

## CHAMBERS C. HUGHES, Ph.D.

Scripps Institution of Oceanography (SIO)  
University of California, San Diego  
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### EDUCATION

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1995–1999	Geneseo College (SUNY)	Geneseo, NY
Earned a B.S. in biochemistry and completed a minor in Latin Graduated <i>summa cum laude</i>		
1999–2004	University of California, Berkeley	Berkeley, CA
Earned a Ph.D. in organic chemistry		

### RESEARCH EXPERIENCE

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1997–1999	Geneseo College (SUNY)	Geneseo, NY
<i>Research assistant</i> (Profs. Robert E. Rosenberg and David K. Johnson)		
1999–2004	UC Berkeley	Berkeley, CA
<i>Graduate student</i> (Profs. Dirk Trauner and David W. C. MacMillan)		
2005–2012	Scripps Institution of Oceanography, UC San Diego	La Jolla, CA
<i>Postdoctoral scholar/Research associate IV</i> (Prof. William Fenical)		
2012–	Scripps Institution of Oceanography, UC San Diego	La Jolla, CA
<i>Assistant Professor of Chemical Biology</i>		

### PRESENTATIONS (SINCE 2012)

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1/2012	National Cancer Institute	Frederick, VA, USA
Talk: "Isolation, structure elucidation, and mode-of-action of marine microbial metabolites"		
2/2012	Scripps Institution of Oceanography	La Jolla, CA, USA
Talk: "The discovery of microbial natural products as therapeutic leads and cellular probes"		
5/2012	Hans Knöll Institute	Jena, Germany
Talk: "The discovery of microbial natural products as therapeutic leads and cellular probes"		
10/2013	Western Regional ACS Meeting	Santa Clara, CA, USA
Talk: Thiol-based probes for discovery of electrophilic natural products from marine bacteria"		
5/2014	SIO Institutional Seminar Series	La Jolla, CA, USA
Talk: "How to find a drug in a sea of cellular debris"		
7/2014	University of Tübingen	Tübingen, Germany
Talk: Thiol-based probes for discovery of electrophilic natural products from marine bacteria"		
8/2014	US-China Summit on Marine Natural Product Sciences	Yantai, China
Talk: Thiol-based probes for discovery of electrophilic natural products from marine bacteria"		

8/2014	IUPAC Conference Talk: "Reactivity-guided isolation of biologically-active natural products"	Busan, Korea
9/2015	2nd European Conference on Natural Products Talk: "Reactivity-guided isolation of biologically-active natural products"	Frankfurt, Germany
6/2016	University of Tübingen Talk: "New directions in the reactivity-guided isolation of natural products"	Tübingen, Germany
5/2017	University of Tübingen Talk: "The discovery of new biologically-active chemical entities from bacteria"	Tübingen, Germany
9/2017	Saarland University Talk: "Labeling natural products in complex extracts"	Saarbrücken, Germany
10/2017	University of Munich Talk: "Labeling natural products in complex extracts"	Munich, Germany
2/2018	Gordon Research Conference Talk: "Labeling natural products in complex extracts"	Ventura, CA, USA
7/2018	ASP 2018 Annual Meeting Poster: "Labeling natural products in complex extracts"	Lexington, KY, USA
8/2018	2nd US-China Summit on Marine Natural Product Sciences Talk: "Labeling natural products in complex extracts"	San Diego, CA, USA
9/2018	3rd European Conference on Natural Products Poster: "Labeling natural products in complex extracts"	Frankfurt, Germany
9/2018	Hans Knöll Institute Talk: "Labeling natural products in complex extracts"	Jena, Germany

## AWARDS AND HONORS

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1999	Honorary Award in Biochemistry
2002	Eli Lilly Predoctoral Fellowship
2003	Roche Biosciences Predoctoral Fellowship
2014	Hellman Foundation Fellowship
2018	Jack L. Beal Award from the <i>Journal of Natural Products</i>

## MENTORED PHD STUDENTS AND POSTDOCTORAL SCHOLARS

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Trevor Purdy	6/2015–present, B.S. in molecular synthesis (UC San Diego), 2015 Ph.D. expected 2020
Grant Seiler	10/2015–present, B.A. in chemistry (Carthage College), 2013 Ph.D. expected 2019
Gabriel Castro-Falcón	7/2014–present, B.S. in chemistry (University of Puerto Rico), 2014 Ph.D. expected 2019

Dr. Daniela Reimer 9/2013–4/2016, Ph.D. in biology (Goethe University Frankfurt), 2013  
Dr. Dongyup Hahn 8/2013–8/2015, Ph.D. in natural science (Seoul National University), 2013

#### MENTORED UNDERGRADUATE STUDENTS

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Michael Nguyen 10/2018–present, B.S. in microbiology (UC San Diego), expected 2020  
Anthony Ornelas 1/2017–present, B.S. in marine biology (UC San Diego), expected 2018  
Yiquan Zhao 1/2017–present, B.S. in chemistry (UC San Diego), expected 2018  
Jeremiah Geronimo 1/2017–8/2017, B.S. in pharmacological chemistry (UC San Diego), 2017  
Austin Perry 6/2016–9/2016, B.S. in microbiology (UC Merced), 2017  
Matia Saeedian 4/2013–12/2015, B.S. in chemistry (UC San Diego), 2015  
Daria Kim 3/2013–5/2014, B.S. in chemistry (UC San Diego), 2014  
Meihui Meng 4/2013–3/2014, B.S. in biology (UC San Diego), 2013

#### MENTORED HIGH SCHOOL STUDENTS

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Christian Tocol 9/2018–present, Lincoln High School, class of 2019

#### MEMBER OF PHD THESIS COMMITTEE

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Jamie Zhang Moore Research Group, Ph.D. expected 2018  
Amanda Carter Smith Research Group, Ph.D. expected 2018  
Nick Tuttle Jensen Research Group, Ph.D. 2018  
Chen Zhang Gerwick Research Group, Ph.D., 2017  
Bailey Miller Gerwick Research Group, Ph.D., 2016  
Taylor Richter Moore Research Group, Ph.D., 2014

#### VISITING PHD STUDENTS

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Maria Roda-Seratt 9/2016–12/2016, University of Southern Denmark  
Florence Schempp 5/2015–7/2015, Goethe University Frankfurt

#### RESEARCH PUBLICATIONS (INDEPENDENT)

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(39) Purdy, T. N., Seiler, G. S., Kim, D., and Hughes, C. C. Formal chemoenzymatic synthesis of (–)-chlorizidine A and evaluation of its enolase inhibitory activity. *manuscript in preparation.*

- (38) Moss, N. A., Seiler, G. S., Leão, T., Castro-Falcon, G., Gerwick, L., Hughes, C. C.,\* and Gerwick, W. H.\* A coumarin-based click probe illuminates prokaryotic multichannel PKS/NRPS biosynthesis in the discovery of vatiamides A-F. *manuscript in preparation*.
- (37) Castro-Falcon, G., and Hughes, C. C. Fluorogenic nitrosocoumarin probe for derivatization and low-level quantification of polyketide natural products. *submitted*.
- (36) Castro-Falcon, G., Molinski, T. F., and Hughes, C. C. Tetrazine probe for the discovery and structure elucidation of isocyanide-containing natural products. *submitted*.
- (35) Castro-Falcon, G., Alanjary, M., Ziemert, N.,\* and Hughes, C. C.\* Discovery of specific polyketide natural products using reactogenomics. *submitted*.
- (34) Mascuch, S. J.,† Castro-Falcon, G.,† Glukhov, E., Gerwick, W. H., Gerwick, L.,\* and Hughes, C. C.\* Discovery of naturally-occurring electrophilic Nrf2-Keap1p pathway activators using a cysteine-based probe. *submitted*.
- (33) Roda-Serrat, M. C., Purdy, T. N., Castro-Falcon, G., Christensen, L. P., and Hughes, C. C. Structure elucidation and thiol reactivity of phycocyanobilin and related compounds formed from ethanolysis of a food colorant. *submitted*
- (32) Seiler, G. S., and Hughes, C. C. Progress toward the total synthesis of the lymphostins: Preparation of a functionalized tetrahydropyrrolo[4,3,2-*de*]quinoline and unusual oxidative dimerization. *submitted*.
- (31) Castro-Falcon, G.,† Seiler, G. S.,† Demir, O., Rathinaswamy, M. K., Hamelin, D., Hoffmann, R. M., Makowski, S. L., Letzel, A.-C., Field, S. J., Burke, J. E., Amaro, R. E., and Hughes, C. C. Neolymphostin A is a covalent phosphoinositide-3-kinase (PI3K)/mammalian target of rapamycin (mTOR) dual inhibitor that employs an unusual electrophilic vinylogous ester (2018). *J. Med. Chem.* published online.
- (30) Castro-Falcon, G., Millán-Aguiñaga, N., Roullier, C., Jensen, P. R., and Hughes, C. C. (2018) Nitrosopyridine probe to detect polyketide natural products with conjugated alkenes: Discovery of novodaryamide and nocarditriene. *ACS Chem. Biol.* *13*, 3097-3106.
- (29) Patin, N. V., Floros, D. J., Hughes, C. C., Dorrestein, P. C., and Jensen, P. R. (2018) The role of inter-species interactions in *Salinispora* specialized metabolism. *Microbiology* *164*, 946–955.
- (28) Mafu, S., Ding, Y., Murphy, K. M., Yaacoobi, O., Addison, J. B., Wang, Q., Shen, Z., Briggs, S. P., Bohlmann, J., Castro-Falcon, G., Hughes, C. C., Betsiashvili, M., Huffaker, A., Schmelz, E. A., and Zerbe, P. (2018) Discovery, biosynthesis and stress-related accumulation of dolabradiene-derived defenses in maize. *Plant Physiol.* *176*, 2677–2690.
- (27) Gallagher, K. A., Wanger, G., Henderson, J., Llorente, M., Hughes, C. C., and Jensen, P. R. (2017) Ecological implications of hypoxia-triggered shifts in secondary metabolism. *Environ. Microbiol.* *19*, 2182–2191.
- (26) Reimer, D., and Hughes, C. C. (2017) Thiol-based probe for electrophilic natural products reveals that most of the ammosamides are artifacts. *J. Nat. Prod.* *80*, 126–133.
- (25) Castro-Falcon, G., Hahn, D., Reimer, D., and Hughes, C. C. (2016) Thiol probes to detect electrophilic natural products based on their mechanism of action. *ACS Chem. Biol.* *11*, 2328–2336.
- (24) Richter, T. K. S., Hughes, C. C., and Moore, B. S. (2015) Sioxanthin, a novel glycosylated carotenoid, reveals an unusual subclustered biosynthetic pathway. *Environ. Microbiol.* *17*, 2158–2171.

- (23) Alvarez-Mico, X., Jensen, P. R., Fenical, W., and Hughes, C. C. (2013) Chlorizidine, a cytotoxic 5H-pyrrolo[2,1-a]isoindol-5-one-containing alkaloid from a marine *Streptomyces* sp. *Org. Lett.* *15*, 988–991.
- (22) Yamanaka, K., Ryan, K. S., Gulder, T. A. M., Hughes, C. C., and Moore, B. S. (2012) Flavoenzyme-catalyzed atropo-selective N,C-bipyrrole homocoupling in marinopyrrole biosynthesis. *J. Am. Chem. Soc.* *134*, 12434–12437.

#### SELECTED RESEARCH PUBLICATIONS (DOCTORATE AND POSTDOCTORATE)

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- (21) Yang, M., Liu, Z., Hughes, C. C., Stern, A. M., Wang, H., Zhong, Z., Kan, B., Fenical, W., and Zhu, J. (2013) Bile salt-induced intermolecular disulfide bond formation activates *Vibrio cholerae* virulence. *Proc. Natl. Acad. Sci.* *110*, 2348–2353.
- (20) Haste, N. M., Hughes, C. C., Tran, D. N., Fenical, W., Jensen, P. R., Nizet, V., and Hensler, M. E. (2011) Pharmacological properties of the marine natural product marinopyrrole A against methicillin-resistant *Staphylococcus aureus*. *Antimicrob. Agents Chemother.* *55*, 3305–3312.
- (19) Hughes, C. C., and Fenical, W. (2010) Antibacterials from the sea. *Chem. - A Eur. J.* *16*, 12512–12525.
- (18) Pangerl, M., Hughes, C. C., and Trauner, D. (2010) Total synthesis of newbouldine via reductive N–N bond formation. *Tetrahedron* *66*, 6626–6631.
- (17) Hughes, C. C., and Fenical, W. (2010) Total synthesis of the ammosamides. *J. Am. Chem. Soc.* *132*, 2528–2529.
- (16) Hughes, C. C., Kauffman, C. A., Jensen, P. R., and Fenical, W. (2010) Structures, reactivities, and antibiotic properties of the marinopyrroles A–F. *J. Org. Chem.* *75*, 3240–3250.
- (15) Hughes, C. C., Yang, Y. L., Liu, W. T., Dorrestein, P. C., La Clair, J. J., and Fenical, W. (2009) Marinopyrrole A target elucidation by acyl dye transfer. *J. Am. Chem. Soc.* *131*, 12094–12096.
- (14) Hughes, C. C., MacMillan, J. B., Gaudêncio, S. P., Jensen, P. R., and Fenical, W. (2009) The ammosamides: structures of cell cycle modulators from a marine-derived *Streptomyces* species. *Angew. Chemie - Int. Ed.* *48*, 725–727.
- (13) Nett, M., Gulder, T. A. M., Kale, A. J., Hughes, C. C., and Moore, B. S. (2009) Function-oriented biosynthesis of  $\beta$ -lactone proteasome inhibitors in *Salinispora tropica*. *J. Med. Chem.* *52*, 6163–6167.
- (12) Hughes, C. C., MacMillan, J. B., Gaudêncio, S. P., Fenical, W., and La Clair, J. J. (2009) Ammosamides A and B target myosin. *Angew. Chemie - Int. Ed.* *48*, 728–732.
- (11) Hughes, C. C., Prieto-Davo, A., Jensen, P. R., and Fenical, W. (2008) The marinopyrroles, antibiotics of an unprecedented structure class from a marine *Streptomyces* sp. *Org. Lett.* *10*, 629–631.
- (10) Miller, A. K., Hughes, C. C., Kennedy-Smith, J. J., Gradl, S. N., and Trauner, D. (2006) Total synthesis of (–)-heptemerone B and (–)-guanacastepene E. *J. Am. Chem. Soc.* *128*, 17057–17062.
- (9) Endicott, C. A., Strauss, H. L., Hughes, C. C., and Trauner, D. (2005) Infrared hole burning and conformational change in a borane-ammonia complex. *J. Phys. Chem. A* *109*, 7714–7717.
- (8) Bowie, A. L., Hughes, C. C., and Trauner, D. (2005) Concise synthesis of ( $\pm$ )-rhazinilam through direct coupling. *Org. Lett.* *7*, 5207–5209.

- (7) Hughes, C. C., Miller, A. K., and Trauner, D. (2005) An electrochemical approach to the guanacastepenes. *Org. Lett.* 7, 3425–8.
- (6) Hughes, C. C., and Trauner, D. (2004) Palladium-catalyzed couplings to nucleophilic heteroarenes: The total synthesis of (–)-frondosin B. *Tetrahedron* 60, 9675–9686.
- (5) Hughes, C. C., Kennedy-Smith, J. J., and Trauner, D. (2003) Synthetic studies toward the guanacastepenes. *Org. Lett.* 5, 4113–4115.
- (4) Johnson, D. K.; Schillinger, K. J.; Kwait, D. M.; Hughes, C. C.; McNamara, E. J.; Ishmael, F.; O'Donnell, R. W.; Chang, M.-M.; Hogg, M. G.; Dordick, J. S.; Santhanam, L.; Ziegler, L. M.; Holland, J. A. (2002) Inhibition of NADPH oxidase activation in endothelial cells by ortho-methoxy-substituted catechols. *Endothelium* 9, 191–203.
- (3) Hughes, C. C., Scharn, D., Mulzer, J., and Trauner, D. (2002) Borane-ammonia complexes stabilized by hydrogen bonding. *Org. Lett.* 4, 4109–11.
- (2) Hughes, C. C., and Trauner, D. (2002) Concise total synthesis of (–)-frondosin B using a novel palladium-catalyzed cyclization. *Angew. Chemie - Int. Ed.* 41, 1569–1572.
- (1) Hughes, C. C., and Trauner, D. (2002) The total synthesis of (–)-amathaspiramide F. *Angew. Chemie - Int. Ed.* 41, 4556–4559.

## PATENTS

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- (1) Fenical, W., Jensen, P. R., MacMillan, J. B., Hughes, C. C., and La Clair, J. J. (2008) Ammosamides as anticancer agents.

## COURSES

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### SIO296 Small molecule structure elucidation

4 teaching units

Structure elucidation of complex natural products requires the mastery of several key instruments. Part I of this course deals with the processes of extraction and chromatographic purification of small molecules from marine organisms. Part II, the majority of the course, covers UV/vis spectroscopy, infrared spectroscopy, mass spectrometry, NMR spectroscopy, X-ray crystallography, and optical rotation with particular emphasis on their application.

### SIO296 Anticancer natural products

4 teaching units

Cytotoxic natural products function by targeting a variety of cellular targets. This course covers the interactions between small molecules and protein/DNA in the context of anticancer chemotherapy.

### SIO192 Antibiotics in the modern age

1 teaching unit

The discovery of antibiotics is one of the most significant scientific achievements in the modern era. This course covers the origin, chemical structure, mechanism of action, and current use/misuse of these molecules for the treatment of bacterial infections.

### SIO262 Chemical biology graduate research presentations and

### SIO291 Marine biology graduate research presentations

1 teaching unit

These classes are a venue for graduate student research talks that are carefully evaluated and critiqued by peers and instructors.