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学歴・職歴

2006年3月	東京大学農学部卒業
2008年3月	東京大学大学院農学生命科学研究科応用生命工学専攻修士課程修了
2008年4月	日本学術振興会特別研究員 DC1
2011年3月	東京大学大学院農学生命科学研究科応用生命工学専攻博士課程修了 指導教官：堀之内末治教授、大西康夫教授
2011年4月	東京大学大学院薬学系研究科・助教
2014年4月	University of California at San Diego, Scripps Institute of Oceanography Prof. Bradley Moore・研修出向
2016年4月	東京大学大学院薬学系研究科・助教（復職）
2018年1月	東京大学大学院薬学系研究科・講師
2019年7月	東京大学大学院薬学系研究科・准教授
2020年11月	令和2年度 東京大学卓越研究員
2022年10月	理化学研究所 環境資源科学研究センター・チームリーダー（主任研究員）（現職）
2024年10月	JST 創発的研究支援事業（有田パネル）研究者（兼任）

受賞歴

2013年6月	日本薬学会 生薬天然物部会奨励賞
2013年9月	日本生薬学会 学術奨励賞
2019年9月	日本放線菌学会 浜田賞（研究奨励賞）
2020年3月	日本薬学会 奨励賞
2020年3月	Kenji Mori Medal, Isoprenoid Society
2020年8月	酵素工学研究会 酵素工学奨励賞
2021年4月	科学技術分野の文部科学大臣表彰 若手科学者賞
2023年4月	長瀬科学技術賞
2024年9月	日本生薬学会 学術貢献賞

学術論文リスト（～2021年まで）

1. Barra, L.,[†] **Awakawa, T.**,^{†,*} Shirai, K., Hu, Z., Bashiri, G., Abe, I.* “β-NAD as a building block in natural product biosynthesis.” *Nature* 600, 754-758 (2021)
†co-first author, *co-corresponding author
2. Li, X.,[†] **Awakawa, T.**,^{†,*} Mori, T., Ling, M., Hu, D., Wu, B., Abe, I.* “Heterodimeric non-heme iron enzymes in fungal meroterpenoid biosynthesis.” *J. Am. Chem. Soc.* 143, 21425-21432 (2021)
†co-first author, *co-corresponding author
3. Bunno, T.,[†] **Awakawa, T.**,^{†,*} Mori, T., Abe, I.* “Aziridine formation by a Fe(II)/α-ketoglutarate dependent oxygenase and 2-aminoisobutyrate biosynthesis in fungi.” *Angew. Chem. Int. Ed.* 60, 15827-15831 (2021)
†co-first author, *co-corresponding author
4. Mori, T.,[†] Kumano, T.,[†] He, H.,[†] Watanabe, S., Senda, M., Moriya, T., Adachi, N., Hori, S., Terashita, Y., Kawasaki, M., Hashimoto, Y., **Awakawa, T.**, Senda, T., Abe, I., Kobayashi, M. “C-Glycoside metabolism in the gut and in nature: Identification, characterization, structural analyses and distribution of C-C bond-cleaving enzymes.” *Nature Commun.* 12, Article number: 6294 (2021)
5. Song, X.-J., Lv, J.-M., Cao, Z.-Q., Huang, H.-Y., Chen, G.-D., **Awakawa, T.**, Hu, D., Gao, H., Abe, I., Yao, X.-S. “Extensive expanding the chemical diversity of fusidane-type antibiotics using a stochastic combinational strategy.” *Acta Pharm. Sinica B*, 11, 1676-1685 (2021)
6. Jiang, J., Li, X., Mori, T., **Awakawa, T.**,* Abe, I.* “Novel cyclohexyl meroterpenes produced by combinatorial biosynthesis.” *Chem. Pharm. Bull.* 69, 444-446 (2021)
***co-corresponding author**
7. Kudo, Y., **Awakawa, T.**, Du, Y.-L., Jordan, P. A., Creamer, K. E., Jensen, P. R., Lington, R. G., Ryan, K. S., Moore, B. S. “Expansion of gamma-butyrolactone signaling molecule biosynthesis to phosphotriester natural products.” *ACS Chem. Biol.* 15, 3253–3261 (2020)
8. Lv, J.-M., Gao, Y.-H., Zhao, H., **Awakawa, T.**, Liu, L., Chen, G.-D., Yao, X.-S., Hu, D., Abe, I., Gao, H. “Biosynthesis of biscognienyne B involving an unprecedented cytochrome P450-dependent alkynylation.” *Angew. Chem. Int. Ed.* 59, 13531-13536 (2020)
9. Hu, Z.,[†] **Awakawa, T.**,^{†,*} Ma, Z., Abe, I.* “Aminoacyl sulfonamide assembly in SB-203208 biosynthesis.” *Nature Commun.* 10, Article number: 184 (2019)
†co-first author, *co-corresponding author
10. Araki, Y.,[†] **Awakawa, T.**,[†] Matsuzaki, M.,[†] Cho, R., Matsuda, Y., Hoshino, S., Shinohara, Y., Yamamoto, M., Kido, Y., Inaoka, D. K., Nagamune, K., Ito, K., Abe, I., Kita, K. “Complete biosynthetic pathways of ascofuranone and ascochlorin in *Acremonium egyptiacum*: branched pathways encoded at two separate loci.”

Proc. Natl. Acad. Sci. USA 116, 8269-8274 (2019)

†co-first author

11. He, F., Mori, T., Morita, I., Nakamura, H., Alblova, M., Hoshino, S., **Awakawa, T.**, Abe, I. "Molecular basis for the P450-catalyzed C–N bond formation in indolactam biosynthesis." **Nature Chem. Biol.** 15, 1206-1213 (2019)
12. Quan, Z.,† **Awakawa, T.**,†,* Wang, D.,† Hu, Y., Abe, I.* "A multidomain P450 epoxidase and a terpene cyclase from ascochlorin biosynthetic pathway in *Fusarium sp.*" **Org. Lett.** 21, 2330-2334 (2019)
†co-first author, *co-corresponding author
13. Hoshino, S., Mitsuhashi, T., Kikuchi, T., Wong, C. P., Morita, H., **Awakawa, T.**, Fujita, M., Abe, I. "Structural elucidation of tenebrathin: cytotoxic C5-substituted γ -pyrone with nitroaryl side chain from *Streptoalloteichus tenebrarius*" **Org. Lett.** 21, 6519-6522 (2019)
14. Hoshino, S., **Awakawa, T.**,* Zhang, H., Hayashi, F., Abe, I.* "Beijinchromes A-D, novel aromatic compounds isolated from *Nocardia beijingensis* NBRC 16342" **Chem. Pharm. Bull.** 67, 775-777 (2019)
*co-corresponding author
15. Sato K, Katsuyama Y, Yokota K, **Awakawa, T.**, Tezuka, T., Ohnishi, Y. "Involvement of β -alkylation machinery and two sets of ketosynthase-chain length factors in the biosynthesis of fogacin polyketides in *Actinoplanes missouriensis*." **ChemBioChem** 20, 1106-1114 (2019)
16. Cao, Z.-Q., Li, S.-Y., Lv, J.-M., Gao, H., Chen, G.-D., **Awakawa, T.**, Abe, I., Yao, X.-S., Hu, D. "Biosynthesis of clinically used antibiotic fusidic acid and identification of two short-chain dehydrogenase/reductases with converse stereoselectivity." **Acta Pharm. Sinica B**, 9, 433-442 (2019)
17. **Awakawa, T.**,* Fujioka, T., Zhang, L., Hoshino, S., Hu, Z., Hashimoto, J., Kozono, I., Ikeda, H., Shin-ya, K.,* Liu, W., Abe, I.* "Reprogramming of the antimycin NRPS-PKS assembly lines inspired by gene evolution." **Nature Commun.** 9, Article number: 3534 (2018)
*co-corresponding author
18. **Awakawa, T.**,* Mori, T., Nakashima, Y., Zhai, R., Wong, C. P., Hillwig, M. L., Liu, X.,* Abe, I.* "Molecular basis for Mg^{2+} -dependent allosteric control of indole prenylation by aromatic prenyltransferase AmbP1." **Angew. Chem. Int. Ed.** 57, 6810-6813 (2018)
*co-corresponding author
19. McKinnie, S. M. K., Miles, Z. D., Jordan, P. A., **Awakawa, T.**, Pepper, H. P., Murray, L. A. M., George, J. H., Moore, B. S. "Total enzyme syntheses of napyradiomycins A1 and B1." **J. Am. Chem. Soc.** 140, 17840-17845 (2018)
20. Wang, G.-Q., Chen, G.-D., Qin, S.-Y., Hu, D., **Awakawa, T.**, Li, S.-Y., Lv, J.-M., Wang, C.-X., Yao, X.-S., Abe, I., Gao, H. "Biosynthetic pathway for furanosteroid

demethoxyviridin and identification of an unusual pregnane side-chain cleavage.” *Nature Commun.* 9, Article number: 1838 (2018)

21. Wong, C. P.,[†] **Awakawa, T.**,[†] * Nakashima, Y., Mori, T., Zhu, Q., Liu, X., * Abe, I.* “Two distinct substrate binding modes for the normal and reverse prenylations of hapalindoles by the prenyltransferase AmbP3.” *Angew. Chem. Int. Ed.* 57, 560-563 (2018)
†co-first author, *co-corresponding author
22. Nakashima, Y., Mori, T., Nakamura, H., **Awakawa, T.**, Hoshino, S., Senda, M., Senda, T., Abe, I. “Structure function and engineering of multifunctional non-heme iron dependent oxygenases in fungal meroterpenoid biosynthesis.” *Nature Commun.* 9, Article number: 104 (2018)
23. Bai, T., Quan, Z., Zhai, R., **Awakawa, T.**, Matsuda, Y., Abe, I. “Elucidation and heterologous reconstitution of chrodriamanin B biosynthesis.” *Org. Lett.* 20, 7504-7508 (2018)
24. Mitsuhashi, T., Kikuchi, T., Hoshino, S., Ozeki, M., **Awakawa, T.**, Shi, S.-P., Fujita, M., Abe, I. “The crystalline sponge method enabled the investigation of a prenyltransferase-terpene synthase chimeric enzyme, whose product exhibits broadened NMR signals.” *Org. Lett.* 20, 5606-5609 (2018)
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26. Hoshino, S., Wong, C. P., Ozeki, M., Zhang, H., Hayashi, F., **Awakawa, T.**, Asamizu, S., Onaka, H., Abe, I. “Umezawamides, new bioactive polycyclic tetramate macrolactams isolated from a combined-culture of *Umezawaea* sp. and mycolic acid-containing bacterium.” *J. Antibiot.* 71, 653-657 (2018)
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28. Amos, G. C., **Awakawa, T.**, Letzel, A., Kim, M. C., Kudo, Y., Tuttle, R. N., Fenical, W., Moore, B. S., Jensen, P. R. “Comparative transcriptomics as a guide to natural product discovery and biosynthetic gene cluster functionality.” *Proc. Natl. Acad. Sci. USA* 114, E11121-E11130 (2017)
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32. Okada, M., Saito, K., Wong, C. P., Li, C., Wang, D., Iijima, M., Taura, F., Kurosaki, F., **Awakawa, T.**, Abe, I. “Combinatorial biosynthesis of (+)-daurichromenic acid and its halogenated analogue.” **Org. Lett.** 19, 3183-3186 (2017)
33. Zhang, L., Hashimoto, T., Qin, B., Hashimoto, J., Kozono, I., Kawahara, T., Okada, M., **Awakawa, T.**, Ito, T., Asakawa, Y., Ueki, M., Takahashi, S., Osada, H., Wakimoto, T., Ikeda, H., Shin-ya, K., Abe, I., “Characterization of giant modular PKSs provides insight into genetic mechanism for structural diversification of aminopolyol polyketides.” **Angew. Chem. Int. Ed.** 56, 1740-1745 (2017)
34. Taguchi T.,[†] **Awakawa T.**,[†] Nishihara Y., Kawamura M., Ohnishi Y., Ichinose K. “Bifunctionality of ActIV as a cyclase-thioesterase revealed by *in vitro* reconstitution of actinorhodin biosynthesis in *Streptomyces coelicolor* A3(2).” **ChemBioChem** 18, 316-323 (2017) [†]co-first author
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37. Zhang, L., Hoshino, S., **Awakawa, T.**, Wakimoto T., Abe, I. “Structural diversification of lyngbyatoxin A by host-dependent heterologous expression of the tleABC biosynthetic gene cluster.” **ChemBioChem** 17, 1407-1411 (2016)
38. Mori, T., Zhang, L., **Awakawa, T.**, Hoshino, S., Okada, M., Morita, H., Abe, I. “Manipulation of prenylation reactions by structure-based engineering of bacterial indolactam prenyltransferases.” **Nature Commun.** 7, Article number: 10849 (2016)
39. Zhang, L., Mori, T., Zheng, Q., **Awakawa, T.**, Yan, Y., Liu, W., Abe, I. “Rational control of polyketide extender units by structure-based engineering of a crotonyl-CoA carboxylase/reductase in antimycin biosynthesis.” **Angew. Chem. Int. Ed.** 54, 13462-13465 (2015)
40. Agarwal, V., Diethelm, S., Ray, L., Garg, N., **Awakawa, T.**, Dorrestein, P. C., Moore, B. S. “Chemoenzymatic synthesis of acyl coenzyme A substrates enables *in situ* labeling of small molecules and proteins.” **Org. Lett.** 17, 4452-4455 (2015)

41. Hoshino, S., Zhang, L., **Awakawa, T.**, Wakimoto, T., Onaka, H., Abe, I. "Arcyriaflavin E, a new cytotoxic indolocarbazole alkaloid isolated by combined-culture of mycolic acid-containing bacteria and *Streptomyces cinnamoneus* NBRC 13823." **J. Antibiot.** 68, 342-344 (2015)
42. **Awakawa T.**, Crusemann M., Munguia J., Ziemert N., Nizet V., Fenical W., Moore B.S. "Salinipyrone and pacificanone are biosynthetic byproducts of the rosamicin polyketide synthase." **ChemBioChem** 16, 1443-1447 (2015)
43. Matsuda Y., Iwabuchi T., Wakimoto T., **Awakawa T.**, Abe I. "Uncovering the unusual D-ring construction in terretonin biosynthesis by collaboration of a multifunctional cytochrome P450 and a unique isomerase." **J. Am. Chem. Soc.** 137, 3393-3401 (2015)
44. Racovita, R. C., Peng, C., **Awakawa, T.**, Abe, I., Jetter, R. "Very-long-chain 3-hydroxy fatty acids, 3-hydroxy fatty acid methyl esters and 2-alkanols from cuticular waxes of *Aloe arborescens* leaves." **Phytochemistry** 113, 183-194 (2015)
45. **Awakawa, T.**, Zhang, L., Wakimoto, T., Hoshino, S., Mori, T., Ito, T., Ishikawa, J., Tanner, M.E., Abe, I. "A methyltransferase initiates terpene cyclization in teleocidin B biosynthesis." **J. Am. Chem. Soc.** 136, 9910-9913 (2014)
46. Yang, X. L., **Awakawa, T.**, Wakimoto, T., Abe, I. "Three acyltetronic acid derivatives: Noncanonical cryptic polyketides from *Aspergillus niger* identified by genome mining." **ChemBioChem** 15, 1578-1583 (2014)
47. Wakimoto, T., Egami, Y., Nakashima, Y., Wakimoto, Y., Mori, T., **Awakawa, T.**, Ito, T., Kenmoku, H., Asakawa, Y., Piel, J., Abe, I. "Calyculin biogenesis from a pyrophosphate protoxin produced by a sponge symbiont." **Nature Chem. Biol.** 10, 648-655 (2014)
48. **Awakawa, T.**, Yang, X. L., Wakimoto, T., Abe, I. "Pyranonigrin E: A PKS-NRPS hybrid metabolite from *Aspergillus niger* identified by genome mining." **ChemBioChem** 14, 2095-2099 (2013)
49. **Awakawa, T.**, Sugai, Y., Otsutomo, K., Ren, S., Masuda, S., Katsuyama, Y., Horinouchi, S., Ohnishi, Y. "4-Hydroxy-3-methyl-6-(1-methyl-2-oxoalkyl)pyran-2-one synthesis by a type III polyketide synthase from *Rhodospirillum centenum*." **ChemBioChem** 14, 1006-1013 (2013)
50. Matsuda, Y., Wakimoto, T., Mori, T., **Awakawa, T.**, Abe, I. "Complete biosynthetic pathway of anditomin: nature's sophisticated synthetic route to a complex fungal meroterpenoid." **J. Am. Chem. Soc.** 136, 15326-15336 (2014)
51. Matsuda, Y., **Awakawa, T.**, Abe, I. "Reconstituted biosynthesis of fungal meroterpenoid andrastin A." **Tetrahedron** 69, 8199-8204 (2013)
52. Matsuda, Y., **Awakawa, T.**, Wakimoto, T., Abe, I. "Spiro-ring formation is catalyzed by a multifunctional dioxygenase in austinol biosynthesis." **J. Am. Chem. Soc.** 135, 10962-10965. (2013)

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57. Yan, Y., Chen, J., Zhang, L., Zheng, Q., Han, Y., Zhang, H., Zhang, D., **Awakawa, T.**, Abe, I., Liu, W. "Multiplexing of combinatorial chemistry in antimycin biosynthesis: Expansion of molecular diversity and utility." **Angew. Chem. Int. Ed.** 52, 12308-12312 (2013)
58. Yang, X. L., Wakimoto, T., Takeshige, Y., He, R., Egami, Y., **Awakawa, T.**, Abe, I. "Indole-porphyrin hybrids produced by metagenomics." **Bioorg. Med. Chem. Lett.** 23, 3810-3813 (2013)
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62. Matsuda, Y., **Awakawa, T.**, Itoh, T., Wakimoto, T., Kushiro, T., Fujii, I., Ebizuka, Y., Abe, I. "Terretonin Biosynthesis Requires Methylation as Essential Step for Cyclization." **ChemBioChem** 13, 1738-1741 (2012)
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66. Funa, N., **Awakawa, T.**, Horinouchi, S. “Pentaketide resorcylic acid synthesis by type III polyketide synthase from *Neurospora crassa*.” *J. Biol. Chem.* 282, 14476-14481 (2007)

著書・総説

1. **Awakawa, T.**,* Mori, T., Ushimaru, R., Abe, I.* “Structure-based engineering of α -ketoglutarate dependent oxygenases in fungal meroterpenoid biosynthesis.” *Nat. Prod. Rep.*, 39, in press (2022)
*co-corresponding author
2. Barra, L., **Awakawa, T.**, Abe, I.* “Noncanonical functions of enzyme cofactors as building blocks in natural product biosynthesis.” *JACS Au*, 2, 1950-1963 (2022)
3. Zhang, L., **Awakawa, T.**, Abe, I. “Understanding and manipulating assembly line biosynthesis by heterologous expression in *Streptomyces*.” *Methods Mol. Biol.* In press (2022)
4. **Awakawa, T.** “Engineered biosynthesis of microbial medicinally active compounds”, *YAKUGAKU ZASSHI* 142, 347-353 (2022)
5. **Awakawa, T.**,* Abe, I.* “Reconstituted biosynthesis of fungal natural products in *Aspergillus oryzae*.” *J. Fungi* 7, Article number: 486 (2021)
*co-corresponding author
6. **Awakawa, T.**,* Barra, L., Abe, I.* “Biosynthesis of sulfonamide and sulfamate antibiotics in *Actinomyces*.” *J. Ind. Microbiol. Biotechnol.* 48, Article number: kuab001 (2021)
*co-corresponding author
7. **Awakawa, T.*** “Engineered biosynthesis of pharmaceutically important compounds.” *Chem. Pharm. Bull.* 69, 415-420 (2021)
8. **Awakawa, T.*** “The enzymatic reactions in teleocidin B biosynthesis.” *J. Nat. Med.* 75, 467-474 (2021)
9. **Awakawa, T.**,* Liu, X.* “Biosynthesis of hapalindole type alkaloids.” *Comprehensive Natural Products III: Chemistry and Biology*, Vol. 1, Elsevier, Chapter 18, pp. 486-499 (2020) *co-corresponding author

10. **Awakawa, T.**,* Abe, I.* “The molecular basis for the plasticity of the aromatic prenyltransferases in hapalindole biosynthesis” *Beilstein J. Org. Chem.* 15, 1545-1551 (2019) *co-corresponding author_
11. **Awakawa, T.** “Exploitation and application of unique actinomycetological alkaloid biosynthetic enzymes”, *Actinomycetologica* 33, S3-S8 (2019)
12. **Awakawa, T.**, Abe, I. “Biosynthesis of the teleocidin-type terpenoid indole alkaloids.” *Org. Biomol. Chem.* 16, 4737–4916 (2018)
13. Matsuda, Y., **Awakawa, T.**, Mori, T., Abe, I. “Unusual chemistries in fungal meroterpenoid biosynthesis.” *Curr. Opin. Chem. Biol.* 31, 1-7 (2016)
14. **淡川孝義**, 阿部郁朗 “補酵素 NAD と SAM を縮合する新奇生合成機構の発見” *バイオサイエンスとインダストリー*, 80, in press (2022)
15. **淡川孝義** “TBA” *ファルマシア*, manuscript in preparation (2022)
16. 荒木康子, **淡川孝義**, 松崎素道, 阿部郁朗 “アスコフラノンの選択的大量生産系の構築～アフリカ睡眠病の根絶を目指して～” *バイオサイエンスとインダストリー*, 71, p. 466-468 (2019)
17. **淡川孝義**, “テルペンインドールアルカロイドテレオシジンの生合成反応” *有機合成化学協会誌*, 76, p. 410-413 (2018)
18. **淡川孝義**, 阿部郁朗 “微生物由来テルペンインドールアルカロイド-テレオシジン生合成” *アルカロイドの化学*, 化学同人, 第7章, pp. 134-148 (2017)
19. **淡川孝義**, “テルペンインドールアルカロイドテレオシジンの生合成反応” *生物工学会誌*, 92, p. 420-423 (2014)