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## 7 APPENDICES

7.1 Appendix A  
The Structures of All 4-Dimethyl Marine Sterols Reported  
to the Beginning of 1977.

Each sterol is given a unique number which is used in subsequent discussions in the text.

The molecular weight ( $M^+$  and common trivial name are given for each sterol.

The nuclei all possess alternating trans-anti stereochemistry at the ring junctures, except the 5\* stanols (farthest right hand column) which possess a cis-A,B ring fusion.

The number of carbon atoms in the side chains is indicated along the left hand border.

See p. 102a for Appendix I.

Appendix A.

MARINE STEROL NUCLEI

MARINE STEROL SIDE CHAINS	NUCLEI								
	HO	HO	HO	HO	HO	HO	HO	HO	
H									
	274	1							
SHORT SIDE CHAINS		300	2						
		300	3						
		302	4						
		314	5						
		316	6		318	7			
C <sub>1</sub>		330	8						
		370	9	370	10	372	11	358	12
		24-NOR-CHOLESTANOL	13						
		342	14						
		366	15	366	16	366	17		
		384	18	384	19	384	20	382	21
		394	23	394	24				
		394	25	394	26	394	27	394	28
		394	29	394	30	394	31	394	32
		394	33						
C <sub>2</sub>		398	34	398	35	400	36	398	37
		398	38	398	39	400	40	398	41
		398	43						
		398	44	398	45	400	46	398	47
		400	48	400	49	402	50	398	51
		400	52	400	53	402	54	398	55
		410	59						
		412	60	412	61	414	62	410	63
		412	66	412	67			400	64
		412	68	412	69	414	70		65
C <sub>3</sub>		412	71	412	72	414	73		
		412	74						
		412	75					400	76
		412	77						
		412	78			414	79		
		414	80	414	81	416	82	412	83
		414	87	414	88	416	89	402	84
		414	90						
		426	91	426	92	428	93		
		428	94						
C <sub>4</sub>		428	95						
		428	96						
		428	97						
		428	97						

7.2 Appendix B  
Sources of Sterol Mass Spectra.

Sterol: names listed on the following two pages indicate spectra that were obtained from the old mass spectral files of Prof. Carl Djerassi. The spectra are divided into two groups: (1) sterols that are known to occur in marine sources, i.e. "4-demethyl marine sterol mass spectra" and (2) all other sterol mass spectra from those files grouped under "4-demethyl synthetic sterol mass spectra". The original CD number is given. These spectra were incorporated in the National Institutes of Health MSSS mass spectral data bank, which is available internationally to researchers employing mass spectral identifications systems. See: S. R. Heller, Biomed. Mass., 1, 207 (1974).

All other mass spectra listed in Appendix 1 have been obtained by running mass spectra of authentic samples provided by researchers from around the world. The samples were either pure compounds or mixtures requiring subsequent purifications here. I would, therefore, like to join Professor Djerassi in thanking these researchers.

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(University of Aberdeen)

Dr. A. Kanazawa  
(University of Kagoshima, Japan)

Dr. A. J. Weinheimer  
(University of Oklahoma)

Dr. B. A. Knights  
(University of Glasgow, Scotland)

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4-DEMETHYL SYNTHETIC STEROL MASS SPECTRA FROM THE FILES OF  
 CARL DJERASSI JAN. 7, 1976  
 (ALL SPECTRA RECORDED AT 70EV)

SD#	CAT#	CD#	MW	MS	FORMULA	STEROL
1	401	05203	276	CEC-103	C19H32O	5ALPHA-ANDROSTAN-3BETA-OL
2	→ 99	16309	300	AEI-MS9	C21H32O	(17(20)Z)-PREGNA-5,17(20)-DIEN-3BETA-OL
3	→ 221	99999	302	MAT-CH4	C21H34O	PREG-5-EN-3BETA-OL
4	219	09576	316	AEI-MS9	C22H34O	23,24-DINOR-CHOL-20-EN-3BETA-OL
5	---	11111	328	U	C23H34O	24-NOR-CHOLA-5,22-DIEN-3BETA-OL
6	5673	20636	342	U	C24H38O	(22E)-CHOLA-5,22-DIEN-3BETA-OL
7	5672	20637	342	U	C24H38O	(22Z)-CHOLA-5,22-DIEN-3BETA-OL
8	78	18697	346	AEI-MS9	C24H42O	5BETA-CHOLAN-3BETA-OL
9	76	18713	346	U	C24H42O	5BETA-CHOLAN-3ALPHA-OL
10	5671	20641	356	U	C25H40O	(22Z)-26,27-DINOR-CHOLESTA-5,22-DIEN-3BETA-OL
11	5670	20639	356	U	C25H40O	(22E)-26,27-DINOR-CHOLESTA-5,22-DIEN-3BETA-OL
12	5669	20659	370	U	C26H42O	(22Z)-24-NOR-CHOLESTA-5,22-DIEN-3BETA-OL
13	5345	99690	370	U	C26H42O	24-NOR-CHOLESTA-5,25-DIEN-3BETA-OL
14	5344	99691	370	U	C26H42O	24-NOR-CHOLESTA-5,23-DIEN-3BETA-OL
15	4691	18661	382	MAT-CH4	C27H42O	CHOLESTA-5,20(21),24-TRIEN-3BETA-OL
16	4692	18659	382	MAT-CH4	C27H42O	(17(20)E)-CHOLESTA-5,17(20),24-TRIEN-3BETA-OL
17	5667	20525	384	U	C27H44O	(22Z)-27-NOR-24-METHYLCHOLESTA-5,22-DIEN-3BETA-OL
18	4693	18803	384	MAT-CH4	C27H44O	(20(22)E)-CHOLESTA-5,20(22)-DIEN-3BETA-OL
19	4698	18723	384	U	C27H44O	CHOLESTA-5,20(21)-DIEN-3BETA-OL
20	3299	99812	386	U	C27H46O	CHOLEST-8(14)-EN-3BETA-OL
21	231	06032	398	CEC-103	C28H46O	24-METHYLCHOLESTA-5,24(25)-DIEN-3BETA-OL
22	234	09180	400	MAT-CH4	C28H48O	24-METHYLCHOLEST-8(14)-EN-3BETA-OL
23	3518	19479	410	U	C29H46O	22,23-METHYLENE-24-METHYLCHOLESTA-5,24(28)-DIEN-3BETA-OL
24	4785	19338	412	MAT-CH4	C29H48O	(22E)-24-DIMETHYLCHOLESTA-5,22-DIEN-3BETA-OL

SR# = SAMPLE BOX NUMBER  
 CAT# = TABLET CATALOG NUMBER  
 CD# = CARL DJERASSI MASS SPECTRUM NUMBER  
 MW = MOLECULAR WEIGHT  
 MS = MASS SPECTROMETER

"→" indicates that spectrum has  
 subsequently been moved to the  
 marine file.

103a

4-DEMETHYL MARINE STEROL MASS SPECTRA FROM THE FILES OF  
 CARL DJERASSI JAN, 7, 1976  
 (ALL SPECTRA RECORDED AT 70EV)

	SB#	CAT#	CD #	MW	MS	FORMULA	STEROL
1	A-2	5668	20660	370	U	C26H420	24-NOR-CHOLESTA-5,22-DIEN-3BETA-OL
2	A-1	5339	18380	372	AEI-MS9	C26H440	24-NOR-CHOLEST-5-EN-3BETA-OL
3	E-2	4739	99754	372	U	C26H440	→(22E)-19-NOR-5ALPHA,10BETA-CHOLEST-22-EN-3BETA-OL
4	A-15	100	16746	384	AEI-MS9	C27H440	CHOLESTA-5,7-DIEN-3BETA-OL
5	A-8	237	05570	384	MAT-CH4	C27H440	CHOLESTA-5,24-DIEN-3BETA-OL
6	B-2	103	16793	384	AEI-MS9	C27H440	→5ALPHA-CHOLESTA-7,9(11)-DIEN-3BETA-OL
7	A-5	4732	17657	386	U	C27H460	CHOLEST-5-EN-3BETA-OL
8	A-11	101	16778	386	AEI-MS9	C27H460	5ALPHA-CHOLEST-7-EN-3BETA-OL
9	A-18	2509	18633	388	U	C27H480	5ALPHA-CHOLESTAN-3BETA-OL
10	A-18	406	05557	388	CEC-103	C27H480	5ALPHA-CHOLESTAN-3BETA-OL
11	B-5	4748	20063	398	AEI-MS9	C28H460	(22E)-24-METHYLCHOLESTA-5,22-DIEN-3BETA-OL
12	B-5	2455	15214	398	U	C28H460	(22E)-24-METHYLCHOLESTA-5,22-DIEN-3BETA-OL
13	B-10	232	06060	398	MAT-CH4	C28H460	24-METHYLCHOLESTA-5,24(28)-DIEN-3BETA-OL
14	R-13	233	09125	398	MAT-CH4	C28H460	(22E)-24-METHYL-SALPHA-CHOLESTA-7,22-DIEN-3BETA-OL
15	C-7	3503	15281	412	AEI-MS9	C29H480	(22E)-24-ETHYLCHOLESTA-5,22-DIEN-3BETA-OL
16	C-7	2454	14916	412	U	C29H480	(22E)-24-ETHYLCHOLESTA-5,22-DIEN-3BETA-OL
17	C-20	236	06052	412	MAT-CH4	C29H480	(22E)-24-ETHYL-SALPHA-CHOLESTA-7,22-DIEN-3BETA-OL
18	C-9	2438	12489	412	U	C29H480	(24E)-STIGMASTA-5,24(28)-DIEN-3BETA-OL
19	C-9	3406	11257	412	AEI-MS9	C29H480	(24E)-STIGMASTA-5,24(28)-DIEN-3BETA-OL
20	C-9	4742	99752	412	U	C29H480	(24E)-STIGMASTA-5,24(28)-DIEN-3BETA-OL
21	C-9	238	06237	412	AEI-MS9	C29H480	(24E)-STIGMASTA-5,24(28)-DIEN-3β-ol
22	D-9	4738	18100	416	U	C29H520	24-ETHYL-SALPHA-CHOLESTAN-3BETA-OL
23	D-14	2450	13915	426	AEI-MS9	C30H500	GORGOSTEROL
24	D-14	4733	17659	426	U	C30H500	GORGOSTEROL
25	D-12	4740	19975	426	U	C30H500	(24Z)-24-PROPYLIDENECHOLEST-5-EN-3BETA-OL

SB# = SAMPLE BOX NUMBER  
 CAT# = TABLET CATALOG NUMBER  
 CD# = CARL DJERASSI MASS SPECTRUM NUMBER  
 MW = MOLECULAR WEIGHT  
 MS = MASS SPECTROMETER

→ indicates spectrum has been moved to the synthetic file  
 "→" indicates spectrum has subsequently been deleted because of poor quality.

## References

1. Bruce G. Buchanan and Dennis H. Smith, "Computer Assisted Chemical Reasoning," in E.V. Ludena, N.H. Sabelli and A.C. Wahl (eds.), *Computers in Chemical Education and Research*, New York: Plenum Press, 1977. P. 401
2. Bruce G. Buchanan, "Issues of Representation in Conveying the Scope and Limitations of Intelligent Assistant Programs," in D. Michie (ed.), *Machine Intelligence 9*, forthcoming.
3. Bruce G. Buchanan and Tom Mitchell. "Model-Directed Learning of Production Rules," in D.A. Waterman and F. Hayes-Roth (eds.), *Pattern-Directed Inference Systems*, New York: Academic Press, forthcoming.
4. Bruce G. Buchanan and Edward A. Feigenbaum, "DENDRAL and Meta-DENDRAL: Their Applications Dimension," *Artificial Intelligence*, forthcoming.
5. Raymond E. Carhart and Dennis H. Smith, "Applications of Artificial Intelligence for Chemical Inference XX. Intelligent Use of Constraints in Computer-Assisted Structure Elucidation", *Computers and Chemistry*, 1, 79 (1976).
6. Raymond E. Carhart, "A Model-Based Approach to the Teletype Printing of Chemical Structures," *Journal of Chemical Information and Computer Sciences*, 16, 82, 1976.
7. R.E. Carhart, T.H. Varkony, and D.H. Smith, "Computer Assistance for the Structural Chemist," in "Computer-Assisted Structure Elucidation," D.H. Smith, (ed.), American Chemical Society, Washington, D.C., 1977, p. 126.
8. C.J. Cheer, D.H. Smith and C. Djerassi, and B. Tursch, J.C. Braekman and D. Daloz, "Applications of Artificial Intelligence for Chemical Inference XXI: The Computer-Assisted Identification of [+]Palustrol in the

Marine Organism *Cespitularia* sp., aff. *Subviridis*",  
*Tetrahedron*, 32, 1807 (1976).

9. C. Djerassi, R. M. K. Carlson, S. Popov and T. H. Varkony. Sterols from Marine Sources. In press.
10. R. G. Dromey, Mark J. Stefik, Thomas C. Rindfleisch, and Alan M. Duffield, "Extraction of Mass Spectra Free of Background and Neighboring Component Contributions from Gas Chromatography/Mass Spectrometry Data," *Analytical Chemistry*, 48, 1368, August 1976.
11. T.M. Mitchell and G.M. Schwenzer, "Applications of Artificial Intelligence for Chemical Inference XXV. A Computer Program for Automated Empirical <sup>13</sup>C NMR Rule Formation," *Organic Magnetic Resonance*, forthcoming.
12. Tom M. Mitchell, "Version Spaces: A Candidate Elimination Approach To Rule Learning," *Proceedings of the Fifth IJCAI*, 1, 305, August 1977.
13. James G. Nourse, "Generalized Stereoisomerization Modes," *Journal of the American Chemical Society*, 99, 2063, 1977.
14. S. Popov, R. M. K. Carlson, A-M. Wegmann and C. Djerassi. Occurrence of 19-Nor Cholesterol and Homologs in Marine Animals. *Tetrahedron Lett.*, 3491 (1976).
15. S. Popov, R. M. K. Carlson, A-M. Wegmann and C. Djerassi. Minor and Trace Sterols in Marine Invertebrates. 1. General Methods of Analysis. *Steroids*, 28, 699 (1976).
16. Gretchen M. Schwenzer, "Applications of Artificial Intelligence for Chemical Inference. XXVI Analysis of C-<sup>13</sup> NMR for Mono-Hydroxy Steroids Incorporating Geometric Distortions," *Journal of Organic Chemistry*, forthcoming.
17. Gretchen M. Schwenzer and Tom M. Mitchell, "Computer Assisted Structure Elucidation Using Automatically Acquired <sup>13</sup>C NMR Rules," in D. Smith, (ed.), *Computer Assisted Structure Elucidation*, ACS Symposium Series, Vol. 54:58, 1977.

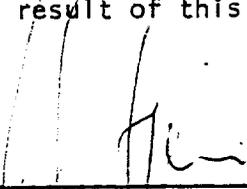
18. D.H. Smith, (ed.), American "Computer-Assisted Structure Elucidation," Chemical Society, Washington, D.C., 1977.
19. D.H. Smith, M. Achenbach, W.J. Yeager, P.J. Anderson, W.L. Fitch, and T.C. Rindfleisch, "Quantitative Comparison of Combined Gas Chromatographic/Mass Spectrometric Profiles of Complex Mixtures," *Anal. Chem.*, **49**, 1623 (1977).
20. D.H. Smith and P.C. Jurs, "Prediction of  $^{13}\text{C}$  NMR Chemical Shifts," *J. Am. Chem. Soc.*, submitted for publication.
21. Dennis H. Smith and Raymond E. Carhart, "Structure Elucidation Based on Computer Analysis of High and Low Resolution Mass Spectral Data," in M.L. Gross (ed.), *Proceedings of the Symposium on Chemical Applications of High Performance Spectrometry*, Washington, D.C.: American Chemical Society, in press.
22. T.H. Varkony, R.E. Carhart, and D.H. Smith, "Applications of Artificial Intelligence for Chemical Inference XXIII. Computer-Assisted Structure Elucidation. Modelling Chemical Reaction Sequences Used in Molecular Structure Problems," in W.T. Wipke, (ed.), *Computer-Assisted Organic Synthesis*, Washington, D.C.: American Chemical Society, 1977.
23. Tomas H. Varkony, Raymond E. Carhart, and Dennis H. Smith, "Computer Assisted Structure Elucidation, Ranking of Candidate Structures, Based on Comparison Between Predicted and Observed Mass Spectra," in *Proceedings of the Twenty-Fifth Annual Conference on Mass Spectrometry and Allied Topics*, Washington, D.C., 1977.
24. Tomas Varkony, Dennis Smith, and Carl Djerassi, "Computer-Assisted Structure Manipulation: Studies in the Biosynthesis of Natural Products," *Tetrahedron*, forthcoming.
25. T.H. Varkony, R.E. Carhart, D.H. Smith, and C. Djerassi, "Computer-Assisted Simulation of Chemical Reaction Sequences. Applications to Problems of Structure Elucidation," *J. Am. Chem. Soc.*, submitted for publication.
26. Annemarie Wegmann, "Variations in Mass Spectral

Fragmentation Produced by Active Sites in a Mass Spectrometer Source," Analytical Chemistry, forthcoming.

The undersigned agrees to accept responsibility for the scientific and technical conduct of the project and for provision of required progress reports if a grant is awarded as the result of this application.

1/26/78

Date

  
Principal Investigator or  
Program Director