

Homologous Series of Liquid Crystalline Steroidal Lipids

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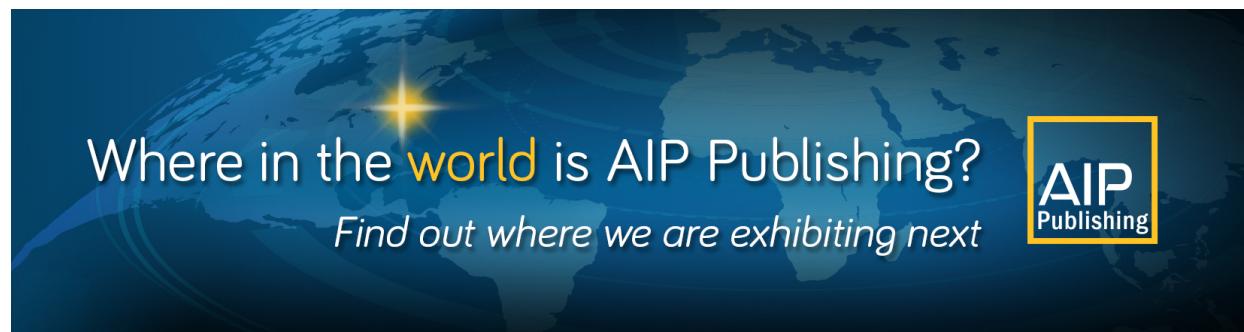
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Homologous Series of Liquid Crystalline Steroidal Lipids

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Steroids are an important source of chiral mesophases. The melting behavior and mesomorphic properties of homologous series of steroid derivatives have been extracted from the literature, tabulated, and discussed. The tables provide the reader with an evaluated compilation of the type of mesophases found for the individual compounds, including their transition temperatures. Where the literature gives more than one set of data for a specific substance, one has been chosen as the main reference, but all alternatives are listed in the footnotes. The data can be used for statistical analysis to show the specific role of substructures within the steroid framework. © 1997 American Institute of Physics and American Chemical Society. [S0047-2689(97)00303-6]

Key words: chiral liquid crystals; lipids; mesophases; steroids; structure–property relationship; transition temperatures.

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1. Introduction

In 1888 F. Reinitzer¹ noticed that cholestryl benzoate had a double melting point. The closer investigation of the melting behavior of this compound by Reinitzer and Lehmann²

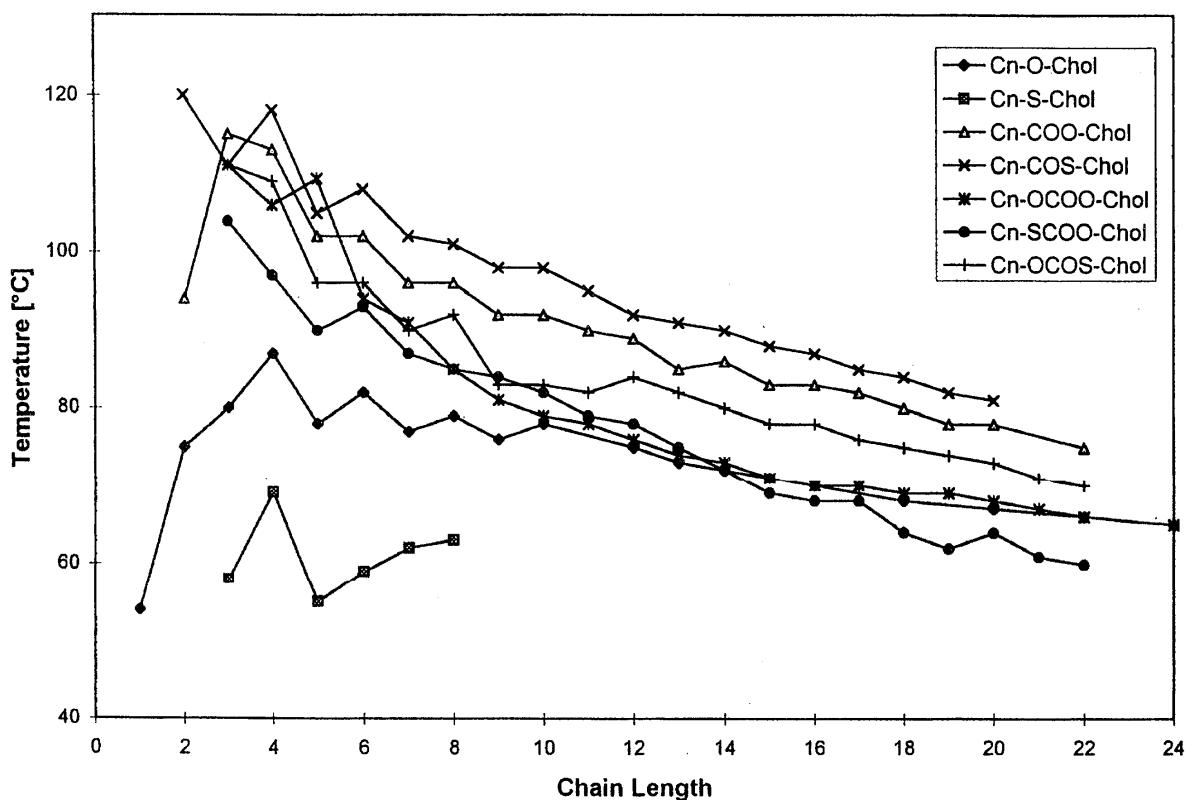


FIG. 1. Clearing temperatures of cholest-5-ene compounds.

was the inception of liquid crystal science as a new discipline. Since then, a multitude of steroidal systems³ have been shown to exhibit liquid crystal behavior. Their inherent chirality, their natural abundance, and today's easy accessibility make them very interesting candidates for applications in modern liquid crystal (LC) technology. A typical recent application of liquid crystalline steroidal compounds is their use in cholesteric color pigments for the automobile industry.⁴ Steroids also play an important role as components of biological membranes.⁵ Thus, cholesterol itself modulates the structural and dynamic properties of phospholipido double-layer membranes, which have the characteristics of a smectic A phase of liquid crystals. Liquid crystalline properties can serve as an indicator for self-organization in nature.

The amount of work done in the field of steroidal research over the last 100 years makes a systematic representation of the mesomorphic properties of steroids and their analogs difficult. This is further complicated by the fact that many of the derivatives have been synthesized from corresponding natural steroids, isolated individually by the researchers themselves. In some cases different isolation techniques were used, resulting in material of different purity. Since the natural product chemist rarely looked for liquid crystalline behavior in his/her compounds, many subtleties in the identification of phases and phase transitions were not realized until very recently. Thus, in many cases, blue phases (BP), twist grain boundary phases (TGB_A), and chiral smectic C phases

(S_{C*}) were overlooked. Other times, the smectic C phase (S_C) was mistaken for the smectic A phase (S_A). Moreover, the two most common phases, S_A and the cholesteric phase (Ch), show very similar textures under the microscope.

2. Arrangement of Data

The melting behavior and mesomorphic properties of homologous series of steroidal derivatives are tabulated in Sec. 7. The data have been extracted from journals, patents, symposia abstracts, and Ph.D. theses. Where possible, the data have been checked for consistency. When available, data for the same compound, but from different sources have been included. Evident discrepancies or obvious misinterpretations of textures are mentioned. When more than one set of (divergent) data was found for a compound, the data which were the best fit for the homologous series were included within the table, while the divergent data can be found in the footnotes. Where there is more than one reference for a given value in the table, all references pertaining to that value are listed within the table.

All steroidal systems listed below are A/B-ring *trans*-configurated and have a 3 β substituent. Compounds possessing an aromatic ring substituent (e.g., esters of aromatic acids) are excluded. Also excluded, are compounds which represent the single member found in the literature of a po-

ential homologous series. The steroids covered are listed in tables headed by their trivial names, where the steroids in each table differ only in their 3 substituent.

3. Evaluation of Data

In certain cases, more than one description of the mesomorphic behavior of a particular compound can be found in the literature. An evaluation of the comparative quality of these data is not always unequivocal. In general, higher published transition temperatures speak for a higher purity of a substance. Very important is the evaluation of the data based on the thoroughness with which the individual authors have described textures and transition temperatures. A good indication for the quality of data of an individual compound is its fit in the homologous series. Thus it is possible to extrapolate transition temperatures from known data.

For the most part, microscopy is used to accurately determine transition temperatures and textures. When differential scanning calorimetry (DSC) has been used for discerning transition temperatures, it is indicated in the tables. For the most part, any values given by DSC can be found in the footnotes of the tables.

In the cases where phases for steroid systems have been characterized as being smectic (S) in the older literature, it can be said with certainty that these are in fact smectic A phases ($S=S_A$).⁶ Reported smectic C phases seem to be incorrectly assigned. Smectic C phases should only be found in steroid systems with aromatic ester and carbonate substituents.⁷

4. Mesophase Characteristics

4.1. Characterization of Mesophases

Crystals are characterized by a three-dimensional long-range order of both position and orientation of the molecules. Isotropic liquids have no long-range order. Mesophases, as an intermediate between the crystalline and the liquid state, exhibit an incomplete long-range order of position and/or orientation of the molecules.

All mesophases exhibiting liquid crystalline behavior have in common an ordering in orientation of anisotropic molecules. In the following, the mesophases listed in the tables and footnotes are described briefly. For a more detailed treatise of mesophases and textures, please consult Kelker.⁸

The *nematic phase* (N) only exhibits long-range orientational order, where the long axes of the compounds align parallel.

The *cholesteric phase* (Ch) is closely related to the nematic phase. Chiral molecules induce a twist in the nematic phase and therefore a helical ordering of the molecules. The *blue phase* (BP) is closely related to the cholesteric phase but exhibits a helical ordering in all three dimensions.

Both liquid crystals of the nematic and of the cholesteric phases possess relatively low viscosity and can be regarded as three-dimensional liquids from the point of positional order.

The *smectic A phase* (S_A) exhibits layers of molecules, where the molecules are aligned parallel to each other and perpendicular to the plane of the layer. S_A can also be regarded as a two-dimensional liquid in positional order of the molecules.

The *smectic C phase* (S_C) is closely related to S_A . The difference to S_A is that, while the molecules are arranged in layers, their long axes are not perpendicular but tilted to the plane of the layer.

4.2. Liquid Crystal Characteristics of Steroidal Lipids

Steroids are chiral molecules. Chirality has profound effects on the order of matter. It reduces symmetry. It induces helical ordering (see Sec. 4.1.). In fact, there have been recent suggestions to use the helical ordering as a measure for quantifying chirality.

The behavior of compounds with liquid crystalline properties in general is that molecules with short chains show a nematic phase, while those with long chains exhibit a smectic phase. This can be specified further—molecules with one long chain show a smectic A phase, molecules with two long chains a smectic C phase. Reentrant phases (i.e., less ordered phases at lower temperature than higher ordered phases) are only found for molecules with dipolar linking groups (e.g., COO , COS , $\text{CH}=\text{N}$) and terminal polar groups (e.g., NO_2 , CN). Aliphatic liquid crystals generally show nematic and ordered smectic phases. Lipids other than steroids generally show highly ordered phases, such as smectic B phases (α phase of lipids).

As is evident from the following tables, steroids show interesting and different behavior compared to what was stated above for other classes of molecules. Thus steroids with substituents of long chain length show cholesteric phases, which is highly unusual for lipids in itself. A reentrant cholesteric phase has been noted for some steroid compounds, although these do not possess a polar group. In these molecules two cholesteric phases are separated by a smectic phase.

Blue phases are also quite common for steroid lipids, but this phase is not normally checked. More compounds with blue phases have been found in the chol-5-ene series than in the cholane series, although this has not been published yet.

The first example of a TGB_A phase was discovered by Goodby⁹ in 1989. Although there has only been one example where a TGB_A phase¹⁰ has been found in a steroid, it may very well be that quite a few steroid systems exhibit this phase.

5. Phase Behavior of Steroidal Lipids—Statistical Analysis of Data

The statistical analysis of the data presented in Tables 1–38 shows that for the most part the range of the mesophases is small. Thus, most of the melting points (i.e., transitions from a crystal to any other phase) are in the vicinity of 80°C , but also most of the clearing points are around 80°C .

Table 3 shows that for 3β -substituted cholest-5-enes there is only a gradual difference in clearing temperature (i.e., the temperature of the transition from any mesophase to the isotropic phase) among compounds with long chains and a much more marked effect among homologues with short chains (see also Fig. 1). The clearing temperature decreases within one series for the following 3β substituents:



It can be seen that the polarity of the substituent has no influence on the clearing temperature. The exchange thio for oxo in the ester and carbonate moieties increases the clearing temperature in otherwise identical systems, while the exchange of a thioether for an ether substituent decreases the clearing temperature. From the fit within the homologous series, the data for $3-(R-\text{SCOO})$ -cholest-5-enes and for the $3-(R-S)$ -cholest-5-enes seem uncertain. It may be also interesting to note that there are few examples of steroids investigated as liquid crystals that are not linked by O or S to their 3β substituent. In only one case (see Sec. 7, Table 4, compounds 9–18) have 3α -alkyl substituted steroids been investigated as liquid crystals. These show high clearing temperatures and one might expect equally high clearing temperatures for esters of Marker's acid, the liquid crystalline behavior of which has not been investigated yet.

In Table 2, the transition temperatures of five different sets of steroids are compared with those of the cholest-5-enes. Only the transition temperatures of pairs of molecules are compared, which have the same 3β substituent, giving a temperature difference for each pair. These temperature differences are averaged. The process is repeated for every transition type. Thus, it can be seen that on the average a cholestan system has a transition temperature (cholesteric to isotropic) that is 19.5°C lower than that of a cholest-5-ene with the same 3β substituent. In all, it can be seen that small changes in the structure of a steroid system in many cases lead to big differences in the mesomorphic properties of the compounds. From Table 2 no definite comparison of the melting points of the given steroid series can be given due to the large statistical error. Nevertheless, it can be seen that sitosterine and stigmasterine favor smectic mesophases, while cholesterines favor cholesteric phases. Cholest-5-enes in general have comparatively high clearing points.

- b) substituent (marked with an R in the drawing),
- c) information on stereocenter(s) in the 3β substituent,
- d) transitions (solid states, types of mesophases, transition temperatures),
- e) clearing temperature,
- f) reference(s),
- g) asterisk (*) denotes further information gathered in the footnotes.

Comments (Footnotes):

Alternative transitions and/or transition temperatures, other physical properties are given in the footnotes. All compounds marked with an asterisk have a comment in the footnote. The footnotes are listed separately for each table. All comments pertaining to one compound are preceded by an asterisk and the number of the compound as listed in the table.

6.2 Abbreviations

Cr	crystalline
Cr_1, Cr_2	transition temperature between two solid states
Ch	cholesteric phase
Ch_{re}	reentrant cholesteric phase
S	smectic phase
S_A	smectic A phase
S_C	smectic C phase
S_{C}^*	chiral smectic C phase
TGB _A	twist grain boundary phase
X	mesophase not specified
BP	blue phase
I	isotropic phase (liquid)
E	extrapolated temperature
O	not tested for mesomorphic properties
U	uncertain data
dec.	decomposition
mp_x	melting point of another crystal modification
CP	clearing parameter
DSC	differential scanning calorimetry (temperatures and enthalpies of phase transitions are given in the reference)
DTA	differential thermal analysis
?	temperature not given

All temperatures are given in $[\text{ }^\circ\text{C}]$.

- Stereo=Information about the stereo centers in the terminal substituents (wing groups)
- (R/S) (R/S) configuration of chiral center in the substituent (wing group)
 - (R) (R) configuration of chiral center in the substituent (wing group)
 - (S) (S) configuration of chiral center in the substituent (wing group)

6. Structure of Tables and Abbreviations

6.1. Structure of Tables

- Heading: Steroid (name and graphical view of steroidal series)
- Columns:
- a) internal reference number of the compound,

7. Tables of the Melting Behavior and Mesomorphic Properties of Steroidal Lipids

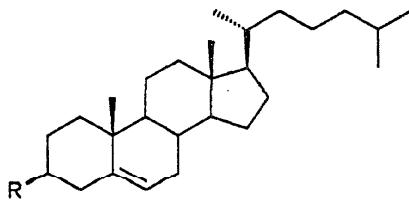
Table 1. Comparison between cholest-5-enes and other steroids (Temperatures, °C, are understood as differences of the upper transition temperatures with respect to cholest-5-ene series as reference)

Steroid	Melting		Cholesteric phase		Smectic phase
cholestane	-7.6±19.9 ^a	(141) ^b	-19.5± 6.9	(97) ^b	-15.3± 7.8 (36) ^b
cholest-8(14)-ene	-26.0±18.4	(25) ^b	-25.7± 8.0	(18) ^b	-15.5± 8.7 (10) ^b
cholest-5,7-diene	3.8±19.1	(14) ^b	14.4± 8.0	(9) ^b	(no data)
coprostanone	-4.0±18.6	(70) ^b	-51.6±22.8	(29) ^b	23.1±28.3 (8) ^b
coprostanol	11.6±19.4	(53) ^b	-47.7±10.6	(7) ^b	-7.6± 9.4 (10) ^b

^aStandard deviation (root mean square).

^bNumber of compounds taken for this statistic. Included are aromatic esters not listed in the tables in Sec. 7. Data were taken from the data base LiqCryst: LiqCryst 2.0—Data base of Liquid Crystalline Compounds for Personal Computers, V. Vill, Fujitsu Kyushu System (FQS) Ltd., Fukuoka 1996; LCI Publishers, Hamburg, 1996.

TABLE 2. Cholest-5-enes

Table 2: 3β -substituted cholest-5-enes

(all temperatures in °C)

No	3β -Substituent	Stereo	Solid State	Mesophase	CP	Reference	Comments
1	CH ₃ -CHMe-COO-		Cr 131		Ch 95	E [11]	*
2	C ₂ H ₇ -CHMe-COO-	(R/S)	Cr 80.1	S 68.2	I [12,13]		
3	C ₃ H ₇ -CHMe-COO-	(R)	Cr 90.4	S 69.1	I [12,13]		
4	C ₃ H ₇ -CHMe-COO-	(S)	Cr 74.3	S 65.5	I [12,13]		
5	C ₄ H ₉ -CHMe-COO-	(R/S)	Cr 44	S 52	I [11]		
6	CH ₃ -CHCl-COO-	(R/S)	Cr 135.9		I [15]		*
7	C ₂ H ₅ -CHCl-COO-	(R/S)	Cr 115		I [19,20]		*
8	C ₃ H ₇ -CHCl-COO-	(R/S)	Cr 85		Ch <? I [19,20]		
9	C ₅ H ₁₁ -CHCl-COO-	(R/S)	Cr 100		Ch 94 I [20]		*
9a	C ₇ H ₁₅ -CHCl-COO-	(R/S)	Cr 64.4	S 51	Ch 55.6 I [19,20]		
10	CH ₃ -CHCl-COS-	(R/S)	Cr 90		Ch <? I [19]		
11	C ₂ H ₅ -CHCl-COS-	(R/S)	Cr 87		Ch <52 I [19]		
12	C ₃ H ₇ -CHCl-COS-	(R/S)	Cr 95		Ch <40 I [19]		
13	C ₅ H ₁₁ -CHCl-COS-	(R/S)	Cr 88		Ch <58 I [19]		
14	C ₇ H ₁₅ -CHCl-COS-	(R/S)	Cr 51	S 41.6	Ch 43.4 I [19]		
15	CH ₃ -CHBr-COO-	(R/S)	Cr 136.3		I [15]		*
16	C ₂ H ₅ -CHBr-COO-	(R/S)	Cr 118		I [19,20]		
17	C ₃ H ₇ -CHBr-COO-	(R/S)	Cr 78		Ch <? I [19]		*
17a	C ₄ H ₉ -CHBr-COO-	(R/S)	Cr 48		Ch 54 I [21]		
18	C ₁₆ H ₃₃ -CHBr-COO-	(R/S)	Cr 43	Ch _{re} 46 S _A 47	Ch 50 I [23]		*
19	CH ₃ -CHBr-COS-	(R/S)	Cr 92		Ch <61 I [19]		
20	C ₂ H ₅ -CHBr-COS-	(R/S)	Cr 79.8		Ch <78 I [19]		
21	C ₃ H ₇ -CHBr-COS-	(R/S)	Cr 77.4		Ch <50 I [19]		
21a	C ₄ H ₉ -CHBr-COS-	(R/S)	Cr ?		Ch ? I [24]		
22	CH ₃ -CHBr-CH ₂ -COO-	(R/S)	Cr 108		Ch 118 I [20,26]		*
23	C ₃ H ₇ -CHBr-CH ₂ -COO-	(R/S)	Cr 105.8		Ch 119 I [25,27]		
23	CF ₃ -COO-		Cr 132		O [28]		*
24	C ₂ F ₅ -COO-		Cr 101	X 79	I [29]		*
25	C ₃ F ₇ -COO-		Cr 108	X 66	I [29]		*
26	C ₄ F ₉ -COO-		Cr 92	X 56	I [29]		
27	C ₅ F ₁₁ -COO-		Cr 90	X 64	I [29]		
28	C ₆ F ₁₃ -COO-		Cr 89	X 40	I [29]		
29	C ₇ F ₁₅ -COO-		Cr 106	S 85 X 100	I [30]		*
30	H-C ₂ F ₄ -COO-		Cr 149.4		I [15,30]		
31	H-C ₄ F ₈ -COO-		Cr 110		I [30]		
32	H-C ₆ F ₁₂ -COO-		Cr 100		I [30]		
33	H-C ₈ F ₁₆ -COO-		Cr 118	X 88	I [30]		

TABLE 2. Cholest-5-enes—Continued

34	H-C ₂ F ₄ -CH ₂ -OCOO-	Cr 107		I	[34,35]			
35	H-C ₄ F ₈ -CH ₂ -OCOO-	Cr 117		I	[34,35]			
36	H-C ₆ F ₁₂ -CH ₂ -OCOO-	Cr 130		Ch 79	I	[34,35]		
37	H-C ₈ F ₁₆ -CH ₂ -OCOO-	Cr 110	S 92	Ch 97	I	[34,35]		
38	H ₂ C=CH-COO-	Cr ₂ 64	Cr ₁ 122.5	Ch 125	I	[36]	*	
39	CH ₃ -CH=CH-COO-		Cr ? Ch _{re} 120	S _A 135	Ch 167	I	[23]	*
40	H ₂ C=CH-COO-C ₃ H ₆ -COO-	Cr 70.5		Ch 67.5	I	[47,48]		
41	H ₂ C=CH-COO-C ₄ H ₈ -COO-	Cr 87		Ch 82	I	[48]		
42	H ₂ C=CH-COO-C ₅ H ₁₀ -COO-	Cr 46	S 31	Ch 68.5	I	[48]	*	
43	H ₂ C=CH-COO-C ₁₀ H ₂₀ -COO-Cr ₂ 28	Cr ₁ 42	S 67	Ch 78	I	[49]	*	
44	H ₂ C=CH-CONH-C ₂ H ₄ -COO-	Cr 125	X ?	Z	[43]	*		
45	H ₂ C=CH-CONH-C ₅ H ₁₀ -COO-	Cr ?		I	[43]			
46	H ₂ C=CH-CONH-C ₁₁ H ₂₂ -COO-	Cr ₂ ? Cr ₁ 104		I	[49]	*		
47	H ₂ C=CH-OOC-C ₂ H ₄ -COO-	Cr 82		Ch 89	I	[51,52]		
48	H ₂ C=CH-OOC-C ₃ H ₆ -COO-	Cr 83		Ch 72	I	[52]		
49	H ₂ C=CH-COO-C ₂ H ₄ -OCOO-	Cr 87		Ch 56	I	[47]		
50	H ₂ C=CH-COO-C ₃ H ₆ -OCOO-	Cr 105		I	[47]			
51	H ₂ C=CH-COO-C ₄ H ₈ -OCOO-	Cr 45		Ch 64	I	[47]		
52	H ₂ C=CH-COO-C ₅ H ₁₀ -OCOO-	Cr 54		Ch 69	I	[47]		
53	H ₂ C=CH-COO-C ₆ H ₁₂ -OCOO-	Cr 52		Ch 62	I	[47]		
54	H ₂ C=CH-C ₂ H ₄ -COO-	Cr 64	S 72	Ch 107	I	[53]	*	
55	H ₂ C=CH-C ₃ H ₆ -COO-	Cr 71		Ch 76.8	I	[54]	*	
56	H ₂ C=CH-C ₄ H ₈ -COO-	Cr 105		I	[54]			
57	H ₂ C=CH-C ₅ H ₁₀ -COO-	Cr 91		Ch 71	I	[54]		
58	H-C≡C-COO-	Cr 127		Ch 105	I	[56]		
59	H-C≡C-C ₂ H ₄ -COO-	Cr 107		Ch 140	I	[56,57]		
60	H-C≡C-C ₈ H ₁₆ -COO-	Cr 51	S _A 74	I	[56,57]			
61	CH ₃ -COO-CH ₂ -	Cr 83		O	[58]	*		
62	C ₃ H ₇ -COO-CH ₂ -	Cr 67		O	[58]	*		
63	C ₅ H ₁₁ -COO-CH ₂ -	Cr 46		O	[58]	*		
64	C ₇ H ₁₅ -COO-CH ₂ -	Cr 50		O	[58]	*		
65	C ₉ H ₁₉ -COO-CH ₂ -	Cr 52		O	[58]	*		
66	C ₁₁ H ₂₃ -COO-CH ₂ -	Cr 45		O	[58]	*		
67	C ₁₃ H ₂₇ -COO-CH ₂ -	Cr 43		O	[58]	*		
68	C ₁₅ H ₃₁ -COO-CH ₂ -	Cr 49.5		O	[58]	*		
69	C ₁₇ H ₃₅ -COO-CH ₂ -	Cr 57		O	[58]	*		
70	CH ₃ -O-	Cr 83.5		Ch 54	I	[59]	*	
71	C ₂ H ₅ -O-	Cr 89		Ch 75	I	[59]	*	
72	C ₃ H ₇ -O-	Cr 101.5		Ch 80.5	I	[60]	*	
73	C ₄ H ₉ -O-	Cr 79.5		Ch 87	I	[59,61]	*	
74	C ₅ H ₁₁ -O-	Cr 67.7		Ch 78.4	I	[60]	*	
75	C ₆ H ₁₃ -O-	Cr ₂ 67 Cr ₁ 69.9		Ch 81.9	I	[60]	*	
76	C ₇ H ₁₅ -O-	Cr 97	S _A 42.6	Ch 76.9	I	[60]	*	
77	C ₈ H ₁₇ -O-	Cr 95.9	S _A 52.5	Ch 79	I	[60]	*	
78	C ₉ H ₁₉ -O-	Cr 70.2	S _A 60.5	Ch 76.5	I	[60,62]	*	
79	C ₁₀ H ₂₁ -O-	Cr 62.7	S _A 64.2	Ch 77.5	I	[60,62]	*	
80	C ₁₂ H ₂₅ -O-	Cr 72.9	S _A 66.2	Ch 75.2	I	[60,62]	*	
81	C ₁₃ H ₂₇ -O-	Cr 61.6	S _A 65.2	Ch 72.8	I	[60]		
82	C ₁₄ H ₂₉ -O-	Cr 49.1	S _A 63.7	Ch 71.6	I	[60,62]	*	
83	C ₁₅ H ₃₁ -O-	Cr 51.4	S _A 63.5	Ch 70.7	I	[60]		
84	C ₁₆ H ₃₃ -O-	Cr 57.8	S _A 62.2	Ch 69.9	I	[60,62]	*	

TABLE 2. Cholest-5-enes—Continued

85	C ₁₈ H ₃₇ -O-	Cr 64.3	S _A 61	Ch 68.4 I	[60,62]	*	
86	C ₂₀ H ₄₁ -O-	Cr 69.9	S _A 60.2	Ch 67.2 I	[60,62]	*	
87	C ₂₂ H ₄₅ -O-	Cr 73.7	S _A 59.5	Ch 66.2 I	[60,62]		
88	C ₂₄ H ₄₉ -O-	Cr 77.2		Ch 64.8 I	[60,62]		
89	C ₂₆ H ₅₃ -O-	Cr 80.2		I	[60,62]		
90	C ₃₀ H ₆₁ -O-	Cr 85.3		I	[60,62]		
91	CH ₃ -S-	Cr 126		I	[59]		
92	C ₂ H ₅ -S-	Cr 132.5		I	[59]		
93	C ₃ H ₇ -S-	Cr 80.5		Ch 58 I	[59]		
94	C ₄ H ₉ -S-	Cr 60.5		Ch 69 I	[59]		
95	C ₅ H ₁₁ -S-	Cr 59.5		Ch 55 I	[59]		
96	C ₆ H ₁₃ -S-	X 36 X 38.5	Cr 64	S <?	Ch 59 I	[59]	*
97	C ₇ H ₁₅ -S-		Cr 72.5	S 51	Ch 61.5 I	[59]	
98	C ₈ H ₁₇ -S-	X 24.5 X 29	Cr 75	S 56	Ch 63 I	[59]	*
99	C ₉ H ₁₉ -S-	X -3 X 30	Cr 59	S 63	I	[59]	*
100	C ₁₀ H ₂₁ -S-	X -4 X 23 X 25 X 36 X 40	Cr 61	S 68	I	[59]	*
101	CH ₃ -SO ₂ -	Cr 172		I	[76]		
102	C ₂ H ₅ -SO ₂ -	Cr 161	X <?	I	[76]		
103	C ₃ H ₇ -SO ₂ -	Cr 157		I	[76]		
104	C ₄ H ₉ -SO ₂ -	Cr ₃ 136 Cr ₂ 146	Cr ₁ 166		I	[76]	
105	C ₅ H ₁₁ -SO ₂ -	Cr ₂ 110	Cr ₁ 173		I	[76]	
106	C ₆ H ₁₃ -SO ₂ -		Cr 159	S 156	I	[76]	
107	C ₇ H ₁₅ -SO ₂ -		Cr 160		I	[76]	
108	C ₈ H ₁₇ -SO ₂ -		Cr 137	S 166	I	[76]	
109	C ₉ H ₁₉ -SO ₂ -		Cr 142	S 167	I	[76]	
110	C ₁₀ H ₂₁ -SO ₂ -		Cr 143	S 169	I	[76]	
111	CH ₃ -O-C ₂ H ₄ -O-	Cr 48.5		Ch 66.5 I	[77]		
112	C ₂ H ₅ -O-C ₂ H ₄ -O-	Cr 42.5		Ch 49.5 I	[77]		
113	C ₃ H ₇ -O-C ₂ H ₄ -O-	Cr 32		Ch 36 I	[77]		
114	C ₄ H ₉ -O-C ₂ H ₄ -O-	Cr 54		Ch 28.5 I	[77]		
115	CH ₃ -COO-C ₂ H ₄ -O-	Cr 55.5	S _A 29.5	Ch 44.5 I	[77]	*	
116	C ₂ H ₅ -COO-C ₂ H ₄ -O-	Cr 51	S -3	Ch 28 I	[77]	*	
117	C ₃ H ₇ -COO-C ₂ H ₄ -O-	Cr 43	S -10	Ch 4.5 I	[77]	*	
118	C ₄ H ₉ -COO-C ₂ H ₄ -O-	Cr 42		I	[78]		
119	C ₅ H ₁₁ -COO-C ₂ H ₄ -O-	Cr 30		I	[78]		
120	C ₆ H ₁₃ -COO-C ₂ H ₄ -O-	Cr 36		I	[78]		
121	C ₈ H ₁₇ -COO-C ₂ H ₄ -O-	Cr 36.5		I	[78]		
122	C ₉ H ₁₉ -COO-C ₂ H ₄ -O-	Cr 37.5		I	[78]		
123	C ₁₇ H ₃₅ -COO-C ₂ H ₄ -O-	Cr 35		I	[78]		
118	CH ₃ -OOC-	Cr 102.5		I	[58,80]	*	
119	C ₂ H ₅ -OOC-	Cr 83	O	[58,80]	*		
120	C ₃ H ₇ -OOC-	Cr 85.6	I	[58]			
121	C ₄ H ₉ -OOC-	Cr 63	I	[58]			
122	C ₅ H ₁₁ -OOC-	Cr 66	I	[58]			
123	C ₆ H ₁₃ -OOC-	Cr 55.5	O	[58]			
124	C ₇ H ₁₅ -OOC-	Cr 59	O	[58]			
125	C ₈ H ₁₇ -OOC-	Cr 45	O	[58]			
126	C ₉ H ₁₉ -OOC-	Cr 48	O	[58]			
127	C ₁₀ H ₂₁ -OOC-	Cr 50	O	[58]			
128	C ₁₁ H ₂₃ -OOC-	Cr 43	O	[58]			
129	C ₁₂ H ₂₅ -OOC-	Cr 47.5	O	[58]			
130	C ₁₄ H ₂₉ -OOC-	Cr 41.5	O	[58]			
131	C ₁₆ H ₃₃ -OOC-	Cr 49	O	[58]			
132	C ₁₈ H ₃₇ -OOC-	Cr 58	O	[58]			

TABLE 2. Cholest-5-enes—Continued

133	CH ₃ -COO-	Cr 116.5	Ch 94.5 I	[84]	*		
134	C ₂ H ₅ -COO-	Cr 101.6	Ch 115.2 I	[33]	*		
135	C ₃ H ₇ -COO-	Cr 102	Ch 113 I	[26,84]	*		
136	C ₄ H ₉ -COO-	Cr 93	Ch 101.5 I	[84]	*		
137	C ₅ H ₁₁ -COO-	Cr 99.5	Ch 101.5 I	[84]	*		
138	C ₆ H ₁₃ -COO-	Cr 114	S <92.5	Ch 95.5 I	[84]	*	
139	C ₇ H ₁₅ -COO-	Cr 110	S 69.5	Ch 96.5 I	[84]	*	
140	C ₈ H ₁₇ -COO-	Cr 80.5	S 77.5	Ch 92 I	[84]	*	
141	C ₉ H ₁₉ -COO-	Cr 85.5	S 81.5	Ch 92.5 I	[84]	*	
142	C ₁₀ H ₂₁ -COO-	Cr 85	S _A 80.1	Ch 90.4 I	[85]	*	
143	C ₁₁ H ₂₃ -COO-	Cr 92.4	S _A 80.2	Ch 88.9 I	[85]	*	
144	C ₁₂ H ₂₅ -COO-	Cr 63.5	S 78.8	Ch 84.8 I	[86]	*	
145	C ₁₃ H ₂₇ -COO-	Cr 73.6	S 80	Ch 85.6 I	[33]	*	
146	C ₁₄ H ₂₉ -COO-	Cr 70	S 78.3	Ch 82.9 I	[86]	*	
147	C ₁₅ H ₃₁ -COO-	Cr 79	S 78.5	Ch 83 I	[84]	*	
148	C ₁₆ H ₃₃ -COO-	Cr 77.8	S 77.7	Ch 82.4 I	[87]	*	
149	C ₁₇ H ₃₅ -COO-	Cr 83	S 75.5	Ch 79.5 I	[84]	*	
150	C ₁₈ H ₃₇ -COO-	Cr 82	S 74.2	Ch 77.8 I	[86]	*	
151	C ₁₉ H ₃₉ -COO-	Cr 85	S 74.3	Ch 78.1 I	[86]	*	
152	C ₂₁ H ₄₃ -COO-	Cr 89.6	S 72.5	Ch 75 I	[88]	*	
153	C ₂₃ H ₄₇ -COO-	Cr 91		I	[89]	*	
154	CH ₃ -COS-	Cr 126.2	Ch 119.5 I	/	[86,170]	*	
155	C ₂ H ₅ -COS-	Cr 111.4	Ch 111.1 I		[86,170]		
156	C ₃ H ₇ -COS-	Cr 100.6	Ch 117.6 I		[86,170]		
157	C ₄ H ₉ -COS-	Cr 90.7	Ch 104.7 I		[86,170]		
158	C ₅ H ₁₁ -COS-	Cr 94.8	Ch 107.7 I		[86,170]		
159	C ₆ H ₁₃ -COS-	Cr 107.0	S 73.1	Ch 102.1 I		[86,170]	*
160	C ₇ H ₁₅ -COS-	Cr 97.3	S 76.6	Ch 100.8 I		[86,170]	
161	C ₈ H ₁₇ -COS-	Cr 68.2	S 84.0	Ch 97.5 I		[86,170]	
162	C ₉ H ₁₉ -COS-	Cr 79.5	S 87.4	Ch 98.3 I		[86,170]	
163	C ₁₀ H ₂₁ -COS-	Cr 80.6	S 88.1	Ch 95.0 I		[86,170]	
164	C ₁₁ H ₂₃ -COS-	Cr 83.5	S 86.7	Ch 92.3 I		[86,170]	
165	C ₁₂ H ₂₅ -COS-	Cr 78.9	S 86.5	Ch 91.4 I		[86,170]	
166	C ₁₃ H ₂₇ -COS-	Cr 72.2	S 85.5	Ch 90.4 I		[86,170]	
167	C ₁₄ H ₂₉ -COS-	Cr 61.3	S 84.3	Ch 88.3 I		[86,170]	
168	C ₁₅ H ₃₁ -COS-	Cr 57.0	S 83.0	Ch 87.3 I		[86,170]	
169	C ₁₆ H ₃₃ -COS-	Cr 67.5	S 81.2	Ch 85.0 I		[86,170]	
170	C ₁₇ H ₃₅ -COS-	Cr 64.5	S 80.2	Ch 84.2 I		[86,170]	
171	C ₁₈ H ₃₇ -COS-	Cr 73.5	S 78.3	Ch 82.4 I		[86,170]	
172	C ₁₉ H ₃₉ -COS-	Cr 71.2	S 77.1	Ch 81.3 I		[86,170]	
173	C ₄ H ₉ -O-C ₂ H ₄ -COO-	Cr 95.8	Ch 81	U	[92]		
174	C ₅ H ₁₁ -O-C ₂ H ₄ -COO-	Cr 80	Ch 65.9	I	[92]		
175	C ₆ H ₁₃ -O-C ₂ H ₄ -COO-	Cr 79.7	Ch 64.7	I	[92]		
176	C ₇ H ₁₅ -O-C ₂ H ₄ -COO-	Cr 84.8	Ch 59.3	I	[92]		
177	C ₈ H ₁₇ -O-C ₂ H ₄ -COO-	Cr 82.2	Ch 59.5	I	[92]		
178	C ₁₂ H ₂₅ -O-C ₂ H ₄ -COO-	Cr 62.4	Ch 58.5	I	[92]		
179	CH ₃ -O-C ₂ H ₄ -O-C ₂ H ₄ -COO-	Cr 74.5	Ch 67.2 I		[92]		
180	C ₂ H ₅ -O-C ₂ H ₄ -O-C ₂ H ₄ -COO-	Cr 57.3	Ch 54.8 I		[92]		
181	CH ₃ -OOC-CH=CH-COO-	Cr 39	Ch 148	I	[172]		
182	C ₂ H ₅ -OOC-CH=CH-COO-	Cr 56	Ch 89	I	[172]		
183	C ₃ H ₇ -OOC-CH=CH-COO-	Cr 58	Ch 106	I	[172]		
184	C ₄ H ₉ -OOC-CH=CH-COO-	Cr 25	Ch 90	I	[172]		
185	C ₅ H ₁₁ -OOC-CH=CH-COO-	Cr 68	Ch 111	I	[172]		

TABLE 2. Cholest-5-enes—Continued

186	CH ₃ -OCOO-	Cr 114	Ch 110.9 I	[173]	*	
187	C ₂ H ₅ -OCOO-	Cr 83.9	Ch 105.8 I	[173]	*	
188	C ₃ H ₇ -OCOO-	Cr 98.8	Ch 101 I	[173]	*	
189	C ₄ H ₉ -OCOO-	Cr 80.2	Ch 94 I	[173]	*	
190	C ₅ H ₁₁ -OCOO-	Cr 101.5	Ch 90.6 I	[174]	*	
191	C ₆ H ₁₃ -OCOO-	Cr 106	Ch 108 I	[175, 176]	*	
192	C ₇ H ₁₅ -OCOO-	Cr 88	Ch 81.3 I	[173]	*	
193	C ₈ H ₁₇ -OCOO-	Cr 54.8	S 35.4	Ch 78.9 I	[173]	*
194	C ₉ H ₁₉ -OCOO-	Cr 79.5	S _A 45	Ch 77.9 I	[85]	*
195	C ₁₀ H ₂₁ -OCOO-	Cr 76.6	S 48.7	Ch 75.9 I	[173]	*
196	C ₁₁ H ₂₃ -OCOO-	Cr 70.5	S 51.1	Ch 74.4 I	[173]	*
197	C ₁₂ H ₂₅ -OCOO-	Cr 61.7	S 51.7	Ch 72.9 I	[173]	*
198	C ₁₃ H ₂₇ -OCOO-	Cr 61.9	S 52.1	Ch 71.3 I	[173]	*
199	C ₁₄ H ₂₉ -OCOO-	Cr 68.7	S 52.9	Ch 70.4 I	[173]	*
200	C ₁₅ H ₃₁ -OCOO-	Cr 69	S 53.9	Ch 69.7 I	[173]	*
201	C ₁₆ H ₃₃ -OCOO-	Cr 73.9	S 54.9	Ch 69.2 I	[173]	*
202	C ₁₇ H ₃₅ -OCOO-	Cr 74.1	S 55.5	Ch 68.6 I	[173]	*
203	C ₁₈ H ₃₇ -OCOO-	Cr 78.2	S 55.6	Ch 67.7 I	[173]	*
204	C ₁₉ H ₃₉ -OCOO-	Cr 78.7		Ch 67.1 I	[173]	*
205	C ₂₀ H ₄₁ -OCOO-	Cr 80.9		Ch 65.9 I	[173]	*
206	C ₂₂ H ₄₅ -OCOO-	Cr 70		Ch 81 U	[175]	*
207	CH ₃ -SCOO-	Cr 101.2		Ch 103.8 I	[184]	*
208	C ₂ H ₅ -SCOO-	Cr 114.7		Ch 97.1 I	[184]	*
209	C ₃ H ₇ -SCOO-	Cr 97.9		Ch 90.3 I	[184]	*
210	C ₄ H ₉ -SCOO-	Cr 97.5		Ch 93.3 I	[184]	*
211	C ₅ H ₁₁ -SCOO-	Cr 92.9	S 40.3	Ch 87.3 I	[184]	*
212	C ₆ H ₁₃ -SCOO-	Cr 94.1	S 58	Ch 85.4 I	[184]	*
213	C ₇ H ₁₅ -SCOO-	Cr 61	S 68.2	Ch 84.2 I	[184]	*
214	C ₈ H ₁₇ -SCOO-	Cr 80.9	S 69.8	Ch 82.3 I	[184]	*
215	C ₉ H ₁₉ -SCOO-	Cr 75.2	S 71.8	Ch 79.3 I	[184]	*
216	C ₁₀ H ₂₁ -SCOO-	Cr 78.1	S 71.3	Ch 77.9 I	[184]	*
217	C ₁₁ H ₂₃ -SCOO-	Cr 72.5	S 69.7	Ch 74.8 I	[184]	*
218	C ₁₂ H ₂₅ -SCOO-	Cr 60.6	S 65.6	Ch 71.6 I	[184]	*
219	C ₁₃ H ₂₇ -SCOO-	Cr 55.2	S 63.6	Ch 69.3 I	[184]	*
220	C ₁₄ H ₂₉ -SCOO-	Cr 59.4	S 60.8	Ch 67.6 I	[184]	*
221	C ₁₅ H ₃₁ -SCOO-	Cr 62.7	S 61.9	Ch 67.6 I	[184]	*
222	C ₁₆ H ₃₃ -SCOO-	Cr 47.1	S 57.2	Ch 63.6 I	[184]	*
223	C ₁₇ H ₃₅ -SCOO-	Cr 68.3	S 55.8	Ch 62.4 I	[184]	*
224	C ₁₈ H ₃₇ -SCOO-	Cr 58.8	S 57.3	Ch 63.5 I	[184]	*
225	C ₁₉ H ₃₉ -SCOO-	Cr 73.6	S 54.1	Ch 60.6 I	[184]	*
226	C ₂₀ H ₄₁ -SCOO-	Cr 64.8	S 54.2	Ch 60.4 I	[184]	*
227	CH ₃ -OCOS-	Cr 126.6		Ch 111.3 I	[185]	*
228	C ₂ H ₅ -OCOS-	Cr 132.2		Ch 109.0 I	[185]	*
229	C ₃ H ₇ -OCOS-	Cr 109.2		Ch 96.1 I	[185]	*
230	C ₄ H ₉ -OCOS-	Cr 101.7	S 35.0	Ch 95.8 I	[185]	*
231	C ₅ H ₁₁ -OCOS-	Cr 96.0	S 56.0	Ch 90.3 I	[185]	*
232	C ₆ H ₁₃ -OCOS-	Cr 95.3	S 65.9	Ch 91.6 I	[185]	*
233	C ₇ H ₁₅ -OCOS-	Cr 92.5	S 65.6	Ch 83.4 I	[185]	*
234	C ₈ H ₁₇ -OCOS-	Cr 87.7	S 66.6	Ch 82.8 I	[185]	*
235	C ₉ H ₁₉ -OCOS-	Cr 76.0	S 70.2	Ch 82.3 I	[185]	*
236	C ₁₀ H ₂₁ -OCOS-	Cr 76.5	S 70.0	Ch 84.0 I	[185]	*
237	C ₁₁ H ₂₃ -OCOS-	Cr 87.7	S 70.4	Ch 81.7 I	[185]	*
238	C ₁₂ H ₂₅ -OCOS-	Cr 92.5	S 69.1	Ch 80.2 I	[185]	*
239	C ₁₃ H ₂₇ -OCOS-	Cr 79.4	S 67.9	Ch 78.4 I	[185]	*
240	C ₁₄ H ₂₉ -OCOS-	Cr 78.5	S 67.3	Ch 77.6 I	[185]	*
241	C ₁₅ H ₃₁ -OCOS-	Cr 84.4	S 66.3	Ch 75.9 I	[185]	*
242	C ₁₆ H ₃₃ -OCOS-	Cr 82.8	S 65.3	Ch 75.0 I	[185]	*

TABLE 2. Cholest-5-enes—Continued

243	C ₁₇ H ₃₅ -OCOS-	Cr 70.6	S 64.3	Ch 73.7 I	[185]	*
244	C ₁₈ H ₃₇ -OCOS-	Cr 63.0	S 63.1	Ch 72.6 I	[185]	*
245	C ₁₉ H ₃₉ -OCOS-	Cr 75.8	S 62.3	Ch 71.3 I	[185]	*
246	C ₂₀ H ₄₁ -OCOS-	Cr 70.1	S 60.4	Ch 70.2 I	[185]	*
247	CH ₃ -SCSO-	Cr 128		Ch <?	I [182]	*
248	C ₂ H ₅ -SCSO-	Cr 144			O [188]	*
249	C ₃ H ₇ -SCSO-	Cr 135			O [189]	
250	C ₆ H ₁₃ -SCSO-	Cr ?		Ch ?	I [186]	
251	CH ₃ -NHCOO-	Cr 205			I [191]	
252	C ₂ H ₅ -NHCOO-	Cr 162			I [191]	*
253	C ₃ H ₇ -NHCOO-	Cr ?		X ?	I [192]	*
254	C ₄ H ₉ -NHCOO-	Cr 129			I [191]	*
255	C ₈ H ₁₇ -NIICOO-	Cr 104		Ch 76	I [193]	
256	C ₁₂ H ₂₅ -NHCOO-	Cr 47			U [194]	
257	C ₁₆ H ₃₃ -NHCOO-	Cr 60	S 79	Ch 81	I [193]	
255	CH ₃ -O-C ₂ H ₄ -O-C ₂ H ₄ -OCO	Cr ?	S 45-59		U [195]	*
256	C ₂ H ₅ -O-C ₂ H ₄ -O-C ₂ H ₄ -OCOO-	Cr ?		Ch 37.5 I	[196]	*
257	C ₄ H ₉ -O-C ₂ H ₄ -O-C ₂ H ₄ -OCOO-	Cr ?		Ch 29 U	[197]	*
258	CH ₃ -OOC-C ₅ H ₁₀ -NH-COO-	Cr 86	Sc 71	Ch 85	I [199]	*
259	C ₂ H ₅ -OOC-C ₅ H ₁₀ -NH-COO-	Cr 95		Ch 75	I [199]	
260	C ₃ H ₇ -OOC-C ₅ H ₁₀ -NH-COO-	Cr 68		Ch 66	I [199]	
261	C ₄ H ₉ -OOC-C ₅ H ₁₀ -NH-COO-	Cr 79		Ch 56	I [199]	
262	C ₅ H ₁₁ -OOC-C ₅ H ₁₀ -NH-COO-	Cr 84.5		Ch 42	I [199]	
263	C ₆ H ₁₃ -OOC-C ₅ H ₁₀ -NH-COO-	Cr 64		Ch 44	I [199]	
264	C ₇ H ₁₅ -OOC-C ₅ H ₁₀ -NH-COO-	Cr 44		Ch 43	I [199]	*
265	C ₈ H ₁₇ -OOC-C ₅ H ₁₀ -NH-COO-	Cr 67.5	Sc 27	Ch 44	I [199]	
266	C ₉ H ₁₉ -OOC-C ₅ H ₁₀ -NH-COO-	Cr 70	Sc 37	Ch 46	I [199]	
267	C ₁₀ H ₂₁ -OOC-C ₅ H ₁₀ -NH-COO-	Cr 57	Sc 43.5	Ch 48.5 I	[199]	
268	C ₁₁ H ₂₃ -OOC-C ₅ H ₁₀ -NH-COO-	Cr 48	S _A 49		I [199]	*
269	C ₁₂ H ₂₅ -OOC-C ₅ H ₁₀ -NH-COO-	Cr 33	S _A 53		I [199]	*
270	CH ₃ -OOC-C ₁₀ H ₂₀ -NH-COO-	Cr ₃ 36 Cr ₂ 48.5 Cr ₁ 62.5		Ch 68	I [200]	*
271	C ₂ H ₅ -OOC-C ₁₀ H ₂₀ -NH-COO-	Cr ₂ 74 Cr ₁ 83		Ch 59	I [200]	*
272	C ₃ H ₇ -OOC-C ₁₀ H ₂₀ -NH-COO-	Cr 85			I [200]	*
273	C ₄ H ₉ -OOC-C ₁₀ H ₂₀ -NH-COO-	Cr 89.5	Sc 23.5	Ch 48.5 I	[200]	*
274	C ₅ H ₁₁ -OOC-C ₁₀ H ₂₀ -NH-COO-	Cr ₂ 40 Cr ₁ 87	Sc 29	Ch 42	I [200]	*
275	C ₆ H ₁₃ -OOC-C ₁₀ H ₂₀ -NH-COO-	Cr ₂ 46 Cr ₁ 70	Sc 28	Ch 42	I [200]	*
276	C ₇ H ₁₅ -OOC-C ₁₀ H ₂₀ -NH-COO-	Cr ₂ 57.5 Cr ₁ 69	Sc 30	Ch 41	I [200]	*
277	C ₈ H ₁₇ -OOC-C ₁₀ H ₂₀ -NH-COO-	Cr 63	Sc 31	Ch 40	I [200]	*
278	C ₉ H ₁₉ -OOC-C ₁₀ H ₂₀ -NH-COO-	Cr 58	Sc 32.5	Ch 40.5 I	[200]	*
279	C ₁₀ H ₂₁ -OOC-C ₁₀ H ₂₀ -NH-COO-	Cr ₃ 22 Cr ₂ 35 Cr ₁ 51	Sc 33	Ch 41	I [200]	*
280	C ₁₁ H ₂₃ -OOC-C ₁₀ H ₂₀ -NH-COO-	Cr 47	Sc 36	Ch 41	I [200]	*
281	C ₁₂ H ₂₅ -OOC-C ₁₀ H ₂₀ -NH-COO-	Cr 49.5	Sc 38	Ch 42	I [200]	*

Footnotes:

- No. Additional published Data
 1 Cr 128 I¹⁴; Cr 127.5 I^{15,16}; Cr 127 I¹⁷; Cr 126.5 I¹⁷
 6 Cr 123 I¹⁹, DSC¹⁵
 7 Cr 109 I²²
 9 Cr 100.4 Ch <? I¹⁹
 15 Cr 128 I^{19,20}
 17 Cr 78-79 I²⁰
 18 Cr ? S 47.7 Ch 50.5 I²⁵; Cr ? S 47.3 Ch 50.5 I²⁰
 22 Cr 124.5 Ch 129 I²⁵; Cr 129 Ch 124.5 I²⁷

TABLE 2. Cholest-5-enes—Continued

23	Cr 127 O ³¹
24	Cr 152 I ³⁰ ; Cr 150 I ³²
25	Cr 114.7 I ^{30,33}
29	Cr 104 X 93 I ²⁹
38	Cr 118 Ch 126 I ¹⁴ ; Cr 127 Ch 90 I ³⁷ ; Cr 118.7 Ch 125.8 I ³⁸ ; Cr 122.5 Ch 125 I ⁴⁰ ; Cr 125.8 Ch 124.8 I ^{41,42} ; Cr 125 I ⁴³ ; DSC ³⁷ ; DTA ⁴⁴
39	Cr 112.7 Ch 162 I ³³ ; Cr 97 Ch 101 I ⁴⁵ ; Cr 90 Ch 149 U ⁴⁶ ; DSC ³³
42	Cr 44 Ch 70 I ^{49,50} ; Cr 45.5 Ch 68.5 I ⁴⁷ ; DSC ⁴⁹
43	Cr ₂ 28 Cr ₁ 42 S 67 Ch 78 I ⁵⁰ ; Cr 54.5 X 71.5 I ⁴⁷ ; Cr 56.0 S 57.6 Ch 71.9 I ⁴⁸ ; DSC ⁴⁹
44	Cr 125 I ⁴⁹
46	mp ₂ 84 ⁴⁹ ; Cr 86 X 104 I ⁴³
54	Cr 74 Ch 95 I ⁴⁵
55	Cr 63 Ch 94 I ⁵⁵
61-69	have never been tested for potential liquid crystalline properties, but good liquid crystalline properties can be expected (high clearing temperatures).
70	Cr 83 I ⁶³ ; Cr 83 Ch 53.5 I ⁶⁴ ; Cr 82 Ch <? I ⁶⁵ ; Cr 84.5 I ⁶⁶ ; Cr 84 I ⁶⁷ ; Cr 83.5 I ⁶¹
71	Cr 87 I ⁶⁸ ; Cr 88.5 Ch 74.5 I ⁶⁴ ; Cr 89 Ch <? I ⁶⁵ ; Cr 88 I ⁶⁷ ; Cr 80 I ⁶⁹ ; Cr 89 I ⁶¹
72	Cr 100 Ch <? I ⁶⁵ ; Cr 100.5 I ⁶⁷ ; Cr 101 I ^{61,59}
73	Cr 79 Ch 86 I ⁶⁵ ; Cr 77 O ⁶⁷ ; Cr 82 O ⁷⁰ ; Cr 78 Ch 86.5 I ⁷¹ ; DSC ⁷¹
74	Cr 97 I, mp ₂ 93 ⁵⁹
75	Cr 68 Ch 79 I ⁶⁵ ; Cr 69-71 O ⁷⁰ ; Cr 70 I ⁷² ; Cr 68 Ch 81 I ^{73,71} ; Cr ₂ 65 Cr ₁ 69 Ch 82 I ⁵⁹ ; DSC ⁷¹
76	Cr 96 Ch <? I ⁶⁵ ; Cr 96 Ch 92.5 I ⁵⁹
77	Cr 97-98 O ⁷⁰ ; Cr 95.5 Ch 79 I ⁷¹ ; Cr 95 S _C 67 Ch 78 I ⁵⁹ ; DSC ⁷¹
78	Cr 68 S _A 52.5 Ch 73 I ⁵⁹
79	Cr 58-62 O ⁷⁰ ; Cr 60 S 61 Ch 75.5 I ⁷¹ ; Cr 63 S _C 63.5 Ch 78 I ⁵⁹ ; DSC ⁷¹
80	Cr 71-73 O ⁷⁰ ; Cr 70.5 S 61 Ch 72 I ⁷¹ ; Cr 73 O ⁷⁴ ; DSC ⁷¹
82	Cr 47-49 O ⁷⁰ ; Cr 52 I ⁷² ; Cr 50 S 58 Ch 65 I ⁷³ ; Cr 47 S 60 Ch 69.5 I ⁷¹ ; Cr 50 O ⁷⁴ ; DSC ⁷¹
84	Cr 57-59 O ⁷⁰ ; Cr 56.5 S 60 Ch 68 I ⁷¹ ; Cr 57 O ⁷⁴ ; Cr 56 O ⁷⁵ ; DSC ⁷¹
85	Cr 65 O ⁷⁰ ; Cr 63.5 S 59 Ch 68 I ⁷¹ ; DSC ⁷¹
86	Cr 61-64 O ⁷⁰ ; Cr 66.5 S 52.5 Ch 60.5 I ⁷¹ ; DSC ⁷¹
96-100	X = unclear transition, solid-solid transitions ?
115	Cr <20 U ⁷⁹ ; Cr 54.5-55.5 I ⁷⁸
116	Cr 51-52 I ⁷⁸
117	Cr 35.5-37 I ⁷⁸
118	Cr 101 I ^{81,82} ; Cr 102 I ⁸³
118-132	(R-OOC-cholest-(5)-ene) have never been tested for potential liquid crystalline properties, although in all probability the substances should show liquid crystalline behaviour. They should have higher clearing points than the analogous compounds 133 - 153 (R-COO-cholest-(5)-ene).
133	Cr ? Ch 95.4 I ⁸⁶ ; Cr 112 Ch 94 I ⁹⁰ ; Cr ₃ 41 Cr ₂ ? Ch ⁹⁰ ; Cr ₂ 75 Cr ₁ 114.0 Ch 94 I ⁹¹ ; Cr 114.4 X <? I ¹ ; Cr 116.2 Ch 112 I ⁹² ; Cr ₂ 40 Cr ₁ 115 I ⁹³ ; Cr 115.5 Ch 95.5 I ⁹⁴ ; Cr 115 Ch 92 I (DTA) ⁹⁴ ; Cr 115 Ch 95 I ⁶⁴ ; Cr 115 I ¹⁶ ; Cr 115 X 94 I, more phases ⁹⁵ ; Cr 112.8 X 80-90 I ¹⁸ ; Cr 117 X ? I ⁹⁶ ; Cr 114 I ⁹⁷ ; Cr ? Ch ? I ⁹⁸ ; 5 solid phases ⁹⁹ ; Cr 115 Ch 93 I ¹⁰⁰ ; Cr 108.6 Ch 102.4 I ¹⁰¹ ; pressure dep. ¹⁰² ; Cr ? Ch 94.1 I, no BP ¹⁰³ ; 4 solid phases ¹⁰⁴ ; DSC ^{86,91,104,105,106,107} ; DTA ¹⁰⁸ mp ₂ 98 ¹⁰⁹ ; Cr 97.2 Ch 113 I ¹¹⁰ ; Cr 102 Ch 116 I ⁸⁴ ; BP ¹¹¹ ; Cr 99.6 Ch 114.1 I ¹¹² ; Cr 99.2 Ch 113.8 I ¹¹³ ; Cr 93 Ch 95 I ¹¹⁴ ; Cr 95.6 Ch 110.9 I ¹⁵ ; Cr 100.6 Ch 115.2 I ⁸⁵ ; Cr 98 X 114 I ¹¹⁵ ; Cr 96 Ch 109 I ⁹² ; Cr 100 Ch 102 I ¹¹⁶ ; Cr 99 Ch 93 I ¹¹⁷ ; Cr 101.5 Ch 113.5 I ⁹⁴ ; Cr 96 Ch 112 I (DTA) ⁹⁴ ; Cr 112 X 114 I ¹⁶ ; Cr 93.0 X 107.2 I ¹⁸ ; Cr 99-102 X 116 I ⁹⁶ ; Cr 97 X 113 I ⁹⁷ ; Cr ? Ch ? I ⁹⁸ ; 3 solid phases ⁹⁹ ; Cr 99 Ch 114 I, mp ₂ 96 ¹⁰⁰ ; Cr 92.0 Ch 106.4 I ¹⁰¹ ; pressure dep. ¹⁰² ; Cr ? Ch 113.5 BP 113.8 I ¹⁰³ ; Cr 95.2 Ch 111.8 I ²⁶ ; DSC ^{15,33,86,106,99,105,107,110,112,118,119,111} ; DTA ^{121,122}
134	Cr 99 Ch 113 I ¹²³ ; Cr 98.6 Ch 112.5 I ³³ ; Cr 98.6 Ch 110.6 I ¹¹³ ; Cr 97.4 Ch 112.4 I ⁸⁵ ; Cr 98 Ch 106 I ⁹² ; Cr 92.8 X 108.4 I ¹⁷ ; Cr 98 Ch 110.5 I ⁹⁴ ; Cr 98 Ch 109 I (DTA) ⁹⁴ ; Cr 103 X 111.5 I ¹⁶ ; Cr 96.4 X 107.3 I ¹⁸ ; Cr 102 X 111 I ⁹⁷ ; Cr ? Ch ? I ⁹⁸ ; Cr 94.0 Ch 104.0 I ¹⁰¹ ; pressure dep. ¹⁰² ; DSC ^{11,33,86,105} ; DTA ¹²¹
135	Cr 92.6 Ch 91 I ¹³³ ; Cr 90.0 Ch 97.7 I ¹¹³ ; pressure dep. ^{124,102} ; Cr 91.0 Ch 97.3 I ⁸⁵ ; Cr 97 Ch 147 I ¹¹⁶ ; Cr 89.6 X 99.3 I ¹⁷ ; Cr 96 Ch 109.5 I ⁹⁴ ; Cr 92 Ch 107 I (DTA) ⁹⁴ ; Cr 92 X 94 I ¹⁶ ; Cr 91.8 X 99.2 I ¹⁸ ; Cr 87.5 X 90 I ⁹⁷ ; Cr 86.4 Ch 94.2 I ¹⁰¹ ; DSC ^{11,33,86,105,125,126} ; DTA ¹²¹

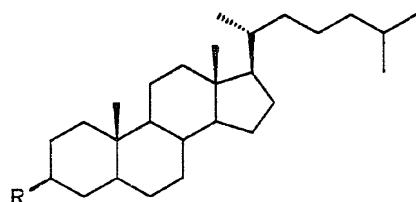
TABLE 2. Cholest-5-enes—Continued

137	Cr 120.4 Ch 98.7 I ³³ ; Cr 98.0 Ch 99.3 I ¹¹³ ; pressure dep. 124,102; Cr 98 Ch 99 I ⁸⁵ ; Cr 98 Ch 99.5 I ⁹² ; Cr 91.2 X 100.1 I ^{17,18} ; Cr 99 Ch 100 I ⁹⁴ ; Cr 96 Ch 98 I (DTA) ⁹⁴ ; Cr 100 Ch 102 I ⁷³ ; Cr 85 X 101 I ¹⁶ ; Cr 93.5 X 94.5 I ⁹⁷ ; Cr 93.0 Ch 95.6 I ¹⁰¹ ; DSC ^{33,86,105,125}
138	Cr 106.8 Ch 93.8 I ^{113,85} ; Cr 110 Ch 101 I ⁹² ; Cr 113 Ch 96 I ⁹⁴ ; Cr 112.2 I ¹²⁷ ; Cr 110.5 X <? I ¹²⁸ ; Cr 106.0 Ch 86.4 I ¹⁰¹ ; DSC ^{33,86,105,106}
139	Cr 112.7 Ch 92.7 I ³³ ; Cr 103.8 Ch 94.5 I ^{113,85} ; Cr 108 S2 72.8 S1 80.2 Ch 94.5 I ¹²⁹ ; Cr 104 Ch 98 I ⁹² ; Cr 106.2 S <? X <? I ¹⁷ ; Cr 109 Ch 91 I ⁹⁴ ; Cr 103 X 108 I ¹⁶ ; Cr 106.4 X 101 I ¹⁸ ; Cr 104.6 X 106 I ⁹⁷ ; Cr ? S ? Ch ? I ⁹⁸ ; Cr 106-108 Ch 88 I ¹³⁰ ; Cr 103.4 Ch 84.2 I ¹⁰¹ ; DSC ^{33,86,105,119,131} ; DTA ¹²²
140	Cr 80.7 Ch 93.0 I ³³ ; BP ¹¹¹ ; Cr ? Ch 94 I ¹³² ; Cr 79.8 S _A 76.0 Ch 90.3 I ¹¹³ ; pressure dep. 133,134,135; Cr 80.2 S _A 74.1 Ch 90.7 I ⁸⁵ ; Cr 76 Ch 89 I ⁹² ; Ch 91.05 BP1 91.35 BP2 91.50 I ¹³⁶ ; Cr ? S 72.8 Ch 90 I ¹²⁸ ; Cr 78 S 79 Ch 90.5 I ⁹⁸ ; Cr 79 S 76 Ch 91 I ¹⁰⁰ ; Cr 79.2 S 73.4 Ch 89.2 I ¹⁰¹ ; Cr 77.5 S 79 Ch 93 I ¹³⁷ ; Cr 80 Ch 90.5 I ¹³⁸ ; Cr ? Ch 91.0 BP 91.5 I ¹³⁹ ; DSC ^{33,86,106,99,105,107,110,118,125,140,141,142,143,144,145} ; DTA ^{108,121,146}
141	Cr 87.2 Ch 91.4 I ³³ ; Cr 83.6 S _A 80.0 Ch 91.7 I ¹¹³ ; Cr ? S _A 78 Ch 91.5 BP 92 I ¹⁴⁷ ; Cr 82.6 S _A 75.5 Ch 91.5 I ⁸⁵ ; Cr 81.5 Ch 89 I ⁹² ; Cr 82.2 S ? X 90.6 I ¹⁷ ; Cr 85 S 79.5 Ch 92 I ⁹⁴ ; Cr 84 S 79 Ch 91 I (DTA) ⁹⁴ ; Cr 82 X 93 I ¹⁶ ; Cr 82.2 X 90.6 I ¹⁸ ; Cr 83 X 91 I ⁹⁷ ; Cr 55.5 S 68.5 Ch 85 I ⁹⁸ ; Cr 78.6 S 76.0 Ch 89.8 I ¹⁰¹ ; DSC ^{33,86,105,106,140,143,148}
142	Cr 84.5 S _A 79.9 Ch 89.5 I ¹¹³ ; Cr 91.3 S 80.2 Ch 87.2 I ¹⁴⁹ ; Cr 89.0 S 77.8 Ch 84.8 I ¹⁰¹ ; DSC ^{86,105,110}
143	Cr 99.0 Ch 87.4 I ³³ ; Cr 93 S 83.5 Ch 90 I ⁸⁴ ; Cr 91.3 S 81.4 Ch 88.6 I ¹¹² ; Cr 91.4 S _A 81.3 Ch 88.1 I ¹¹³ ; Cr 92.0 S _A 81.5 Ch 87.8 I ¹⁵⁰ ; Cr 91.2 S _A 79.7 Ch 86.9 BP 87.3 I ¹⁵¹ ; Cr 77 S 80 Ch 89 I ¹⁵² ; Cr 93 S 75.3 S 85.3 Ch 87.9 I ¹²⁹ ; .76 S 87.5 Ch ., B = 0.9 Tesla ¹²⁹ ; ... Ch 87.9 I, B = 1.2 Tesla ¹²⁹ ; Cr 78.5 S 80 Ch 88 I ⁹⁴ ; Cr 76 S 78 Ch 85 I (DTA) ⁹⁴ ; Cr 95 I ¹²⁷ ; Cr 91 I ¹⁶ ; -> Text ¹²⁸ ; Cr 91.8 X 92 I ⁹⁷ ; Cr ? S ? Ch ? I ⁹⁸ ; Cr 90.6 S 77.2 Ch 84.6 I ¹⁰¹ ; DSC ^{33,86,110,112,153}
144	Cr 75.0 S 76.0 Ch 80.4 I ¹⁰¹ ; DSC ^{86,110,140}
145	pressure dep. 133,134,135,154; Cr 71 S 81 Ch 86.5 I ⁸⁴ ; Cr 71.0 S 79.1 Ch 84.6 I ¹¹² ; Cr 70.7 S _A 79.1 Ch 83.9 I ¹¹³ ; Cr 71.4 A 79.3 Ch 84.1 I ¹⁵⁰ ; ..A 79.16 Ch 84.05 BP 84.64 I ¹⁵⁵ ; Cr 70.7 A 78.6 Ch 84.4 I ⁸⁵ ; Cr 70.0 S 79.8 Ch 84.9 I ¹⁵⁶ ; Cr 72.1 S 79.2 Ch 84.8 I ¹⁵⁷ ; Cr 72 S 80 Ch 85 I ¹⁷³ ; Cr 80 X 86 I ¹⁶ ; -> Text ¹²⁸ ; Cr 73 X 80 I ⁹⁷ ; Cr 72 S 78 Ch 83 I ⁹⁸ ; Cr 69.0 S 75.0 Ch 80.0 I ¹⁰¹ ; Cr ? Ch 83.9 BP 84.5 I ¹³⁹ ; Cr ? S 79.5 Ch 84.2 BP 84.2 I ¹⁰³ ; ¹ H(A-Ch) pressure dep. ¹⁵⁴ ; DSC ^{33,86,96,106,110,112,120,131,140,141,142,143,148,156,158,159,160,161,162} ; DTA ¹⁶³
146	Cr 67.4 S 74.0 Ch 77.9 I ¹⁰¹ ; DSC ^{86,110,140}
147	Cr 76.6 A 74.3 Ch 78.5 I ¹¹³ ; Cr 76.6 A 74.1 Ch 82.5 I ⁸⁵ ; Cr 77.5 Ch 82 I ¹⁶⁴ ; Cr 76 S 75.5 Ch 80 I ⁹⁴ ; Cr 77 S 75 Ch 80 I (DTA) ⁹⁴ ; Cr 76.6 S 76.2 Ch 80.7 I ¹⁵⁷ ; Cr 78 X 90 I ¹⁶ ; -> Text ¹²⁸ ; Cr 75 X 80.5 I ⁹⁷ ; Cr 73.6 S 72.6 Ch 77.4 I ¹⁰¹ ; Cr ? S 78.0 Ch 82.0 BP 82.0 I ¹⁰³ ; DSC ^{33,86,105,106,110,120,159,161,162,165,166} ; DTA ¹²²
148	DSC ^{86,87,107,110,118}
149	Cr 81.8 S 74.3 Ch 78.3 I ¹⁶⁷ ; Cr 81.3 A 73.5 Ch 77.4 I ¹¹³ ; Cr 76 S 75.5 Ch 80 I ⁹⁴ ; Cr 77 S 75 Ch 80 I (DTA) ⁹⁴ ; Cr 78 I ¹²⁷ ; Cr 81.5 S 73.4 Ch 77.0 I ¹⁵⁷ ; Cr 78 X 82.5 I ¹⁶ ; -> Text ¹²⁸ ; Cr 71 X 79.5 I ⁹⁷ ; Cr ? S ? I ⁹⁸ ; Cr 79.4 S 71.2 Ch 74.0 I ¹⁰¹ ; Cr 79 S 76 Ch 79.2 I ⁸⁸ ; pressure dep. ¹⁶⁸ ; DSC ^{33,86,105,106,110,126,159,167,169} ; DTA ¹²²
150	DSC ^{86,110}
151	Cr 83.1 S 72.0 Ch 75.6 I ⁸⁹ ; DSC ^{86,110}
152	Cr 88.5 I ⁸⁹
153	Cr 87 X 89 I ¹⁶
154	Cr 122.5-124.5 I ¹⁷¹
155	Cr ? S 67.0 Ch 96.1 BP ? I ¹⁰³
156	Cr 114 Ch <? I, sinters at 112; mp ₂ < 110 ¹⁷⁷ ; pressure dep. ¹⁰² ; Cr 110 Ch 114 I ¹⁷⁸ ; DSC ¹⁷³
157	Cr 83.7 Ch 105.7 I ¹¹² ; Cr 83.0 Ch 103.5 I ⁸⁵ ; Cr 83 X 104 I ¹⁷⁹ ; Cr 84 Ch ? I ¹⁸⁰ ; Cr 83 Ch 103.5 I ¹⁷⁷ ; Cr 82 X 103 I, mp ₂ 72 ¹⁸¹ ; Cr 84 I ¹⁸² ; pressure dep. ¹⁰² ; DSC ^{112,173,183}
158	Cr 96.9 Ch 99.0 I ⁸⁵ ; Cr 96-99 Ch 101 I, sinters at 95 ¹⁷⁷ ; pressure dep. ¹⁰² ; DSC ^{173,183}
159	Cr 78.0 Ch 92.1 I ⁸⁵ ; Cr 78 Ch 90 I ¹⁷⁷ ; Cr 79.9 Ch 92.2 BP 92.7 I ¹⁰³ ; DSC ^{173,183}
160	Cr 106.3 I ¹⁷³ ; Cr 106.2 Ch <? I ⁸⁵ ; Cr 98 Ch 102 I ^{175,176} ; DSC ^{173,183}
161	Cr 108.3 I ¹⁷³ ; Cr 108 Ch <? I ⁸⁵ ; DSC ^{173,183}
162	Cr 79.2 Ch 77.0 I ⁸⁵ ; Cr 79 Ch 85 I ^{175,176} ; Cr 80.1 Ch 79.7 BP 80.1 I ¹⁰³ ; DSC ^{173,183}
163	Cr 53.0 A 44.5 Ch 75.6 I ⁸⁵ ; Cr 53 Ch 83 I ^{175,176} ; DSC ^{173,183}
164	Cr 79.3 S 45.1 Ch 77.2 I ¹⁷³ ; Cr 78 Ch 81 I ¹⁷⁵ ; Cr 78 Ch 78 I ¹⁷⁶ ; DSC ^{173,183}

TABLE 2. Cholest-5-enes—Continued

195	Cr 76.5 A 47.2 Ch 74.0 I ¹⁸⁵ ; Cr 76 Ch 79.5 I ^{175,176} ; DSC ^{173,183}
196	Cr 61.6 A 51.2 Ch 73.0 I ¹⁸⁵ ; Cr 53 Ch 78 I ^{175,176} ; DSC ^{173,183}
197	Cr 62.5 Ch 73 I ¹⁷⁵ ; Cr 62.5 Ch 76 I ¹⁷⁶ ; DSC ¹⁷³
198	DSC ¹⁷³
199	Cr 70 Ch 75 I ^{175,176} ; DSC ¹⁷³
200	DSC ¹⁷³
201	Cr 69 Ch 75 I ^{175,176} ; DSC ¹⁷³
202	DSC ¹⁷³
203	Cr 79.5 Ch 81 I ^{175,176} ; DSC ¹⁷³
204	DSC ¹⁷³
205	Cr 69 Ch 71 I ^{175,176} ; DSC ¹⁷³
206	Cr 70 Ch 81 I ¹⁷⁶
207-226	DSC
207	Cr ? Ch 102.7 BP 103.0 I ¹⁰³
212	Cr ? S 55.4 Ch > 82.1 I, no BP ¹⁰³
224	Cr ? S 60.2 Ch > 63.8 I, no BP ¹⁰³
227-246	DSC ¹⁸⁵
227	Cr 126 Ch 111 I ¹⁸⁶
228	Cr 131 Ch 108 I ¹⁸⁶ ; Cr 144 U ¹⁸⁷
229	Cr 108 Ch 96 I ¹⁸⁶ ; Cr 110 Ch 61 U ¹⁸⁷
230	Cr 101 S 30 Ch 95 I ¹⁸⁶
231	Cr 94 S 58 Ch 91 I ¹⁸⁶ ; Cr 102 Ch 107 U ¹⁸⁷
232	Cr 91 S 67 Ch 94 I ¹⁸⁶ ; Cr 96 Ch 101 U ¹⁸⁷
233	Cr 93 S 63 Ch 83 I ¹⁸⁶ ; Cr 95 Ch 107.5 U ¹⁸⁷ ; Cr ? S 59.9 Ch > 78.5 I, no BP ¹⁰³
234	Cr 89 S 65 Ch 83 I ¹⁸⁶
235	Cr 72 S 71 Ch 85 I ¹⁸⁶ ; Cr 72 Ch 82 U ¹⁸⁷
236	Cr 78 S 71 Ch 84 I ¹⁸⁶ ; Cr 77 Ch 86 U ¹⁸⁷
237	Cr 88 S 71 Ch 81 I ¹⁸⁶
238	Cr 93 S 70 Ch 81 I ¹⁸⁶
239	Cr 80 S 68 Ch 78 I ¹⁸⁶ ; Cr 83 Ch 78 U ¹⁸⁷
240	Cr 79 S 67 Ch 77 I ¹⁸⁶
241	Cr 84 S 66 Ch 76 I ¹⁸⁶
242	Cr 83 S 65 Ch 75 I ¹⁸⁶ ; Cr 82 Ch 78 U ¹⁸⁷
243	Cr 71 S 64 Ch 75 I ¹⁸⁶ ; Cr ? S 63.4 Ch > 70.8 I, no BP ¹⁰³
244	Cr 64 S 63 Ch 73 I ¹⁸⁶
245	Cr 75 S 62 Ch 71 I ¹⁸⁶
246	Cr 70 S 61 Ch 71 I ¹⁸⁶
247	Cr 128 O ¹⁸⁸ ; Cr 126.5 O ¹⁸⁹ ; Cr 128 I ¹⁹⁰
248	Cr 141.5 O ¹⁸⁹
252	Cr 182 I ¹⁹⁴
253	Cr 142 O ¹⁹¹
254	Cr 125 I ¹⁹³
255	Cr ? Ch 62 U ¹⁹⁷ ; Cr 24 Ch 44 U ¹⁹⁸
256	Cr ? Ch 48.5 I ¹⁹⁷
257	Cr ? Ch -1 I ¹⁹⁵
258	Most probably Sc given for compounds 258, 265 - 267 in ref. [199] is S _A . mp ₂ 54 ¹⁹⁹
264	mp ₂ 40.5 ¹⁹⁹
268	mp ₂ 42 ¹⁹⁹
269	mp ₂ 19 ¹⁹⁹
270	mp ₂ 47, mp ₃ 34 ²⁰⁰
271	mp ₂ 59 ²⁰⁰
272	mp ₂ 62 ²⁰⁰
273	Most probably Sc given for compounds 273 - 281 in ref. [200] is S _A . mp ₂ 35 ²⁰⁰
274	mp ₂ -1 ²⁰⁰
278	mp ₂ 40, mp ₃ 27 ²⁰⁰
280	mp ₂ 44, mp ₃ 32.5 ²⁰⁰
281	mp ₂ 37 ²⁰⁰

TABLE 3. Cholestanes

Table 3: 3β -substituted cholestanes

(all temperatures in °C)

No	3β -Substituent	Solid State	Mesophase	CP	Reference	Comments
1	$\text{CF}_3\text{-COO-}$	Cr 108		I	[201]	
2	$\text{C}_2\text{F}_5\text{-COO-}$	Cr 117		I	[201]	
3	$\text{C}_3\text{F}_7\text{-COO-}$	Cr 115		I	[201]	
4	$\text{C}_6\text{F}_{13}\text{-COO-}$	Cr 86		I	[201]	
5	$\text{H-C}_2\text{F}_4\text{-COO-}$	Cr ₂ 93.9	Cr ₁ 124.9	I	[201,202]	
6	$\text{H-C}_4\text{F}_8\text{-COO-}$	Cr ₂ 63.9	Cr ₁ 87.9	I	[201,202]	
7	$\text{H-C}_6\text{F}_{12}\text{-COO-}$	Cr ₂ 66.9	Cr ₁ 72.9	I	[201,202]	
8	$\text{H-C}_8\text{F}_{16}\text{-COO-}$		Cr 98.9	I	[201,202]	
9	$\text{CH}_3\text{-}$	Cr 106		O	[203]	*
10	$\text{C}_2\text{H}_5\text{-}$	Cr ?		I	[204]	
11	$\text{C}_3\text{H}_7\text{-}$	Cr 91		O	[205]	
12	$\text{C}_4\text{H}_9\text{-}$	Cr ?		I	[204]	
13	$\text{C}_5\text{H}_{11}\text{-}$	Cr ?		I	[204]	
14	$\text{C}_6\text{H}_{13}\text{-}$	Cr 67		Ch 88	I	[206]
15	$\text{C}_8\text{H}_{17}\text{-}$	Cr 43	S _A 62	Ch 91	I	[206]
16	$\text{C}_{10}\text{H}_{21}\text{-}$	Cr 46.5	S _A 83	Ch 94	I	[206]
17	$\text{C}_{14}\text{H}_{29}\text{-}$	Cr 64	S _A 83.5	Ch 87.5	I	[206]
18	$\text{C}_{16}\text{H}_{33}\text{-}$	Cr 70	S _A 82	Ch 85	I	[206]
19	$\text{CH}_3\text{-O-}$	Cr 86.2		I	[10]	
20	$\text{C}_2\text{H}_5\text{-O-}$	Cr 82.8		I	[10]	
21	$\text{C}_3\text{H}_7\text{-O-}$	Cr 65		Ch 46.4	I	[10]
22	$\text{C}_4\text{H}_9\text{-O-}$	Cr 74.2		Ch 52.6	I	[10]
23	$\text{C}_5\text{H}_{11}\text{-O-}$	Cr 74.8		Ch 42.8	I	[10]
24	$\text{C}_6\text{H}_{13}\text{-O-}$	Cr 67.9		Ch 51.5	I	[10]
25	$\text{C}_7\text{H}_{15}\text{-O-}$	Cr 51.7		Ch 47.1	I	[10]
26	$\text{C}_8\text{H}_{17}\text{-O-}$	Cr 41.2		Ch 53.1	I	[10]
27	$\text{C}_9\text{H}_{19}\text{-O-}$	Cr 53.3	S _A 24.2	Ch 53.9	I	[10]
28	$\text{C}_{10}\text{H}_{21}\text{-O-}$	Cr 51.6	S _A 38.5	Ch 57.7	I	[62,10]
29	$\text{C}_{12}\text{H}_{25}\text{-O-}$	Cr 60.8	S _A 45.5	Ch 57.8	I	[10]
30	$\text{C}_{13}\text{H}_{27}\text{-O-}$	Cr 69.4	S _A 46.6	Ch 56.0	I	[10]
31	$\text{C}_{14}\text{H}_{29}\text{-O-}$	Cr 68.2	S _A 47.1	Ch 56.7	I	[62,10]
32	$\text{C}_{15}\text{H}_{31}\text{-O-}$	Cr 75.4	S _A 47.7	Ch 55.8	I	[10]
33	$\text{C}_{16}\text{H}_{33}\text{-O-}$	Cr 73.2	S _A 48.5	Ch 56.4	I	[10]
34	$\text{C}_{18}\text{H}_{37}\text{-O-}$	Cr 78.3	S _A 49.0	Ch 56.5	I	[62,10]]
35	$\text{C}_{20}\text{H}_{41}\text{-O-}$	Cr 82.1		Ch >53	I	[10]
36	$\text{C}_{22}\text{H}_{25}\text{-O-}$	Cr 85.1			I	[10]
37	$\text{C}_{24}\text{H}_{49}\text{-O-}$	Cr 87.6			I	[10]
38	$\text{CH}_3\text{-COO-}$	Cr ?		Ch 59	I	[209]
39	$\text{C}_2\text{H}_5\text{-COO-}$	Cr ?		Ch 88	I	[209]
40	$\text{C}_3\text{H}_7\text{-COO-}$	Cr 88		Ch 83	I	[210]

TABLE 3. Cholestanes—Continued

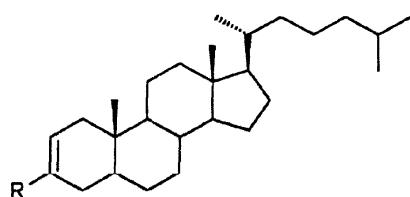
41	C ₄ H ₉ -COO-	Cr ?	Ch 70	I	[209]		
42	C ₅ H ₁₁ -COO-	Cr 87	Ch 73	I	[210]	*	
43	C ₆ H ₁₃ -COO-	Cr ?	Ch 68	I	[209]		
44	C ₇ H ₁₅ -COO-	Cr 76	Ch 69	I	[130,210]	*	
45	C ₈ H ₁₇ -COO-	Cr ?	S 45	Ch 70	I	[209]	*
46	C ₉ H ₁₉ -COO-	Cr 82.5	S 53	Ch 72	I	[210]	*
47	C ₁₀ H ₂₁ -COO-	Cr ?	S 61	Ch 72	I	[209]	
48	C ₁₁ H ₂₃ -COO-	Cr ?	S 63	Ch 73	I	[209]	*
49	C ₁₂ H ₂₅ -COO-	Cr ?	S 62	Ch 69	I	[209]	
50	C ₁₃ H ₂₇ -COO-	Cr ?	S 62	Ch 69	I	[209]	*
51	C ₁₄ H ₂₉ -COO-	Cr ?	S 61	Ch 68	I	[209]	
52	C ₁₅ H ₃₁ -COO-	Cr ?	S 58	Ch 68	I	[209]	*
53	C ₁₆ H ₃₃ -COO-	Cr ?		I	[209]	*	
54	C ₁₇ H ₃₅ -COO-	Cr 97		I	[210]	*	
55	C ₁₈ H ₃₇ -COO-	Cr ?		I	[209]	*	
56	C ₁₉ H ₃₉ -COO-	Cr 99		I	[210]	*	
57	CH ₃ -OCOO-	Cr 100	Ch 88	I	[213]	*	
58	C ₂ H ₅ -OCOO-	Cr 106.5	Ch 80.5	I	[213]	*	
59	C ₃ H ₇ -OCOO-	Cr 109		I	[213]		
60	C ₄ H ₉ -OCOO-	Cr 87	Ch 69	I	[213]	*	
61	C ₅ H ₁₁ -OCOO-	Cr 73	Ch 66	I	[213]	*	
62	C ₆ H ₁₃ -OCOO-	Cr 71	Ch 61	I	[213]		
63	C ₇ H ₁₅ -OCOO-	Cr 52	Ch 62	I	[213]	*	
64	C ₈ H ₁₇ -OCOO-	Cr 64	Ch 59	I	[213]		
65	C ₉ H ₁₉ -OCOO-	Cr 67	Ch 60.5	I	[213]		
66	C ₁₀ H ₂₁ -OCOO-	Cr 71	Ch 60	I	[213]		
67	C ₁₁ H ₂₃ -OCOO-	Cr 68	Ch 60.5	I	[213]		
68	C ₁₂ H ₂₅ -OCOO-	Cr 77.5	Ch 60.5	I	[213]	*	
69	C ₁₃ H ₂₇ -OCOO-	Cr 74	Ch 58.5	I	[213]		
70	C ₁₄ H ₂₉ -OCOO-	Cr 82.5	Ch 57.5	I	[213]		
71	C ₁₅ H ₃₁ -OCOO-	Cr 80	Ch 58	I	[213]		
72	C ₁₆ H ₃₃ -OCOO-	Cr 84		I	[213]		
73	C ₁₇ H ₃₅ -OCOO-	Cr 82		I	[213]		
74	C ₁₈ H ₃₇ -OCOO-	Cr 90.5		I	[213]		
75	C ₁₉ H ₃₉ -OCOO-	Cr 78		I	[213]		
76	C ₂₀ H ₄₁ -OCOO-	Cr 87		I	[213]		
77	C ₂₂ H ₄₅ -OCOO-	Cr 86		I	[213]		
78	CH ₃ -SCOO-	Cr ?	Ch 80	I	[186]		
79	C ₄ H ₉ -SCOO-	Cr ?	Ch 68	I	[186]		
80	C ₅ H ₁₁ -SCOO-	Cr ?	Ch 63	I	[186]		
81	C ₆ H ₁₃ -SCOO-	Cr ?	Ch 65	I	[186]		
82	C ₇ H ₁₅ -SCOO-	Cr ?	Ch 64	I	[186]		
83	C ₈ H ₁₇ -SCOO-	Cr ?	Ch 65	I	[186]		
84	C ₉ H ₁₉ -SCOO-	Cr ?	S 53	Ch 63	I	[186]	*
85	C ₁₀ H ₂₁ -SCOO-	Cr ?	S 55	Ch 63	I	[186]	
86	C ₁₁ H ₂₃ -SCOO-	Cr ?	S 54	Ch 60	I	[186]	
87	C ₁₂ H ₂₅ -SCOO-	Cr ?	S 54	Ch 59	I	[186]	
88	C ₁₃ H ₂₇ -SCOO-	Cr ?	S 53	Ch 57	I	[186]	
89	C ₁₄ H ₂₉ -SCOO-	Cr ?	S 53	Ch 57	I	[186]	
90	C ₁₅ H ₃₁ -SCOO-	Cr ?	S 53	Ch 57	I	[186]	*
91	C ₁₆ H ₃₃ -SCOO-	Cr ?	S 53	Ch 57	I	[186]	
92	C ₁₇ H ₃₅ -SCOO-	Cr ?	S 53	Ch 56	I	[186]	
93	C ₁₈ H ₃₇ -SCOO-	Cr ?	S 53	Ch 57	I	[186]	
94	C ₁₉ H ₃₉ -SCOO-	Cr ?	S 52	Ch 57	I	[186]	
95	C ₂₀ H ₄₁ -SCOO-	Cr ?	S 52	Ch 55	I	[186]	

TABLE 3. Cholestanes—Continued

No.	Additional published Data
9	Cr ₂ 93 Cr ₁ 98 I ²⁰⁵
17	pressure dep. ²⁰⁷ ; DSC ²⁰⁷
19	Cr 85 I ⁶⁶
20	Cr 79 I ²⁰⁸
38	Cr 109 I ²¹⁰ ; Cr 111 I ²¹¹ ; DSC ²¹⁰
39	Cr 124 Ch <? I ²¹²
40	Cr 86-94 Ch 83 I, several crystalline modifications ²¹⁰ ; Cr ? Ch 85 I ²⁰⁹ ; DSC ²¹⁰
42	Cr ? Ch 73 I ²⁰⁹ ; DSC ²¹⁰
44	Cr ? Ch 70 I ²⁰⁹ ; DSC ²¹⁰
45	Cr ? S 45.2 Ch 70.3 I, no BP ¹⁰³
46	Cr 82.5 S 53 Ch 72 I ²¹⁰ ; Cr ? S 56 Ch 72 I ²⁰⁹ ; DSC ²¹⁰
48	Cr 87.5 S 58 Ch 67 I ²¹⁰ ; Cr ? S 63 Ch 73 I ²⁰⁹ ; Cr ? S 63.1 Ch 72.0 BP 72.0 I ¹⁰³ ; DSC ²¹⁰
50	Cr 91 S 61 Ch 65 I ²¹⁰ ; Cr ? S 62 Ch 69 I ²⁰⁹ ; DSC ²¹⁰
52	Cr 95 I ²¹⁰ ; Cr ? S 58 Ch 68 I ²⁰⁹ ; DSC ²¹⁰
53	not LC ²⁰⁹
54	not LC ²⁰⁹ ; DSC ²¹⁰
55	not LC ²⁰⁹
56	not LC ²⁰⁹ ; DSC ²¹⁰
57	Cr ? Ch 86.5 BP 86.6 I ¹⁰³
58	Cr 106 I ^{180,182} ; Cr 101-105 I ²¹⁴
60	Cr 84.2 Ch <? I ¹⁰³ ; Cr ? Ch ? BP ? I ¹⁰³
61	Cr ? Ch 64.5 BP ? I ¹⁰³
63	Cr 53 Ch 59 I ²¹⁵ ; Cr ? Ch 61.6 BP 61.6 I ¹⁰³
68	Cr ? S 42 Ch 57.4 BP 57.4 I ¹⁰³
84	Cr ? S 52.0 Ch >60.1 I, no BP ¹⁰³
90	Cr 55.3 S <55 Ch 56.0 I ²¹⁶ ; DSC ²¹⁶

TABLE 4. Cholest-2-enes

Table 4: 3-substituted cholest-2-enes



(all temperatures in °C)

No 3β-Substituent

Solid State

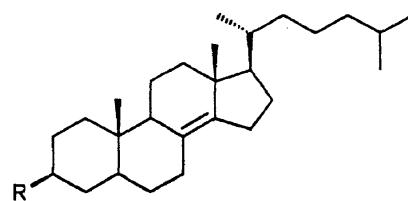
Mesophase

CP

Reference

1	CH ₃ -	Cr 84	O	[217]
2	C ₆ H ₁₃ -	Cr ₂ 44.5 Cr ₁ 47	Ch 57.5 I	[206]
3	C ₈ H ₁₇ -	Cr 47	Ch 62 I	[206]
4	C ₁₀ H ₂₁ -	Cr 45.5	S _A 54 Ch 66.5 I	[206]
5	C ₁₄ H ₂₉ -	Cr 33	S _A 59.5 Ch 64.5 I	[206]
6	C ₁₆ H ₃₃ -	Cr 41.5	S _A 58.5 Ch 62.5 I	[206]

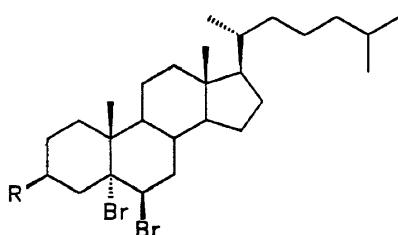
TABLE 5. Cholest-8(14)-enes (doristerols)

Table 5: 3 β -substituted cholest-8(14)-enes (doristerol)

(all temperatures in °C)

No	3 β -Substituent	Solid State	Mesophase	CP	Reference	Comments
1	H-COO-	Cr 106.4		I	[218]	
2	CH ₃ -COO-	Cr 78		I	[218,219,220]	*
3	C ₂ H ₅ -COO-	Cr 82.3	Ch 85.2 I	[218]		*
4	C ₃ H ₇ -COO-	Cr 85.3	Ch 77.3 I	[218]		*
5	C ₄ H ₉ -COO-	Cr 84.2	Ch 67.4 I	[218]		*
6	C ₅ H ₁₁ -COO-	Cr 85.9	Ch 68 I	[218]		*
7	C ₆ H ₁₃ -COO-	Cr 63.4	Ch 66.8 I	[218]		*
8	C ₇ H ₁₅ -COO-	Cr 48.7	Ch 68.4 I	[218]		*
9	C ₈ H ₁₇ -COO-	Cr 43.7	S 40.1 Ch 70.9 I	[218]		*
10	C ₉ H ₁₉ -COO-	Cr 44.4	S 58.9 Ch 71.8 I	[218]		*
11	C ₁₀ H ₂₁ -COO-	Cr 57.1	S 63.9 Ch 70.7 I	[218]		*
12	C ₁₁ H ₂₃ -COO-	Cr 57	S 67 Ch 71.2 I	[218]		*
13	C ₁₂ H ₂₅ -COO-	Cr 54.3	S 68.1 Ch 70 I	[218]		*
14	C ₁₃ H ₂₇ -COO-	Cr 64.4	S 66.1 Ch 67.2 I	[218]		*
15	C ₁₄ H ₂₉ -COO-	Cr 63.9	S 68.1 Ch 68.5 I	[218]		*
16	C ₁₅ H ₃₁ -COO-	Cr 73.1	S 67.8 I	[218]		*
17	C ₁₆ H ₃₃ -COO-	Cr 69.4	S 66.9 I	[218]		*
18	C ₁₇ H ₃₅ -COO-	Cr 77.5	S 66.7 I	[218]		*
19	C ₆ H ₁₃ -OCOO-	Cr 53	Ch 62 I	[220,222]		
20	C ₇ H ₁₅ -OCOO-	Cr 41.5	Ch 62 I	[220,222]		
21	C ₈ H ₁₇ -OCOO-	Cr 31	Ch 48 I	[220,222]		

No.	Additional published Data
2-18	DSC ²²¹
3	Cr 80.5 Ch 83.5 I ^{220,222}
4	Cr 81 Ch 76 I ^{220,222}
5	Cr 83 Ch 67 I ^{220,222}
6	Cr 85 Ch 68 I ^{220,222}
7	Cr 65 Ch 55.5 I ^{220,222}
8	Cr 48.5 Ch 69 I ^{220,222}
9	Cr 45 S 37 Ch 69 I ²²⁰ ; Cr 45 Ch 69 I ²²²
10	Cr 58.7 Ch 71.2 I ²²²
12	Cr 66.5 Ch 70.2 I ²²²
13	Cr 67.8 Ch 68.9 I ²²²
14	Cr 66.6 Ch 68.4 I ²²²

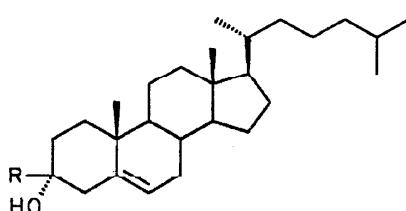
TABLE 6. $5\alpha,6\beta$ -DibromocholestanesTable 6: 3β -substituted $5\alpha,6\beta$ -dibromocholestanes

(all temperatures in °C)

No	3β -Substituent	Solid State	Mesophase	CP	Reference	Comments
1	$\text{CH}_3\text{-COO-}$	Cr 117.6		I	[1]	*
2	$\text{C}_2\text{H}_5\text{-COO-}$	Cr 97		I	[223]	
3	$\text{C}_3\text{H}_7\text{-COO-}$	Cr 107		I	[223]	
4	$\text{C}_5\text{H}_{11}\text{-COO-}$	Cr 70		I	[223]	
5	$\text{C}_6\text{H}_{13}\text{-COO-}$	Cr 91.5		I	[223]	
6	$\text{C}_7\text{H}_{15}\text{-COO-}$	Cr 78		I	[223]	*
7	$\text{C}_8\text{H}_{17}\text{-COO-}$	Cr 56		I	[223]	
8	$\text{C}_9\text{H}_{19}\text{-COO-}$	Cr 70		I	[223]	
9	$\text{C}_{11}\text{H}_{23}\text{-COO-}$	Cr 80.5		I	[223]	
10	$\text{C}_{13}\text{H}_{27}\text{-COO-}$	Cr 58		I	[223]	
11	$\text{C}_{15}\text{H}_{31}\text{-COO-}$	Cr 55		U	[223]	
12	$\text{C}_{17}\text{H}_{35}\text{-COO-}$	Cr 65		U	[223]	

No. Additional published Data
1 mp_2 115.4¹; Cr 110.5 I²²³
6 Cr 78 I, mp_2 72²²³

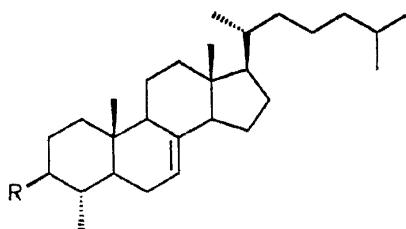
Compounds 1 - 12 have never been investigated for potential liquid crystalline properties. Sterically not so suitable

TABLE 7. 3α -HydroxycholestanesTable 7: 3β -substituted 3α -hydroxycholestanes

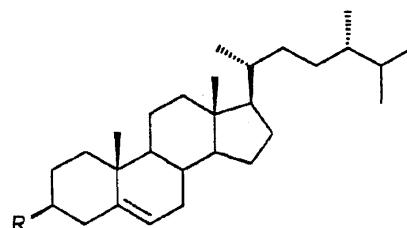
(all temperatures in °C)

No	3β -Substituent	Solid State	Mesophase	CP	Reference	Comments
1	$\text{CH}_3\text{-}$	Cr 127		O	[203]	*
2	$\text{C}_6\text{H}_{13}\text{-}$	Cr 122		Ch 122.5	I [206]	
3	$\text{C}_8\text{H}_{17}\text{-}$	Cr 155	S_A 117	Ch 125	I [206]	
4	$\text{C}_{10}\text{H}_{21}\text{-}$	Cr 106.5	S_A 127		I [206]	
5	$\text{C}_{14}\text{H}_{29}\text{-}$	Cr ₂ 107	Cr ₁ 110	S_A 124.5	I [206]	
6	$\text{C}_{16}\text{H}_{33}\text{-}$	Cr 97		S_A 118.5	I [206]	

No. Additional published Data
1 Cr 124 I²¹⁷

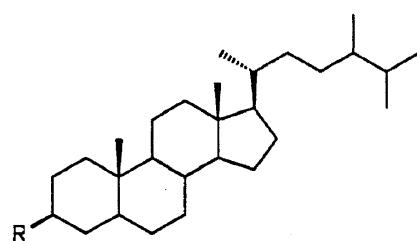
TABLE 8. 4α -Methylcholest-7-enes (lophenols)Table 8: 3β -substituted 4α -methylcholest-7-enes (lophenol)(all temperatures in °C)
No 3β -Substituent

No	3β -Substituent	Solid State	Mesophase	CP	Reference	Comments
1	CH ₃ -COO-	Cr 121	S 96	I	[224]	
2	C ₃ H ₇ -COO-	Cr 73	S 127	I	[224]	
3	C ₉ H ₁₉ -COO-	Cr 59	S 96	I	[224]	
4	C ₁₁ H ₂₃ -COO-	Cr 74	S 94	I	[224]	
5	C ₁₃ H ₂₇ -COO-	Cr 68	S 87	I	[224]	
6	C ₁₅ H ₃₁ -COO-	Cr 75	S 82	I	[224]	*

No. Additional published Data
6 Cr 75.5 S <75 Ch 78.9 I²¹⁶; DSC²¹⁶TABLE 9. ($3\beta,24R$)-Ergost-5-enes (camosterols)Table 9: 3β -substituted ($3\beta,24R$) ergost-5-enes (campesterol)(all temperatures in °C)
No 3β -Substituent

No	3β -Substituent	Solid State	Mesophase	CP	Reference
1	C ₆ H ₁₃ -COO-	Cr 98.2	S 74.8 Ch 75.8	I	[225]
2	C ₇ H ₁₅ -COO-	Cr 84.2	S 78.9	I	[225]
3	C ₈ H ₁₇ -COO-	Cr 69.4	S 79.5	I	[225]
4	C ₁₅ H ₃₁ -COO-	Cr 91.2	S 72.4	I	[216]
5	C ₁₇ H ₃₅ -COO-	Cr 94	S 70	I	[225]

TABLE 10. Ergostanes

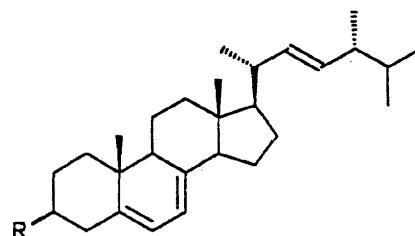
Table 10: 3 β -substituted ergostanes

(all temperatures in °C)

No.	3 β -Substituent	Solid State	Mesophase	CP	Reference	Comments
1	H-COO-	Cr 112.5		I	[226]	
2	C ₂ H ₅ -COO-	Cr 151		I	[226]	
3	C ₈ H ₁₇ -COO-	Cr 100.5		I	[226]	
4	C ₁₁ H ₂₃ -COO-	Cr 103		I	[226]	
5	C ₁₅ H ₃₁ -COO-	Cr 108	S 85	I	[164]	*
6	C ₁₇ H ₃₅ -COO-	Cr 105	X ?	I	[226]	

No. Additional published Data
 4 Cr 106 X ? I²²⁶

TABLE 11. Ergosta-5,7,22E-trienes (ergosterols)

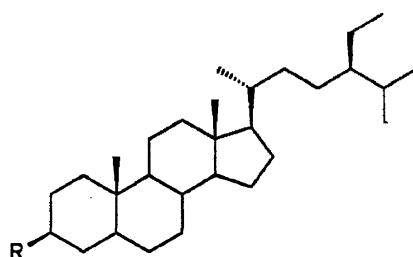
Table 11: 3 β -substituted ergosta-5,7,22E-trienes (ergosterol)

(all temperatures in °C)

No.	3 β -Substitution	Solid State	Mesophase	CP	Reference	Comments
1	H-COO-	Cr 161.5		I	[227]	
2	CH ₃ -COO-	Cr 180		I	[228]	*
3	C ₂ H ₅ -COO-	Cr 180.5		I	[227]	
4	C ₃ H ₇ -COO-	Cr 132		Ch 142	I [228]	*
5	C ₅ H ₁₁ -COO-	Cr 119	S _A 142	I	[228]	*
6	C ₆ H ₁₃ -COO-	Cr 94	S _A 130	I	[228]	
7	C ₇ H ₁₅ -COO-	Cr 110	S _A 138	I	[228]	*
8	C ₈ H ₁₇ -COO-	Cr 90	S _A 131	I	[228]	
9	C ₉ H ₁₉ -COO-	Cr 110	S _A 132	I	[228]	*
10	C ₁₁ H ₂₃ -COO-	Cr 114	S _A 127.5	I	[228]	*
11	C ₁₂ H ₂₅ -COO-	Cr 103	S _A 118.5	I	[228]	
12	C ₁₃ H ₂₇ -COO-	Cr 115	S _A 118	I	[228]	*
13	C ₁₅ H ₃₁ -COO-	Cr 109	S _A 110	I	[228]	*
14	C ₁₇ H ₃₅ -COO-	Cr 113	S _A 104	I	[228]	*
15	C ₂₁ H ₄₃ -COO-	Cr 115		I	[229]	

No.	Additional published Data
2	Cr 177 I ²²⁹ ; Cr 181 I ²³⁰
4	Cr 129.5 I ²²⁷ ; Cr 134 I ²²⁹
5	Cr 125.5 I ²²⁹
7	Cr 121 I ²²⁹
9	Cr 117.5 I ²²⁹
10	Cr 116 I ²²⁹
12	Cr 115 I ²²⁹
13	Cr 107 I ²³¹ ; Cr 110 I ²²⁹ ; Cr 109.5 S 102 I ¹⁶⁴
14	Cr 113 I ²²⁹

TABLE 12. Stigmastanes

Table 12: 3 β -substituted stigmastanes

(all temperatures in °C)

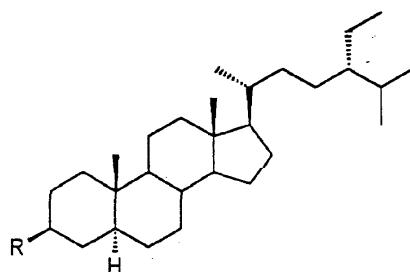
No.	3β -Substituent	Solid State	Mesophase	CP	Reference	Comments
1	$\text{CH}_3\text{-COO-}$	Cr 136		I	[229]	
2	$\text{C}_3\text{H}_7\text{-COO-}$	Cr 117		I	[229]	
3	$\text{C}_5\text{H}_{11}\text{-COO-}$	Cr 109		I	[229]	
4	$\text{C}_7\text{H}_{15}\text{-COO-}$	Cr 102		I	[229]	
5	$\text{C}_9\text{H}_{19}\text{-COO-}$	Cr 96		I	[229]	
6	$\text{C}_{11}\text{H}_{23}\text{-COO-}$	Cr 91		I	[229]	
7	$\text{C}_{13}\text{H}_{27}\text{-COO-}$	Cr 89.5		I	[229]	
8	$\text{C}_{15}\text{H}_{31}\text{-COO-}$	Cr 103		I	[164]	*
9	$\text{C}_{17}\text{H}_{35}\text{-COO-}$	Cr 92		I	[229]	
10	$\text{C}_{21}\text{H}_{43}\text{-COO-}$	Cr 98		I	[229]	

No. Additional published Data

1 Cr 130 [232]; Cr 138 [230];

8 Cr 90.5 [229]

Compounds 1 - 10 probably are monotropic.

TABLE 13. γ -SitostanesTable 13: 3β -substituted γ -sitostanes

(all temperatures in °C)

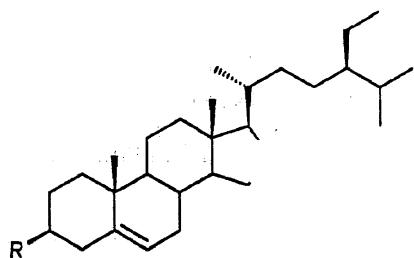
No.	3β Substituent	Solid State	Mesophase	CP	Reference	Comments
1	$\text{CH}_3\text{-COO-}$	Cr 139		I	[229]	
2	$\text{C}_3\text{H}_7\text{-COO-}$	Cr 120		I	[229]	
3	$\text{C}_5\text{H}_{11}\text{-COO-}$	Cr 112.5		I	[229]	
4	$\text{C}_7\text{H}_{15}\text{-COO-}$	Cr 104.5		I	[229]	
5	$\text{C}_9\text{H}_{19}\text{-COO-}$	Cr 97		I	[229]	
6	$\text{C}_{11}\text{H}_{23}\text{-COO-}$	Cr 92		I	[229]	
7	$\text{C}_{13}\text{H}_{27}\text{-COO-}$	Cr 90		I	[229]	
8	$\text{C}_{15}\text{H}_{31}\text{-COO-}$	Cr 93		I	[229]	
9	$\text{C}_{17}\text{H}_{35}\text{-COO-}$	Cr 96		I	[229]	
10	$\text{C}_{21}\text{H}_{43}\text{-COO-}$	Cr 103		I	[229]	

No.

Additional published Data

1 Cr 129 I²³³; Cr 142 I²³⁴; Cr 144 I²³⁰; Cr 133 I²³²

Compounds 1 - 10 probably are monotropic.

TABLE 14. (24R)-Stigmast-5-enes (β -sitosterols)Table 14: 3 β -substituted (24R)-stigmast-5-enes (β -sitosterol)

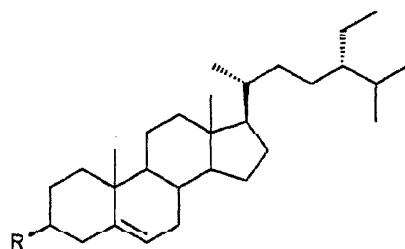
(all temperatures in °C)

No.	3 β -Substituent	Solid State	Mesophase	CP	Reference	Comments
1	CH ₃ -O-	Cr 107		I	[235]	
2	C ₂ H ₅ -O-	Cr 82.5	S 85	I	[235]	
3	C ₃ H ₇ -O-	Cr 113.5		I	[235]	
4	C ₄ H ₉ -O-	Cr 102	S 105	I	[235]	
5	C ₆ H ₁₃ -O-	Cr 104.5	S 108	I	[235]	
6	C ₈ H ₁₇ -O-	Cr 94	S 102	I	[235]	
7	H-COO-	Cr 94		I	[164]	
8	CH ₃ -COO-	Cr 128		I	[236,237]	*
9	C ₃ H ₇ -COO-	Cr 111		I	[229]	
10	C ₅ H ₁₁ -COO-	Cr 105.5		I	[229]	
11	C ₇ H ₁₅ -COO-	Cr 99		I	[229]	*
12	C ₉ H ₁₉ -COO-	Cr 92		I	[229]	
13	C ₁₁ H ₂₃ -COO-	Cr 84	S <?	I	[229]	
14	C ₁₃ H ₂₇ -COO-	Cr 86.5	S <?	I	[229]	
15	C ₁₅ H ₃₁ -COO-	Cr 94		I	[164]	*
16	C ₁₇ H ₃₅ -COO-	Cr 89		I	[229]	
17	C ₂₁ H ₄₃ -COO-	Cr 95		I	[229]	
17	C ₇ H ₁₅ -OCOO-	Cr 68.5	S 28.7	I	[238]	
18	C ₈ H ₁₇ -OCOO-	Cr 69	S 33.1	I	[238]	
19	C ₉ H ₁₉ -OCOO-	Cr 71.1	S 37.7	I	[238]	

No. Additional published Data

8 Cr 125 I²²⁹; Cr 122.5 I²³⁸11 Cr 72.6 S 63.2 I²³⁸15 Cr 85.5 I²²⁹; Cr 91-94 I¹⁶⁴

Compounds 8 - 17 probably are monotropic.

TABLE 15. (24S)-Stigmast-5-enes (γ -sitosterols)Table 15: 3 β -substituted (24S)-stigmast-5-enes (γ -sitosterol)

(all temperatures in °C)

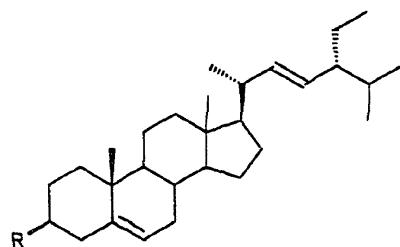
No	3 β -Substituent	Solid State	Mesophase	CP	Reference	Comments
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1	CH ₃ -COO-	Cr 140		I	[229]	
2	C ₃ H ₇ -COO-	Cr 121.5		I	[229]	
3	C ₅ H ₁₁ -COO-	Cr 114.5		I	[229]	
4	C ₇ H ₁₅ -COO-	Cr 108		I	[229]	
5	C ₉ H ₁₉ -COO-	Cr 101		I	[229]	
6	C ₁₁ H ₂₃ -COO-	Cr 95		I	[229]	
7	C ₁₃ H ₂₇ -COO-	Cr 91		I	[229]	
8	C ₁₅ H ₃₁ -COO-	Cr 95		I	[229]	
9	C ₁₇ H ₃₅ -COO-	Cr 98		I	[229]	
10	C ₂₁ H ₄₃ -COO-	Cr 104		I	[229]	

No. Additional published Data
1 Cr 144²³⁰; Cr 141²³⁹

TABLE 16. (24S)-24-Ethylcholesta-5,22E-dienes (stigmasterols)

Table 16: (24S)-24-ethylcholesta-5,22E-dienes (stigmasterol)



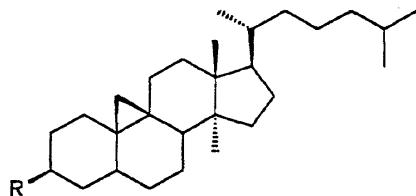
(all temperatures in °C)

No	3β-Substituent	Solid State	Mesophase	CP	Reference	Comments
1	CH ₃ -COO-	Cr 142		I	[229,240]	
2	C ₂ H ₅ -COO-	Cr 122		I	[241]	*
3	C ₃ H ₇ -COO-	Cr 115	S 76	I	[240]	*
4	C ₄ H ₉ -COO-	Cr 122	S 76	I	[240]	
5	C ₅ H ₁₁ -COO-	Cr 106.5	S 76	I	[240]	*
6	C ₆ H ₁₃ -COO-	Cr 75	S 72	I	[240]	
7	C ₇ H ₁₅ -COO-	Cr 91	S 74	I	[240]	*
8	C ₈ H ₁₇ -COO-	Cr 77	S 74	I	[240]	
9	C ₉ H ₁₉ -COO-	Cr 92.5	S 71	I	[240]	*
10	C ₁₁ H ₂₃ -COO-	Cr 96.5	S 68	I	[240]	*
11	C ₁₃ H ₂₇ -COO-	Cr 100	S 64	I	[240]	*
12	C ₁₅ H ₃₁ -COO-	Cr 96	S 61	I	[240]	*
13	C ₁₇ H ₃₅ -COO-	Cr 102		I	[229]	*
14	C ₂₁ H ₄₃ -COO-	Cr 106		I	[229]	
15	CH ₃ -OCOO-	Cr 108		I	[244]	
16	C ₂ H ₅ -OCOO-	Cr 149.5		I	[244]	
17	C ₃ H ₇ -OCOO-	Cr 136.5		I	[244]	
18	C ₄ H ₉ -OCOO-	Cr 127		I	[244]	
19	C ₅ H ₁₁ -OCOO-	Cr 99		I	[244]	
20	C ₆ H ₁₃ -OCOO-	Cr 91	S 42	I	[244]	
21	C ₇ H ₁₅ -OCOO-	Cr 86.5	S 43	I	[244]	
22	C ₈ H ₁₇ -OCOO-	Cr 89.5	S 44	I	[244]	
23	C ₉ H ₁₉ -OCOO-	Cr 85	X 46	I	[244]	
24	C ₁₀ H ₂₁ -OCOO-	Cr 92	S 46	I	[244]	
25	C ₁₁ H ₂₃ -OCOO-	Cr 90	S 44	I	[244]	
26	C ₁₂ H ₂₅ -OCOO-	Cr 94	X 49	I	[244]	
27	C ₁₄ H ₂₉ -OCOO-	Cr 96		I	[244]	
28	C ₁₆ H ₃₃ -OCOO-	Cr 94		I	[244]	
29	C ₁₈ H ₃₇ -OCOO-	Cr 98		I	[244]	
30	C ₂₀ H ₄₁ -OCOO-	Cr 90		I	[244]	
31	C ₂₂ H ₄₅ -OCOO-	Cr 95		I	[244]	
32	CH ₃ -NHCOO-	Cr 210		I	[245]	
33	C ₄ H ₉ -NHCOO-	Cr 141	O	[245]		
34	C ₈ H ₁₇ -NHCOO-	Cr 105	O	[245]		

TABLE 16. (24S)-24-Ethylcholesta-5,22*E*-dienes (stigmasterols)—Continued

No.	Additional published Data
2	Cr 119.5-120.5 I ²⁴⁰
3	Cr 123 O ²²⁹
5	Cr 115 O ²²⁹
7	Cr 112 O ²²⁹
9	Cr 106 O ²²⁹
10	Cr 102.5 O ²²⁹
11	Cr 101.5 O ²²⁹
12	Cr 96.0 I ²⁴² ; Cr 99.0 I ²⁴³ ; Cr 99.5 I ²²⁹ ; Cr 102.6 I ²¹⁶ ; Cr 101-102 I ¹⁶⁴ ; DSC ²¹⁶
13	Cr 98-99 I ²⁴⁰

TABLE 17. Pollistanes

Table 17: 3 β -substituted pollinastanes

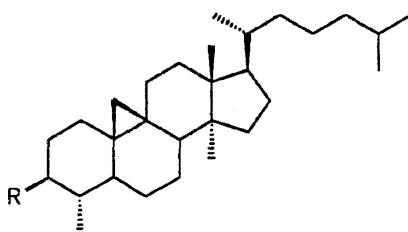
(all temperatures in °C)

No.	3 β -Substituent	Solid State	Mesophase	CP	Reference	Comments
1	CH ₃ -COO-	Cr 85		Ch 48	I	[246]
2	C ₅ H ₁₁ -COO-	Cr 77		Ch 58	I	[246]
3	C ₉ H ₁₉ -COO-	Cr 44	S 45	Ch 49	I	[246]
4	C ₁₁ H ₂₃ -COO-	Cr 51	S 46	Ch 47	I	[246]
5	C ₁₃ H ₂₇ -COO-	Cr 59	S 46	Ch 48	I	[246]
6	C ₁₅ H ₃₁ -COO-	Cr 60	S 48	Ch 49	I	[246] *

No. Additional published Data

1 Cr 89 I^{247,248}; Cr 90²⁴⁹6 Cr 58.7 S 44.4 Ch 50.3 I²⁵⁰; DSC²⁵⁰

TABLE 18. 31-Norcycloartanes

Table 18: 3 β -substituted 31-norcycloartanes

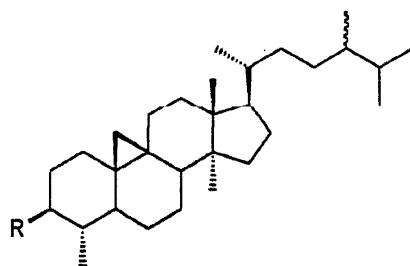
(all temperatures in °C)

No	3 β -Substituent	Solid State	Mesophase	CP	Reference	Comments
1	CH ₃ -COO-	Cr 99		Ch 98	I [251]	
2	C ₃ H ₇ -COO-	Cr 82		Ch 103	I [251]	
3	C ₅ H ₁₁ -COO-	Cr 69		Ch 98	I [251]	
4	C ₇ H ₁₅ -COO-	Cr 74		Ch 88	I [251]	
5	C ₉ H ₁₉ -COO-	Cr 80	S 57	Ch 88	I [251]	
6	C ₁₁ H ₂₃ -COO-	Cr 75	S 65	Ch 83	I [251]	
7	C ₁₃ H ₂₇ -COO-	Cr 68	S 68	Ch 78	I [251]	
8	C ₁₅ H ₃₁ -COO-	Cr 62	S 68	Ch 75	I [251]	*

No. Additional published Data

8 Cr 67.7 S 55.5 S 62.2 Ch 70.2 I²⁵⁰; mp₂ 60.9²⁵⁰; DSC²⁵⁰

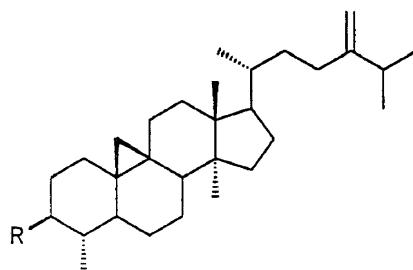
TABLE 19. 24-Dihydrocycloecalenes

Table 19: 3 β -substituted 24-dihydrocycloecalenes

(all temperatures in °C)

No	3 β -Substituent	Solid State	Mesophase	CP	Reference
1	CH ₃ -COO-	Cr 110		I	[164]
2	C ₅ H ₁₁ -COO-	Cr 90		Ch 77	I [164]
3	C ₇ H ₁₅ -COO-	Cr 63		Ch 77	I [164]
4	C ₉ H ₁₉ -COO-	Cr 77		Ch 69	I [164]
5	C ₁₁ H ₂₃ -COO-	Cr 59.5		Ch 68	I [164]
6	C ₁₃ H ₂₇ -COO-	Cr 67		Ch 61	I [164]
7	C ₁₅ H ₃₁ -COO-	Cr 64		Ch 52	I [164,252]
8	C ₁₇ H ₃₅ -COO-	Cr 76	S 69		I [164]

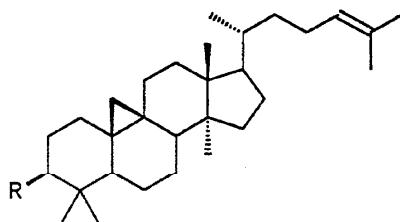
TABLE 20. Cycloecalenes

Table 20: 3 β -substituted cycloecalenes

(all temperatures in °C)

No.	3 β -Substituent	Solid State	Mesophase	CP	Reference	Comments
1	CH ₃ -COO-	Cr 107		I	[164]	*
2	C ₅ H ₁₁ -COO-	Cr 74		Ch 59	I	[164]
3	C ₇ H ₁₅ -COO-	Cr 78		Ch 61	I	[164]
4	C ₉ H ₁₉ -COO-	Cr 77		Ch 56	I	[164]
5	C ₁₁ H ₂₃ -COO-	Cr 65	S 55		I	[164]
6	C ₁₃ H ₂₇ -COO-	Cr 59	S 49		I	[164]
7	C ₁₅ H ₃₁ -COO-	Cr 62			I	[164,252]
8	C ₁₇ H ₃₅ -COO-	Cr 77	S 56		I	[164]

No. Additional published Data
1 Cr 108 - 109²³⁹

TABLE 21. 9 β ,19-Cyclolanost-24-enesTable 21: 3 β -substituted 9 β ,19-cyclolanost-24-enes

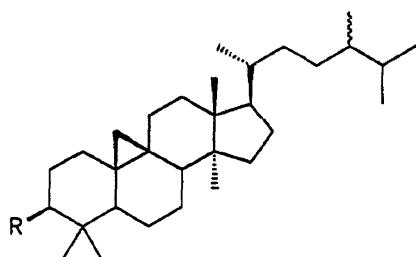
(all temperatures in °C)

No.	3 β -Substituent	Solid State	Mesophase	CP	Reference	Comments
1	CH ₃ -COO-	Cr 123		I	[237]	*
2	C ₃ H ₇ -COO-	Cr 87		I	[164]	
3	C ₇ H ₁₅ -COO-	Cr 58	Ch 59	I	[164]	
4	C ₉ H ₁₉ -COO-	Cr 71	Ch 59	I	[164]	
5	C ₁₁ H ₂₃ -COO-	Cr 53.5	Ch 58	I	[164]	
6	C ₁₃ H ₂₇ -COO-	Cr 50	Ch 56	I	[164]	
7	C ₁₅ H ₃₁ -COO-	Cr 54	Ch 51	I	[252]	*
8	C ₁₇ H ₃₅ -COO-	Cr 64	Ch 56	I	[164]	

No. Additional published Data
1 Cr 120 I¹⁶⁴

7 Cr 54.8 Ch 44.6 I²⁵⁰; mp₂ 51.5²⁵⁰; mp₃ 39²⁵⁰; Cr 62-64 Ch 51 I¹⁶⁴; DSC²⁵⁰

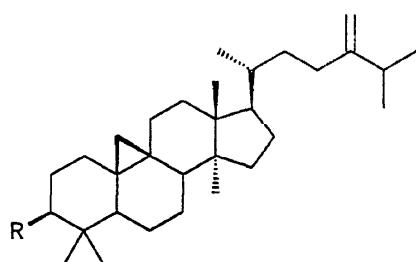
TABLE 22. 24-Methylcyclolanostanes

Table 22: 3 β -substituted 24-methylcyclolanostanes

(all temperatures in °C)
No 3 β -Substituent

No	3 β -Substituent	Solid State	Mesophase	CP	Reference
1	CH ₃ -COO-	Cr 111.5		I	[164,252]
2	C ₃ H ₇ -COO-	Cr 78	S 114.5	I	[164,252]
3	C ₅ H ₁₁ -COO-	Cr 108	S 122	I	[164,252]
4	C ₇ H ₁₅ -COO-	Cr 64	S 83.5	I	[164,252]
5	C ₉ H ₁₉ -COO-	Cr 84	S 83.5	I	[164,252]
6	C ₁₁ H ₂₃ -COO-	Cr 60	Ch 65.5	I	[164,252]
7	C ₁₃ H ₂₇ -COO-	Cr 66	Ch 67.5	I	[164,252]
8	C ₁₅ H ₃₁ -COO-	Cr 65	Ch 64	I	[164,252]
9	C ₁₇ H ₃₅ -COO-	Cr 68		I	[164,252]

Long-chain-3 β -substituted 24-methylcyclolanostanes show a cholesteric phase. It is unusual that higher homologues show a cholesteric phase, when shorter-chained molecules show a smectic phase.

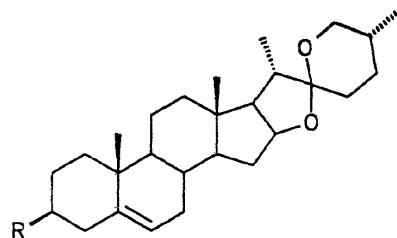
TABLE 23. (9β)-24-Methylene-9,19-cyclolanostanesTable 23: 3β -substituted (9β)-24-methylene-9,19-cyclolanostanes

(all temperatures in °C)

No	3β -Substituent	Solid State	Mesophase	CP	Reference	Comments
1	$\text{CH}_3\text{-COO-}$	Cr 112		I	[164,252]	
2	$\text{C}_3\text{H}_7\text{-COO-}$	Cr 73	S 110.5	I	[164,252]	
3	$\text{C}_5\text{H}_{11}\text{-COO-}$	Cr 107	S 112	I	[164,252]	
4	$\text{C}_7\text{H}_{15}\text{-COO-}$	Cr 75	S 101.5	I	[164,252]	
5	$\text{C}_9\text{H}_{19}\text{-COO-}$	Cr 67	S 55	I	[164,252]	
6	$\text{C}_{11}\text{H}_{23}\text{-COO-}$	Cr 57		I	[164]	*
7	$\text{C}_{13}\text{H}_{27}\text{-COO-}$	Cr 62		I	[164,252]	
8	$\text{C}_{15}\text{H}_{31}\text{-COO-}$	Cr 59		I	[164,252]	
9	$\text{C}_{17}\text{H}_{35}\text{-COO-}$	Cr 63		I	[164,252]	

No.	Additional published Data	Solid State	Mesophase	CP	Reference	Comments
6	Cr 72 I ²⁵²					

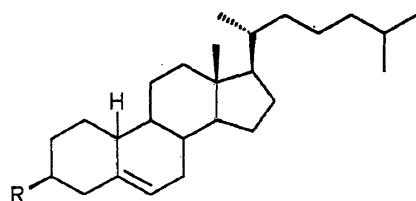
TABLE 24. Diosgenines

Table 24: 3β -substituted diosgenines

(all temperatures in °C)

No	3β -Substituent	Solid State	Mesophase	CP	Reference	Comments
1	C ₆ H ₁₃ -COO-	Cr 121.3	Ch 128.9 I		[253]	
2	C ₇ H ₁₅ -COO-	Cr 114	Ch 124 I		[253]	
3	C ₉ H ₁₉ -COO-	Cr 110	Ch 122 I		[253]	
4	C ₁₃ H ₂₇ -COO-	Cr 135.6	Ch 144.8 I		[253]	
5	C ₁₇ H ₃₅ -COO-	Cr 171.4	Ch 182.1 U		[253]	

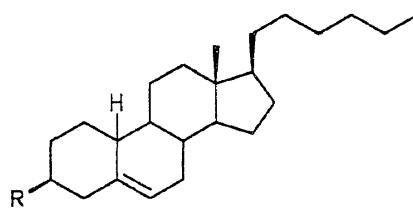
TABLE 25. 19-Norcholest-5-enes

Table 25: 3β -substituted 19-norcholest-5-enes

(all temperatures in °C)

No	3β -Substituent	Solid State	Mesophase	CP	Reference
1	CH ₃ -COO-	Cr 86.5		Ch 91.0 I	[254]
2	C ₂ H ₅ -COO-	Cr 88.3		Ch 117.8 I	[254]
3	C ₃ H ₇ -COO-	Cr 75.0		Ch 109.0 I	[254]
4	C ₄ H ₉ -COO-	Cr 65.6	S 83.3	Ch 99.0 I	[254]
5	C ₅ H ₁₁ -COO-	Cr 71.1		Ch 109.1 I	[254]
6	C ₆ H ₁₃ -COO-	Cr 70.5		Ch 104.6 I	[254]
7	C ₇ H ₁₅ -COO-	Cr 71.1		Ch 106.3 I	[254]
8	C ₈ H ₁₇ -COO-	Cr 61.7		Ch 106.8 I	[254]
9	C ₉ H ₁₉ -COO-	Cr 64.5		Ch 94.0 I	[254]
10	C ₁₀ H ₂₁ -COO-	Cr 66.7		Ch 106.4 I	[254]
11	C ₁₁ H ₂₃ -COO-	Cr 62.5		Ch 103.8 I	[254]
12	C ₁₂ H ₂₅ -COO-	Cr 61.4		Ch 101.3 I	[254]
13	C ₁₃ H ₂₇ -COO-	Cr 62.0		Ch 100.0 I	[254]
14	C ₁₅ H ₃₁ -COO-	Cr 51.9		Ch 91.2 I	[254]
15	C ₁₇ H ₃₅ -COO-	Cr <50		Ch 89.5 I	[254]

TABLE 26. 19,21,27-Trinorcholest-5-enes

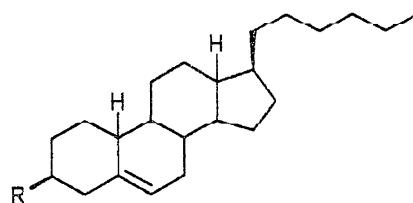
Table 26: 3 β -substituted 19,21,27-trinorcholest-5-enes

(all temperatures in °C)

No	3 β -Substituent	Solid State	Mesophase	CP	Reference
1	C ₅ H ₁₁ -COO-	Cr 62.0		Ch 72.3 I	[255]
2	C ₆ H ₁₃ -COO-	Cr 49.8		Ch 67.7 I	[255]
3	C ₇ H ₁₅ -COO-	Cr 38.5	S _A 59.2	Ch 71.8 I	[255]
4	C ₈ H ₁₇ -COO-	Cr ?	S _A 64.1	Ch 68.5 I	[255]
5	C ₉ H ₁₉ -COO-	Cr ?	S _A 69.7	I	[255]
6	C ₁₀ H ₂₁ -COO-	Cr ?		Ch 71.7 I	[255]
7	C ₁₁ H ₂₃ -COO-	Cr 34.0		Ch 72.8 I	[255]
8	C ₁₂ H ₂₅ -COO-	Cr 36.0	S _A 72.0	I	[255]

For compounds 5 and 8 S_A-phase may in fact be a cholesteric phase.

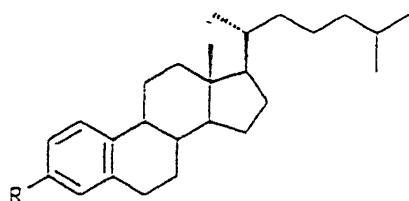
TABLE 27. 18,19,21,27-Tetranorcholest-5-enes

Table 27: 3 β -substituted 18,19,21,27-tetranorcholest-5-enes

(all temperatures in °C)

No	3 β -Substituent	Solid State	Mesophase	CP	Reference
1	C ₇ H ₁₅ -COO-	Cr 116.5		I	[255]
2	C ₈ H ₁₇ -COO-	Cr 109.8		I	[255]
3	C ₉ H ₁₉ -COO-	Cr 114.5		I	[255]
4	C ₁₀ H ₂₁ -COO-	Cr 117.4		I	[255]

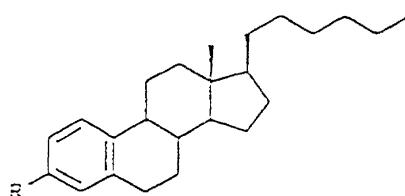
TABLE 28. 19-Norcholesta-1,3,5(10)-trienes

Table 28: 3-substituted 19-norcholesta-1,3,5(10)-trienes

(all temperatures in °C)

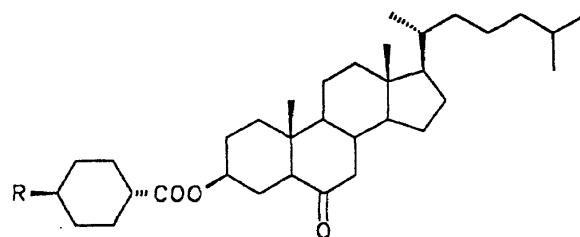
No	3β-Substituent	Solid State	Mesophase	CP	Reference
1	C ₅ H ₁₁ -COO-	Cr 59.0		Ch 62.9 I	[255]
2	C ₆ H ₁₃ -COO-	Cr 44.8		Ch 60.4 I	[255]
3	C ₇ H ₁₅ -COO-	Cr 49.8		Ch 62.4 I	[255]
4	C ₈ H ₁₇ -COO-	Cr 37.5	S _A 56.6	Ch 60.1 I	[255]
5	C ₉ H ₁₉ -COO-	Cr 44.8	S _A 61.0	Ch 62.4 I	[255]
6	C ₁₀ H ₂₁ -COO-	Cr 48.1	S _A 62.2	I	[255]
7	C ₁₁ H ₂₃ -COO-	Cr 32.2	S _A 64.3	I	[255]
8	C ₁₂ H ₂₅ -COO-	Cr 33.5	S _A 63.9	I	[255]

TABLE 29. 19,21,27-Trinorcholesta-1,3,5(10)-trienes

Table 29: 3-substituted 19,21,27-trinorcholesta-1,3,5(10)-trienes

(all temperatures in °C)

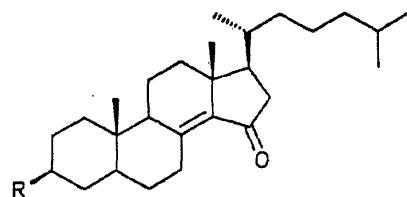
No	3β-Substituent	Solid State	Mesophase	CP	Reference
1	C ₇ H ₁₅ -COO-	Cr 54.0		I	[255]
2	C ₈ H ₁₇ -COO-	Cr 55.8		I	[255]
3	C ₉ H ₁₉ -COO-	Cr 53.8		I	[255]
4	C ₁₀ H ₂₁ -COO-	Cr 61.1		I	[255]
5	C ₁₁ H ₂₃ -COO-	Cr 56.7		I	[255]
6	C ₁₂ H ₂₅ -COO-	Cr 52.8		I	[255]

TABLE 30. 3β -(trans-4-alkyl-cyclohexylcarbonyloxy)-6-KetocholestanesTable 30: 3β -(trans-4-alkyl-cyclohexylcarbonyloxy)-6-ketocholestanes

(all temperatures in °C)

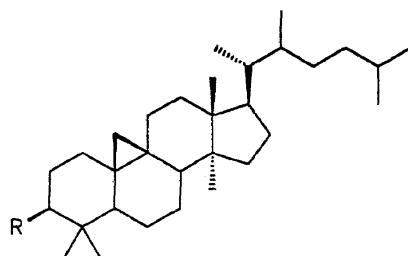
No	3β -Substituent	Solid State	Mesophase	CP	Reference
1	C ₂ H ₅ -	Cr 161		Ch 205	I [256]
2	C ₅ H ₁₁ -	Cr 119		Ch 209	I [256]
3	C ₆ H ₁₃ -	Cr 119	S _A 221		I [256]

TABLE 31. 15-Ketocholest-8(14)-enes

Table 31: 3β -substituted 15-ketocholest-8(14)-enes

(all temperatures in °C)

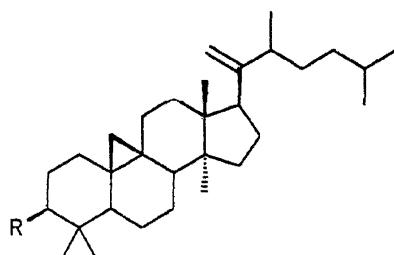
No	3β -Substituent	Solid State	Mesophase	CP	Reference
1	C ₉ H ₁₉ -COO-	Cr 95.5		O	[257]
2	C ₁₀ H ₂₁ -COO-	Cr 84		O	[257]
3	C ₁₁ H ₂₃ -COO-	Cr 91		O	[257]
4	C ₁₂ H ₂₅ -COO-	Cr 94		O	[257]
5	C ₁₃ H ₂₇ -COO-	Cr 92.5		O	[257]
6	C ₁₄ H ₂₉ -COO-	Cr 83.5		O	[257]
7	C ₁₅ H ₃₁ -COO-	Cr 79.5		O	[257]
8	C ₁₆ H ₃₃ -COO-	Cr 81		O	[257]
9	C ₁₇ H ₃₅ -COO-	Cr 84		O	[257]
10	C ₁₈ H ₃₇ -COO-	Cr 84.5		O	[257]
11	C ₁₉ H ₃₉ -COO-	Cr 88		O	[257]
12	C ₂₀ H ₄₁ -COO-	Cr 88.5		O	[257]
13	C ₂₁ H ₄₃ -COO-	Cr 90.5		O	[257]
14	C ₂₂ H ₄₅ -COO-	Cr 90		O	[257]
15	C ₂₃ H ₄₇ -COO-	Cr 93		O	[257]

TABLE 32. 22-Methyl-9 β ,19-cyclo-20 ϵ -lanostanes (cycloswietanols)Table 32: 3 β -substituted 22-methyl-9 β ,19-cyclo-20 ϵ -lanostanes (cycloswietanol)

(all temperatures in °C)

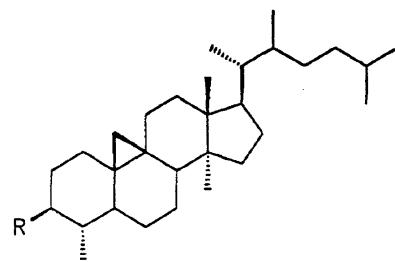
No	3 β -Substituent	Solid State	Mesophase	CP	Reference
1	C ₆ H ₁₃ -COO-	Cr 72.5	S 88	I	[258]
2	C ₇ H ₁₅ -COO-	Cr 69.5	Ch 72	I	[258]
3	C ₈ H ₁₇ -COO-	Cr 64	Ch 68	I	[258]
4	C ₉ H ₁₉ -COO-	Cr 59.5	Ch 65	I	[258]

TABLE 33. 22-Methylcyclolanost-20-enes (cycloswietenols)

Table 33: 3 β -substituted 22-methylcyclolanost-20-enes (cycloswietenol)

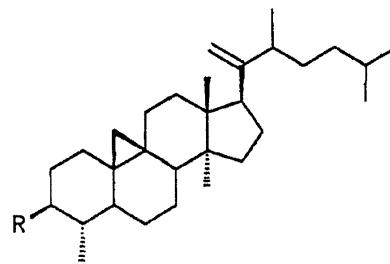
(all temperatures in °C)

No	3 β -Substituent	Solid State	Mesophase	CP	Reference
1	C ₆ H ₁₃ -COO-	Cr 71	S 85	I	[258]
2	C ₇ H ₁₅ -COO-	Cr 68.5	Ch 70.5	I	[258]
3	C ₈ H ₁₇ -COO-	Cr 62	Ch 65.5	I	[258]
4	C ₉ H ₁₉ -COO-	Cr 58	Ch 62.5	I	[258]

TABLE 34. $4\alpha,14\alpha,22$ -Trimethylcyclocholestanes (31-norcycloswietanols)Table 34: 3β -substituted $4\alpha,14\alpha,22$ -trimethylcyclocholestanes (31-norcycloswietanol)

(all temperatures in °C)

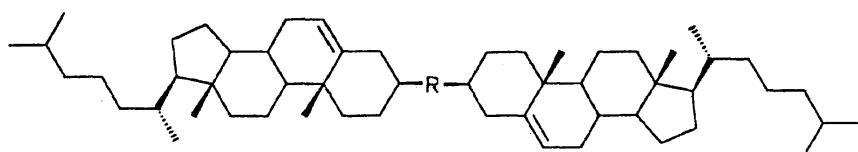
No	3β -Substituent	Solid State	Mesophase	CP	Reference
1	$C_6H_{13}-COO-$	Cr 87.5	S 90	I	[258]
2	$C_7H_{15}-COO-$	Cr 84.5	Ch 90.5 I	[258]	
3	$C_9H_{19}-COO-$	Cr 76	Ch 81.5 I	[258]	

TABLE 35. $4\alpha,14\alpha,22$ -Trimethylcyclocholest-20-enes (31-norcyclo-swietenols)Table 35: 3β -substituted $4\alpha,14\alpha,22$ -trimethylcyclocholest-20-enes (31-norcycloswietenol)

(all temperatures in °C)

No	3β -Substituent	Solid State	Mesophase	CP	Reference
1	$C_6H_{13}-COO-$	Cr 86	S 89.5	I	[258]
2	$C_7H_{15}-COO-$	Cr 83	Ch 87	I	[258]
3	$C_8H_{17}-COO-$	Cr ?		I	[258]
4	$C_9H_{19}-COO-$	Cr 74	Ch 79	I	[258]

TABLE 36. Bis(cholest-5-enes)

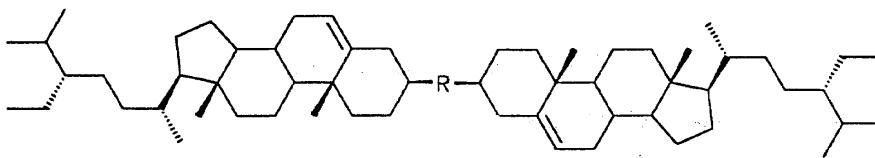
Table 36: bis(3β -substituted cholest-5-enes)

(all temperatures in °C)

No.	Spacer	Solid State	Mesophase	CP	Reference
1	OOC-COO	Cr 227	Ch 253	I	[259]
2	OOC-CH ₂ -COO	Cr 178	O	[260]	
3	OOC-C ₂ H ₄ -COO	Cr 220	Ch 235	I	[10]
4	OOC-C ₃ H ₆ -COO	Cr 195.5		I	[10]
5	OOC-C ₄ H ₈ -COO	Cr 193.8	Ch 225.5	I	[33]
6	OOC-C ₅ H ₁₀ -COO	Cr 160	Ch <?	I	[116]
7	OOC-C ₆ H ₁₂ -COO	Cr 183	Ch 164	I	[259]
8	OOC-C ₇ H ₁₄ -COO	Cr 156	Ch 161	I	[116]
9	OOC-C ₈ H ₁₆ -COO	Cr 180.4	Ch 175.8	I	[33]
10	OOC-C ₂ F ₄ -COO	Cr 211		I	[29]
11	OOC-C ₃ F ₆ -COO	Cr 197		I	[29]
12	OOC-C ₄ F ₈ -COO	Cr 163	X 110	I	[29]
13	OOC-C ₅ F ₁₀ -COO	Cr 149	X 106	I	[29]
14	OOCO-C ₂ H ₄ -OOCO	Cr ₃ 103.7	Cr ₂ 122.2	Cr 169.6	Ch 160.7 I [261]
15	OOCO-C ₄ H ₈ -OOCO		Cr 181.4		Ch 252.4 I [261]
16	OCO-NH-C ₂ H ₄ -NH-COO	Cr 233	S 215	I	[261,262]
17	OCO-NH-C ₃ H ₆ -NH-COO	Cr 195	S 210	I	[261,262]
18	OCO-NH-C ₄ H ₈ -NH-COO	Cr 161	S 209	I	[261,262]
19	OCO-NH-C ₅ H ₁₀ -NH-COO	Cr 151	S 199	I	[261,262]
20	OCO-NH-C ₆ H ₁₂ -NH-COO	Cr 169	S 198	I	[261,262]
21	OCO-NH-C ₈ H ₁₆ -NH-COO	Cr 152	S 134	Ch 177	I [261,262]

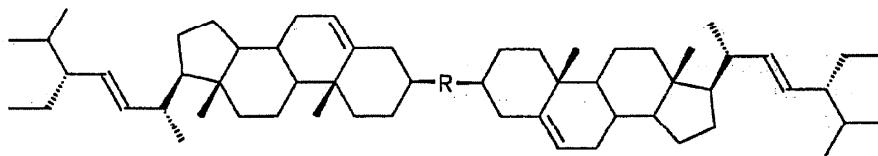
No. Additional published Data

- 1 Cr 222 O²⁶⁰; Cr 220 X ? Z¹⁰
 3 Cr 217 Ch 208 I²⁵⁹; Cr 214 Ch 248 I¹¹⁶
 4 Cr 190 I¹¹⁶
 5 Cr 199 Ch 185 I²⁵⁹; Cr 180 Ch 188 I¹¹⁶; Cr 195 X 222 I¹⁰
 7 Cr 192 S 195 Ch 224 Ch 227 I¹¹⁶; Cr 179.5 I¹⁰
 9 Cr 176 Ch 151 I²⁵⁹; Cr 174 Ch 179 I¹¹⁶

TABLE 37. Bis(β -sitosterols)Table 37: bis(3 β -substituted β -sitosterol)

No	Spacer	Solid State	Mesophase	CP	Reference
125	OOC-COO	Cr 195	X 198	Z	[263]
127	OOC-CH ₂ -COO	Cr 170	X 172	I	[263]
129	OOC-C ₂ H ₄ -COO	Cr 198	X 201	I	[263]
131	OOC-C ₃ H ₆ -COO	Cr 168	X 171	I	[263]
133	OOC-C ₄ H ₈ -COO	Cr 189	X 195	I	[263]
136	OOC-C ₆ H ₁₂ -COO	Cr 143	X 146	I	[263]
138	OOC-C ₇ H ₁₄ -COO	Cr 145	X 148	I	[263]
140	OOC-C ₈ H ₁₆ -COO	Cr 127	X 137	I	[263]

No. Additional published Data
125 Cr 196 O²⁶⁰

TABLE 38. Bis(β -stigmasterols)Table 38: bis(3 β -substituted β -stigmasterol)

No	Spacer	Solid State	Mesophase	CP	Reference
147	OCOO-C ₂ H ₄ -OCOO	Cr 219		I	[244]
148	OCOO-C ₃ H ₆ -OCOO	Cr 212		I	[244]
150	OCOO-C ₄ H ₈ -OCOO	Cr 232		I	[244]
151	OCOO-C ₅ H ₁₀ -OCOO	Cr 175	S 109	I	[244]
152	OCOO-C ₆ H ₁₂ -OCOO	Cr 171	S 113	I	[244]
153	OCOO-C ₇ H ₁₄ -OCOO	Cr 161	S 107	I	[244]
154	OCOO-C ₈ H ₁₆ -OCOO	Cr 167.5	S 108	I	[244]
155	OCOO-C ₉ H ₁₈ -OCOO	Cr 164	S 104	I	[244]
156	OCOO-C ₁₀ H ₂₀ -OCOO	Cr 151	S 104	I	[244]

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