

Teaching Plan of Topic Modules

0403505: Natural Products Chemistry

Credits 3 (3-0-6)

Teaching Staffs:

1. Professor Dr. Her Royal Highness Princess Chulabhorn Mahidol, *CRI and CGI*
2. Dr. Prasat Kittakooop, *Coordinator, CGI*
3. Dr. Vilailak Prachyawarakorn, *CRI and CGI*
4. Dr. Tawatchai Thongkongkaew, *CGI*

Course Description:

Applications of natural products. Procedures in natural product research including extraction, isolation, and characterization of natural products. Biosynthesis of natural products including methods for biosynthetic studies, enzymes involving in biosynthesis, and recent advanced research in biosynthesis. Classes and biosynthesis of natural products. Research in modern natural products chemistry.

January 7, 2021 – May 6, 2021 (45Hours)

Thursday 13:00-16:00

Date	Hour	Topic	Lecturer	Remark
January 7, 2021	1	Natural products from various sources and their applications for drug development, agrochemicals and cosmetics	Professor Dr. Her Royal Highness Princess Chulabhorn Mahidol	
	2	Natural products from various sources and their applications for drug development, agrochemicals and cosmetics	Professor Dr. Her Royal Highness Princess Chulabhorn Mahidol	
	3	Natural products from various sources and their applications for drug development, agrochemicals and cosmetics	Professor Dr. Her Royal Highness Princess Chulabhorn Mahidol	
January 14, 2021	4	Bioactivity screening of natural products	Dr. Prasat Kittakoop	
	5	Isolation techniques of natural products	Dr. Prasat Kittakoop	
	6	Structural elucidation of natural products	Dr. Prasat Kittakoop	
January 21, 2021	7	Structural elucidation of natural products	Dr. Prasat Kittakoop	
	8	Structural elucidation of natural products	Dr. Prasat Kittakoop	
	9	Structural elucidation of natural products	Dr. Prasat Kittakoop	
January 28, 2021	10	Structural elucidation of natural products	Dr. Prasat Kittakoop	
	11	Determination of absolute configuration of natural products	Dr. Prasat Kittakoop	
	12	Determination of absolute configuration of natural products	Dr. Prasat Kittakoop	
February 4, 2021	13	Determination of absolute configuration of natural products	Dr. Prasat Kittakoop	
	14	^{14}C Radioactive-labeled and ^{13}C NMR techniques in biosynthetic study	Dr. Prasat Kittakoop	
	15	^{14}C Radioactive-labeled and ^{13}C NMR techniques in biosynthetic study	Dr. Prasat Kittakoop	
February 11, 2021	16	Enzymes in biosynthesis of natural products: Introduction and polyketide synthase (types I, II, and III), chalcone synthase, and other enzymes	Dr. Prasat Kittakoop	
	17	Enzymes in biosynthesis of natural products: polyketide synthase (types I, II, and III), chalcone synthase, and other enzymes	Dr. Prasat Kittakoop	

Date	Hour	Topic	Lecturer	Remark
	18	Enzymes in biosynthesis of natural products: polyketide synthase (types I, II, and III), chalcone synthase, and other enzymes	Dr. Prasat Kittakoop	
February 18, 2021	19	Enzymes in biosynthesis of natural products: polyketide synthase (types I, II, and III), chalcone synthase, and other enzymes	Dr. Prasat Kittakoop	
	20	Enzymes in biosynthesis of natural products: polyketide synthase (types I, II, and III), chalcone synthase, and other enzymes	Dr. Prasat Kittakoop	
	21	Enzymes in biosynthesis of natural products: polyketide synthase (types I, II, and III), chalcone synthase, and other enzymes	Dr. Prasat Kittakoop	
February 25, 2021	22	Recent discovery of new bioactive natural products through the manipulation of genes and enzymes involving biosynthetic pathways	Dr. Prasat Kittakoop	
	23	Recent discovery of new bioactive natural products through the manipulation of genes and enzymes involving biosynthetic pathways	Dr. Prasat Kittakoop	
	24	Recent discovery of new bioactive natural products through the manipulation of genes and enzymes involving biosynthetic pathways	Dr. Prasat Kittakoop	
March 4, 2021		<i>Midterm Examination</i>		
		<i>Midterm Examination</i>		
		<i>Midterm Examination</i>		
March 11, 2021	25	Classes of natural products and its biosynthesis	Dr. Vilailak Prachyawarakorn	
	26	Classes of natural products and its biosynthesis	Dr. Vilailak Prachyawarakorn	
	27	Classes of natural products and its biosynthesis	Dr. Vilailak Prachyawarakorn	
March 18, 2021	28	Classes of natural products and its biosynthesis	Dr. Vilailak Prachyawarakorn	
	29	Classes of natural products and its biosynthesis	Dr. Vilailak Prachyawarakorn	
	30	Classes of natural products and its biosynthesis	Dr. Tawatchai Thongkongkaew	
March 25, 2021	31	Classes of natural products and its biosynthesis	Dr. Tawatchai Thongkongkaew	
	32	Classes of natural products and its biosynthesis	Dr. Tawatchai Thongkongkaew	

Date	Hour	Topic	Lecturer	Remark
	33	Classes of natural products and its biosynthesis	Dr. Tawatchai Thongkongkaew	
April 1, 2021	34	Classes of natural products and its biosynthesis	Dr. Tawatchai Thongkongkaew	
	35	Classes of natural products and its biosynthesis	Dr. Tawatchai Thongkongkaew	
	36	Classes of natural products and its biosynthesis	Dr. Tawatchai Thongkongkaew	
April 8, 2021	37	Modern natural products chemistry and drug discovery	Dr. Prasat Kittakoop	
	38	Modern natural products chemistry and drug discovery	Dr. Prasat Kittakoop	
	39	Modern natural products chemistry and drug discovery	Dr. Prasat Kittakoop	
April 22, 2021	40	Modern natural products chemistry and drug discovery	Dr. Tawatchai Thongkongkaew	
	41	Modern natural products chemistry and drug discovery	Dr. Tawatchai Thongkongkaew	
	42	Anticancer drugs and potential anticancer leads inspired by natural products	Dr. Prasat Kittakoop	
April 29, 2021	43	Student presentation: Drug discovery (bioactive compounds) inspired from the knowledge of Thai traditional medicine	Dr. Prasat Kittakoop	
	44	Student presentation: Drug discovery (bioactive compounds) inspired from the knowledge of Thai traditional medicine	Dr. Prasat Kittakoop	
	45	Student presentation: Drug discovery (bioactive compounds) inspired from the knowledge of Thai traditional medicine	Dr. Prasat Kittakoop	
May 6, 2021		<i>Final Examination</i>		
		<i>Final Examination</i>		
		<i>Final Examination</i>		

Grading: Evaluation is based on two examinations (midterm and final), class attendance, and presentation:

1. Midterm examination (57 %)
2. Final examination (33 %)
3. Presentation (5 %)
4. Class attendance (5 %)

Textbooks and articles:

1. Dewick, P. M., Medicinal natural products: a biosynthetic approach; West Sussex: John Wiley & Sons, 2001, 507 p.
2. Hesse, Manfred, Alkaloids: nature's curse or blessing?; Weinheim: Wiley-VCH, 2002, 413 p.
3. Liang, Xiao-Tian; Fang, Wei-Shuo (Eds), Medicinal chemistry of bioactive natural products; Wiley-Interscience, 2006, 460 p.
4. Stanforth, S. P., Natural product chemistry at a glance, Oxford: Blackwell, 2006, 141 p.
5. Holzgrabe, U.; Wawer, I.; Diehl, B. (Eds), NMR spectroscopy in drug development and analysis; Weinheim: Wiley-VCH, 1999, 299 p.
6. Friebolin, H., Basic one- and two-dimensional NMR spectroscopy; Weinheim: Wiley-VCH, 2005, 406 p.
7. Hoffmann, de E.; Stroobant, V., Mass spectrometry: principles and applications; New York: Wiley, 2001, 407 p.
8. Silverstein, R. M.; Webster, F. X.; Kiemle, D. J, Spectrometric identification of organic compounds; John Wiley & Sons, 2007, 502 p.
9. Hill, A. M. The biosynthesis, molecular genetics and enzymology of the polyketide-derived metabolites. Nat Prod Rep. 2006, 23, 256-320.
10. Smith, S.; Tsai, S. C. The type I fatty acid and polyketide synthases: a tale of two megasynthases. Nat Prod Rep. 2007, 24, 1041-72.
11. Hertweck, C.; Luzhetskyy, A.; Rebets, Y.; Bechthold, A. Type II polyketide synthases: gaining a deeper insight into enzymatic teamwork. Nat Prod Rep. 2007, 24, 162-90.
12. Austin, M. B.; Noel, J. P. The chalcone synthase superfamily of type III polyketide synthases. Nat Prod Rep. 2003, 20, 79-110.
13. Moore, B. S.; Hertweck, C. Biosynthesis and attachment of novel bacterial polyketide synthase starter units. Nat Prod Rep. 2002, 19, 70-99.
14. Bode, H. B.; Bethe, B.; Hofs, R.; Zeeck, A. Big effects from small changes: possible ways to explore nature's chemical diversity. ChemBioChem 2002, 3, 619-627.
15. Chung, Y. M.; El-Shazly, M.; Chuang, D. W.; Hwang, T. L.; Asai, T.; Oshima, Y.; Ashour, M. L.; Wu, Y. C.; Chang, F. R. Suberoylanilide hydroxamic acid, a histone deacetylase inhibitor, induces the production of anti-inflammatory cyclodepsipeptides from *Beauveria felina*. J. Nat. Prod. 2013, 76, 1260-1266.
16. Hewage, R.T.; Aree, T.; Mahidol, C.; Ruchirawat, S.; Kittakoop, P. One strain-many compounds (OSMAC) method for production of polyketides, azaphilones, and an isochromanone using the endophytic fungus *Dothideomycete* sp., Phytochemistry 2014; 108: 87-94.
17. Walsh, C.T. and Tang, Y., Natural product biosynthesis: Chemical logic and enzymatic machinery; Royal Society of Chemistry, 2017, 765 p