Alan Rizzo | PhD pt 1999- 2004 (taken over from S. Moss) Gut flora of fly larvae |
| Elke Reufels | MPhil pt 2001-2004 Plankton of Langstone Harbour |

| | |
|-------------------|--|
| Angelika Praël | PhD ft then pt 1998-2003 Evaluation of marine wood preservatives |
| Claire Tupper | PhD ft 1995-1999 <i>Limnoria</i> digestion |
| Suzanne Henderson | PhD ft 1994-1998 Wood location behaviour of <i>Limnoria</i> |
| Ruth Albuquerque | PhD ft 1993-1998 Effects of pollution from CCA treated timbers |

Plus twelve completed PhD and three MRes second supervisions

Director of studies ongoing

| | |
|------------------|---|
| Richard Nembhard | PhD pt 2013- Wood degradation in Honduras mangroves |
| Elea Giraud | PhD ft 2018- Nudibranch-cnidarian trophic relationships |
| Lucy Martin | MPhil ft 2019- Evaluating novel anti borer treatments |
| Ewan Tregarot | PhD by publication 2020 Mangrove ecosystem valuation |

Plus three PhD second supervisions and one MPhil second supervision

5.2. Postdoctoral supervision

| | |
|---------------------|---|
| Andrew Pitman | 1995-97 <i>Limnoria</i> feeding and digestion |
| Jo Dymond | 2004-07 <i>Limnoria</i> enzyme expression and gut function |
| Simon Streeter | 2009-13 Marine borer enzymes for biotechnology |
| Graham Malyon | 2011-13 Wood chemistry modification and (joint with Dr Tim Hebbes) epigenetics of <i>Limnoria</i> |
| Ian Hendy | 2014-15 Ecological projects including mangrove carbon fluxes |
| Lourdes Cruz Garcia | 2014-15 Borer husbandry and molecular biology |
| Amaia Green Etxabe | 2014-16 Bioinformatics of wood digestion |
| Chenyi Wu | 2014-19 Bioprospecting among borer enzymes |
| Elizabeth Clutton | 2017-19 Borer husbandry and molecular biology |
| Laura Michie | 2018-20 Enzyme prospecting |

6. Research Degree Examination

External examiner for research degrees at:

- Cadiz, 2017 (x2)
- Pondicherry University 2016/17
- Gothenburg University 2015
- Institute of Food Research/ University of East Anglia 2014
- James Cook University 2013
- Kingston 2012
- Southampton 2012
- Oxford University 2010
- University of Surrey 2008
- University of Abertay (x2) 2002, 2008
- Brunel University 2007
- Imperial College (x2) 2002, 2004
- University of the Algarve 1998
- University of Wales, Bangor 1998

and internal examiner fourteen times at Portsmouth and four times under Brunel University regulations (Buckinghamshire College)

7. Research leadership

- **Team leadership:** currently Col and Board Member for the Centre of Enzyme Innovation (£12M over five years, 21 PIs, postdocs and research technicians plus associated PhD students); coordinated the research of staff (McGeehan, Guille, Hebbes, Lloyd) and associated postdocs and postgraduates in marine borer enzyme discovery programme with University of York and NREL, USA (Leverhulme, BBSRC, sLoLa, USA partnering) and the gribble genome project; built up a research team of four academic staff and six research students at Buckinghamshire College (1990-1996); lead a team of ten scientific civil servants at the Forest Products Research Centre in Port Moresby (1984-5).
- **Research collaboration and coordination:**
 - Lead for microSEAP UK/Singapore project involving 30 researchers (2020-23)
 - Member of cross-faculty Electron Microscopy and Microanalysis Unit (2020 onwards)
 - Member of Board for the Centre for Enzyme Innovation, University of Portsmouth (E3, Southern LEP and University of Portsmouth funding >£12M (2019 onwards)
 - Member of Mangrove Specialist Group for International Union for Conservation of Nature (IUCN) (2013 onward)
 - Member of management board for BSBEC (BBSRC Bioenergy Centre) (2009 - 2019)
 - Led collaboration with Centre for Novel Agricultural Products, University of York (2007 2019)
 - co-ordinator for European Union MAST research project involving six partners from five countries (1995-7)
 - chair of Papua New Guinea National Mangrove Committee (1983-1985); member of Asia/ Pacific Task Force on Mangroves (UNESCO/UNDP Regional Project) (1983-1985).
- **Organization of scientific meetings:**
 - coordinator, *Lignocellulose Degradation Mechanisms from Across the Tree of Life* at Linnean Society (2013)
 - coordinator for *Molluscan Life Histories* for Malacological Society (2012)
 - member of planning committee for 33rd meeting of International Research Group on Wood Preservation, Cardiff (2002)
 - director of Workshop on Mangrove Ecosystem Dynamics (UNESCO/UNDP Regional Project RAS/79/002) (1985).

8. Consultancies

I use consultancies as a means of supporting my self-funded research students and also research facilities.

- Potential of heat modified wood for marine use (2011) for Kebony AS (Norway)
- Resistance of Guyana timbers to *Limnoria* (2007-8) with TRADA for Guyana Forestry Commission

- Alternatives for greenheart and ekki in marine construction (2007-8) with TRADA, for Environment Agency
- Aquaculture potential for Langstone Harbour (2006) with Business School, for SEEDA
- Antifouling efficacy of new paint formulations (2005) for Nippon Paints
- Evaluation of treated sycamore for use in the sea (2005-6) for Building Research Establishment
- Evaluation of durable timbers for marine construction (2002-4) for Timber Research and Development Association, UK
- Assessment of the status of Rye Admiralty Jetty (1997) for Environment Agency
- Evaluation of ekki as a timber for maritime construction (1995) for Wijma Hout (Netherlands)
- Establishment and monitoring of test of marine wood preservatives at a number of sites (1993-2000) for CSI Laporte (USA)
- Preparation of teaching material on timber preservation for technicians in southern Africa for Timber Research and Development Association (1991)
- Assessment of forest products education in the Philippines on behalf of Drew Management & Consultancy Services for ASEAN Timber Technology Centre (Oct/Nov 1991)
- Preparation of material for trial of termiticides for Wellcome Foundation (1988)
- Biodeterioration of Madang Wharf: Damage Assessment and Remedial Measures (1984-1985) for Papua New Guinea Harbours Board
- Environmental impact of a log-loading wharf on Umboit Island (1983) for Office of Environment and Conservation (Papua New Guinea)
- Ecology of the Mangrove Ecosystem of Purari Delta (1982) for Office of Environment and Conservation (Papua New Guinea)

9. Past and Current Roles in University of Portsmouth

- Teaching for the following units in which at all levels, but particularly at levels 6 and 7, a research perspective is forefronted, wherever possible based on direct experience:
 - L4 - Biodiversity & Evolution, Laboratory Skills and Marine & Terrestrial Ecosystems;
 - L5 - Animal Science, Marine Organisms & Ecosystems, and Community Ecology & Residential Field Course
 - L6 – Coastal Ecosystems, Applied Marine Biology, Marine Ecophysiology, Aquatic Microbiology
 - L7 – Ecosystem Function and Management
- Course Leader for BSc Marine Biology (50-60 intake per year)
- Unit Leader L6 Unit Coastal Ecosystems
- Mentor for three new members of staff

- Manager of the Electron Microscope Unit in the King Henry Building, which operates as a cross-Faculty and external user facility with a significant outreach and marketing function.
- Member of Peer Review College
- Developer of an Impact Case Study for the REF

10. Professional activities and recognition

- **Public engagement:**
 - schools activities from day sessions at a local primary school to hosting A-level activities (e.g. the Think Smaller programme) at the Electron Microscope Unit
 - Café Scientifique sessions in Portsmouth and Bath
 - media engagement through press releases timed with key publications, radio and TV interviews, web-based news items on key discoveries and their implications.
- **Service on editorial boards:** *Journal of Experimental Marine Biology and Ecology* (2006 – 2017), *J Molluscan Studies* (2007 – present), *Wood Material Science and Engineering* (2006 - present), *J Shellfish Res* (1995 - present), *International Wood Products Journal* (2010-) and *Papua New Guinea Journal of Agriculture, Forestry and Fisheries* (1983-1985).
- **Refereeing for scientific journals** (ten or more manuscripts per year): *Journal of Experimental Marine Biology and Ecology*, *Sarsia*, *Estuarine Coastal and Shelf Science*, *Journal of the Marine Biological Association*, *Marine Biology*, *Advances in Marine Biology*, *Sciencias Mariñas*, *Journal of Shellfish Research*, *Journal of Molluscan Studies*, *Raffles Bulletin*, *Journal of World Mariculture*, *Holzforschung*, *Journal of the Institute of Wood Science*, *Journal of Wood Protection*, *Scottish Forester*, *Enzyme & Microbial Technology*, *Environmental Science and Technology*, *Pest Management Science*, *Talanta*, *Journal of Archaeological Science*.
- **Refereeing for grant awarding organisations:** US National Science Foundation (2013), BBSRC (2010 and 2011), USA Binational Science Foundation (2010), Prime Minister's Initiative (British Council) (2008); Netherlands Organisation for Scientific Research (NWO) (2007); Earthwatch (2007); Malacological Society of London (annually 2007-present), Danish Council for Development Research (2003), Sea Grant (US) (2001).
- **Recognition by learned societies:** Elected Fellow of the Institute of Wood Science (FIWSc) in 1993, Elected Fellow of the Linnean Society (FLS) in 2000.
- **Officer for scientific societies:** Vice President Malacological Society of London (2012 to 2015) and councillor, (1990-1993, 2004-); coordinator for Working Party 1.7 Marine Borers and chairman of Working Group IV-Marine Preservation, International Research Group on Wood Preservation (1983-2010).