Homologous Series of Liquid Crystalline Steroidal Lipids

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Received March 1, 1995

Steroids are an important source of chiral mesophases. The melting behavior and mesomorphic properties of homologous series of steroidal 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 steroidal framework. [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. Reinitzer[1] noticed that cholesteryl benzoate had a double melting point. The closer investigation of the melting behavior of this compound by Reinitzer and Lehmann[2]

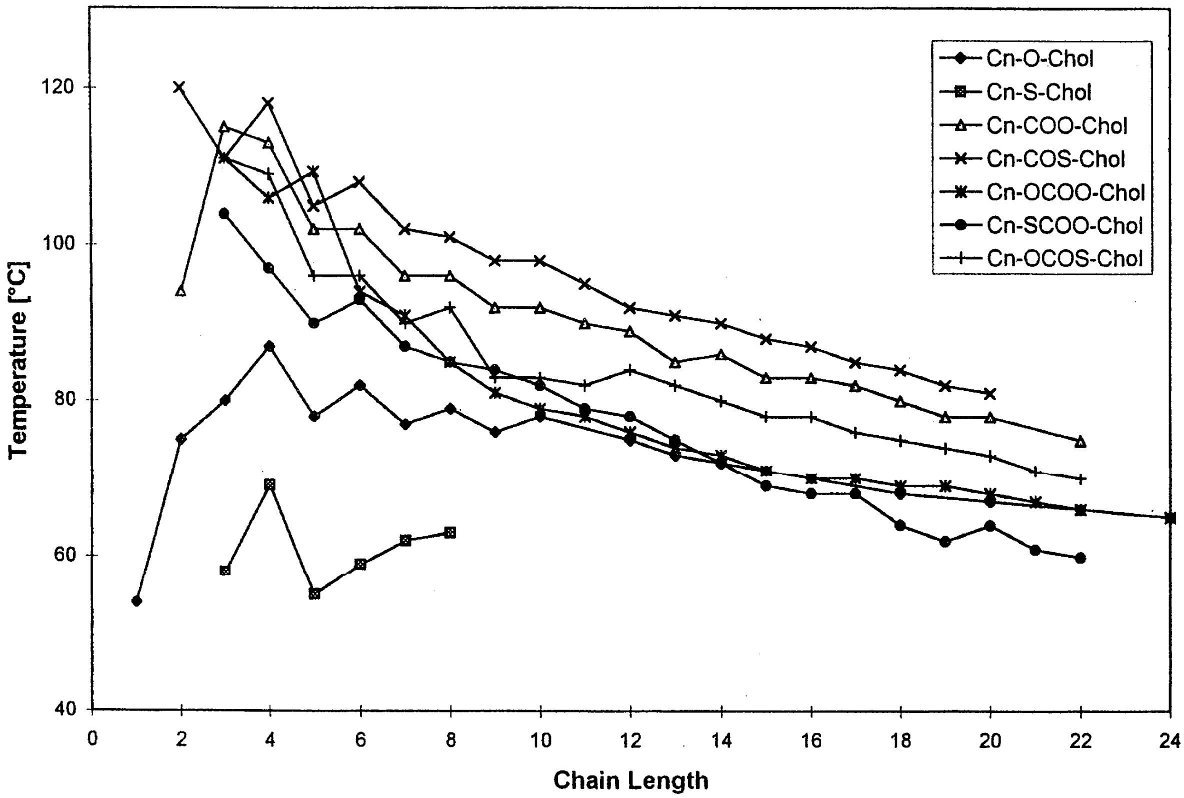


FIG. 1. Clearing temperatures of cholest-5-ene compounds.

was the inception of liquid crystal science as a new discipline. Since then, a multitude of steroidal systems[3] 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 3β 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 poential homologous series. The steroids covered are listed in 38 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 steroidal 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 steroidal 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, CH═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 steroidal compounds, although these do not posses a polar group. In these molecules two cholesteric phases are separated by a smectic phase.

Blue phases are also quite common for steroidal 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 Goodby[9] in 1989. Although there has only been one example where a TGB_A phase[10] has been found in a steroid, it may very well be that quite a few steroidal 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:

$$\mathrm{COS} > \mathrm{COO} > \mathrm{OCOS} > \mathrm{OCOO} \approx \mathrm{OSCOO} > \mathrm{S}.$$

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-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 3-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 cholestane 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 steroidal 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 steroidal 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.

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,

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 temperatures
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 [°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)

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

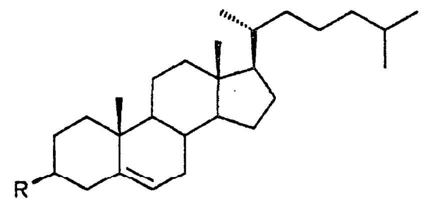
Table 1. Comparison between cholest-5-enes and other steroids (Temperatures, °C, are understood as differences of the upper transition temperatures with the cholest-5-ene series as reference)

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)	
Sitosterine	−4.0±18.6	(70)[b]	−51.6±22.8	(29)[b]	23.1±28.3	(8)[b]
Stigmasterine	11.6±19.4	(53)[b]	−47.7±10.6	(7)[b]	−7.6± 9.4	(10)[b]

[a]Standard deviation (root mean square).
[b]Number 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: 3ß-substituted cholest-5-enes



(all temperatures in °C)

No	3ß-Substituent	Stereo	Solid State	Mesophase	CP	Reference	Comments
1	CH_3-CHMe-COO-		Cr 131	Ch 95	E	[11]	*
2	C_3H_7-CHMe-COO-	(R/S)	Cr 80.1	S 68.2	I	[12,13]	
3	C_3H_7-CHMe-COO-	(R)	Cr 90.4	S 69.1	I	[12,13]	
4	C_3H_7-CHMe-COO-	(S)	Cr 74.3	S 65.5	I	[12,13]	
5	C_4H_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_2H_5-CHCl-COO-	(R/S)	Cr 115		I	[19,20]	*
8	C_3H_7-CHCl-COO-	(R/S)	Cr 85	Ch <?	I	[19,20]	
9	C_5H_{11}-CHCl-COO-	(R/S)	Cr 100	Ch 94	I	[20]	*
9a	C_7H_{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_2H_5-CHCl-COS-	(R/S)	Cr 87	Ch <52	I	[19]	
12	C_3H_7-CHCl-COS-	(R/S)	Cr 95	Ch <40	I	[19]	
13	C_5H_{11}-CHCl-COS-	(R/S)	Cr 88	Ch <58	I	[19]	
14	C_7H_{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_2H_5-CHBr-COO-	(R/S)	Cr 118		I	[19,20]	
17	C_3H_7-CHBr-COO-	(R/S)	Cr 78	Ch <?	I	[19]	*
17a	C_4H_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_2H_5-CHBr-COS-	(R/S)	Cr 79.8	Ch <78	I	[19]	
21	C_3H_7-CHBr-COS-	(R/S)	Cr 77.4	Ch <50	I	[19]	
21a	C_4H_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_3H_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_2F_5-COO-		Cr 101	X 79	I	[29]	*
25	C_3F_7-COO-		Cr 108	X 66	I	[29]	*
26	C_4F_9-COO-		Cr 92	X 56	I	[29]	
27	C_5F_{11}-COO-		Cr 90	X 64	I	[29]	
28	C_6F_{13}-COO-		Cr 89	X 40	I	[29]	
29	C_7F_{15}-COO-		Cr 106	S 85 X 100	I	[30]	*
30	H-C_2F_4-COO-		Cr 149.4		I	[15,30]	
31	H-C_4F_8-COO-		Cr 110		I	[30]	
32	H-C_6F_{12}-COO-		Cr 100		I	[30]	
33	H-C_8F_{16}-COO-		Cr 118	X 88	I	[30]	

TABLE 2. Cholest-5-enes—Continued

34	H-C_2F_4-CH_2-OCOO-		Cr 107			I	[34,35]	
35	H-C_4F_8-CH_2-OCOO-		Cr 117			I	[34,35]	
36	H-C_6F_{12}-CH_2-OCOO-		Cr 130		Ch 79	I	[34,35]	
37	H-C_8F_{16}-CH_2-OCOO-		Cr 110	S 92	Ch 97	I	[34,35]	
38	H_2C=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_2C=CH-COO-C_3H_6-COO-		Cr 70.5		Ch 67.5	I	[47,48]	
41	H_2C=CH-COO-C_4H_8-COO-		Cr 87		Ch 82	I	[48]	
42	H_2C=CH-COO-C_5H_{10}-COO-		Cr 46	S 31	Ch 68.5	I	[48]	*
43	H_2C=CH-COO-$C_{10}H_{20}$-COO-	Cr_2 28	Cr_1 42	S 67	Ch 78	I	[49]	*
44	H_2C=CH-CONH-C_2H_4-COO-		Cr 125	X ?		Z	[43]	*
45	H_2C=CH-CONH-C_5H_{10}-COO-		Cr ?			I	[43]	
46	H_2C=CH-CONH-$C_{11}H_{22}$-COO-	Cr_2 ?	Cr_1 104			I	[49]	*
47	H_2C=CH-OOC-C_2H_4-COO-		Cr 82		Ch 89	I	[51,52]	
48	H_2C=CH-OOC-C_3H_6-COO-		Cr 83		Ch 72	I	[52]	
49	H_2C=CH-COO-C_2H_4-OCOO-		Cr 87		Ch 56	I	[47]	
50	H_2C=CH-COO-C_3H_6-OCOO-		Cr 105			I	[47]	
51	H_2C=CH-COO-C_4H_8-OCOO-		Cr 45		Ch 64	I	[47]	
52	H_2C=CH-COO-C_5H_{10}-OCOO-		Cr 54		Ch 69	I	[47]	
53	H_2C=CH-COO-C_6H_{12}-OCOO-		Cr 52		Ch 62	I	[47]	
54	H_2C=CH-C_2H_4-COO-		Cr 64	S 72	Ch 107	I	[53]	*
55	H_2C=CH-C_3H_6-COO-		Cr 71		Ch 76.8	I	[54]	*
56	H_2C=CH-C_4H_8-COO-		Cr 105			I	[54]	
57	H_2C=CH-C_5H_{10}-COO-		Cr 91		Ch 71	I	[54]	
58	H-C$\equiv$C-COO-		Cr 127		Ch 105	I	[56]	
59	H-C$\equiv$C-C_2H_4-COO-		Cr 107		Ch 140	I	[56,57]	
60	H-C$\equiv$C-C_8H_{16}-COO-		Cr 51	S_A 74		I	[56,57]	
61	CH_3-COO-CH_2-		Cr 83			O	[58]	*
62	C_3H_7-COO-CH_2-		Cr 67			O	[58]	*
63	C_5H_{11}-COO-CH_2-		Cr 46			O	[58]	*
64	C_7H_{15}-COO-CH_2-		Cr 50			O	[58]	*
65	C_9H_{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_2H_5-O-		Cr 89		Ch 75	I	[59]	*
72	C_3H_7-O-		Cr 101.5		Ch 80.5	I	[60]	*
73	C_4H_9-O-		Cr 79.5		Ch 87	I	[59,61]	*
74	C_5H_{11}-O-		Cr 67.7		Ch 78.4	I	[60]	*
75	C_6H_{13}-O-	Cr_2 67	Cr_1 69.9		Ch 81.9	I	[60]	*
76	C_7H_{15}-O-		Cr 97	S_A 42.6	Ch 76.9	I	[60]	*
77	C_8H_{17}-O-		Cr 95.9	S_A 52.5	Ch 79	I	[60]	*
78	C_9H_{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_2H_5-S-		Cr 132.5			I	[59]	
93	C_3H_7-S-		Cr 80.5		Ch 58	I	[59]	
94	C_4H_9-S-		Cr 60.5		Ch 69	I	[59]	
95	C_5H_{11}-S-		Cr 59.5		Ch 55	I	[59]	
96	C_6H_{13}-S-	X 36 X 38.5	Cr 64	S <?	Ch 59	I	[59]	*
97	C_7H_{15}-S-		Cr 72.5	S 51	Ch 61.5	I	[59]	
98	C_8H_{17}-S-	X 24.5 X 29	Cr 75	S 56	Ch 63	I	[59]	*
99	C_9H_{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_2H_5-SO_2-		Cr 161	X <?		I	[76]	
103	C_3H_7-SO_2-		Cr 157			I	[76]	
104	C_4H_9-SO_2-	Cr_3 136 Cr_2 146	Cr_1 166			I	[76]	
105	C_5H_{11}-SO_2-	Cr_2 110	Cr_1 173			I	[76]	
106	C_6H_{13}-SO_2-		Cr 159	S 156		I	[76]	
107	C_7H_{15}-SO_2-		Cr 160			I	[76]	
108	C_8H_{17}-SO_2-		Cr 137	S 166		I	[76]	
109	C_9H_{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_2H_4-O-		Cr 48.5		Ch 66.5	I	[77]	
112	C_2H_5-O-C_2H_4-O-		Cr 42.5		Ch 49.5	I	[77]	
113	C_3H_7-O-C_2H_4-O-		Cr 32		Ch 36	I	[77]	
114	C_4H_9-O-C_2H_4-O-		Cr 54		Ch 28.5	I	[77]	
115	CH_3-COO-C_2H_4-O-		Cr 55.5	S_A 29.5	Ch 44.5	I	[77]	*
116	C_7H_5-COO-C_2H_4-O-		Cr 51	S -3	Ch 28	I	[77]	*
117	C_3H_7-COO-C_2H_4-O-		Cr 43	S -10	Ch 4.5	I	[77]	*
118	C_4H_9-COO-C_2H_4-O-		Cr 42			I	[78]	
119	C_5H_{11}-COO-C_2H_4-O-		Cr 30			I	[78]	
120	C_6H_{13}-COO-C_2H_4-O-		Cr 36			I	[78]	
121	C_8H_{17}-COO-C_2H_4-O-		Cr 36.5			I	[78]	
122	C_9H_{19}-COO-C_2H_4-O-		Cr 37.5			I	[78]	
123	$C_{17}H_{35}$-COO-C_2H_4-O-		Cr 35			I	[78]	
118	CH_3-OOC-		Cr 102.5			I	[58,80]	*
119	C_2H_5-OOC-		Cr 83			O	[58,80]	*
120	C_3H_7-OOC-		Cr 85.6			I	[58]	
121	C_4H_9-OOC-		Cr 63			I	[58]	
122	C_5H_{11}-OOC-		Cr 66			I	[58]	
123	C_6H_{13}-OOC-		Cr 55.5			O	[58]	
124	C_7H_{15}-OOC-		Cr 59			O	[58]	
125	C_8H_{17}-OOC-		Cr 45			O	[58]	
126	C_9H_{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_2H_5-COO-	Cr 101.6		Ch 115.2	I	[33]	*
135	C_3H_7-COO-	Cr 102		Ch 113	I	[26,84]	*
136	C_4H_9-COO-	Cr 93		Ch 101.5	I	[84]	*
137	C_5H_{11}-COO-	Cr 99.5		Ch 101.5	I	[84]	*
138	C_6H_{13}-COO-	Cr 114	S <92.5	Ch 95.5	I	[84]	*
139	C_7H_{15}-COO-	Cr 110	S 69.5	Ch 96.5	I	[84]	*
140	C_8H_{17}-COO-	Cr 80.5	S 77.5	Ch 92	I	[84]	*
141	C_9H_{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_2H_5-COS-	Cr 111.4		Ch 111.1	I	[86,170]	
156	C_3H_7-COS-	Cr 100.6		Ch 117.6	I	[86,170]	
157	C_4H_9-COS-	Cr 90.7		Ch 104.7	I	[86,170]	
158	C_5H_{11}-COS-	Cr 94.8		Ch 107.7	I	[86,170]	
159	C_6H_{13}-COS-	Cr 107.0	S 73.1	Ch 102.1	I	[86,170]	*
160	C_7H_{15}-COS-	Cr 97.3	S 76.6	Ch 100.8	I	[86,170]	
161	C_8H_{17}-COS-	Cr 68.2	S 84.0	Ch 97.5	I	[86,170]	
162	C_9H_{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_4H_9-O-C_2H_4-COO-	Cr 95.8	Ch 81		U	[92]	
174	C_5H_{11}-O-C_2H_4-COO-	Cr 80	Ch 65.9		I	[92]	
175	C_6H_{13}-O-C_2H_4-COO-	Cr 79.7	Ch 64.7		I	[92]	
176	C_7H_{15}-O-C_2H_4-COO-	Cr 84.8	Ch 59.3		I	[92]	
177	C_8H_{17}-O-C_2H_4-COO-	Cr 82.2	Ch 59.5		I	[92]	
178	$C_{12}H_{25}$-O-C_2H_4-COO-	Cr 62.4	Ch 58.5		I	[92]	
179	CH_3-O-C_2H_4-O-C_2H_4-COO-	Cr 74.5		Ch 67.2	I	[92]	
180	C_2H_5-O-C_2H_4-O-C_2H_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_2H_5-OOC-CH=CH-COO-	Cr 56		Ch 89	I	[172]	
183	C_3H_7-OOC-CH=CH-COO-	Cr 58		Ch 106	I	[172]	
184	C_4H_9-OOC-CH=CH-COO-	Cr 25		Ch 90	I	[172]	
185	C_5H_{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_2H_5-OCOO-	Cr 83.9		Ch 105.8 I	[173]	*
188	C_3H_7-OCOO-	Cr 98.8		Ch 101 I	[173]	*
189	C_4H_9-OCOO-	Cr 80.2		Ch 94 I	[173]	*
190	C_5H_{11}-OCOO-	Cr 101.5		Ch 90.6 I	[174]	*
191	C_6H_{13}-OCOO-	Cr 106		Ch 108 I	[175,176]	*
192	C_7H_{15}-OCOO-	Cr 88		Ch 81.3 I	[173]	*
193	C_8H_{17}-OCOO-	Cr 54.8	S 35.4	Ch 78.9 I	[173]	*
194	C_9H_{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_2H_5-SCOO-	Cr 114.7		Ch 97.1 I	[184]	*
209	C_3H_7-SCOO-	Cr 97.9		Ch 90.3 I	[184]	*
210	C_4H_9-SCOO-	Cr 97.5		Ch 93.3 I	[184]	*
211	C_5H_{11}-SCOO-	Cr 92.9	S 40.3	Ch 87.3 I	[184]	*
212	C_6H_{13}-SCOO-	Cr 94.1	S 58	Ch 85.4 I	[184]	*
213	C_7H_{15}-SCOO-	Cr 61	S 68.2	Ch 84.2 I	[184]	*
214	C_8H_{17}-SCOO-	Cr 80.9	S 69.8	Ch 82.3 I	[184]	*
215	C_9H_{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_2H_5-OCOS-	Cr 132.2		Ch 109.0 I	[185]	*
229	C_3H_7-OCOS-	Cr 109.2		Ch 96.1 I	[185]	*
230	C_4H_9-OCOS-	Cr 101.7	S 35.0	Ch 95.8 I	[185]	*
231	C_5H_{11}-OCOS-	Cr 96.0	S 56.0	Ch 90.3 I	[185]	*
232	C_6H_{13}-OCOS-	Cr 95.3	S 65.9	Ch 91.6 I	[185]	*
233	C_7H_{15}-OCOS-	Cr 92.5	S 65.6	Ch 83.4 I	[185]	*
234	C_8H_{17}-OCOS-	Cr 87.7	S 66.6	Ch 82.8 I	[185]	*
235	C_9H_{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}H39-OCOS-	Cr 75.8	S 62.3	Ch 71.3	I	[185]	*
246	C_{20}H41-OCOS-	Cr 70.1	S 60.4	Ch 70.2	I	[185]	*
247	CH_3-SCSO-	Cr 128		Ch <?	I	[182]	*
248	C_2H_5-SCSO-	Cr 144			O	[188]	*
249	C_3H_7-SCSO-	Cr 135			O	[189]	
250	C_6H_{13}-SCSO-	Cr ?		Ch ?	I	[186]	
251	CH_3-NHCOO-	Cr 205			I	[191]	
252	C_2H_5-NHCOO-	Cr 162			I	[191]	*
253	C_3H_7-NHCOO-	Cr ?		X ?	I	[192]	*
254	C_4H_9-NHCOO-	Cr 129			I	[191]	*
255	C_8H_{17}-NHCOO-	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_2H_4-O-C_2H_4-OCO	Cr ?	S 45-59		U	[195]	*
256	C_2H_5-O-C_2H_4-O-C_2H_4-OCOO-	Cr ?		Ch 37.5	I	[196]	*
257	C_4H_9-O-C_2H_4-O-C_2H_4-OCOO-	Cr ?		Ch 29	U	[197]	*
258	CH_3-OOC-C_5H_{10}-NH-COO-	Cr 86	S_C 71	Ch 85	I	[199]	*
259	C_2H_5-OOC-C_5H_{10}-NH-COO-	Cr 95		Ch 75	I	[199]	
260	C_3H_7-OOC-C_5H_{10}-NH-COO-	Cr 68		Ch 66	I	[199]	
261	C_4H_9-OOC-C_5H_{10}-NH-COO-	Cr 79		Ch 56	I	[199]	
262	C_5H_{11}-OOC-C_5H_{10}-NH-COO-	Cr 84.5		Ch 42	I	[199]	
263	C_6H_{13}-OOC-C_5H_{10}-NH-COO-	Cr 64		Ch 44	I	[199]	
264	C_7H_{15}-OOC-C_5H_{10}-NH-COO-	Cr 44		Ch 43	I	[199]	*
265	C_8H_{17}-OOC-C_5H_{10}-NH-COO-	Cr 67.5	S_C 27	Ch 44	I	[199]	
266	C_9H_{19}-OOC-C_5H_{10}-NH-COO-	Cr 70	S_C 37	Ch 46	I	[199]	
267	$C_{10}H_{21}$-OOC-C_5H_{10}-NH-COO-	Cr 57	S_C 43.5	Ch 48.5	I	[199]	
268	$C_{11}H_{23}$-OOC-C_5H_{10}-NH-COO-	Cr 48	S_A 49		I	[199]	*
269	$C_{12}H_{25}$-OOC-C_5H_{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_2H_5-OOC-$C_{10}H_{20}$-NH-COO-	Cr_2 74 Cr_1 83		Ch 59	I	[200]	*
272	C_3H_7-OOC-$C_{10}H_{20}$-NH-COO-	Cr 85			I	[200]	*
273	C_4H_9-OOC-$C_{10}H_{20}$-NH-COO-	Cr 89.5	S_C 23.5	Ch 48.5	I	[200]	*
274	C_5H_{11}-OOC-$C_{10}H_{20}$-NH-COO-	Cr_2 40 Cr_1 87	S_C 29	Ch 42	I	[200]	*
275	C_6H_{13}-OOC-$C_{10}H_{20}$-NH-COO-	Cr_2 46 Cr_1 70	S_C 28	Ch 42	I	[200]	*
276	C_7H_{15}-OOC-$C_{10}H_{20}$-NH-COO-	Cr_2 57.5 Cr_1 69	S_C 30	Ch 41	I	[200]	*
277	C_8H_{17}-OOC-$C_{10}H_{20}$-NH-COO-	Cr 63	S_C 31	Ch 40	I	[200]	*
278	C_9H_{19}-OOC-$C_{10}H_{20}$-NH-COO-	Cr 58	S_C 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	S_C 33	Ch 41	I	[200]	*
280	$C_{11}H_{23}$-OOC-$C_{10}H_{20}$-NH-COO-	Cr 47	S_C 36	Ch 41	I	[200]	*
281	$C_{12}H_{25}$-OOC-$C_{10}H_{20}$-NH-COO-	Cr 49.5	S_C 38	Ch 42	I	[200]	*

Footnotes:

No.	Additional published Data
1	Cr 128 I[14]; Cr 127.5 I[15,16]; Cr 127 I[17]; Cr 126.5 I[1]
6	Cr 123 I[19], DSC[15]
7	Cr 109 I[22]
9	Cr 100.4 Ch <? I[19]
15	Cr 128 I[19,20]
17	Cr 78-79 I[20]
18	Cr ? S 47.7 Ch 50.5 I[25]; Cr ? S 47.3 Ch 50.5 I[20]
22	Cr 124.5 Ch 129 I[25]; Cr 129 Ch 124.5 I[27]

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[39]; Cr_2 64 Cr_1 122.5 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]
134	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]
135	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]
136	Cr 92.6 Ch 91 I[33]; 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

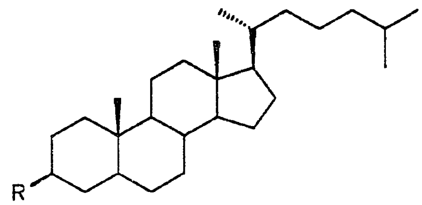
137	Cr 120.4 Ch 98.7 I[33]; Cr 98.0 Ch 99.3 I[113]; pressure dep.[124,102]; Cr 98 Ch 99 I[85]; Cr 98 Ch 99.5 I[92]; Cr 91.2 X 100.1 I[17,18]; Cr 99 Ch 100 I[94]; Cr 96 Ch 98 I (DTA)[94]; Cr 100 Ch 102 I[73]; Cr 85 X 101 I[16]; Cr 93.5 X 94.5 I[97]; Cr 93.0 Ch 95.6 I[101]; DSC[33,86,105,125]
138	Cr 106.8 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[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[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[73]; 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]; ^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]
159	Cr ? S 67.0 Ch 96.1 BP ? I[103]
186	Cr 114 Ch <? I, sinters at 112; mp_2 < 110[177]; pressure dep.[102]; Cr 110 Ch 114 I[178]; DSC[173]
187	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]
188	Cr 96.9 Ch 99.0 I[85]; Cr 96-99 Ch 101 I, sinters at 95[177]; pressure dep.[102]; DSC[173,183]
189	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]
190	Cr 106.3 I[173]; Cr 106.2 Ch <? I[85]; Cr 98 Ch 102 I[175,176]; DSC[173,183]
191	Cr 108.3 I[173]; Cr 108 Ch <? I[85]; DSC[173,183]
192	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]
193	Cr 53.0 A 44.5 Ch 75.6 I[85]; Cr 53 Ch 83 I[175,176]; DSC[173,183]
194	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[85]; Cr 76 Ch 79.5 I[175,176]; DSC[173,183]
196	Cr 61.6 A 51.2 Ch 73.0 I[85]; 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]
	Most probably S_C given for compounds **258**, **265 - 267** in ref. [199] is S_A.
258	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]
	Most probably S_C given for compounds **273** - **281** in ref. [200] is S_A.
273	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: 3ß-substituted cholestanes



(all temperatures in °C)

No	3ß-Substituent	Solid State	Mesophase	CP	Reference	Comments
1	CF_3-COO-	Cr 108		I	[201]	
2	C_2F_5-COO-	Cr 117		I	[201]	
3	C_3F_7-COO-	Cr 115		I	[201]	
4	C_6F_{13}-COO-	Cr 86		I	[201]	
5	H-C_2F_4-COO-	Cr_2 93.9 Cr_1 124.9		I	[201,202]	
6	H-C_4F_8-COO-	Cr_2 63.9 Cr_1 87.9		I	[201,202]	
7	H-C_6F_{12}-COO-	Cr_2 66.9 Cr_1 72.9		I	[201,202]	
8	H-C_8F_{16}-COO-	Cr 98.9		I	[201,202]	
9	CH_3-	Cr 106		O	[203]	*
10	C_2H_5-	Cr ?		I	[204]	
11	C_3H_7-	Cr 91		O	[205]	
12	C_4H_9-	Cr ?		I	[204]	
13	C_5H_{11}-	Cr ?		I	[204]	
14	C_6H_{13}-	Cr 67	Ch 88	I	[206]	
15	C_8H_{17}-	Cr 43	S_A 62 Ch 91	I	[206]	
16	$C_{10}H_{21}$-	Cr 46.5	S_A 83 Ch 94	I	[206]	
17	$C_{14}H_{29}$-	Cr 64	S_A 83.5 Ch 87.5	I	[206]	*
18	$C_{16}H_{33}$-	Cr 70	S_A 82 Ch 85	I	[206]	
19	CH_3-O-	Cr 86.2		I	[10]	
20	C_2H_5-O-	Cr 82.8		I	[10]	
21	C_3H_7-O-	Cr 65	Ch 46.4	I	[10]	
22	C_4H_9-O-	Cr 74.2	Ch 52.6	I	[10]	
23	C_5H_{11}-O-	Cr 74.8	Ch 42.8	I	[10]	
24	C_6H_{13}-O-	Cr 67.9	Ch 51.5	I	[10]	
25	C_7H_{15}-O-	Cr 51.7	Ch 47.1	I	[10]	
26	C_8H_{17}-O-	Cr 41.2	Ch 53.1	I	[10]	
27	C_9H_{19}-O-	Cr 53.3	S_A 24.2 Ch 53.9	I	[10]	
28	$C_{10}H_{21}$-O-	Cr 51.6	S_A 38.5 Ch 57.7	I	[62,10]	
29	$C_{12}H_{25}$-O-	Cr 60.8	S_A 45.5 Ch 57.8	I	[10]	
30	$C_{13}H_{27}$-O-	Cr 69.4	S_A 46.6 Ch 56.0	I	[10]	
31	$C_{14}H_{29}$-O-	Cr 68.2	S_A 47.1 Ch 56.7	I	[62,10]	
32	$C_{15}H_{31}$-O-	Cr 75.4	S_A 47.7 Ch 55.8	I	[10]	
33	$C_{16}H_{33}$-O-	Cr 73.2	S_A 48.5 Ch 56.4	I	[10]	
34	$C_{18}H_{37}$-O-	Cr 78.3	S_A 49.0 Ch 56.5	I	[62,10]]	
35	$C_{20}H_{41}$-O-	Cr 82.1	Ch >53	I	[10]	
36	$C_{22}H_{25}$-O-	Cr 85.1		I	[10]	
37	$C_{24}H_{49}$-O-	Cr 87.6		I	[10]	
38	CH_3-COO-	Cr ?	Ch 59	I	[209]	*
39	C_2H_5-COO-	Cr ?	Ch 88	I	[209]	*
40	C_3H_7-COO-	Cr 88	Ch 83	I	[210]	*

TABLE 3. Cholestanes—Continued

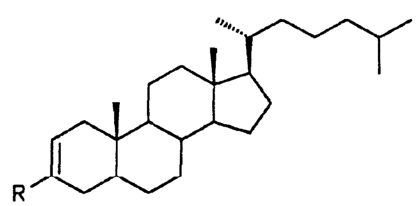
41	C_4H_9-COO-	Cr ?			Ch 70	I	[209]	
42	C_5H_{11}-COO-	Cr 87			Ch 73	I	[210]	*
43	C_6H_{13}-COO-	Cr ?			Ch 68	I	[209]	
44	C_7H_{15}-COO-	Cr 76			Ch 69	I	[130,210]	*
45	C_8H_{17}-COO-	Cr ?	S	45	Ch 70	I	[209]	*
46	C_9H_{19}-COO-	Cr 82.5	S	53	Ch 72	I	[210]	*
47	$C_{10}H_{21}$-COO-	Cr ?	S	61	Ch 72	I	[209]	
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_2H_5-OCOO-	Cr 106.5			Ch 80.5	I	[213]	*
59	C_3H_7-OCOO-	Cr 109				I	[213]	
60	C_4H_9-OCOO-	Cr 87			Ch 69	I	[213]	*
61	C_5H_{11}-OCOO-	Cr 73			Ch 66	I	[213]	*
62	C_6H_{13}-OCOO-	Cr 71			Ch 61	I	[213]	
63	C_7H_{15}-OCOO-	Cr 52			Ch 62	I	[213]	*
64	C_8H_{17}-OCOO-	Cr 64			Ch 59	I	[213]	
65	C_9H_{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}H39-OCOO-	Cr 78				I	[213]	
76	C_{20}H41-OCOO-	Cr 87				I	[213]	
77	C_{22}H45-OCOO-	Cr 86				I	[213]	
78	CH_3-SCOO-	Cr ?			Ch 80	I	[186]	
79	C_4H_9-SCOO-	Cr ?			Ch 68	I	[186]	
80	C_5H_{11}-SCOO-	Cr ?			Ch 63	I	[186]	
81	C_6H_{13}-SCOO-	Cr ?			Ch 65	I	[186]	
82	C_7H_{15}-SCOO-	Cr ?			Ch 64	I	[186]	
83	C_8H_{17}-SCOO-	Cr ?			Ch 65	I	[186]	
84	C_9H_{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

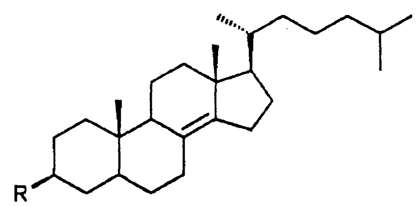


(all temperatures in °C)

No	3β-Substituent	Solid State	Mesophase	CP	Reference
1	CH_3-	Cr 84		O	[217]
2	C_6H_{13}-	Cr_2 44.5 Cr_1 47	Ch 57.5	I	[206]
3	C_8H_{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: 3ß-substituted cholest-8(14)-enes (doristerol)



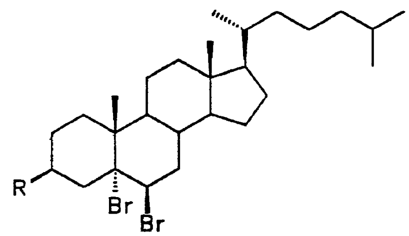
(all temperatures in °C)

No	3ß-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_2H_5-COO-	Cr 82.3		Ch 85.2	I	[218]	*
4	C_3H_7-COO-	Cr 85.3		Ch 77.3	I	[218]	*
5	C_4H_9-COO-	Cr 84.2		Ch 67.4	I	[218]	*
6	C_5H_{11}-COO-	Cr 85.9		Ch 68	I	[218]	*
7	C_6H_{13}-COO-	Cr 63.4		Ch 66.8	I	[218]	*
8	C_7H_{15}-COO-	Cr 48.7		Ch 68.4	I	[218]	*
9	C_8H_{17}-COO-	Cr 43.7	S 40.1	Ch 70.9	I	[218]	*
10	C_9H_{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_6H_{13}-OCOO-	Cr 53		Ch 62	I	[220,222]	
20	C_7H_{15}-OCOO-	Cr 41.5		Ch 62	I	[220,222]	
21	C_8H_{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. 5α,6β-Dibromocholestanes

Table 6: 3ß-substituted 5α,6ß-dibromocholestanes



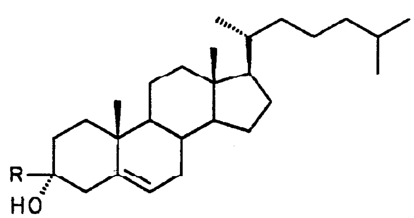
(all temperatures in °C)

No	3ß-Substituent	Solid State	Mesophase	CP	Reference	Comments
1	CH_3-COO-	Cr 117.6		I	[1]	*
2	C_2H_5-COO-	Cr 97		I	[223]	
3	C_3H_7-COO-	Cr 107		I	[223]	
4	C_5H_{11}-COO-	Cr 70		I	[223]	
5	C_6H_{13}-COO-	Cr 91.5		I	[223]	
6	C_7H_{15}-COO-	Cr 78		I	[223]	*
7	C_8H_{17}-COO-	Cr 56		I	[223]	
8	C_9H_{19}-COO-	Cr 70		I	[223]	
9	$C_{11}H_{23}$-COO-	Cr 80.5		I	[223]	
10	$C_{13}H_{27}$-COO-	Cr 58		I	[223]	
11	$C_{15}H_{31}$-COO-	Cr 55		U	[223]	
12	$C_{17}H_{35}$-COO-	Cr 65		U	[223]	

No.	Additional published Data
1	mp_2 115.4[1]; Cr 110.5 I[223]
6	Cr 78 I, mp_2 72[223]
	Compounds 1 - 12 have never been investigated for potential liquid crystalline properties. Sterically not so suitable

TABLE 7. 3α-Hydroxycholestanes

Table 7: 3ß-substituted 3α-hydroxycholestanes



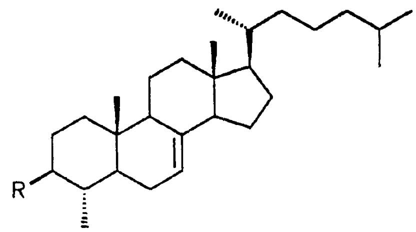
(all temperatures in °C)

No	3ß-Substituent	Solid State	Mesophase	CP	Reference	Comments
1	CH_3-	Cr 127		O	[203]	*
2	C_6H_{13}-	Cr 122	Ch 122.5	I	[206]	
3	C_8H_{17}-	Cr 155	S_A 117 Ch 125	I	[206]	
4	$C_{10}H_{21}$-	Cr 106.5	S_A 127	I	[206]	
5	$C_{14}H_{29}$-	Cr_2 107 Cr_1 110	S_A 124.5	I	[206]	
6	$C_{16}H_{33}$-	Cr 97	S_A 118.5	I	[206]	

No.	Additional published Data
1	Cr 124 I[217]

TABLE 8. 4α-Methylcholest-7-enes (lophenols)

Table 8: 3ß-substituted 4α-methylcholest-7-enes (lophenol)



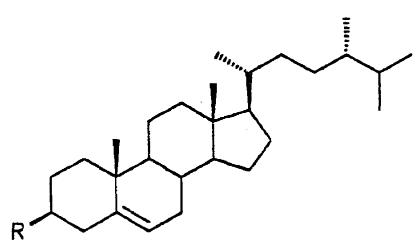
(all temperatures in °C)

No	3ß-Substituent	Solid State	Mesophase	CP	Reference	Comments
1	CH_3-COO-	Cr 121	S 96	I	[224]	
2	C_3H_7-COO-	Cr 73	S 127	I	[224]	
3	C_9H_{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 I[216]; DSC[216]

TABLE 9. (3β,24R)-Ergost-5-enes (campesterols)

Table 9: 3ß-substituted (3ß,24R) ergost-5-enes (campesterol)

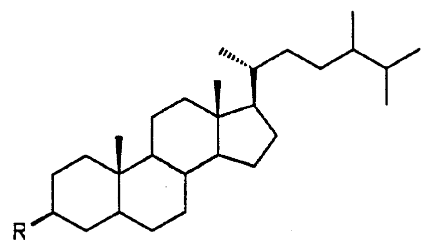


(all temperatures in °C)

No	3ß-Substituent	Solid State	Mesophase	CP	Reference
1	C_6H_{13}-COO-	Cr 98.2	S 74.8 Ch 75.8	I	[225]
2	C_7H_{15}-COO-	Cr 84.2	S 78.9	I	[225]
3	C_8H_{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: 3ß-substituted ergostanes



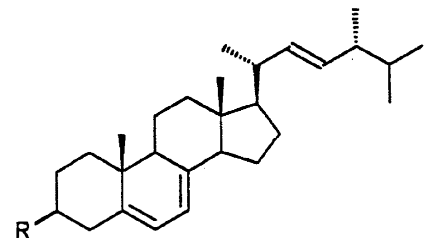
(all temperatures in °C)

No	3ß-Substituent	Solid State	Mesophase	CP	Reference	Comments
1	H-COO-	Cr 112.5		I	[226]	
2	C_2H_5-COO-	Cr 151		I	[226]	
3	C_8H_{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 ? I[226]

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

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



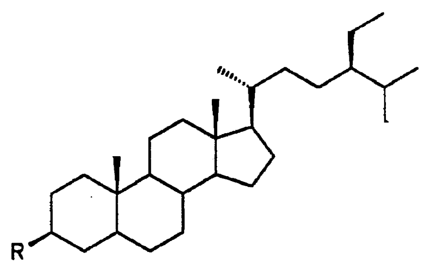
(all temperatures in °C)

No	3ß-Substituent	Solid State	Mesophase		CP	Reference	Comments
1	H-COO-	Cr 161.5			I	[227]	
2	CH_3-COO-	Cr 180			I	[228]	*
3	C_2H_5-COO-	Cr 180.5			I	[227]	
4	C_3H_7-COO-	Cr 132		Ch 142	I	[228]	*
5	C_5H_{11}-COO-	Cr 119	S_A 142		I	[228]	*
6	C_6H_{13}-COO-	Cr 94	S_A 130		I	[228]	
7	C_7H_{15}-COO-	Cr 110	S_A 138		I	[228]	*
8	C_8H_{17}-COO-	Cr 90	S_A 131		I	[228]	
9	C_9H_{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: 3ß-substituted stigmastanes



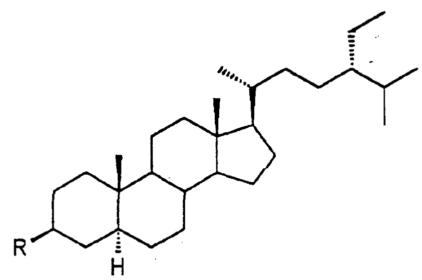
(all temperatures in °C)

No	3ß-Substituent	Solid State	Mesophase	CP	Reference	Comments
1	CH_3-COO-	Cr 136		I	[229]	
2	C_3H_7-COO-	Cr 117		I	[229]	
3	C_5H_{11}-COO-	Cr 109		I	[229]	
4	C_7H_{15}-COO-	Cr 102		I	[229]	
5	C_9H_{19}-COO-	Cr 96		I	[229]	
6	$C_{11}H_{23}$-COO-	Cr 91		I	[229]	
7	$C_{13}H_{27}$-COO-	Cr 89.5		I	[229]	
8	$C_{15}H_{31}$-COO-	Cr 103		I	[164]	*
9	$C_{17}H_{35}$-COO-	Cr 92		I	[229]	
10	$C_{21}H_{43}$-COO-	Cr 98		I	[229]	

No.	Additional published Data
1	Cr 130[232]; Cr 138 I[230];
8	Cr 90.5 I[229]
	Compounds **1** - **10** probably are monotropic.

TABLE 13. γ-Sitostanes

Table 13: 3ß-substituted γ-sitostanes



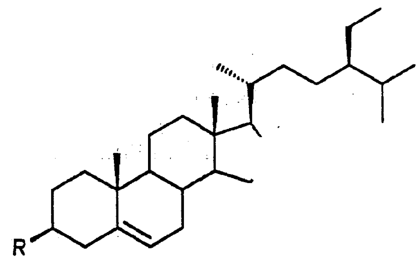
(all temperatures in °C)

No	3ß Substituent	Solid State	Mesophase	CP	Reference	Comments
1	CH_3-COO-	Cr 139		I	[229]	
2	C_3H_7-COO-	Cr 120		I	[229]	
3	C_5H_{11}-COO-	Cr 112.5		I	[229]	
4	C_7H_{15}-COO-	Cr 104.5		I	[229]	
5	C_9H_{19}-COO-	Cr 97		I	[229]	
6	$C_{11}H_{23}$-COO-	Cr 92		I	[229]	
7	$C_{13}H_{27}$-COO-	Cr 90		I	[229]	
8	$C_{15}H_{31}$-COO-	Cr 93		I	[229]	
9	$C_{17}H_{35}$-COO-	Cr 96		I	[229]	
10	$C_{21}H_{43}$-COO-	Cr 103		I	[229]	

No.	Additional published Data
1	Cr 129 I[233]; Cr 142 I[234]; Cr 144 I[230]; Cr 133 I[232]
	Compounds **1 - 10** probably are monotropic.

TABLE 14. (24R)-Stigmast-5-enes (β-sitosterols)

Table 14: 3ß-substituted (24R)-stigmast-5-enes (ß-sitosterol)



(all temperatures in °C)

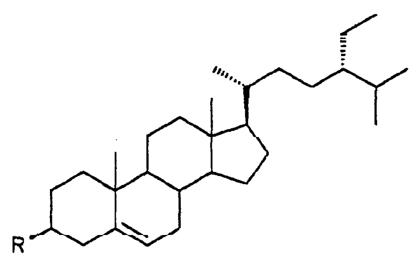
No	3ß-Substituent	Solid State	Mesophase	CP	Reference	Comments
1	CH_3-O-	Cr 107		I	[235]	
2	C_2H_5-O-	Cr 82.5	S 85	I	[235]	
3	C_3H_7-O-	Cr 113.5		I	[235]	
4	C_4H_9-O-	Cr 102	S 105	I	[235]	
5	C_6H_{13}-O-	Cr 104.5	S 108	I	[235]	
6	C_8H_{17}-O-	Cr 94	S 102	I	[235]	
7	H-COO-	Cr 94		I	[164]	
8	CH_3-COO-	Cr 128		I	[236,237]	*
9	C_3H_7-COO-	Cr 111		I	[229]	
10	C_5H_{11}-COO-	Cr 105.5		I	[229]	
11	C_7H_{15}-COO-	Cr 99		I	[229]	*
12	C_9H_{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_7H_{15}-OCOO-	Cr 68.5	S 28.7	I	[238]	
18	C_8H_{17}-OCOO-	Cr 69	S 33.1	I	[238]	
19	C_9H_{19}-OCOO-	Cr 71.1	S 37.7	I	[238]	

No.	Additional published Data
8	Cr 125 I^{229}; Cr 122.5 I^{238}
11	Cr 72.6 S 63.2 I^{238}
15	Cr 85.5 I^{229}; Cr 91-94 I^{164}

Compounds **8** - **17** probably are monotropic.

TABLE 15. (24S)-Stigmast-5-enes (γ-sitosterols)

Table 15: 3ß-substituted (24S)-stigmast-5-enes (γ-sitosterol)



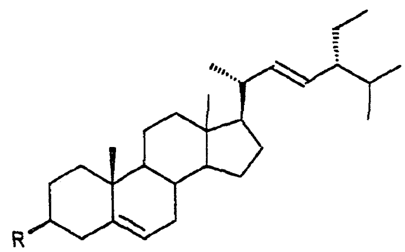
(all temperatures in °C)

No	3ß-Substituent	Solid State	Mesophase	CP	Reference	Comments
1	CH_3-COO-	Cr 140		I	[229]	
2	C_3H_7-COO-	Cr 121.5		I	[229]	
3	C_5H_{11}-COO-	Cr 114.5		I	[229]	
4	C_7H_{15}-COO-	Cr 108		I	[229]	
5	C_9H_{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 144[230]; Cr 141[239]

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

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



(all temperatures in °C)

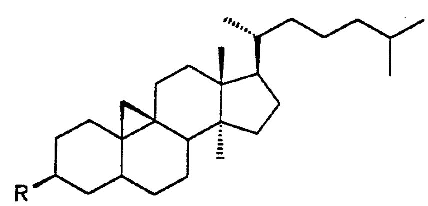
No	3ß-Substituent	Solid State	Mesophase	CP	Reference	Comments
1	CH_3-COO-	Cr 142		I	[229,240]	
2	C_2H_5-COO-	Cr 122		I	[241]	*
3	C_3H_7-COO-	Cr 115	S 76	I	[240]	*
4	C_4H_9-COO-	Cr 122	S 76	I	[240]	
5	C_5H_{11}-COO-	Cr 106.5	S 76	I	[240]	*
6	C_6H_{13}-COO-	Cr 75	S 72	I	[240]	
7	C_7H_{15}-COO-	Cr 91	S 74	I	[240]	*
8	C_8H_{17}-COO-	Cr 77	S 74	I	[240]	
9	C_9H_{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_2H_5-OCOO-	Cr 149.5		I	[244]	
17	C_3H_7-OCOO-	Cr 136.5		I	[244]	
18	C_4H_9-OCOO-	Cr 127		I	[244]	
19	C_5H_{11}-OCOO-	Cr 99		I	[244]	
20	C_6H_{13}-OCOO-	Cr 91	S 42	I	[244]	
21	C_7H_{15}-OCOO-	Cr 86.5	S 43	I	[244]	
22	C_8H_{17}-OCOO-	Cr 89.5	S 44	I	[244]	
23	C_9H_{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_4H_9-NHCOO-	Cr 141		O	[245]	
34	C_8H_{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: 3ß-substituted pollinastanes



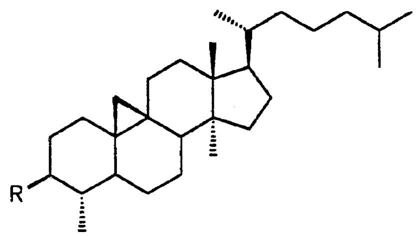
(all temperatures in °C)

No	3ß-Substituent	Solid State		Mesophase				CP	Reference	Comments
1	CH_3-COO-	Cr	85			Ch	48	I	[246]	
2	C_5H_{11}-COO-	Cr	77			Ch	58	I	[246]	
3	C_9H_{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 90[249]
6	Cr 58.7 S 44.4 Ch 50.3 I[250]; DSC[250]

TABLE 18. 31-Norcycloartanes

Table 18: 3ß-substituted 31-norcycloartanes



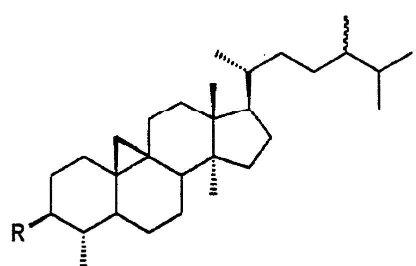
(all temperatures in °C)

No	3ß-Substituent	Solid State	Mesophase		CP	Reference	Comments
1	CH_3-COO-	Cr 99		Ch 98	I	[251]	
2	C_3H_7-COO-	Cr 82		Ch 103	I	[251]	
3	C_5H_{11}-COO-	Cr 69		Ch 98	I	[251]	
4	C_7H_{15}-COO-	Cr 74		Ch 88	I	[251]	
5	C_9H_{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 I[250]; mp_2 60.9[250]; DSC[250]

TABLE 19. 24-Dihydrocycloeucalenes

Table 19: 3ß-substituted 24-dihydrocycloeucalenes

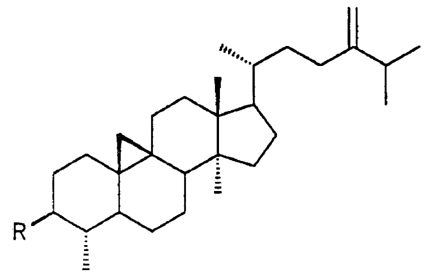


(all temperatures in °C)

No	3ß-Substituent	Solid State	Mesophase		CP	Reference
1	CH_3-COO-	Cr 110			I	[164]
2	C_5H_{11}-COO-	Cr 90		Ch 77	I	[164]
3	C_7H_{15}-COO-	Cr 63		Ch 77	I	[164]
4	C_9H_{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. Cycloeucalenes

Table 20: 3ß-substituted cycloeucalenes



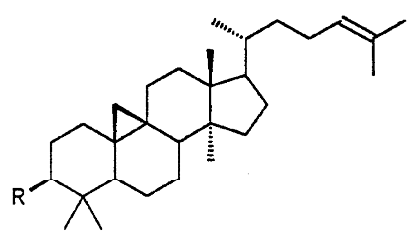
(all temperatures in °C)

No	3ß-Substituent	Solid State	Mesophase		CP	Reference	Comments
1	CH_3-COO-	Cr 107			I	[164]	*
2	C_5H_{11}-COO-	Cr 74		Ch 59	I	[164]	
3	C_7H_{15}-COO-	Cr 78		Ch 61	I	[164]	
4	C_9H_{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 - 109[239]

TABLE 21. 9β,19-Cyclolanost-24-enes

Table 21: 3ß-substituted 9ß,19-cyclolanost-24-enes



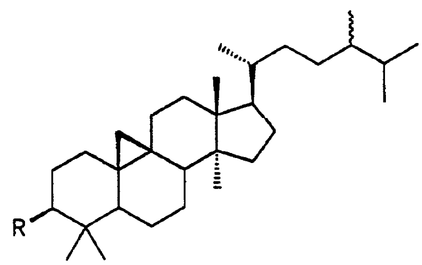
(all temperatures in °C)

No	3ß-Substituent	Solid State	Mesophase		CP	Reference	Comments
1	CH_3-COO-	Cr 123			I	[237]	*
2	C_3H_7-COO-	Cr 87			I	[164]	
3	C_7H_{15}-COO-	Cr 58		Ch 59	I	[164]	
4	C_9H_{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 I[164]
7	Cr 54.8 Ch 44.6 I[250]; mp_2 51.5[250]; mp_3 39[250]; Cr 62-64 Ch 51 I[164]; DSC[250]

TABLE 22. 24-Methylcyclolanostanes

Table 22: 3ß-substituted 24-methylcyclolanostanes



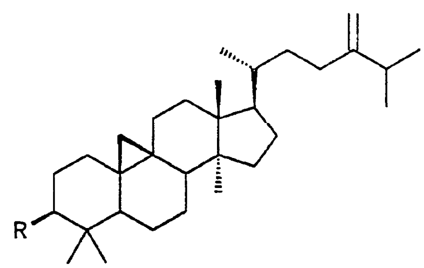
(all temperatures in °C)

No	3ß-Substituent	Solid State	Mesophase	CP	Reference
1	CH_3-COO-	Cr 111.5		I	[164,252]
2	C_3H_7-COO-	Cr 78	S 114.5	I	[164,252]
3	C_5H_{11}-COO-	Cr 108	S 122	I	[164,252]
4	C_7H_{15}-COO-	Cr 64	S 83.5	I	[164,252]
5	C_9H_{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-3ß-substituted 24-methylcyclolanostanes show a cholesteric phase. It is unusual that higher homologes show a cholesteric phase, when shorter-chained molecules show a smectic phase.

TABLE 23. (9β)-24-Methylene-9,19-cyclolanostanes

Table 23: 3ß-substituted (9ß)-24-methylene-9,19-cyclolanostanes



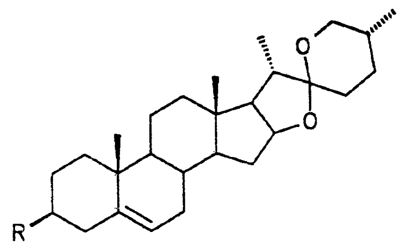
(all temperatures in °C)

No	3ß-Substituent	Solid State	Mesophase	CP	Reference	Comments
1	CH_3-COO-	Cr 112		I	[164,252]	
2	C_3H_7-COO-	Cr 73	S 110.5	I	[164,252]	
3	C_5H_{11}-COO-	Cr 107	S 112	I	[164,252]	
4	C_7H_{15}-COO-	Cr 75	S 101.5	I	[164,252]	
5	C_9H_{19}-COO-	Cr 67	S 55	I	[164,252]	
6	$C_{11}H_{23}$-COO-	Cr 57		I	[164]	*
7	$C_{13}H_{27}$-COO-	Cr 62		I	[164,252]	
8	$C_{15}H_{31}$-COO-	Cr 59		I	[164,252]	
9	$C_{17}H_{35}$-COO-	Cr 63		I	[164,252]	

No.	Additional published Data
6	Cr 72 I[252]

TABLE 24. Diosgenines

Table 24: 3ß-substituted diosgenines

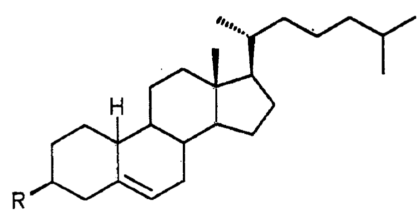


(all temperatures in °C)

No	3ß-Substituent	Solid State	Mesophase	CP	Reference	Comments
1	C_6H_{13}-COO-	Cr 121.3	Ch 128.9	I	[253]	
2	C_7H_{15}-COO-	Cr 114	Ch 124	I	[253]	
3	C_9H_{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: 3ß-substituted 19-norcholest-5-enes

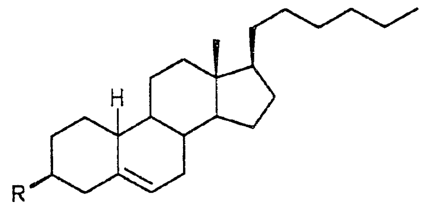


(all temperatures in °C)

No	3ß-Substituent	Solid State	Mesophase	CP	Reference
1	CH_3-COO-	Cr 86.5	Ch 91.0	I	[254]
2	C_2H_5-COO-	Cr 88.3	Ch 117.8	I	[254]
3	C_3H_7-COO-	Cr 75.0	Ch 109.0	I	[254]
4	C_4H_9-COO-	Cr 65.6	S 83.3 Ch 99.0	I	[254]
5	C_5H_{11}-COO-	Cr 71.1	Ch 109.1	I	[254]
6	C_6H_{13}-COO-	Cr 70.5	Ch 104.6	I	[254]
7	C_7H_{15}-COO-	Cr 71.1	Ch 106.3	I	[254]
8	C_8H_{17}-COO-	Cr 61.7	Ch 106.8	I	[254]
9	C_9H_{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: 3ß-substituted 19,21,27-trinorcholest-5-enes



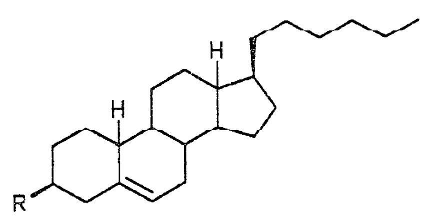
(all temperatures in °C)

No	3ß-Substituent	Solid State	Mesophase	CP	Reference
1	C_5H_{11}-COO-	Cr 62.0	Ch 72.3	I	[255]
2	C_6H_{13}-COO-	Cr 49.8	Ch 67.7	I	[255]
3	C_7H_{15}-COO-	Cr 38.5	S_A 59.2 Ch 71.8	I	[255]
4	C_8H_{17}-COO-	Cr ?	S_A 64.1 Ch 68.5	I	[255]
5	C_9H_{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: 3ß-substituted 18,19,21,27-tetranorcholest-5-enes

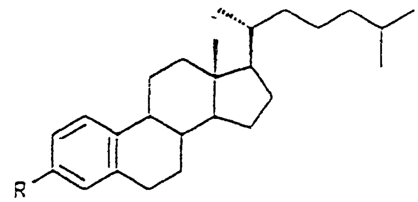


(all temperatures in °C)

No	3ß-Substituent	Solid State	Mesophase	CP	Reference
1	C_7H_{15}-COO-	Cr 116.5		I	[255]
2	C_8H_{17}-COO-	Cr 109.8		I	[255]
3	C_9H_{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

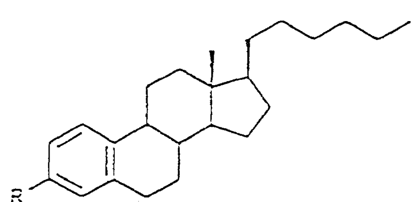


(all temperatures in °C)

No	3ß-Substituent	Solid State	Mesophase		CP	Reference
1	C_5H_{11}-COO-	Cr 59.0		Ch 62.9	I	[255]
2	C_6H_{13}-COO-	Cr 44.8		Ch 60.4	I	[255]
3	C_7H_{15}-COO-	Cr 49.8		Ch 62.4	I	[255]
4	C_8H_{17}-COO-	Cr 37.5	S_A 56.6	Ch 60.1	I	[255]
5	C_9H_{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

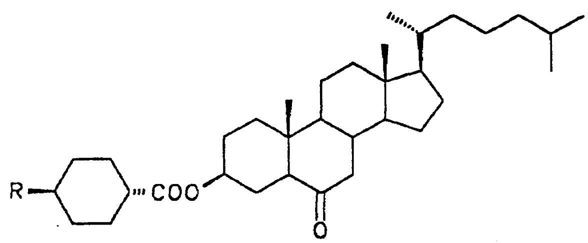


(all temperatures in °C)

No	3ß-Substituent	Solid State	Mesophase	CP	Reference
1	C_7H_{15}-COO-	Cr 54.0		I	[255]
2	C_8H_{17}-COO-	Cr 55.8		I	[255]
3	C_9H_{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 Ketocholestanes

Table 30: 3ß-(trans-4-alkyl-cyclohexylcarbonyloxy-) 6-ketocholestanes

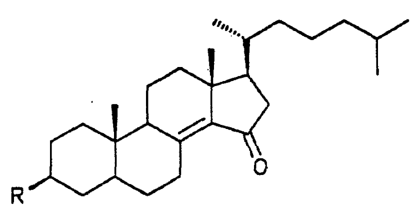


(all temperatures in °C)

No	3ß-Substituent	Solid State	Mesophase	CP	Reference
1	C_2H_5-	Cr 161	Ch 205	I	[256]
2	C_5H_{11}-	Cr 119	Ch 209	I	[256]
3	C_6H_{13}-	Cr 119	S_A 221	I	[256]

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

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

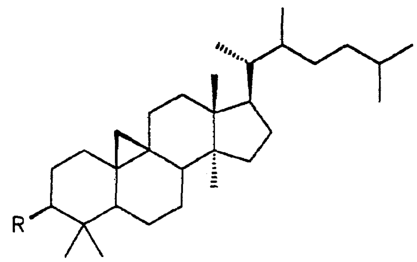


(all temperatures in °C)

No	3ß-Substituent	Solid State	Mesophase	CP	Reference
1	C_9H_{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-9β,19-cyclo-20ϵ-lanostanes (cycloswietanols)

Table 32: 3ß-substituted 22-methyl-9ß,19-cyclo-20ϵ-lanostanes (cycloswietanol)

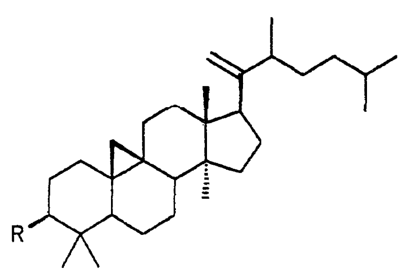


(all temperatures in °C)

No	3ß-Substituent	Solid State	Mesophase		CP	Reference
1	C_6H_{13}-COO-	Cr 72.5	S 88		I	[258]
2	C_7H_{15}-COO-	Cr 69.5		Ch 72	I	[258]
3	C_8H_{17}-COO-	Cr 64		Ch 68	I	[258]
4	C_9H_{19}-COO-	Cr 59.5		Ch 65	I	[258]

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

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

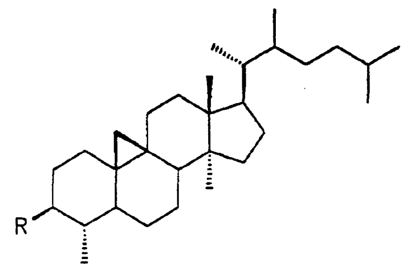


(all temperatures in °C)

No	3ß-Substituent	Solid State	Mesophase		CP	Reference
1	C_6H_{13}-COO-	Cr 71	S 85		I	[258]
2	C_7H_{15}-COO-	Cr 68.5		Ch 70.5	I	[258]
3	C_8H_{17}-COO-	Cr 62		Ch 65.5	I	[258]
4	C_9H_{19}-COO-	Cr 58		Ch 62.5	I	[258]

TABLE 34. 4α,14α,22-Trimethylcyclocholestanes (31-norcycloswietanols)

Table 34: 3ß-substituted 4α,14α,22-trimethylcyclocholestanes (31-norcycloswietanol)

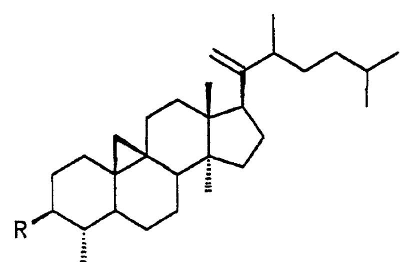


(all temperatures in °C)

No	3ß-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. 4α,14α,22-Trimethylcyclocholest-20-enes (31-norcyclo-swietenols)

Table 35: 3ß-substituted 4α,14α,22-trimethylcyclocholest-20-enes (31-norcycloswietenol)

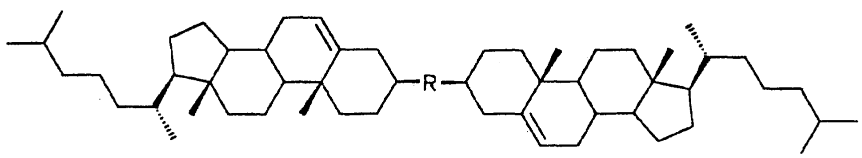


(all temperatures in °C)

No	3ß-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(3ß-substituted cholest-5-enes)



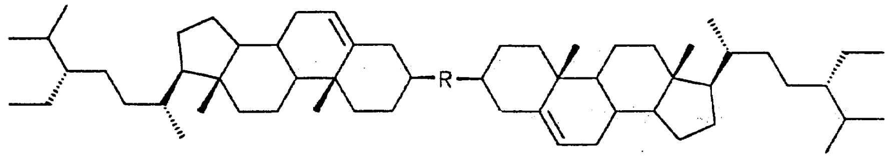
(all temperatures in °C)

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_2H_4-COO	Cr 220	Ch 235	I	[10]	*
4	OOC-C_3H_6-COO	Cr 195.5		I	[10]	*
5	OOC-C_4H_8-COO	Cr 193.8	Ch 225.5	I	[33]	*
6	OOC-C_5H_{10}-COO	Cr 160	Ch <?	I	[116]	
7	OOC-C_6H_{12}-COO	Cr 183	Ch 164	I	[259]	*
8	OOC-C_7H_{14}-COO	Cr 156	Ch 161	I	[116]	
9	OOC-C_8H_{16}-COO	Cr 180.4	Ch 175.8	I	[33]	*
10	OOC-C_2F_4-COO	Cr 211		I	[29]	
11	OOC-C_3F_6-COO	Cr 197		I	[29]	
12	OOC-C_4F_8-COO	Cr 163	X 110	I	[29]	
13	OOC-C_5F_{10}-COO	Cr 149	X 106	I	[29]	
14	OCOO-C_2H_4-OCOO	Cr_3 103.7 Cr_2 122.2 Cr 169.6	Ch 160.7	I	[261]	
15	OCOO-C_4H_8-OCOO	Cr 181.4	Ch 252.4	I	[261]	
16	OCO-NH-C_2H_4-NH-COO	Cr 233	S 215	I	[261,262]	
17	OCO-NH-C_3H_6-NH-COO	Cr 195	S 210	I	[261,262]	
18	OCO-NH-C_4H_8-NH-COO	Cr 161	S 209	I	[261,262]	
19	OCO-NH-C_5H_{10}-NH-COO	Cr 151	S 199	I	[261,262]	
20	OCO-NH-C_6H_{12}-NH-COO	Cr 169	S 198	I	[261,262]	
21	OCO-NH-C_8H_{16}-NH-COO	Cr 152	S 134 Ch 177	I	[261,262]	

No.	Additional published Data
1	Cr 222 O[260]; Cr 220 X ? Z[10]
3	Cr 217 Ch 208 I[259]; Cr 214 Ch 248 I[116]
4	Cr 190 I[116]
5	Cr 199 Ch 185 I[259]; Cr 180 Ch 188 I[116]; Cr 195 X 222 I[10]
7	Cr 192 S 195 Ch 224 Ch 227 I[116]; Cr 179.5 I[10]
9	Cr 176 Ch 151 I[259]; Cr 174 Ch 179 I[116]

TABLE 37. Bis(β-sitosterols)

Table 37: bis(3ß-substituted ß-sitosterol)

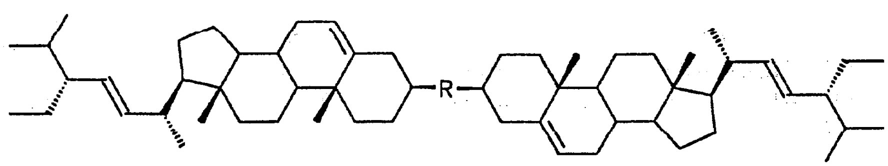


No	Spacer	Solid State	Mesophase	CP	Reference
125	OOC-COO	Cr 195	X 198	Z	[263]
127	OOC-CH_2-COO	Cr 170	X 172	I	[263]
129	OOC-C_2H_4-COO	Cr 198	X 201	I	[263]
131	OOC-C_3H_6-COO	Cr 168	X 171	I	[263]
133	OOC-C_4H_8-COO	Cr 189	X 195	I	[263]
136	OOC-C_6H_{12}-COO	Cr 143	X 146	I	[263]
138	OOC-C_7H_{14}-COO	Cr 145	X 148	I	[263]
140	OOC-C_8H_{16}-COO	Cr 127	X 137	I	[263]

No.	Additional published Data
125	Cr 196 O[260]

TABLE 38. Bis(β-stigmasterols)

Table 38: bis(3ß-substituted ß-stigmasterol)



(all temperatures in °C)

No	Spacer	Solid State	Mesophase	CP	Reference
147	OCOO-C_2H_4-OCOO	Cr 219		I	[244]
148	OCOO-C_3H_6-OCOO	Cr 212		I	[244]
150	OCOO-C_4H_8-OCOO	Cr 232		I	[244]
151	OCOO-C_5H_{10}-OCOO	Cr 175	S 109	I	[244]
152	OCOO-C_6H_{12}-OCOO	Cr 171	S 113	I	[244]
153	OCOO-C_7H_{14}-OCOO	Cr 161	S 107	I	[244]
154	OCOO-C_8H_{16}-OCOO	Cr 167.5	S 108	I	[244]
155	OCOO-C_9H_{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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