Biosynthetic Products for Cancer Chemotherapy

Volume 3

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Preface

Fortunately the scientific and medical literature related to cancer chemotherapy is now expanding rapidly. While this is most excellent for future cancer treatment prospects, it is becoming more difficult for all the researchers in chemotherapy—bio-organic chemists involved with the discovery of new anticancer drugs, biologists and pharmacologists developing these new drugs, and physicians doing the clinical research—to keep abreast of current achievements in these disciplines so vitally important to effective cancer treatment. The purpose of Volumes 1 and 2 of this work was to provide useful reviews of current progress in discovery and clinical application of new biosynthetic cancer chemotherapeutic drugs. Volume 1 gave a general view of the cancer problem and cancer treatment using biosynthetic products, based on literature available through December 1975. Volume 2 included mainly the first summary of plant and animal biosynthetic antineoplastic and/or cytotoxic constituents to April 1976.

The survey comprising this third volume has been divided into two sections. Section A provides an extension of the Volume 2 data on plant and animal antineoplastic and/or cytotoxic constituents to July 1977. The introduction to Section A brings the summary of such biosynthetic products to literature available November 1, 1977. Section B incorporates a summary of data of essentially all previously isolated and characterized marine animal constituents irrespective of biological activity. The rapidly increasing likelihood that clinically useful cancer chemotherapeutic drugs will be isolated from marine animals suggested that a relatively complete synopsis of marine animal biosynthetic products known through July 1977 would be especially timely and useful to a broad cross section of chemists and biologists. The outline of Section B was begun some seven years ago when our Cancer Research Institute programs began to routinely require such information. It is hoped that the result will now be helpful to all chemists and biologists concerned with marine animal chemistry. When the preparation of Section B was initiated, no such summary was available and this situation obtained until 1976 when the very useful but less detailed work of Baker and Murphy became available.[26] Their work covers marine animal and marine plant constituents through 1973.

In Section B our attempts at locating all pure and characterized marine animal components for the past approximately 100 years has probably not been perfect. Some compounds were no doubt missed and we extend our apologies to anyone affected by such oversights and other possible errors in this volume. We appreciate very much the assistance of Drs. T. R. Kasturi, P. R. Reucroft, and T. B. Harvey, III with some early literature studies needed for preparation of the marine animal data. Grateful appreciation is also extended to Mrs. Christine H. Duplissa for general and expert assistance with preparation of the data and to Mrs. Marie Baughman and Miss Melinda A. Duplissa for very helpful aid in final manuscript preparation.

George R. Pettit
Paradise Valley, Arizona
November, 1977

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Section A
New Biosynthetic Antineoplastic and/or Cytotoxic Agents: Tabular Survey

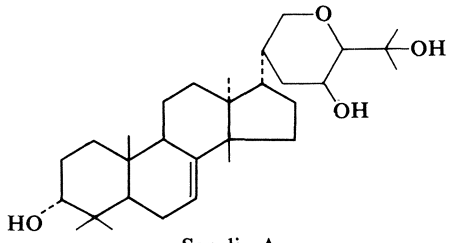
Introduction

The U.S. National Cancer Institute's program, begun in 1957, directed at isolation of naturally occurring antineoplastic agents, has amply demonstrated that certain plants and animals do indeed produce a great variety of anticancer agents. In recent years the dramatic discoveries arising from this program have stimulated a great deal of interest and initiation of analogous programs on a worldwide basis. This fortunate series of events is now allowing new antineoplastic and/or cytotoxic biosynthetic products to be discovered at an increasing rate. Very illustrative are the 487 antineoplastic and/or cytotoxic compounds described in Volume 2 of this series, which covers the literature to April 1976. In this section of the present volume are listed 99 compounds appearing in the literature from that date to July 1977. The following three-month period to November 1977 yielded more new results that will be briefly summarized here and eventually incorporated in a subsequent volume.

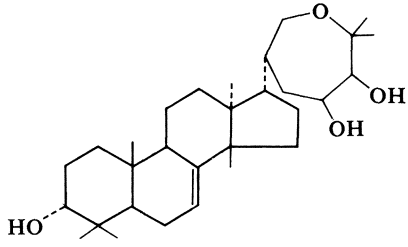
Before we begin a summary of the most recent advances, two important reviews of plant antineoplastic and cytotoxic constituents need to be cited. Cordell and Farnsworth[105] have summarized their recent studies concerning the isolation of plant anticancer agents and have prepared a broader review of plant anticancer agents appearing in the 1974–1976 period.[104] A specific treatment of structure/activity relationships in the colchicine area has been prepared by Kiselev.[233] Most importantly, a complete issue of the 1976 *Cancer Treatment Reports* was devoted to recent status of the National Cancer Institute's higher and lower plant programs. The summaries and conclusions of Hartwell (higher plant constituents),[175] Spjut and Perdue (primitive medical plant leads),[397] Douros (lower plant constituents),[113] Wall *et al.* (isolation techniques),[425] Smith *et al.* (homoharringtonine),[393] Kupchan (mechanisms of action),[255] and Carter and Livingston (clinical trials)[72] are particularly noteworthy.

The following outline of advances appearing in the literature over the three-month period August–November 1977 provides an illustration of current efforts to discover new higher and lower plant cancer chemotherapeutic drugs. In 1973, we reported the first pseudoguaianolide-type sesquiterpene to display *in vivo* antineoplastic activity.[328,330] At that time, we found the sesquiterpene lactone helenalin to be quite active against the

P388 lymphocytic leukemia (T/C 220 at 3 mg/kg) and the Walker 256 carcinoma (subcutaneous, 47 to 58% inhibition at 1.5 to 3 mg/kg). Subsequently helenalin was found to be the active antineoplastic constituent of several compositae, the most recent being *Anaphalis morrisonicola* Hay.[273] Helenalin has been shown to inhibit DNA synthesis and DNA polymerase enzyme action in Ehrlich ascites tumor cells.[272] Similarly, two other known active sesquiterpene lactones, costunolide and parthenolide, have been isolated from *Michelia champaca* and *Talauma ovata.*[182] The cytotoxic agents of *Bursera klugii* (Burseraceae) were found to be sapelin A and sapelin B.[209] The major cytotoxic and antineoplastic constituent of

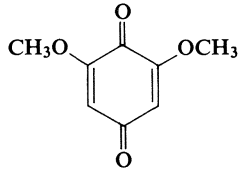


Sapelin A
PS: T/C 136 (5 mg/kg)
Reference 209



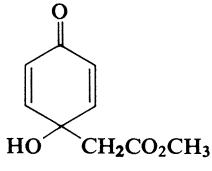
Sapelin B
PS: T/C 138 (1.25 mg/kg)
Reference 209

Simarouba versicolor (Simaroubaceae) was shown to be the known quassinoid-type terpene glaucarubinone.[159] A very simple cytotoxic constituent, namely 2,6-dimethoxybenzoquinone, was isolated from the pantropical *Xylosma velutina* (Flacourtiaceae).[103] The Farnsworth group has also



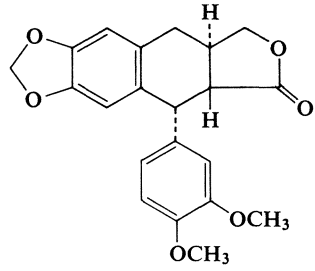
2,6-dimethoxybenzoquinone
KB: ED_{50}, 2.8 μg/ml
Reference 103

isolated the dieneone jacaranone from twig-leaf and stem bark from the Columbian plant *Jacaranda caucana* Pittier (Bignoniaceae).[316] Three new



Jacaranone
PS: T/C 165 (2 mg/kg)
PS: ED_{50}, 1.3 μg/ml
References 105, 316

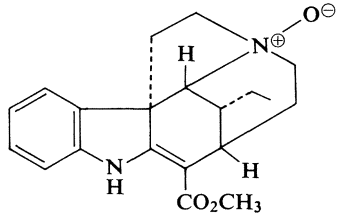
possibly cytotoxic diterpenoids bearing 2-pyrone ring systems have been isolated from *Podocarpus nagi*.[177] In the lignan area 5′-desmethoxydeoxypodophyllotoxin has been characterized as the active component of



5′-Desmethyldeoxypodophyllotoxin
PS: T/C 127 (50 mg/kg)
KB: ED_{50}, 4 × 10^{-4} μg/ml
Reference 208

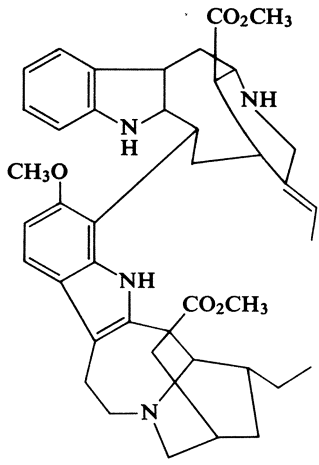
Bursera morelensis (Buseraceae).[208] In addition the known deoxypodophyllotoxin was isolated again from *Juniperus bermudiana* (Pinaceae).[406]

Among the nitrogen-containing plant biosynthetic products, the indole alkaloids continue to receive major emphasis. The previously known tubotaiwine *N*-oxide was found to be the cytotoxic component of *Tabernaemontana holstii* K. Schum. (Apocynaceae).[231] The same plant has been



Tubotaiwine *N*-Oxide
PS: ED_{50}, 1.8 μg/ml
KB: inactive
Reference 231

found to yield the bisindole alkaloid gabunine as a companion cytotoxic constituent.[232] Kutney and colleagues[264] have continued to develop excellent synthetic approaches to the clinically important bisindole alkaloids vincristine and vinblastine. For example, catharanthine *N*-oxide and vindoline have been condensed in the presence of trifluoroacetic anhydride at low temperatures to yield 3′,4′-dehydrovinblastine.[268] Kutney *et al.*[266,270] have devised a very useful synthesis of the antineoplastic bisindole alkaloid leurosine based on analogous Polonovoski-type coupling between 3β,4β-epoxy-3,4-dihydrocatharanthine N_b-oxide with vindoline. Synthesis of 3′-hydroxyvinblastine[266] has been completed and methods have also been devised recently for obtaining other modifications of the vinca alkaloids.[265,267,269] A review of the ergot-type indole alkaloids as possible prolactin and mammary cancer inhibitors has been prepared by Cassady

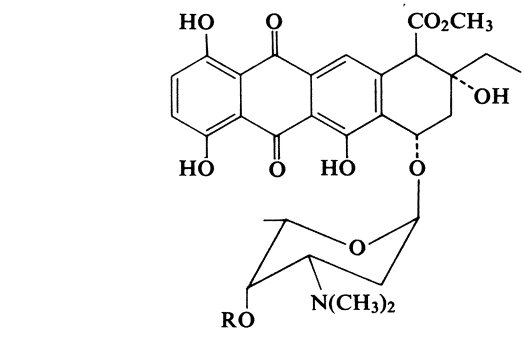


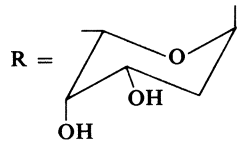
Gabunine
PS: ED_{50}, 3.2 μg/ml
Reference 232

and Floss.[73] The most significant recent advance involving the nitrogen-containing macromolecules has been purification of the glycoprotein cesalin from the seeds of *Caesalpinia gilliesii* Wall.[304]

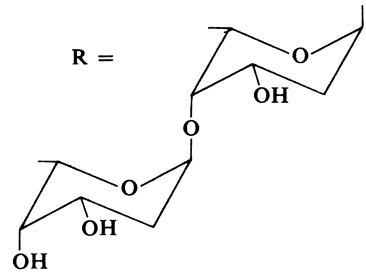
A potentially useful model for drug design based on structure/activity relationships among the higher plant antineoplastic agents has been summarized by Moore.[306] The concept of bioactivation as one mechanism for drug action was extended to the assumption that certain naturally occurring antineoplastic drugs may undergo reduction *in vivo* to yield a potent alkylating unit. Such bioreductive alkylating agents would contain olefin systems capable of undergoing Michael-type addition reactions by nucleophiles.

The lower plants have continued to be a fruitful source of antineoplastic biosynthetic products. From the anthracycline mixture produced by an *Actinosporangium* sp. Nettleton *et al.* have isolated and characterized two new antitumor antibiotics, namely, musettamycin and marcellomycin.[313] Attempts have also been made to carry out microbiological transformations of daunomycinone[213] and Arcamone[23] has synthesized an interesting variety of daunomycin and adriamycin derivatives and related anthracyclines. The previously known antibiotic vermiculine from *Pencillium vermiculatum* Dangeard[186] has been shown to be cytotoxic to HeLa and L5178Y cells. A related study of some well-known commercial antibiotics using murine L1210 cells showed tetracycline to be the most cytotoxic followed by erythromycin, clindamycin, chloramphenicol, and cephaloglycin.[279] The new anticancer antibiotics of unknown structure include PSX-L (very active against L1210 murine lymphocytic leukemia).[154] PO-357 from a *Streptosporangium* sp. (a basic polypeptide of molecular weight 8500–9000)[419] and SS-228 Y from an Actinomycetales of marine origin.[239,320] Doubtlessly, the marine muds will prove to be an excellent





Musettamycin



Marcellomycin

Antineoplastic activity
Reference 313

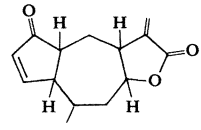
source of potentially useful antineoplastic agents.[320,324] A very helpful review concerned with the production and structural elucidation of the bleomycins and phleomycins has been prepared by Umezawa.[418]

The new antineoplastic and/or cytotoxic agents appearing in the literature over the period April 1976 through July 1977 have been collected in Chapters 1–8. The data have been arranged as in Volume 2 of this series.[329] The plant and animal antineoplastic and/or cytotoxic agents have been grouped according to natural products chemistry classification and biosynthetic origin and arranged in order of increasing carbon atom content within each group. The data include, where known, a structure, a common name, the system and results of antineoplastic screening and/or cytotoxicity evaluations, a melting point and optical rotation value, whether certain spectral data have been reported, and finally the organism of origin and reference. A compilation of the better known *in vitro* and *in vivo* anticancer screening systems and criteria for significant activity (for the most commonly employed) used by the National Cancer Institute have been entered in the appendix of Volume 2.[329]

Chapter 1

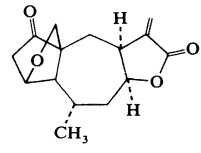
Higher Plant Terpenoids

$C_{14}H_{16}O_3$ Mexicanin-E



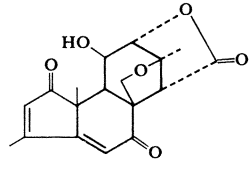
MOL. WT.: 232
MELTING POINT: 95–100°C
$[\alpha]_D$: −55 SOLVENT: Chf
SPECTRAL DATA: IR, PMR
ORGANISM: *Helenium microcephalum* (Compositae)
LOCATION: Texas
REFERENCE: 275

$C_{15}H_{18}O_4$ Microhelenin-A



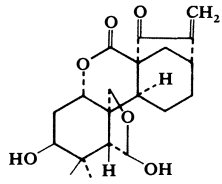
MOL. WT.: 262
BIOACTIVITY: Walker 256
T/C, 148 (2.5 mg/kg)
MELTING POINT: 140–141°C
$[\alpha]_D$: +89 SOLVENT: Me
SPECTRAL DATA: PMR, Mass Spec
ORGANISM: *Helenium microcephalum* (Compositae)
REFERENCE: 274

$C_{18}H_{18}O_6$ Samaderin A



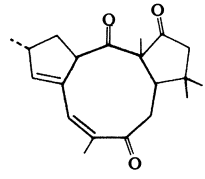
MOL. WT.: 330
BIOACTIVITY: KB and PS: Inactive
MELTING POINT: 253–255°C
$[\alpha]_D$: −31.3 SOLVENT: Py
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Samadera indica* (Simaroubaceae)
REFERENCE: 426

$C_{20}H_{24}O_6$ Enmein



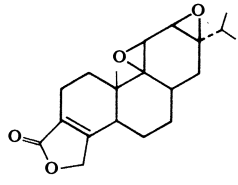
MOL. WT.: 360
BIOACTIVITY: Ehrlich ascites
Increase in life span, 66%
ORGANISM: *Isodon japonicus* and *Isodon trichocarpus* (Labiatae)
REFERENCE: 151

$C_{20}H_{26}O_3$ Jatrophatrione



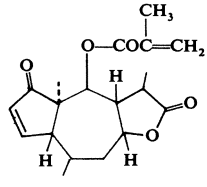
MOL. WT.: 314
MELTING POINT: 148–150°C
$[\alpha]_D$: −187 SOLVENT: Chf
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Jatropha macrorhiza* Benth. (Euphorbiaceae)
REFERENCE: 409

$C_{20}H_{26}O_4$ Stemolide



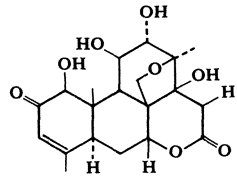
MOL. WT.: 330
MELTING POINT: 235–237°C
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Stemodia maritima* (Scrophulariaceae)
REFERENCE: 285

$C_{20}H_{26}O_5$ Microhelenin-C



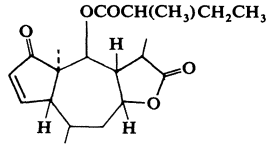
MOL. WT.: 346
MELTING POINT: Gum
$[\alpha]_D$: −85.0 SOLVENT: Me
SPECTRAL DATA: IR, PMR, Mass Spec
ORGANISM: *Helenium microcephalum* (Compositae)
LOCATION: Texas
REFERENCE: 275

$C_{20}H_{26}O_8$ Samaderin E



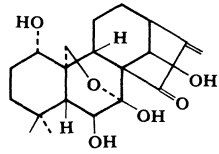
MOL. WT.: 394
BIOACTIVITY: KB and P388: Moderate activity
MELTING POINT: 202–207°C; Diacetate, 267–270°C
$[\alpha]_D$: −11.7 SOLVENT: Py
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Samadera indica* (Simaroubaceae)
REFERENCE: 426

$C_{20}H_{28}O_5$ Microhelenin-B



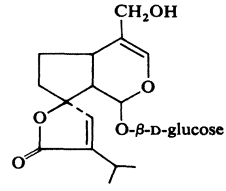
MOL. WT.: 348
MELTING POINT: 111–113°C
$[\alpha]_D$: −84.9 SOLVENT: Me
SPECTRAL DATA: IR, PMR, Mass Spec
ORGANISM: *Helenium microcephalum* (Compositae)
LOCATION: Texas
REFERENCE: 275

$C_{20}H_{28}O_6$ Oridonin



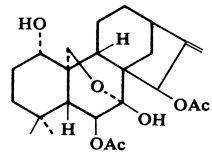
MOL. WT.: 364
BIOACTIVITY: Ehrlich ascites
Increase in life span, 115%
ORGANISM: *Isodon japonicus* and *Isodon trichocarpus* (Labiatae)
REFERENCE: 151

$C_{21}H_{30}O_{10}$ Penstemide



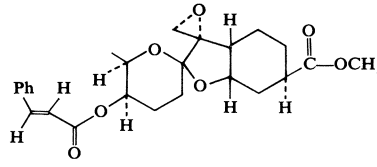
MOL. WT.: 442
BIOACTIVITY: PS: T/C, 184 (50 mg/kg)
SPECTRAL DATA: UV, IR, PMR
ORGANISM: *Penstemon deutus* Dougl. ex Lindl. (Scrophulariaceae)
REFERENCE: 207

$C_{24}H_{34}O_7$ Trichokaurin



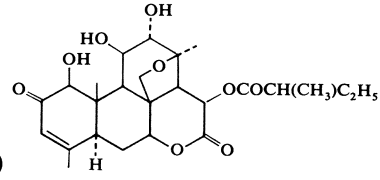
MOL. WT.: 436
BIOACTIVITY: Ehrlich ascites
Increase in life span, 17%
ORGANISM: *Isodon japonicus* and *Isodon trichocarpus* (Labiatae)
REFERENCE: 151

$C_{25}H_{30}O_7$ Phyllanthocin



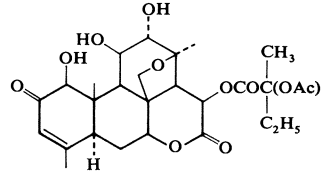
MOL. WT.: 442
BIOACTIVITY: KB: ED_{50}, 10^{-2} μg/ml
MELTING POINT: 126–127°C
$[\alpha]_D$: +25.2 SOLVENT: Chf
SPECTRAL DATA: UV, PMR, Mass Spec
ORGANISM: *Phyllanthus brasiliensis* (Muell.) (Euphorbiaceae)
LOCATION: Costa Rica
REFERENCE: 259

$C_{25}H_{34}O_9$ Simalikalactone D



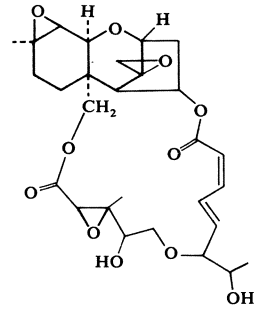
MOL. WT.: 478
BIOACTIVITY: PS: T/C, 165–175 (4–1 mg/kg)
KB: ED_{50}, 10^{-2}–10^{-3} μg/ml
ORGANISM: *Quassia amara* L. (Simaroubaceae)
REFERENCE: 262

$C_{27}H_{36}O_{11}$ Quassimarin



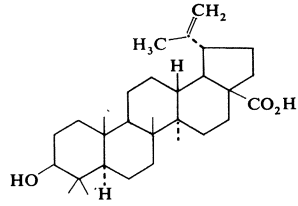
MOL. WT.: 536
BIOACTIVITY: PS: T/C, 165–175 (4–1 mg/kg)
KB: ED_{50}, 10^{-2}–10^{-3} μg/ml
MELTING POINT: 237.5–238.5°C
$[\alpha]_D$: +22.4 SOLVENT: Chf
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Quassia amara* L. (Simaroubaceae)
REFERENCE: 262

$C_{28}H_{50}O_{11}$ Baccharin



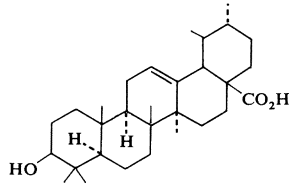
MOL. WT.: 562
BIOACTIVITY: PS: T/C, 200 (1.25–5.0 mg/kg)
KB: ED_{50}, 10^{-3}–10^{-4} μg/ml
MELTING POINT: 200–230°C
$[\alpha]_D$: +41.5 SOLVENT: Chf
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Baccharis megapotamica* Spreng (Asteraceae)
REFERENCE: 256

$C_{30}H_{48}O_3$ Betulinic Acid



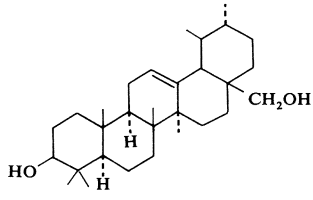
MOL. WT.: 456
BIOACTIVITY: PS: T/C, 135 (100 mg/kg)
T/C, 140 (50 mg/kg)
MELTING POINT: 284–286°C
SPECTRAL DATA: IR, PMR, Mass Spec
ORGANISM: *Vauquelinia corymbosa* Correa (Rosaceae)
REFERENCE: 410

$C_{30}H_{48}O_3$ Ursolic Acid



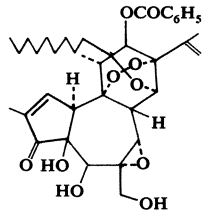
MOL. WT.: 456
BIOACTIVITY: PS: T/C 125 (50 mg/kg)
MELTING POINT: 288–291°C
$[\alpha]_D$: +60
SPECTRAL DATA: IR, PMR, Mass Spec
ORGANISM: *Vauquelinia corymbosa* Correa (Rosaceae)
REFERENCE: 410

$C_{30}H_{50}O_2$ Uvaol



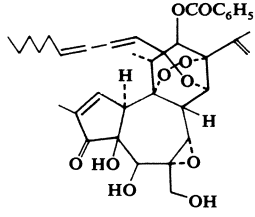
MOL. WT.: 442
BIOACTIVITY: PS: T/C, 125 (100 and 200 mg/kg)
MELTING POINT: 224–225°C
SPECTRAL DATA: IR, PMR, Mass Spec
ORGANISM: *Vauquelinia corymbosa* Correa (Rosaceae)
REFERENCE: 410

$C_{32}H_{46}O_{10}$ Gnidiglaucin



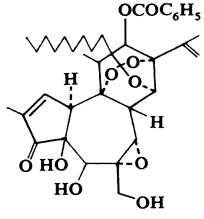
MOL. WT.: 590
$[\alpha]_D$: +36 SOLVENT: Chf
SPECTRAL DATA: UV, IR, Mass Spec
ORGANISM: *Gnidia glaucus* Fres. (Thymelaeaceae)
REFERENCE: 261

$C_{37}H_{44}O_{10}$ Gnidilatidin



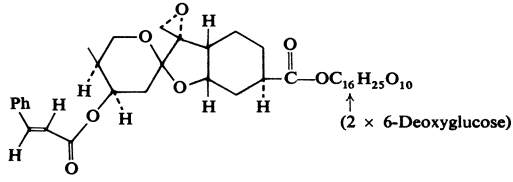
MOL. WT.: 648
$[\alpha]_D$: +28 SOLVENT: Chf
SPECTRAL DATA: UV, IR, Mass Spec
ORGANISM: *Gnidia latifolia* Gilg. (Thymelaeaceae)
REFERENCE: 261

$C_{37}H_{48}O_{10}$ Gnidilatin



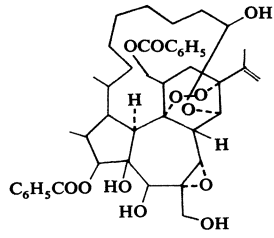
MOL. WT.: 652
BIOACTIVITY: PS: T/C, 130–140
P388: ED_{50}, 20–80 μg/kg
$[\alpha]_D$: +52 SOLVENT: Chf
SPECTRAL DATA: UV, IR, Mass Spec
ORGANISM: *Gnidia latifolia* Gilg. (Thymelaeaceae)
REFERENCE: 261

$C_{40}H_{52}O_{17}$ Phyllanthoside



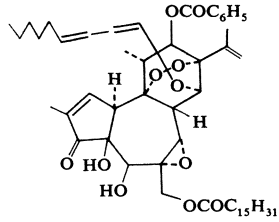
MOL. WT.: 804
BIOACTIVITY: PS: T/C, 137–153 (6–24 mg/kg)
KB: Inactive
MELTING POINT: 125–126°C; Pentaacetate, 114–117°C
$[\alpha]_D$: +19.2 SOLVENT: Chf
SPECTRAL DATA: UV, IR, PMR
ORGANISM: *Phyllanthus brasiliensis* (Muell.) (Euphorbiaceae)
LOCATION: Costa Rica
REFERENCE: 259

$C_{44}H_{54}O_{12}$ Gnidimacrin



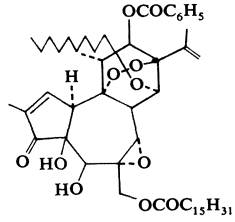
MOL. WT.: 774
BIOACTIVITY: PS: T/C, 180
P388: ED_{50}, 12–16 μg/kg
MELTING POINT: 172–174°C
$[\alpha]_D$: −3.9 SOLVENT: Chf
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Gnidia subcordata* Meissn. Engl. (Thymelaeaceae)
REFERENCE: 260

$C_{53}H_{74}O_{11}$ Gnidilatidin 20-palmitate



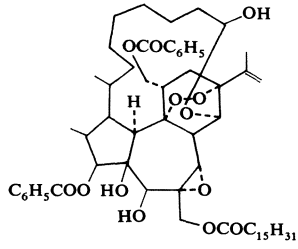
MOL. WT.: 886
BIOACTIVITY: PS: T/C, 170
P388: ED_{50}, 2–0.5 μg/kg
$[\alpha]_D$: +27 SOLVENT: Chf
SPECTRAL DATA: UV, IR, Mass Spec
ORGANISM: *Gnidia latifolia* Gilg. (Thymelaeaceae)
REFERENCE: 261

$C_{53}H_{78}O_{11}$ Gnidilatin 20-palmitate



MOL. WT.: 890
BIOACTIVITY: PS: T/C, 170
P388: ED_{50}, 2–0.5 μg/kg
$[\alpha]_D$: +45 SOLVENT: Chf
SPECTRAL DATA: UV, IR, Mass Spec
ORGANISM: *Gnidia latifolia* Gilg. (Thymelaeaceae)
REFERENCE: 261

$C_{60}H_{84}O_{13}$ Gnidimacrin 20-palmitate

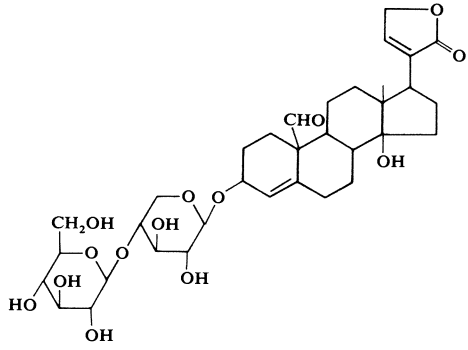


MOL. WT.: 1012
BIOACTIVITY: PS:T/C, 190
P388: ED_{50}, 30–50 μg/kg
$[\alpha]_D$: −1.5 SOLVENT: Chf
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Gnidia subcordata* Meissn. Engl. (Thymelaeaceae)
REFERENCE: 260

Chapter 2

Higher Plant Steroids

$C_{34}H_{48}O_{14}$ **Hyrcanoside**

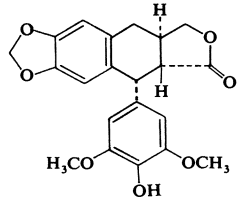


MOL. WT.: 680
BIOACTIVITY: PS: T/C, 133 (1.25 mg/kg)
KB: ED_{50}, 0.1, 0.7 μg/ml
MELTING POINT: 205–208°C
SPECTRAL DATA: UV, IR, PMR
ORGANISM: *Coronilla varia* L. (var. penngift) (Leguminosae)
REFERENCE: 442

Chapter 3

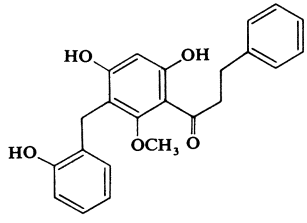
Higher Plant Lignans

$C_{21}H_{20}O_7$ 4′-Demethyldeoxypodophyllotoxin



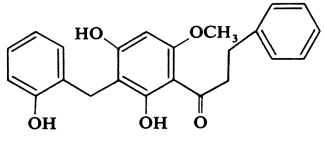
MOL. WT.: 384
BIOACTIVITY: PS: T/C, 132 (2.1 mg/kg)
KB: ED_{50}, 1.2×10^{-3} μg/ml
MELTING POINT: 246–248°C
SPECTRAL DATA: IR, PMR, Mass Spec
ORGANISM: *Polygala macradenia* Gray (Polygalaceae)
LOCATION: Texas
REFERENCE: 183

$C_{23}H_{22}O_5$ Isouvaretin



MOL. WT.: 378
BIOACTIVITY: KB: ED_{50}, 1.9 μg/ml
P388, ED_{50}, 1.9 μg/kg
MELTING POINT: Gum
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Uvaria chamae* (Annonaceae)
LOCATION: Ghana
REFERENCE: 271

$C_{23}H_{22}O_5$ Uvaretin

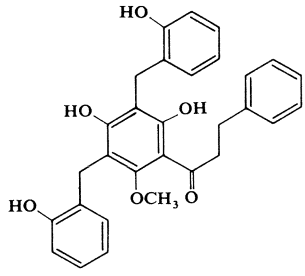


MOL. WT.: 378
BIOACTIVITY: PS: T/C, 133 (10 mg/kg)
MELTING POINT: 162–163°C
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Uvaria cucuminata* Oliv. (Annonaceae)
REFERENCE: 100

$C_{23}H_{22}O_5$ Uvaretin

BIOACTIVITY: mono-Me: T/C, 132 (1 mg/kg)
di-Me: T/C, 144 (4 mg/kg)
T/C, 141 (2 mg/kg)
MELTING POINT: 138–139°C; 122–123°C
ORGANISM: *Uvaria cucuminata* oliv. (Annonaceae)
REFERENCE: 100
BIOACTIVITY: KB: ED_{50}, 1.0 μg/ml
P388: ED_{50}, 1.0 μg/kg
MELTING POINT: 164–165°C
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Uvaria chamae* (Annonaceae)
LOCATION: Ghana
REFERENCE: 271

$C_{30}H_{28}O_6$ Diuvaretin

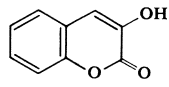


MOL. WT.: 484
BIOACTIVITY: KB: ED_{50}, 2.0 μg/ml
P388: ED_{50}, 0.84 μg/kg
MELTING POINT: Gum
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Uvaria chamae* (Annonaceae)
LOCATION: Ghana
REFERENCE: 271

Chapter 4

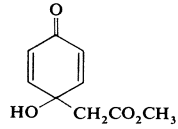
Quinones, Flavans, and Other Nonnitrogenous Higher Plant Products

$C_9H_6O_3$ Umbelliferone



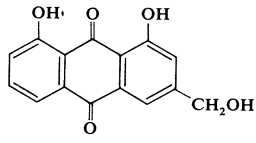
MOL. WT.: 162
BIOACTIVITY: KB: ED_{50}, 33 μg/ml
MELTING POINT: 223–224°C
SPECTRAL DATA: UV, IR PMR, Mass Spec
ORGANISM: *Coronilla varia* L. (var. penngift) (Leguminosae)
REFERENCE: 442

$C_9H_{10}O_4$ Jacaranone



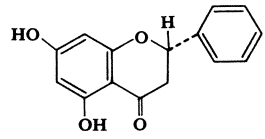
MOL. WT.: 182
BIOACTIVITY: PS: T/C, 165 (2 mg/kg)
KB: ED_{50}, 2.1 μg/ml
MELTING POINT: 53–54°C
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Jacaranda caucana* Pittier (Bignoniaceae)
LOCATION: Colombia
REFERENCE: 317

$C_{15}H_{10}O_5$ Aloe emodin



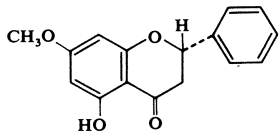
MOL. WT.: 270
BIOACTIVITY: PS: T/C, 133–154 (20 mg/kg)
MELTING POINT: 223–224°C
ORGANISM: *Rhamnus frangula* L. (Rhamnaceae)
REFERENCE: 257

$C_{15}H_{12}O_4$ Pinocembrin



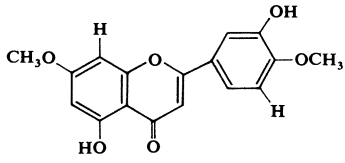
MOL. WT.: 256
BIOACTIVITY: KB: ED_{50}, 21 μg/ml
P388: ED_{50}, 10.5 μg/kg
MELTING POINT: 194–195°C
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Uvaria chamae* (Annonaceae)
LOCATION: Ghana
REFERENCE: 271

$C_{16}H_{14}O_4$ Pinostrobin



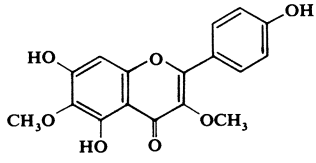
MOL. WT.: 270
MELTING POINT: 109–110°C
SPECTRAL DATA: UV, IR, PMR
ORGANISM: *Uvaria chamae* (Annonaceae)
LOCATION: Ghana
REFERENCE: 271

$C_{17}H_{14}O_6$ 3,5-Dihydroxy-4′,7-dimethoxyflavone



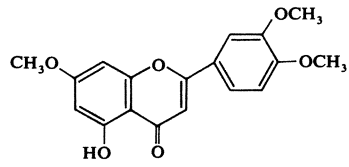
MOL. WT.: 314
BIOACTIVITY: KB: ED_{50}, 3.0 μg/ml
MELTING POINT: 229–231°C
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Lychnophora affinis* Gardn. (Compositae)
LOCATION: Brazil
REFERENCE: 278

$C_{17}H_{14}O_7$ 3,6-Dimethoxy-4′,5,7-trihydroxyflavone



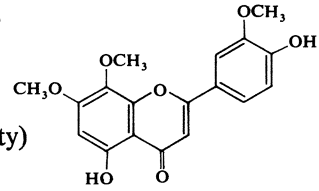
MOL. WT.: 330
BIOACTIVITY: PS: Inactive
KB: Inactive
P388: ED_{50}, 3.4 μg/kg
MELTING POINT: 198–200°C
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Acanthospermum glabratum* (D.C) Wild (Compositae)
LOCATION: Tanzania
REFERENCE: 353

$C_{18}H_{16}O_6$ 5-Hydroxy-3′,4′,7-trimethoxyflavone



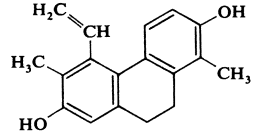
MOL. WT.: 328
BIOACTIVITY: KB: ED_{50}, >1.00 μg/ml
MELTING POINT: 166–168°C
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Lychnophora affinis* Gardn. (Compositae)
LOCATION: Brazil
REFERENCE: 278

$C_{18}H_{16}O_7$ 4′,5-Dihydroxy-3′,7,8-trimethoxyflavone



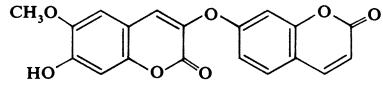
MOL. WT.: 344
BIOACTIVITY: KB: ED_{50}, >10 μg/ml (low solubility)
MELTING POINT: 163–166°C
SPECTRAL DATA: UR, IR, PMR, Mass Spec
ORGANISM: *Lychnophora affinis* Gardn. (Compositae)
LOCATION: Brazil
REFERENCE: 278

$C_{18}H_{18}O_2$ Juncusol



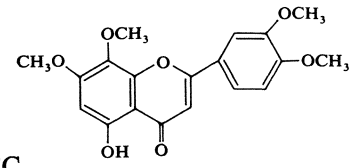
MOL. WT.: 266
BIOACTIVITY: KB: ED_{50}, 0.3 μg/ml
MELTING POINT: 176°C; Diacetate, 110°C
SPECTRAL DATA: IR, PMR, Mass Spec
ORGANISM: *Juncus roemerianus* (Juncaceae)
LOCATION: Mississippi
REFERENCE: 292

$C_{19}H_{12}O_7$ Daphnoretin



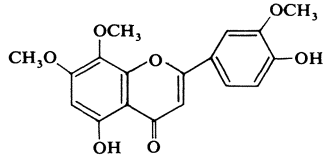
MOL. WT.: 352
BIOACTIVITY: KB: ED_{50}, 43 μg/ml
MELTING POINT: 246–247°C
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Coronilla varia* L. (var. penngift) (Leguminosae)
REFERENCE: 442

$C_{19}H_{18}O_7$ 5-Hydroxy-3′,4′,7,8-tetramethoxyflavone



MOL. WT.: 358
BIOACTIVITY: KB: ED_{50}, >100 μg/ml
MELTING POINT: 155–158°C; Acetate, 176–180°C
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Lychnophora affinis* Gardn. (Compositae)
LOCATION: Brazil
REFERENCE: 278

$C_{19}H_{18}O_8$ 3′,5-Dihydroxy-4′,5′,7,8-tetramethoxyflavone

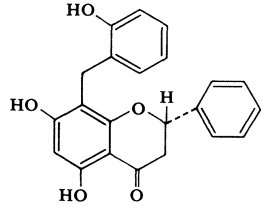


MOL. WT.: 374
BIOACTIVITY: KB: ED_{50}, >10 μg/ml
MELTING POINT: 141–146°C
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Lychnophora affinis* Gardn. (Compositae)
LOCATION: Brazil
REFERENCE: 278

$C_{19}H_{24}O_6$ Tagitinin F

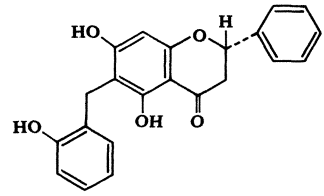
MOL. WT.: 348
BIOACTIVITY: PS: T/C, 161–155 (50–12.5 mg/kg)
MELTING POINT: 128–130°C
$[\alpha]_D$: −144
SPECTRAL DATA: UV, IR, Mass Spec
ORGANISM: *Tithonia tagitiflora* Desf. (Compositae)
REFERENCE: 321

$C_{22}H_{18}O_5$ Chamanetin



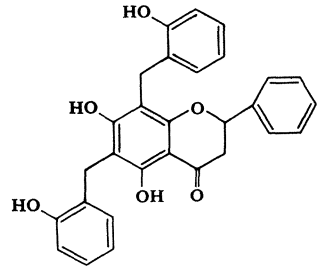
MOL. WT.: 362
BIOACTIVITY: KB: ED_{50}, 5.2 μg/ml
P388: ED_{50}, 2.4 μg/kg
MELTING POINT: 210–211°C
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Uvaria chamae* (Annonaceae)
LOCATION: Ghana
REFERENCE: 271

$C_{22}H_{18}O_5$ Isochamanetin



MOL. WT.: 362
BIOACTIVITY: KB: ED_{50}, 2.4 μg/ml
P388: ED_{50}, 2.2 μg/kg
MELTING POINT: 215–217°C
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Uvaria chamae* (Annonaceae)
LOCATION: Ghana
REFERENCE: 271

$C_{29}H_{24}O_6$ Dichamanetin



MOL. WT.: 468
BIOACTIVITY: KB: ED_{50}, 1.2 μg/ml
P388: ED_{50}, 1.4 μg/kg
MELTING POINT: 118–120°C
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Uvaria chamae* (Annonaceae)
LOCATION: Ghana
REFERENCE: 271

Polysaccharide F-1

BIOACTIVITY: Ehrlich ascites carcinoma
20 mg/kg
10 of 10 survived 60 days
ORGANISM: *Sargassum thunbergii* (Phaeophyta)
(Fucales Order)
REFERENCE: 202

Polysaccharide F-2

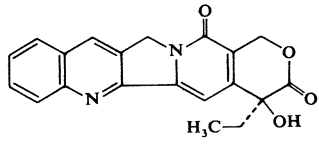
Polysaccharide

BIOACTIVITY: Active against Sarcoma 180
ORGANISM: *Coriolus versicolor* (Basidiomycetes—Class)
REFERENCE: 181

Chapter 5

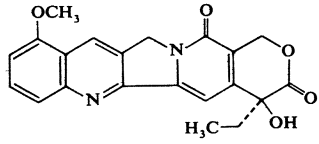
Higher Plant Alkaloids, Amides, and Ansa Macrolides

$C_{20}H_{16}N_2O_4$ Camptothecin



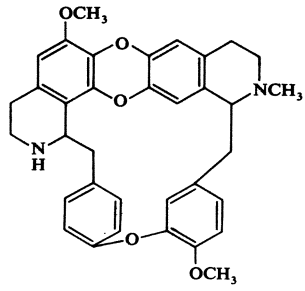
MOL. WT.: 348
ORGANISM: *Ophiorrhiza mungos* Linn. (Rubiaceae)
LOCATION: S.E. Asia
REFERENCE: 405

$C_{21}H_{18}N_2O_5$ 10-Methoxycamptothecin



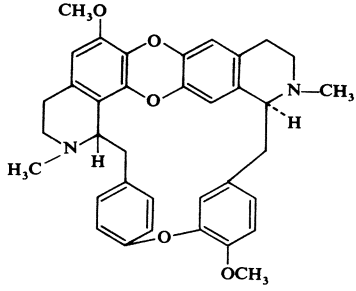
MOL. WT.: 378
BIOACTIVITY: 10 times better against herpes virus than camptothecin
Antiviral
Herpes virus
100% and 89% inhibition of plaques
20 and 10 ng/ml
ORGANISM: *Ophiorrhiza mungos* Linn. (Rubiaceae)
LOCATION: S.E. Asia
REFERENCE: 405

$C_{35}H_{34}N_2O_5$ Trilobine



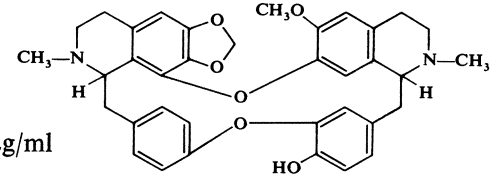
MOL. WT.: 562
BIOACTIVITY: HeLa-S_3: ED_{50}, 1.1 μg/ml
REFERENCE: 263

$C_{36}H_{36}N_2O_5$



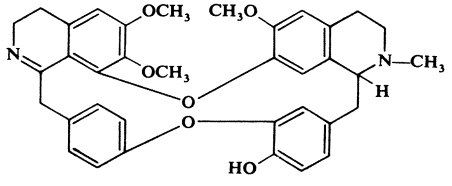
MOL. WT.: 576
BIOACTIVITY: HeLa-S_3: ED_{50}, 2 μg/ml
EAC: 30
S-180: 25
LD_{50}, 115
REFERENCE: 263

$C_{36}H_{36}N_2O_6$ Cepharanoline



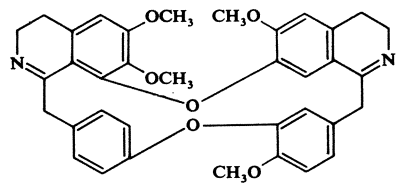
MOL. WT.: 592
BIOACTIVITY: HeLa: ED_{50}, >30 μg/ml
REFERENCE: 263

$C_{36}H_{38}N_2O_6$ Hypoepistephanine



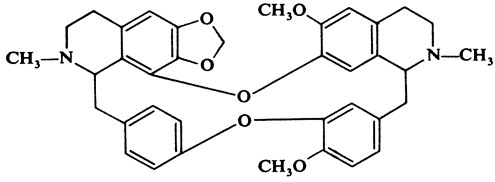
MOL. WT.: 594
BIOACTIVITY: EAC: Inactive
HeLa: ED_{50}, 12 μg/ml
REFERENCE: 263

$C_{36}H_{38}N_2O_6$ Stebisimine



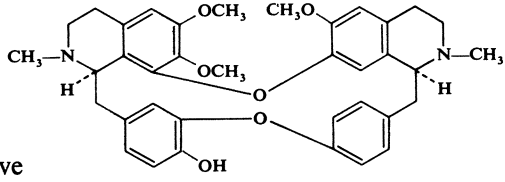
MOL. WT.: 594
BIOACTIVITY: HeLa: ED_{50}, 16 μg/ml
REFERENCE: 263

$C_{37}H_{38}N_2O_6$ Cepharanthine



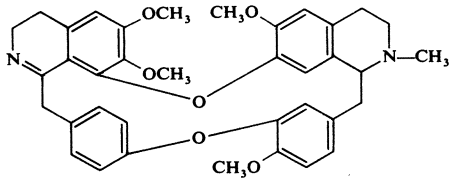
MOL. WT.: 606
BIOACTIVITY: EAC: 30
S-180: 100
LD_{50}: 125
HeLa: ED_{50}, 5.5 μg/ml
REFERENCE: 263

$C_{37}H_{40}N_2O_6$ Berbamine



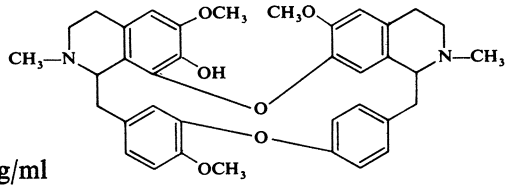
MOL. WT.: 608
BIOACTIVITY: EAC, S-180: Inactive
HeLa-S_3: ED_{50} >10 μg/ml
LD_{50}: 75
REFERENCE: 263

$C_{37}H_{40}N_2O_6$ Epistephanine



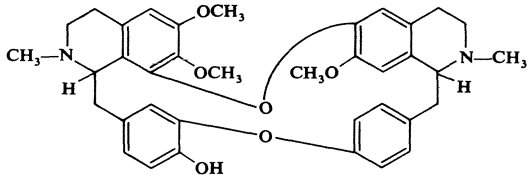
MOL. WT.: 608
BIOACTIVITY: EAC: Inactive
HeLa: ED_{50}, 14 μg/ml
REFERENCE: 263

$C_{37}H_{40}N_2O_6$ Fangchinoline



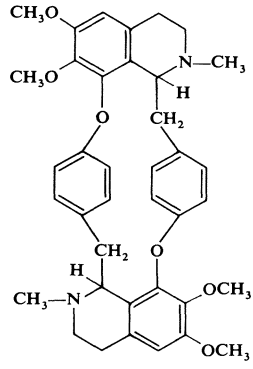
MOL. WT.: 608
BIOACTIVITY: EAC: Inactive
LD_{50}: >50
HeLa: ED_{50}, 4.1 μg/ml
REFERENCE: 263

$C_{37}H_{40}N_2O_6$ Thalicberine



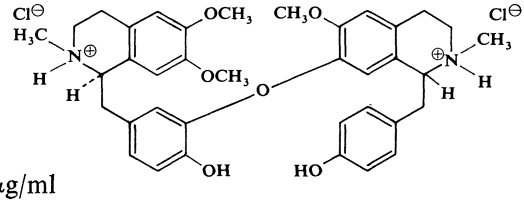
MOL. WT.: 608
BIOACTIVITY: S-180: Inactive
EAC: 62.5
LD_{50}: >125
HeLa: ED_{50}, 13 μg/ml
REFERENCE: 263

$C_{37}H_{42}N_2O_6$ Cycleanine



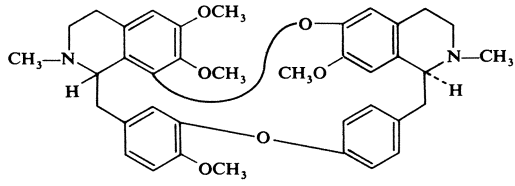
MOL. WT.: 610
BIOACTIVITY: HeLa: ED_{50}, 12 μg/ml
REFERENCE: 263

$C_{37}H_{44}Cl_2N_2O_6$ Isoliensinine dihydochloride



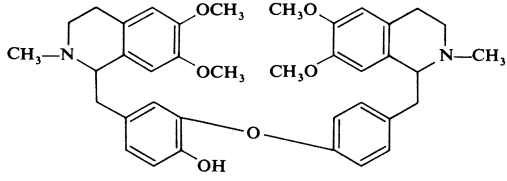
MOL. WT.: 683
BIOACTIVITY: HeLa: ED_{50}, 16 μg/ml
EAC: Inactive
REFERENCE: 263

$C_{38}H_{42}N_2O_6$ 0-Methylthalicberine



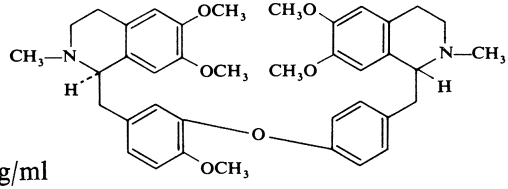
MOL. WT.: 622
BIOACTIVITY: EAC: Inactive
LD_{50}: 125
REFERENCE: 263

$C_{38}H_{44}N_2O_6$ Dauricine



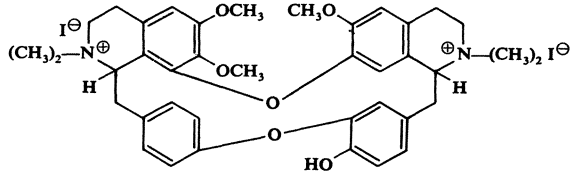
MOL. WT.: 624
BIOACTIVITY: HeLa-S_3: ED_{50}, 10 μg/ml
EAC: >100
S-180: Inactive
LD_{50}: >125
REFERENCE: 263

$C_{39}H_{46}N_2O_6$ 0-Methyldauricine



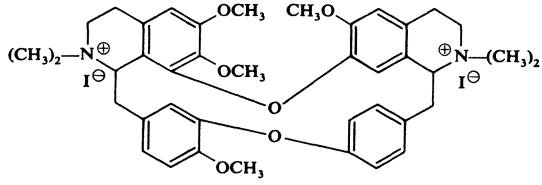
MOL. WT.: 638
BIOACTIVITY: HeLa: ED_{50}, 11 μg/ml
EAC: >100
S-180: Inactive
LD_{50}: >125
REFERENCE: 263

$C_{39}H_{46}I_2N_2O_6$ Oxyacanthine dimethiodide



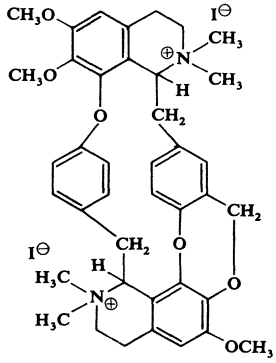
MOL. WT.: 892
BIOACTIVITY: HeLa: ED_{50}, >30 μg/ml
EAC: Inactive
REFERENCE: 263

$C_{40}H_{46}I_2N_2O_6$ Tetraandrine dimethiodide



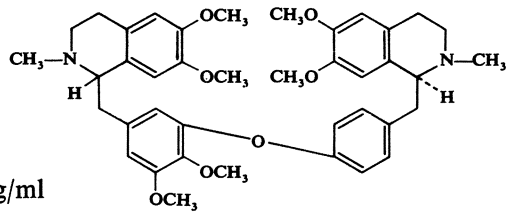
MOL. WT.: 904
BIOACTIVITY: EAC: Inactive
LD_{50}: 7
HeLa: ED_{50}, >30 μg/ml
REFERENCE: 263

$C_{40}H_{46}I_2N_2O_6$ Insularine dimethiodide



MOL. WT.: 904
BIOACTIVITY: EAC: Inactive
LD_{50}: 10
HeLa: ED_{50} >30 μg/ml
REFERENCE: 263

$C_{40}H_{48}N_2O_6$ Tetramethylmagnolamine

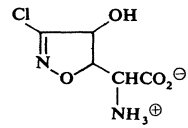


MOL. WT.: 652
BIOACTIVITY: HeLa: ED_{50}, 13 μg/ml
REFERENCE: 263

Chapter 6

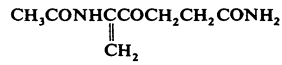
Fungi and Other Lower Plant Biosynthetic Products

$C_5H_7ClN_2O_4$ U-43,795 (NSC-176324)



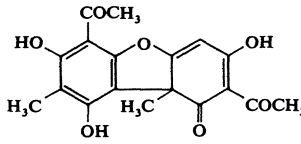
MOL. WT.: 194
MELTING POINT: 165°C
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Streptomyces sviceus* (Streptomycetaceae)
REFERENCE: 286

$C_8H_{12}N_2O_3$ Primocarcin



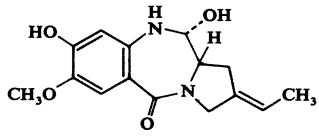
MOL. WT.: 184
SPECTRAL DATA: UV, IR
REFERENCE: 201, 403

$C_8H_{16}O_7$ Usnic acid



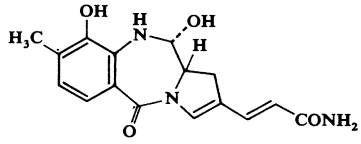
MOL. WT.: 224
BIOACTIVITY: PS: T/C, 135–152 (20–200 mg/kg)
ORGANISM: *Cladonia leptoclada* des.Abb. (Cladoniaceae)
REFERENCE: 258

$C_{15}H_{18}N_2O_4$ Tomaymycin



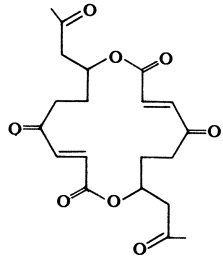
MOL. WT.: 301
BIOACTIVITY: Active against gram-positive
Marked inhibitory effect on L1210 *in vitro*
MELTING POINT: Methyl ether ~145–146°C (dec.)
$[\alpha]_D$: +423 SOLVENT: Py
SPECTRAL DATA: UV
ORGANISM: *Streptomyces achromogenes* var. *tomaymyceticus* (Streptomycetaceae)
REFERENCE: 191

$C_{16}H_{17}N_3O_4$ Anthramycin



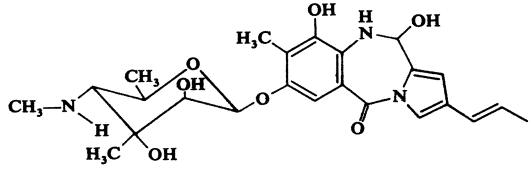
MOL. WT.: 315
BIOACTIVITY: Wide antibacterial *in vitro*
In vivo inactive
Antitumor Sarcoma 180
Walker 256
EA
Human epidermoid carcinoma No. 3
Human adenoma No. 1
MELTING POINT: 120°C (dec.)
$[\alpha]_D$: +930 SOLVENT: DMF
SPECTRAL DATA: UV
ORGANISM: *Streptomyces refuineus* var. *thermotolerans* (Streptomycetaceae)
REFERENCE: 191

$C_{20}H_{24}O_8$ Vermiculine



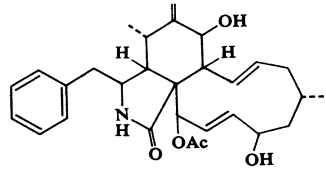
MOL. WT.: 392
BIOACTIVITY: Cytotoxic antibiotic
ORGANISM: *Penicillium vermiculatum* Dangeard (Moniliaceae)
REFERENCE: 152

$C_{24}H_{31}N_3O_7$ Sibiromycin



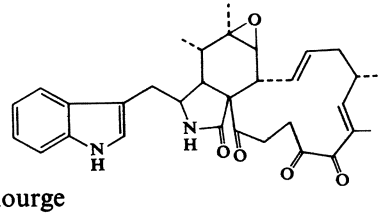
MOL. WT.: 473
BIOACTIVITY: Active against *Bacillus* sp., *Staphylococcus aureus*, E. coli, six transplanted mice tumors
Effective against squamous praegastric cancer cells (OG-5), ascitic forms of tumors, Sarcoma 180
MELTING POINT: 120°C (dec.)
$[\alpha]_D$: +525 SOLVENT: DMF
SPECTRAL DATA: UV
ORGANISM: *Streptosporangium sibiricum* (Actinomycetaceae)
REFERENCE: 191

$C_{30}H_{39}NO_5$ Kodo-cytochalasin-1 (Cytochalasin H)



MOL. WT. 493
BIOACTIVITY: LD_{50}: 12.5 μg/kg
SPECTRAL DATA: PMR
ORGANISM: *Phomopsis* sp. (Unknown)
REFERENCE: 33

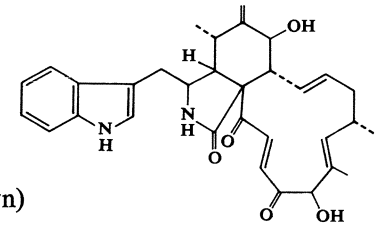
$C_{32}H_{36}N_2O_5$ Chaetoglobosin C



MOL. WT.: 528
BIOACTIVITY: Toxin
MELTING POINT: 257–259°C
SPECTRAL DATA: IR, PMR, Mass Spec
ORGANISM: *Penicillium aurantio-virens* Biourge (Moniliaceae)
REFERENCE: 398

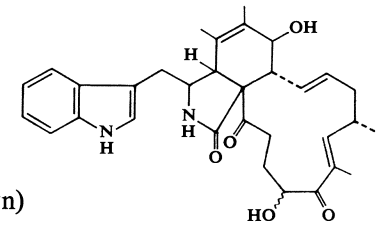
MELTING POINT: 260–263°C
$[\alpha]_D$: −30 SOLVENT: Me
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Chaetomium globosum* (Unknown)
REFERENCE: 372

$C_{32}H_{36}O_5N_2$ Chaetoglobosin D



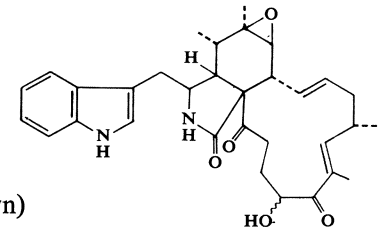
MOL. WT.: 528
MELTING POINT: 216°C
$[\alpha]_D$: −269 SOLVENT: Me
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Chaetomium globosum* (Unknown)
REFERENCE: 372

$C_{32}H_{38}O_5N_2$ Chaetoglobosin E



MOL. WT.: 530
MELTING POINT: 279–280°C
$[\alpha]_D$: +158 SOLVENT: Me
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Chaetomium globosum* (Unknown)
REFERENCE: 372

$C_{32}H_{38}O_5N_2$ Chaetoglobosin F

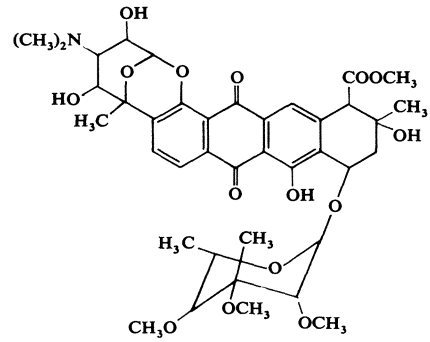


MOL. WT.: 530
MELTING POINT: 177–178°C
$[\alpha]_D$: −69 SOLVENT: Chf
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Chaetomium globosum* (Unknown)
REFERENCE: 372

$C_{34}H_{44}N_2SO_{18}$ U-43,120 (NSC-163500)

MOL. WT.: 800
BIOACTIVITY: PS: T/C, Toxic (150 mg/kg)
150 (25.0 mg/kg)
139 (12.5 mg/kg)
Antibiotic gram-positive, 1–2 μg/ml
P388 and LD: ED_{50}, 2.5 μg/ml
MELTING POINT: 119–122°C
$[\alpha]_D$: +9.3 SOLVENT: Chf
SPECTRAL DATA: UV, IR, PMR
ORGANISM: *Streptomyces paulus* Dietz sp.n. (Streptomycetaceae)
REFERENCE: 173, 440

$C_{39}H_{45}NO_{16}$ Nogalamycin



MOL.WT.: 787
SPECTRAL DATA: UV, PMR
ORGANISM: *Streptomyces nogalater* var. *nogalater* sp.n. (Streptomycetaceae)
REFERENCE: 441

Unknown polysaccharide

BIOACTIVITY: Ehrlich ascites carcinoma
16 of 20 mice had complete regression at 60 days and 20 mg/kg
ORGANISM: Culture filtrate *Fomes fomentarius* (Polyporaceae)
REFERENCE: 203

Sporamycin

ORGANISM: *Streptosporangium pseudovulgare* (No. PO-357) (Actinomycetaceae)
REFERENCE: 249

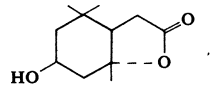
Neothramycins A and B

ORGANISM: *Streptomyces* sp. No. MC916-C4 (Streptomycetaceae)
REFERENCE: 191

Chapter 7

Marine Invertebrate and Other Lower Animal Biosynthetic Products

$C_{11}H_{16}O_3$ Loliolide



MOL. WT.: 196
BIOACTIVITY: P388: ED_{50}, 3.5 μg/kg
MELTING POINT: 153–154°C
SPECTRAL DATA: IR, PMR, Mass Spec
ORGANISM: *Dolabella ecaudata* (Mollusca)
REFERENCE: 335

$C_{16}H_{30}O_2$ Palmitoleic acid

$CH_3(CH_2)_5CH{=}CH(CH_2)_7CO_2H$

MOL. WT.: 254
BIOACTIVITY: P388: ED_{50}, 0.96 μg/kg
MELTING POINT: Methyl ester
SPECTRAL DATA: Mass Spec
ORGANISM: *Vespula pensylvanica* (Arthropoda/Insecta) Hymenoptera
REFERENCE: 327

$C_{18}H_{34}O_2$ Oleic acid

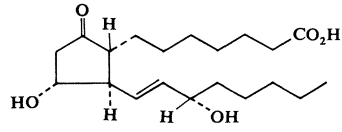
$CH_3(CH_2)_7CH{=}CH(CH_2)_7CO_2H$

MOL. WT.: 282
BIOACTIVITY: P388: ED_{50}, 0.67 μg/kg
MELTING POINT: Methyl ester
SPECTRAL DATA: Mass Spec
ORGANISM: *Vespula pensylvanica* (Arthropoda/Insecta) Hymenoptera
REFERENCE: 327

Chapter 8

Marine Vertebrate and Other Higher Animal Biosynthetic Products

$C_{20}H_{34}O_5$ Prostaglandin E_1



MOL. WT.: 370
BIOACTIVITY: B1 cell line growth inhibition
REFERENCE: 355

60-Unit protein

Leu-Lys-Cys-Asn-Lys-Leu-Val-Pro-
Leu-Phe-Tyr-Lys-Thr-Cys-Pro-Ala-Gly-
Lys-Asn-Leu-Cys-Tyr-Lys-Met-Phe-Met-
Val-Ser-Asn-Leu-Thr-Val-Pro-Val-Lys-
Arg-Gly-Cys-Ile-Asp-Val-Cys-Pro-Lys-
Asn-Ser-Ala-Leu-Val-Lys-Tyr-Val-Cys-
Cys-Asn-Thr-Asp-Arg-Cys-Asn

BIOACTIVITY: LD_{50}: 56 μg/ml
Yoshida sarcoma: ED_{50}, 7.4 μg/ml
ORGANISM: *Naja naja atra* (Chordata/Reptilia) Formosan cobra
REFERENCE: 212

Sphyrnastatin 1 (glycoprotein)

BIOACTIVITY: PS: T/C, 120 (1.25 mg/kg)
ORGANISM: *Sphyrna lewini* (Chordata/Pisces) Sphyrnidae
REFERENCE: 338

Sphyrnastatin 2 (glycoprotein)

BIOACTIVITY: PS: T/C, 144 (15 mg/kg)
ORGANISM: *Sphyrna lewini* (Chordata/Pisces) Sphyrnidae
REFERENCE: 338

Strongylostatin 1 (glycoprotein)

BIOACTIVITY: PS: T/C, 153 (10 mg/kg)
ORGANISM: *Strongylocentrotus drobachiensis* (Echinodermata)
REFERENCE: 332

Strongylostatin 2

BIOACTIVITY: PS: T/C, 131 (8 mg/kg)
ORGANISM: *Strongylocentrotus drobachiensis* (Echinodermata)
REFERENCE: 332

Section B
Marine Animal Biosynthetic Products

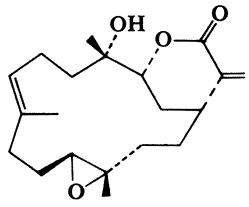
Introduction

Marine organisms represent a vast available resource for new drugs of use in medicine. However, this exceedingly valuable natural resource has been subject to surprisingly little of the bio-organic chemical investigation necessary to discover new drugs. Fortunately, this situation is rapidly changing for the better and we hope that the survey of marine animal constituents prepared for this section will enhance progress, especially in the isolation and characterization of new marine animal antineoplastic and/or cytotoxic components. A history and rationale for this approach to developing new cancer chemotherapeutic drugs has already been provided in Volume 1 of this series.[325] A recent summary of marine-organism-derived drugs for a broad range of medical problems has been made by Grant and Mackie.[165] Some of the better-known clinical advances include the isolation of cephalosporin C produced by a fungus isolated from an ocean sewage outfall. A related example is the bromine-containing anti-fungal agent thelepin related to griseofulvin.[179] The pyrrolidine derivative kainic acid obtained from the red algae *Digenia simplex* is being used in Japan as an effective anthelmintic for intestinal worms.[417] Another interesting clinical example entails the use of tetrodotoxin as an analgesic and muscle relaxant in patients with cancer and neurogenic leprosy.[318,352] Most importantly, adenine arabinoside (ara-A) was first synthesized and characterized as part of the National Cancer Institute's program directed by Baker in 1960,[276] which was based on the valuable leads provided by the earlier isolation of 1-β-D-arabinofuranosyl derivatives of thymine (spongothymidine)[37] and uracil (spongouridine)[38] from the Caribbean sponge *Cryptotethya crypta*. Ara-A[80,176,357,402] has proved to be the treatment of choice for the usually fatal human viral disease herpes encephalitis. The human mortality rate from herpes simplex encephalitis is about 70% and it fell to 28% in the initial clinical trial of this first truly curative agent for human viral disease.[439] Of course, cytosine arabinoside (ara-C), a well-known cancer chemotherapeutic drug, was also developed from the early lead presented by these sponge nucleoside arabinosides.[329] The potential contribution of the prostaglandins to medicine is widely known and certain soft coral species produce some of these important substances. For example, subjecting the prostaglandin ester mixture from *Plexaura*

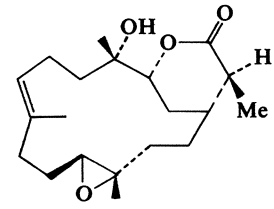
homomalla to enzymatic hydrolysis has led to isolation of prostaglandins A_2, 5,6-*trans*-A_2, $F_{2\alpha}$, 13,14-*cis*-A_2, 13,14-dihydro-A acetate methyl ester, and the internal Michael adduct derived from 13,14-dihydro-A_2.[370] Interestingly, prostaglandin E_1 significantly inhibits growth of the B-16 melanoma cell line and a derivative 16-dimethyl-E_2 methyl ester significantly inhibits *in vivo* growth of this tumor system.[355] Useful amino acid derived marine animal medicinal agents range from the potent hypotensive undecapeptide eledoisin[19,326] (from the salivary gland of the octopus *Eledone moschata*) to the fish insulins. For example, preparations from tuna fish islets of Langerhan's were used to treat diabetic patients in Japan during the Second World War.[165]

Doubtlessly, a tremendous number of marine animal macromolecules will be discovered and found of utility in medicine. By way of illustration, we have isolated the first two antineoplastic agents from a shark (the hammerhead *Sphyrna lewini*) and both were found to be glycoproteins.[338] More recently we found two new glycoproteins in the green sea urchin, *Strongylocentrotus drobachiensis* that also significantly inhibit growth of the P388 murine lymphocytic leukemia.[336] At the time of writing we are in the process of uncovering several more antineoplastic proteins in relatively small marine vertebrates.[331] Quite likely the shark glycoproteins (sphyrnastatins 1 and 2) and other such protein antineoplastic substances act by stimulating the immune system to more effective measures against invading neoplastic disease. In this regard Sigel *et al.*[388] have been investigating serum proteins from the nurse shark *Ginglymostoma cirratum* in respect to immune antibody formation. On this basis, immunotherapy with crude macromolecular extracts such as BCG might better be considered as just another facet of cancer chemotherapy.

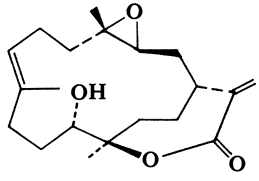
A good selection of marine animals from Florida and the Caribbean Island have been screened recently for cardiovasuclar and central nervous system active constituents and a number of promising leads were uncovered.[221a] Clearly the isolation of marine animal medicinal agents is only beginning. A contemporary synopsis of marine animal bio-organic chemistry can be obtained in reviews by Minale[293,294] of Porifera constituents, a treatment by Scheuer[360] of marine organism toxins, and in more comprehensive reviews.[26,137,138,140,361] The current thrust of marine animal natural products chemistry can be partially ascertained by considering the advances summarized from July to November 1977. Two new cembranolides from the soft coral *Sinularia flexibilis* were shown to be cytotoxic. The Weinheimer group[428] also found sinularin and dihydrosinularin to be accompanied by the known sinulariolide.[414] While no biological activity was described for any of the other new low molecular weight marine animal biosynthetic products, some of these structures suggest that such evaluation would be fruitful. For example, mycosporine from the Zoanthid *Palythoa tuberculosa* obtained by the Hirata group,[204] a new capnellene from the soft coral *Capnella imbricata* by the Djerassi and Tursch group,[383] the diterpene xenicin isolated by Schmitz and colleagues[423] from the soft coral



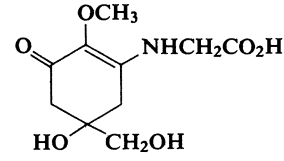
Sinularin
P388: ED_{50}, 0.3 μg/ml
KB: ED_{50}, 0.3 μg/ml
Reference 428



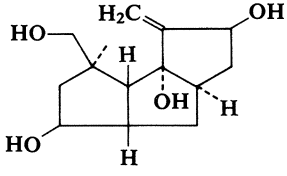
Dihydrosinularin
P388: ED_{50}, 20 μg/ml
KB: ED_{50}, 1.1 μg/ml
Reference 428



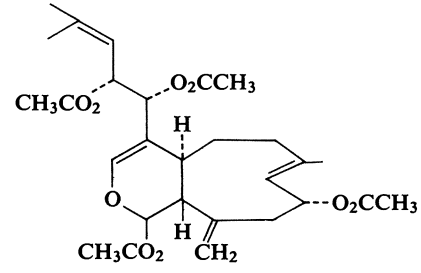
Sinulariolide
P388: ED_{50}, 7 μg/ml
KB: ED_{50}, 20 μg/ml
Reference 428



Mycosporine
Reference 204

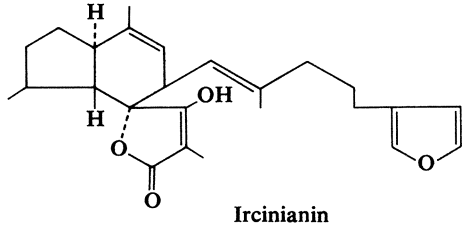


$\Delta^{9(12)}$-Capnellene-3β, 8β,10α, 14-tetrol
Reference 383

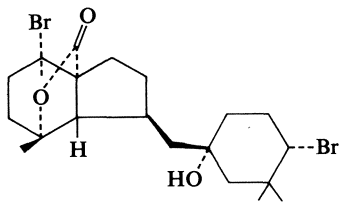


Xenicin
Reference 423

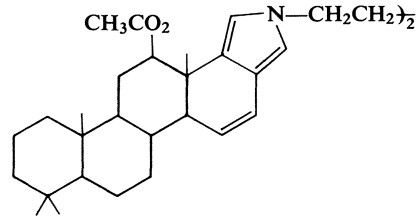
Zenia elongata, another unusual terpene (sester-)ircinianin (from a member of the sponge genus Ircinia in the Basel Laboratories of Hoffmann-LaRoche Laboratories),[185] our isolation of angasiol from the sea hare *Aplysia angasi*,[333] the pyrrolloterpene molliorin-B from the Italian sponge *Cacaspongia mollior*,[62] and the tryptophan derivative 6-bromohypaphorin



Ircinianin
Reference 185

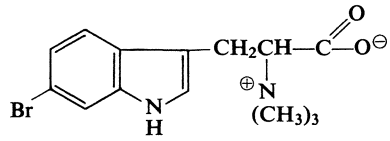


Angasiol
Reference 333



Molliorin-B
Reference 62

from the British sponge *Pachymatisma johnstoni* by Thomson *et al.*[347] In the same period other sponge,[17,63] soft coral,[52,101] and sea hare[199,454]



6-Bromohypaphorine
Reference 347

terpenes were isolated. Five depsipeptides were isolated from the sea cucumber *Stichopus japonicus*,[200] three polypeptides with cardiotoxic and neurotoxic activity were obtained from the sea anemone *Anemonia sulcata*, and a toxin designated maculotoxin was isolated from the blue-ringed octopus *Hapalochlaena maculosa*.[107] A second toxin was obtained from the same octopus and called hapalotoxin,[356] On the basis of chromatographic behavior both of these posterior salivary gland components seemed related to tetrodotoxin and LD_{50} values of 50 and 150 μg/kg were found, respectively, for maculotoxin and hapalotoxin.[356] Understandably, the octopus *H. maculosa* has been responsible for a number of human deaths. Mosher and colleagues[322] have continued their investigation of Central American frogs for tetrodotoxin-like substances and have isolated the potent neurotoxins tetrodotoxin and chiriquitoxin from eggs of the Costa Rican *Atelopus chiriquiensis*. Since both toxins had to be extracted with 3% acetic acid and were not extracted by water it appears they might occur (in the eggs) in a bound form.

Several of the preceding new contributions to marine animal chemistry provide some striking illustrations of the abundance in which certain biosynthetic products are produced, especially terpenes.[101,185,199,423] For example, 100 g of the crushed sponge *Ircinia sp.* was extracted with ligroin and upon concentrating and cooling 2.3 g of ircinianin crystallized.[185] Analogously, 100 g of a freeze-dried powder prepared from the soft coral *Sarcophyton sp.* when extracted with ligroin afforded upon concentration of the extract 0.3 g of a new cembrenoid diterpene.[101] However, the isolation of other types of compounds is generally more challenging than with higher plants and the discovery of antineoplastic constituents is usually considerably to exceedingly more difficult.

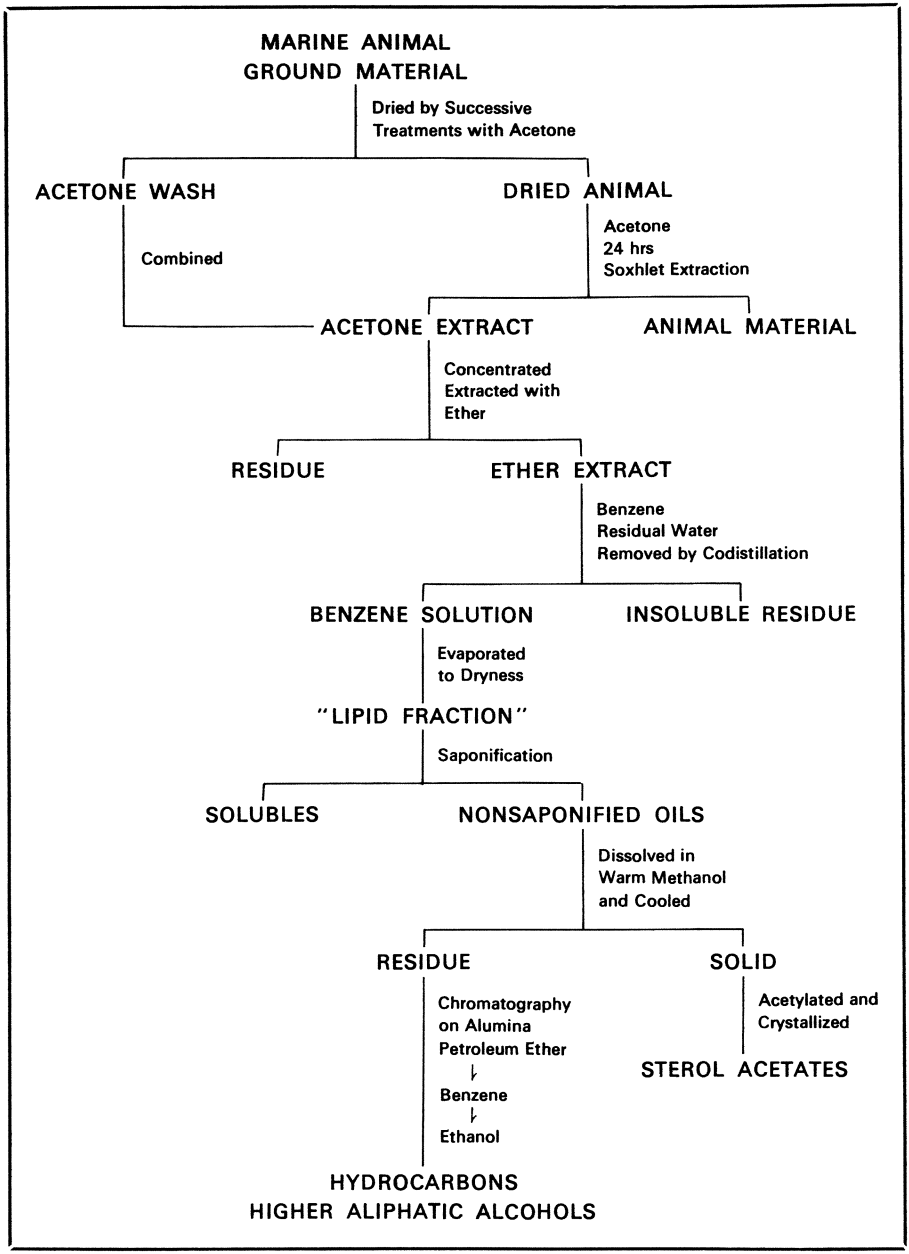
Primarily over the past twenty-five years a number of specialized isolatin techniques have been applied to marine animal problems. A selection of the more classic and workable approaches have been summarized in Schemes 1–6. The first two methods (Schemes 1, 2) have been employed to obtain a variety of hydrocarbons, long-chain alcohols, and sterols.[39,123] More recently the use of glc–mass spectrometry techniques with, for example, silyl ether derivatives has been developed, especially by Djerassi and colleagues,[112,302,303,341,342,378,381,400,420] into a most powerful technique for final purification and characterization of marine organism sterols. Scheme 3, developed by Scheuer and colleagues, has proved very effective for isolating sea urchin pigments.[308] The isolation of sea cucumber saponins has been of increasing interest due to their antifungal and cytotoxic properties[334] and Schemes 4 and 5 have been included to exemplify the earlier approach of Chanley[77] and the improved procedure of Djerassi.[350,379] The isolation of tetrodotoxin shown in Scheme 6 exemplifies an elegant separation procedure specifically designed for the isolation of tetrodotoxin in gram quantities.[161] By this means, 100 kg of chopped fresh ovaries from the puffer fish *Spheroides rubripes* in 200 liters of water led to 1–2 g yields of pure tetrodotoxin.[161]

For the past 12 years our group[337] has been exploring various separation techniques for isolating marine animal antineoplastic and/or cytotoxic constituents. The hitherto unpublished procedure outlined in Scheme 7 represents a generally workable approach for initial concentration of marine animal components for biological evaluation. In the 1965–1966 period one of us (GRP) began using 2-propanol routinely for preservation and shipment of field collections. Thus, removal of solvent from the 2-propanol solution serves as an initial extract. The residual marine animal or plant material is then treated as outlined in Scheme 7. Once the most promising fraction has been detected by bioassay, further separation is conducted using essentially all of the better known adsorption, gel permeation, ion exchange, and reverse phase chromatographic techniques outlined in Volume 2 of this series.[329] A great variety of other isolation methods effective for obtaining marine animal components can be obtained by consulting specific entries in Chapters 9–15.

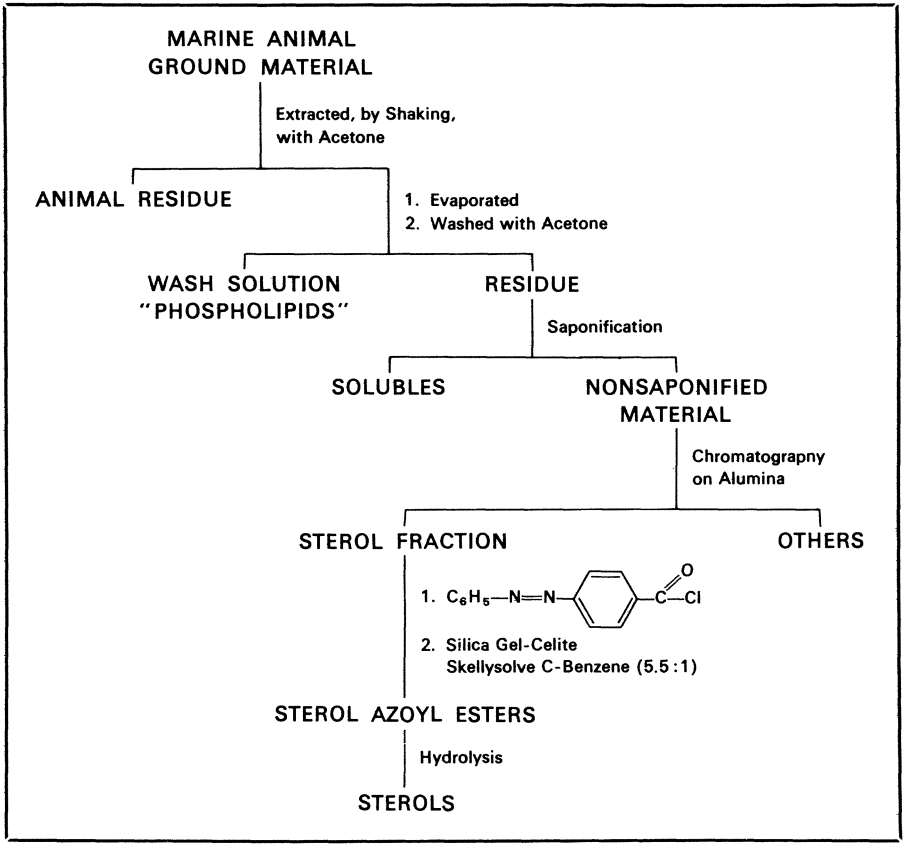
As already noted in the preface, our need for the survey of data presented in the following chapters became acutely obvious about 1970. At the same time interest in marine animal chemistry began to increase markedly. In the next five years nearly 200 papers concerned with marine animal bio-organic chemistry appeared. This is in contrast to only 14 such manuscripts in the period 1900–1950, increasing to 34 in the 1950s and to 87 by the late 1960s. Consequently the data of Chapters 9–15 were prepared to provide ready access to information needed for the rapid identification of previously known constituents and to assist in characterization of new marine animal biosynthetic products. The data have been arranged according to the class of compound and each chapter has been sequenced on

the basis of increasing empirical formula. When known with some certainty the structure has been entered along with a trivial name, if known; the melting point, optical rotation at the sodium-D line (with solvent), a notation concerning any spectral data, and the original marine organism have been noted. Biologically active fractions and other such mixtures were not included. Thus, only pure substances with reasonably well established structures are listed. Synthetic modifications of these marine animal natural products were not included unless they represented simple derivatives used for characterization. It is hoped that the data in the following chapters will encourage the investigation of many of these substances for biological activity. Only in a small number of instances does a biological study seem to have been initiated. Most of the substances listed have never been evaluated, for example, for antineoplastic and/or cytotoxic activity. The same observation applies to other areas of major medical interest.

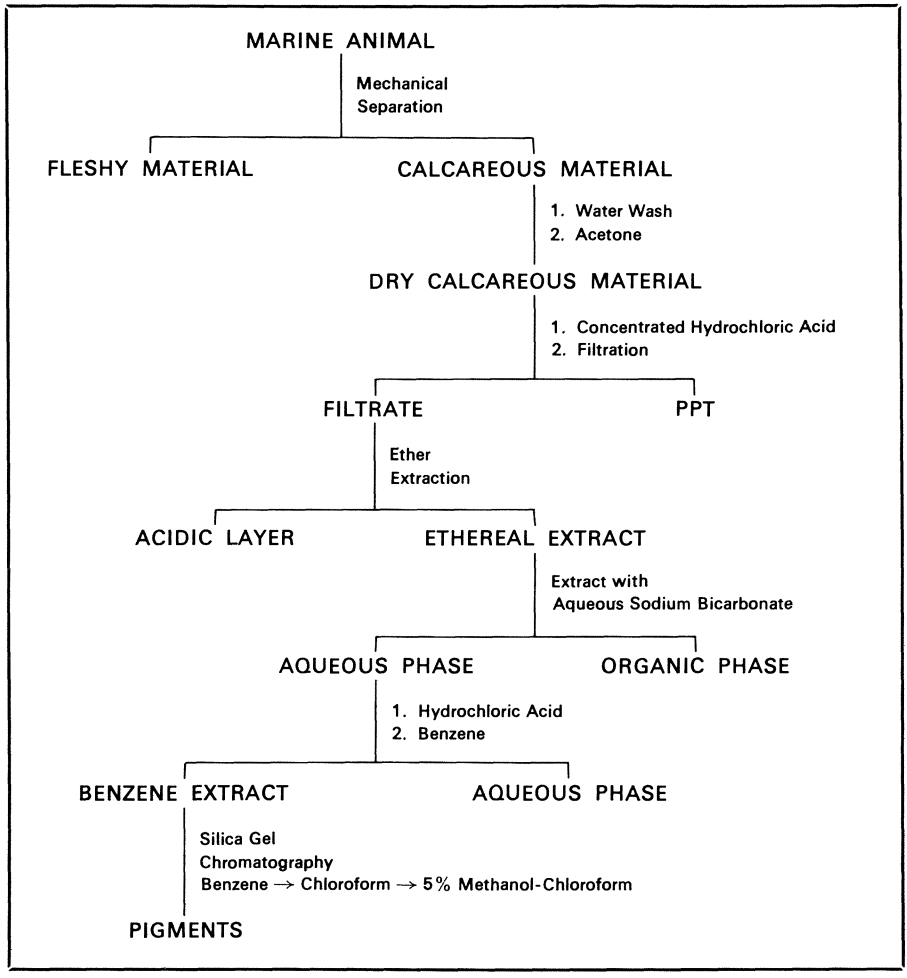
SCHEME 1
Isolation of Hydrocarbons, Alcohols, and Sterols[39]



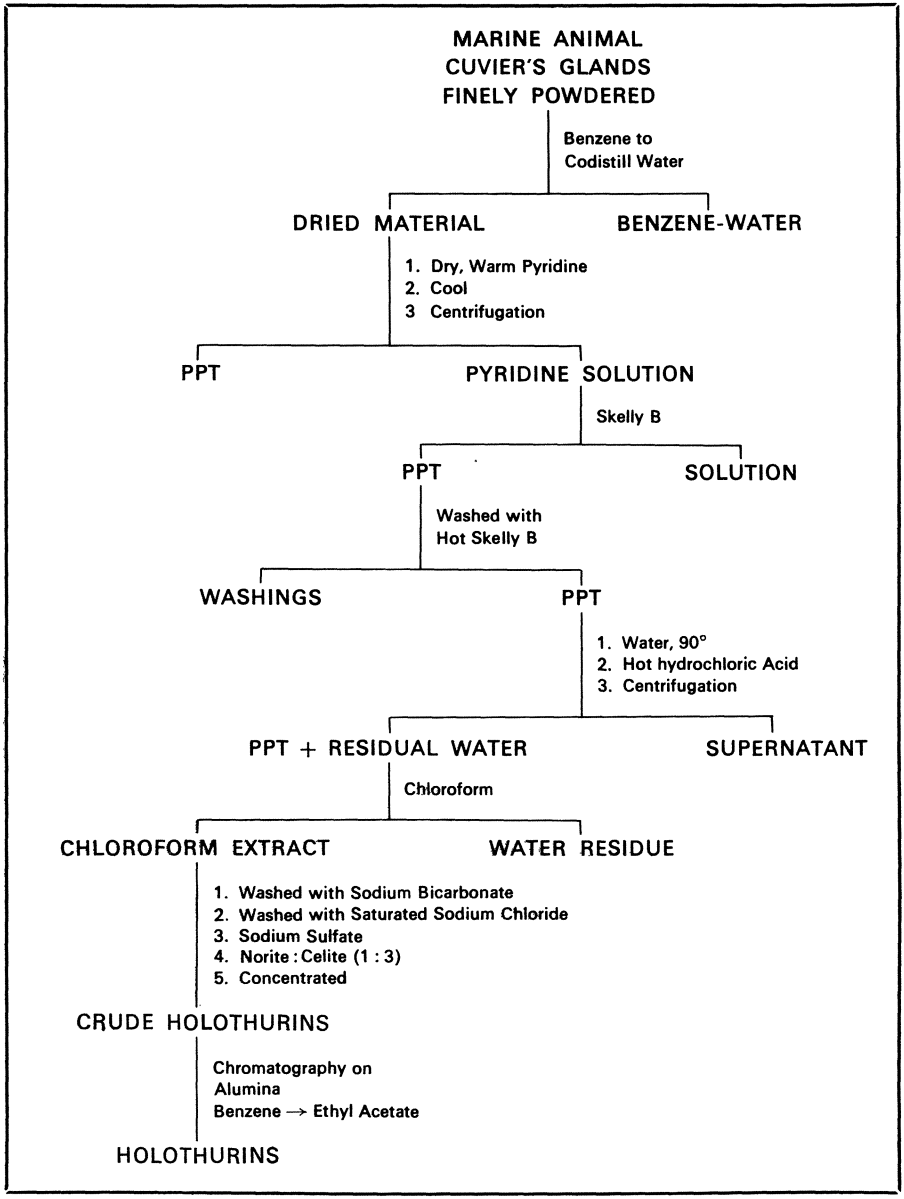
SCHEME 2
Isolation of Sterols[123]



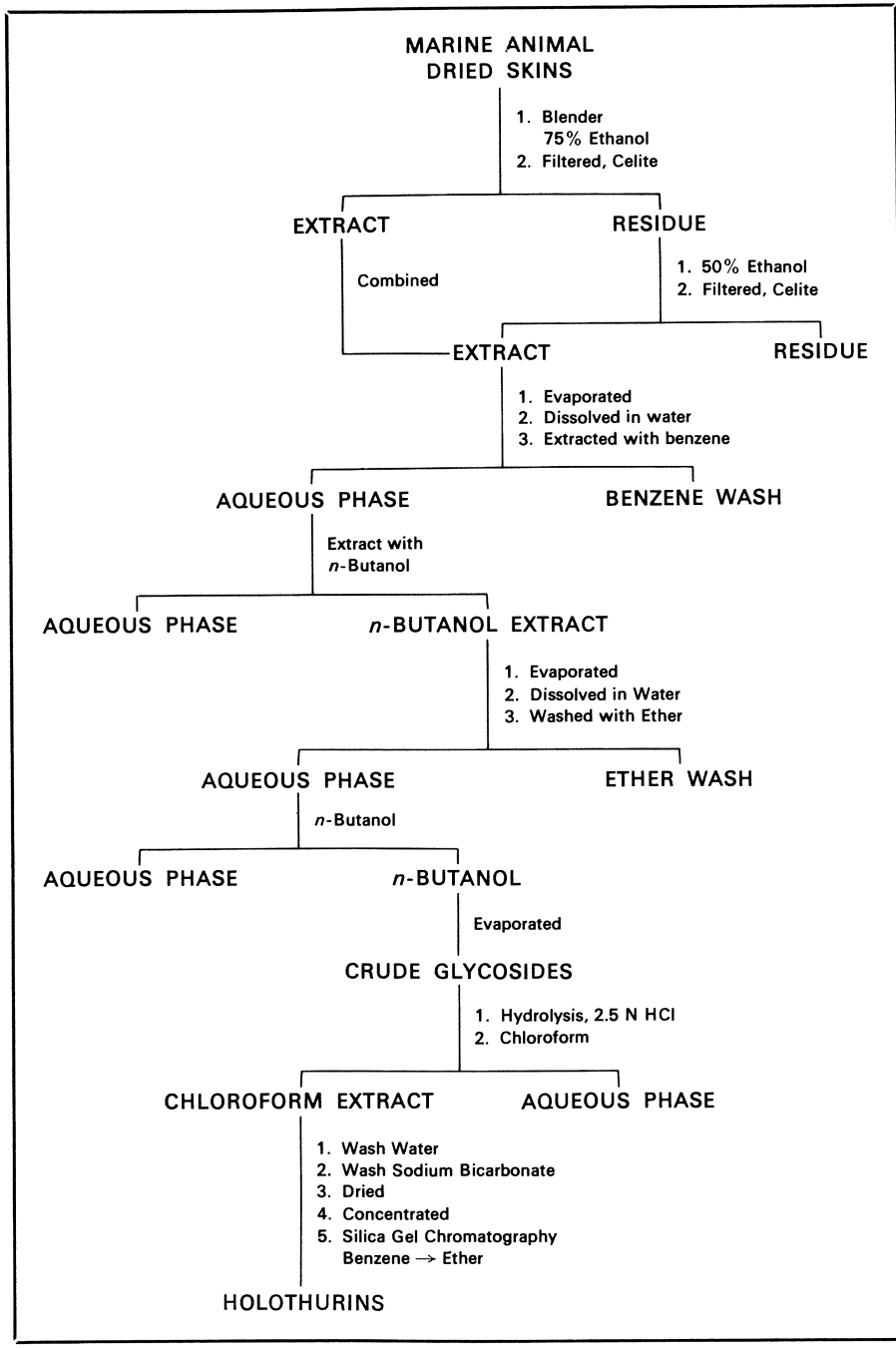
SCHEME 3
Separation of Pigments from Echinoids[308]



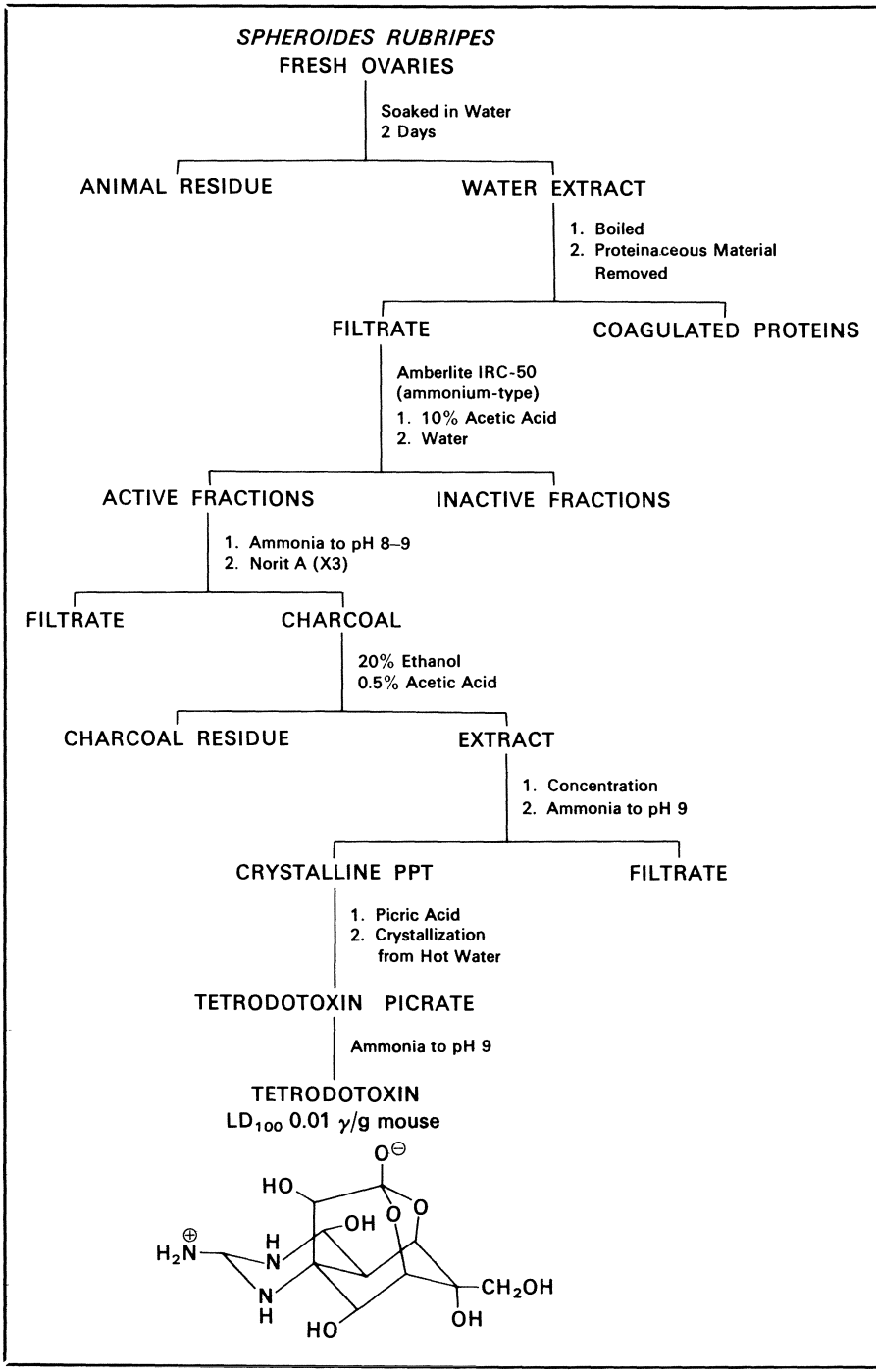
SCHEME 4
Isolation of Holothurins Method A[77]



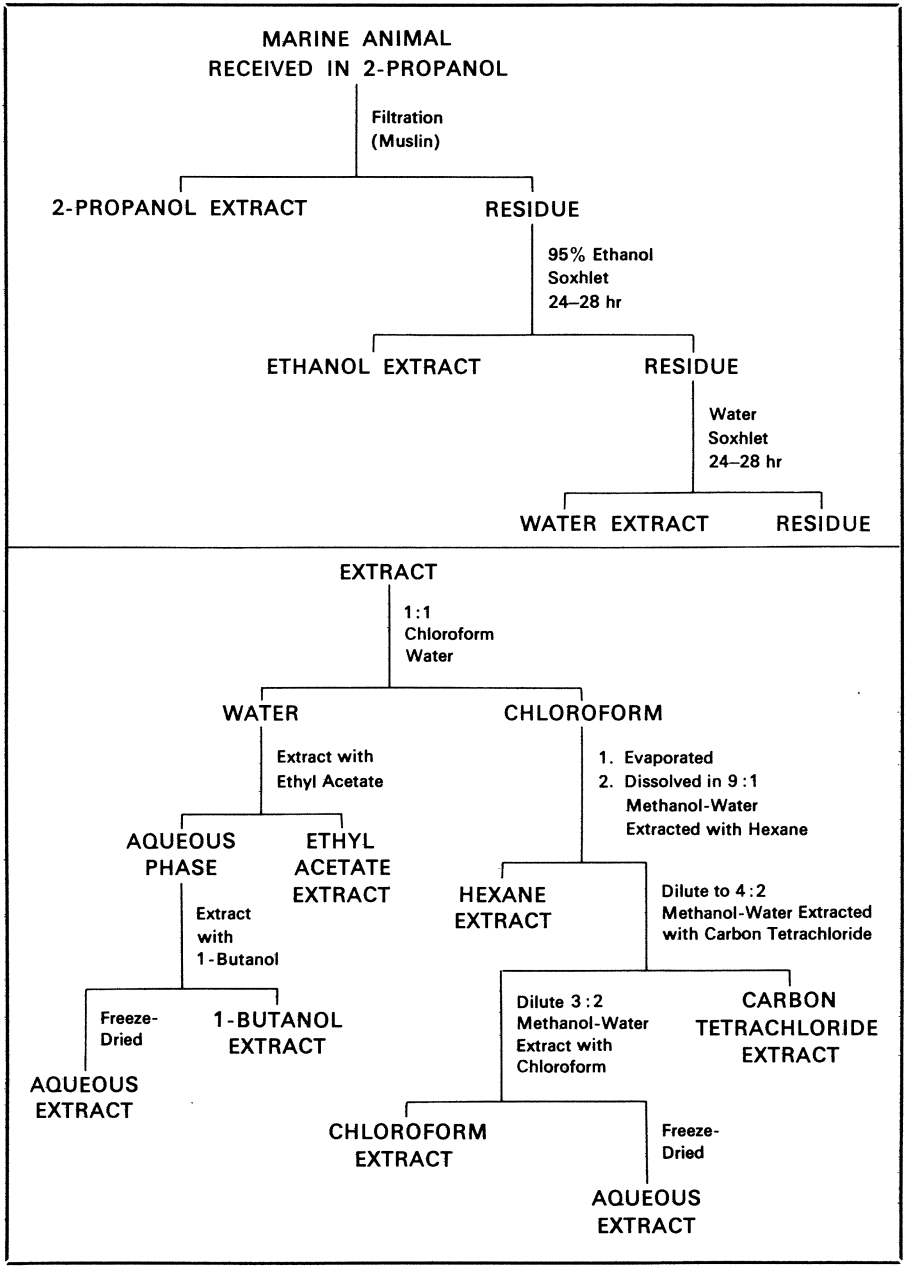
SCHEME 5
Isolation of Holothurins Method B[350]



SCHEME 6
Separation of Tetrodotoxin[161]



SCHEME 7
A Solvent Separation for Preliminary Biological Evaluation[337]



Chapter 9

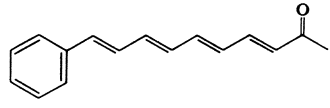
Hydrocarbons, Alcohols, and Esters

$C_{14}H_{30}O$ Tetradecanol

$CH_3(CH_2)_{12}CH_2OH$

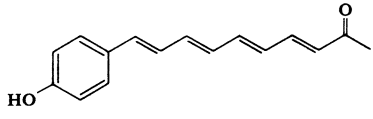
MOL. WT.: 214
MELTING POINT: 38–38.5°C; 3,5-Dinitrobenzoate, 66.5°C; Phenylurethane, 70.5°C
ORGANISM: *Condylactis gigantea* (Coelenterata)
REFERENCE: 39

$C_{16}H_{16}O$ Navenone B



MOL. WT.: 224
MELTING POINT: 125–140°C
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Navanax inermis* (Cooper) (Mollusca)
REFERENCE: 392

$C_{16}H_{16}O_2$ Navenone C



MOL. WT.: 240
MELTING POINT: Oil; Acetate 135–137°C
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Navanax inermis* (Cooper) (Mollusca)
REFERENCE: 392

$C_{16}H_{34}O$ Hexadecanol

$CH_3(CH_2)_{14}CH_2OH$

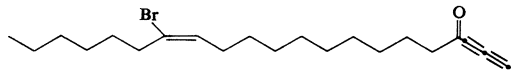
MOL. WT.: 242
MELTING POINT: 49°C; 3,5-Dinitrobenzoate, 72°C
ORGANISM: *Condylactis gigantea* (Coelenterata)
REFERENCE: 39

$C_{18}H_{38}O$ Octadecanol

$CH_3(CH_2)_{16}CH_2OH$

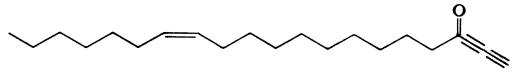
MOL. WT.: 270
MELTING POINT: 56.5°C; Phenylurethane, 75.5°C
ORGANISM: *Condylactis gigantea* (Coelenterata)
REFERENCE: 39

$C_{22}H_{33}BrO$ Renierin-1



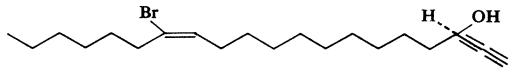
MOL. WT.: 394
MELTING POINT: Oil
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Reniera fulva* (Porifera)
REFERENCE: 83

$C_{22}H_{34}O$ Debromorenierin-1



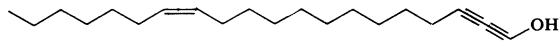
MOL. WT.: 314
MELTING POINT: Oil
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Reniera fulva* (Porifera)
REFERENCE: 83

$C_{22}H_{35}BrO$ 18-Dihydrorenierin-1



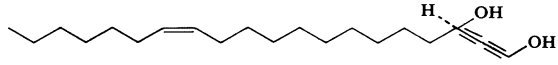
MOL. WT.: 396
MELTING POINT: Oil
$[\alpha]_D$: −5.4 SOLVENT: Chf
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Reniera fulva* (Porifera)
REFERENCE: 83

$C_{23}H_{38}O$ Renierin-2



MOL. WT.: 330
MELTING POINT: 35°C
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Reniera fulva* (Porifera)
REFERENCE: 83

$C_{23}H_{38}O_2$ 18-Hydroxyrenierin-2



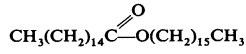
MOL. WT.: 346
MELTING POINT: 32°C
$[\alpha]_D$: −38 SOLVENT: Me
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Reniera fulva* (Porifera)
REFERENCE: 83

$C_{27}H_{56}$ Heptacosane

$CH_3(CH_2)_{25}CH_3$

MOL. WT.: 380
MELTING POINT: 59.5°C
ORGANISM: *Spheciospongia vesparia* (Porifera)
REFERENCE: 41

$C_{32}H_{64}O_2$ Cetyl palmitate

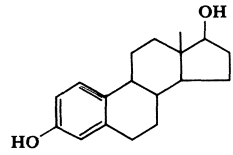


MOL. WT.: 480
MELTING POINT: 50.9–51.5°C
ORGANISM: *Palythoa mammilosa* (Coelenterata)
REFERENCE: 39

Chapter 10

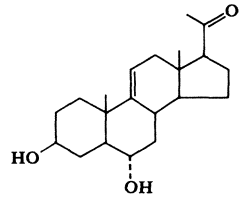
Sterols and Steroids

$C_{18}H_{24}O_2$ **Estradiol**



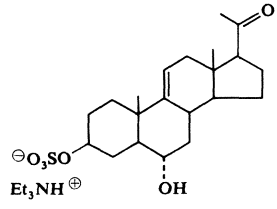
MOL. WT.: 272
MELTING POINT: 222°C
$[\alpha]_D$: +84
ORGANISM: *Torpedo marmorata* (Chordata/Pisces)
REFERENCE: 54

$C_{21}H_{32}O_3$



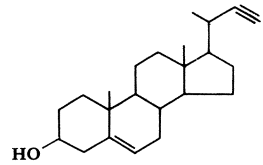
MOL. WT.: 332
MELTING POINT: 157–160°C
$[\alpha]_D$: +65.2
SPECTRAL DATA: IR, PMR, Mass Spec
ORGANISM: *Asterias amurensis* Lutkin (Echinodermata)
REFERENCE: 198, 455

$C_{21}H_{32}O_6S$



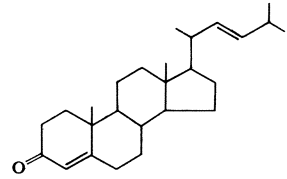
MOL. WT.: 412
MELTING POINT: 160–161°C
$[\alpha]_D$: +20
SPECTRAL DATA: PMR
ORGANISM: *Asterias amurensis* Lutkin (Echinodermata)
REFERENCE: 196

$C_{25}H_{38}O$



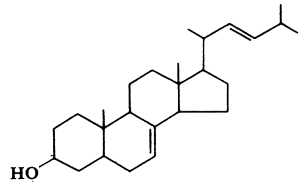
MOL. WT.: 354
MELTING POINT: 104–105°C; Acetate, 122–125°C
$[\alpha]_D$: −42.2
SPECTRAL DATA: IR, PMR, Mass Spec
ORGANISM: *Calyx nicaaensis* (Porifera)
REFERENCE: 400

$C_{26}H_{40}O$



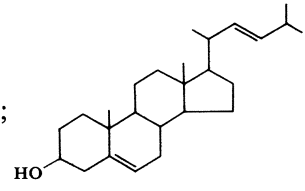
MOL. WT.: 368
SPECTRAL DATA: PMR, Mass Spec
ORGANISM: *Stelleta clarella* (Porifera)
REFERENCE: 381

$C_{26}H_{42}O$ Asterosterol



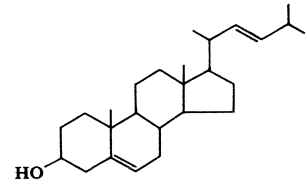
MOL. WT.: 370
MELTING POINT: 129–130°C; Acetate, 134–135°C
$[\alpha]_D$: 0
SPECTRAL DATA: IR, Mass Spec
ORGANISM: *Asterias amurensis* Lutkin (Echinodermata)
REFERENCE: 247

$C_{26}H_{42}O$



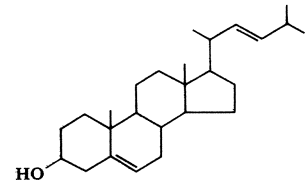
MOL. WT. 370
MELTING POINT: 137–138°C; Acetate, 131–132.5°C; Propionate, 113–115°C
SPECTRAL DATA: PMR, Mass Spec
ORGANISM: *Cliona celata*, *Stelleta clarella*, *Tethya aurantia*, *Lissodendoryx noxiosa*, *Haliclona permollis*, and *Haliclona* sp. (Porifera)
REFERENCE: 119, 381

$C_{26}H_{42}O$



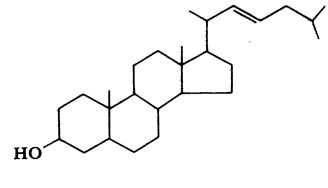
MOL. WT.: 370
MELTING POINT: 104–105°C
$[\alpha]_D$: −52
SPECTRAL DATA: IR, PMR, Mass Spec
ORGANISM: *Placopecten magellanicus* Gmelin (Mollusca)
REFERENCE: 194

$C_{26}H_{42}O$



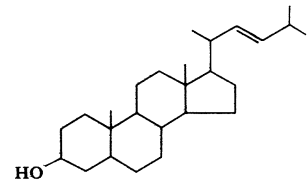
MOL. WT.: 370
MELTING POINT: 143–144°C; Acetate, 142.5–143°C
$[\alpha]_D$: −65
ORGANISM: *Placopecten magellanicus* Gmelin (Mollusca)
REFERENCE: 148, 149

$C_{26}H_{44}O$



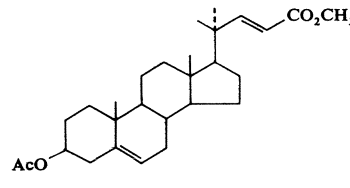
MOL. WT.: 372
MELTING POINT: Acetate, 103–105°C
ORGANISM: *Axinella polypoides* (Porifera)
REFERENCE: 299

$C_{26}H_{44}O$



MOL. WT. 372
MELTING POINT: 85°C; 119–121°C; Acetate, 116–121°C
ORGANISM: *Hymeniacidon perleve* (Porifera)
REFERENCE: 119

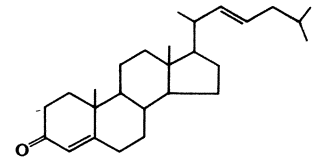
$C_{27}H_{40}O_4$



MOL. WT.: 428
MELTING POINT: 151–151.5°C
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Ptilosarcus gurneyi* (Gray) (Coelenterata)
REFERENCE: 420

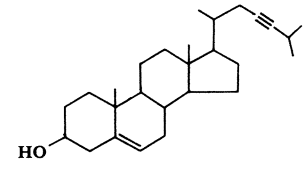
$C_{27}H_{42}O$

MOL. WT.: 382
SPECTRAL DATA: Mass Spec
ORGANISM: *Stelleta clarella* (Porifera)
REFERENCE: 381



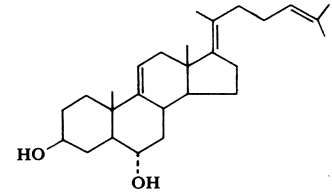
$C_{27}H_{42}O$

MOL. WT.: 382
MELTING POINT: 119–120°C; Acetate, 151–153°C
$[\alpha]_D$: −38.8
SPECTRAL DATA: IR, PMR, Mass Spec
ORGANISM: *Calyx nicaaensis* (Porifera)
REFERENCE: 400



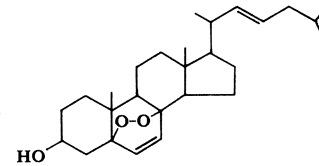
$C_{27}H_{42}O_2$

MOL. WT.: 398
MELTING POINT: 138–140°C
$[\alpha]_D$: +43.2 SOLVENT: Chf
SPECTRAL DATA: IR, PMR, Mass Spec
ORGANISM: *Acanthaster planci* Linn. (Echinodermata)
REFERENCE: 386



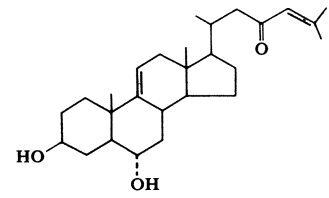
$C_{27}H_{42}O_3$

MOL. WT.: 414
MELTING POINT: 202–206°C; Acetate, 147–150°C
$[\alpha]_D$: −17.5 SOLVENT: Chf
SPECTRAL DATA: PMR, Mass Spec
ORGANISM: *Axinella cannabina* (Porifera)
REFERENCE: 130

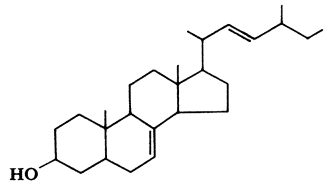


$C_{27}H_{42}O_3$

MOL. WT.: 414
ORGANISM: *Marthasterias glacialis* (Echinodermata)
REFERENCE: 394

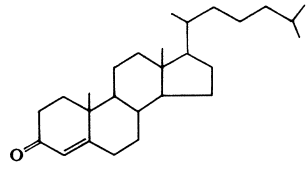


$C_{27}H_{44}O$ Amuresterol



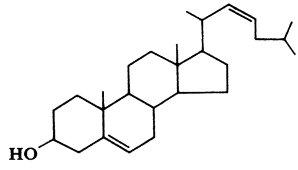
MOL. WT.: 384
MELTING POINT: 151–153°C; Acetate, 161–163°C
$[\alpha]_D$: +3
SPECTRAL DATA: IR, PMR, Mass Spec
ORGANISM: *Asterias amurensis* Lutkin (Echinodermata)
REFERENCE: 245

$C_{27}H_{44}O$



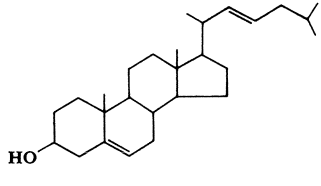
MOL. WT.: 384
SPECTRAL DATA: Mass Spec
ORGANISM: *Stelleta clarella* (Porifera)
REFERENCE: 381

$C_{27}H_{44}O$



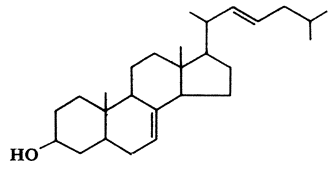
MOL. WT.: 384
MELTING POINT: 134–136°C; Acetate, 128–131°C; 4-Bromoacetate, 178–179°C
$[\alpha]_D$: −58.5 SOLVENT: Chf
SPECTRAL DATA: IR
ORGANISM: *Placopecten magellanicus* Gmelin (Mollusca), *Stelleta clarella*, *Tethya aurantia*, and *Lissodendoryx noxiosa* (Porifera)
REFERENCE: 381, 407, 456

$C_{27}H_{44}O$



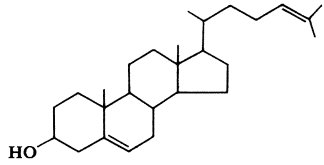
MOL. WT.: 384
MELTING POINT: Acetate, 129–130°C
$[\alpha]_D$: −19.2 SOLVENT: Chf
ORGANISM: *Stelleta clarella*, *Tethya aurantia*, and *Lissodendoryx noxiosa* (Porifera)
REFERENCE: 381

$C_{27}H_{44}O$



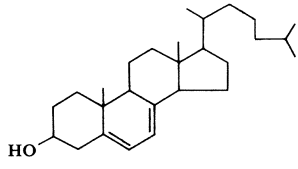
MOL. WT.: 384
MELTING POINT: 129–130.5°C; Acetate, 140–142.5°C
$[\alpha]_D$: −4.2 SOLVENT: Chf
SPECTRAL DATA: IR, Mass Spec
ORGANISM: *Asterias amurensis* Lutkin (Echinodermata)
REFERENCE: 247

$C_{27}H_{44}O$



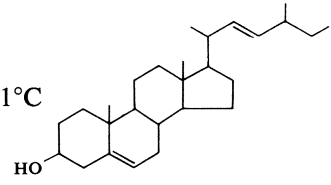
MOL. WT.: 384
MELTING POINT: 117°C; Acetate, 101.5°C; Benzoate, 129°C
$[\alpha]_D$: −38.7 SOLVENT: Chf
ORGANISM: *Balanus glandula* (Arthropoda/Crustacea)
REFERENCE: 124

$C_{27}H_{44}O$



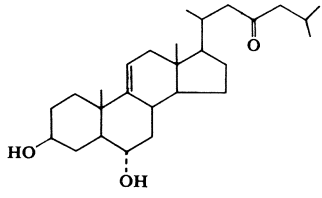
MOL. WT.: 384
MELTING POINT: Acetate, 176.5°C
ORGANISM: *Madrepora cervicornis* (Coelenterata)
REFERENCE: 42

$C_{27}H_{44}O$



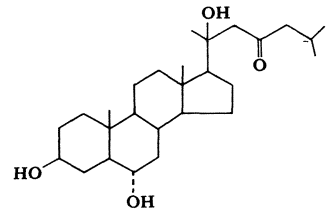
MOL. WT.: 384
MELTING POINT: 128.5–129.5°C; Acetate, 138–141°C
$[\alpha]_D$: −43
SPECTRAL DATA: IR, PMR, Mass Spec
ORGANISM: *Pseudopotamilla occelata* Moore (Annelida)
REFERENCE: 244

$C_{27}H_{44}O_3$



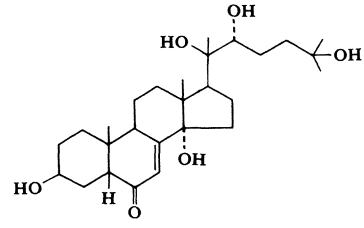
MOL. WT.: 416
MELTING POINT: 167–169°C
SPECTRAL DATA: IR, PMR, Mass Spec
ORGANISM: *Marthasterias glacialis* (Echinodermata)
REFERENCE: 394

$C_{27}H_{44}O_4$ Thornasterol A



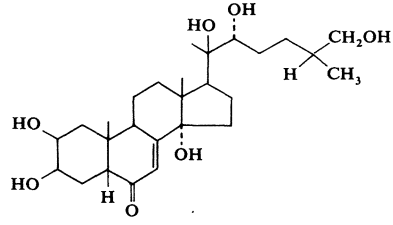
MOL. WT.: 432
MELTING POINT: Diacetate, 158–159°C
ORGANISM: *Acanthaster planci* Linn. (Echinodermata)
REFERENCE: 236

$C_{27}H_{44}O_6$ 2-Deoxycrustecdysone



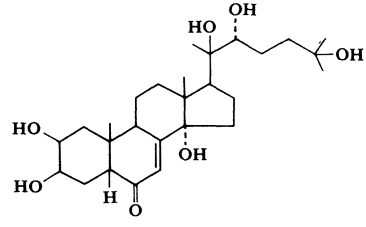
MOL. WT.: 464
SPECTRAL DATA: IR, PMR, Mass Spec
ORGANISM: *Jasus lalandei* (Chordata/Pisces)
REFERENCE: 156, 157

$C_{27}H_{44}O_7$ Callinecdysone A



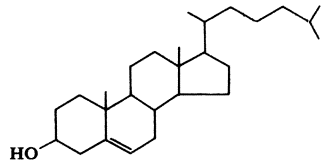
MOL. WT.: 480
ORGANISM: *Callinectes sapidus* (Arthropoda/Curstacea)
REFERENCE: 143

$C_{27}H_{44}O_7$ Crustecdysone



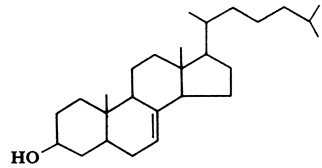
MOL. WT.: 480
MELTING POINT: 150–151°C
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Jasus lalandei* (Chordata/Pisces), *Polypodium vulgare* L. (Coelenterata), and *Callinectes sapidus* (Arthropoda/Crustacea)
REFERENCE: 143, 172, 187, 188, 206

$C_{27}H_{46}O$ Cholesterol



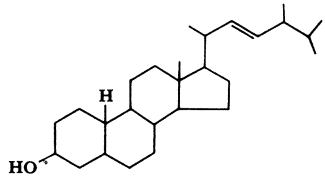
MOL. WT.: 386
MELTING POINT: 148°C; Acetate, 116°
$[\alpha]_D$: −40.2 SOLVENT: Chf
SPECTRAL DATA: Mass Spec
ORGANISM: *Balanus glandula*, *Chionoecetes opilio*, *Paralithodes* sp. (Arthropoda/Crustacea), *Zoanthus confertus* (Coelenterata), *Ctenodiseus crispatus* Retzius, *Asterina pectinifera*, *Asterias amurensis* Lutkin, *Distolasterias sticantha*, *Certonardoa semiregularis*, *Lysastrosoma anthostictha*, *Solaster paxillatas* (Echinodermata), *Muricea appressa*, *Plexaura* sp., *Eugorgia ampla* (Coelenterata), *Artemia salina* L. (Arthropoda/Crustaceae), *Meandra areolata* (Coelenterata), *Suberites compacta* (Porifera), *Pseudopotamilla occelata* Moore (Annelida), *Cliona celata*, *Hymeniacidon perleve* (Porifera), *Lytechinus variegatus* (Echinodermata), and *Axinella cannabina* (Porifera)
REFERENCE: 40, 42, 47, 64, 81, 119, 124, 166, 167, 168, 193, 246, 248, 253, 323, 456

$C_{27}H_{46}O$ Lathosterol



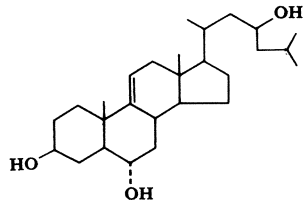
MOL. WT.: 386
MELTING POINT: 121–123°C; Acetate, 116–118°C; 153–155°C
$[\alpha]_D$: +4.3
ORGANISM: *Chiton tuberculatus* L. (Mollusca)
REFERENCE: 230

$C_{27}H_{46}O$



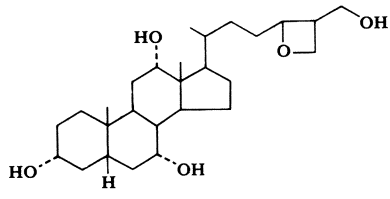
MOL. WT.: 386
MELTING POINT: Acetate, 112–113°C
ORGANISM: *Axinella polypoides* (Porifera)
REFERENCE: 299

$C_{27}H_{46}O_3$



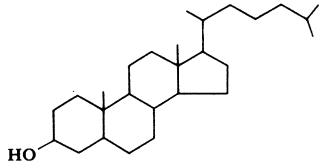
MOL. WT.: 418
MELTING POINT: 240–243°C
$[\alpha]_D$: +41.5 SOLVENT: EtOH
SPECTRAL DATA: Mass Spec
ORGANISM: *Asterias amurensis* Lutkin (Echinodermata)
REFERENCE: 197

$C_{27}H_{46}O_5$ Scymanol



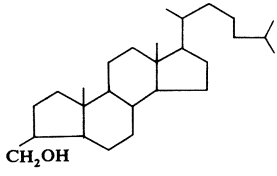
MOL. WT.: 450
MELTING POINT: 186–188°C; Tetra-acetate 145.5–147°C
ORGANISM: *Galeocerdo arcticus*, and *Scymnus borealis* (Chordata/Pisces)
REFERENCE: 44, 108

$C_{27}H_{48}O$ Cholestanol



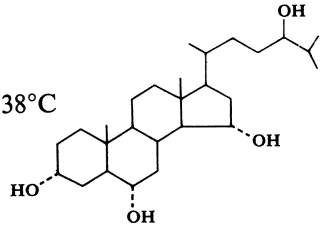
MOL. WT.: 388
MELTING POINT: 142°C
$[\alpha]_D$: +24 SOLVENT: Chf
SPECTRAL DATA: PMR, Mass Spec
ORGANISM: *Stelleta clarella*, *Tethya aurantia*, *Lissodendoryx noxiosa*, and *Haliclona* sp. (Porifera)
REFERENCE: 381

$C_{27}H_{48}O$



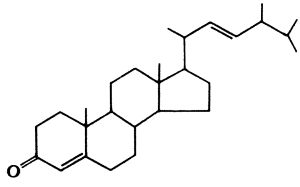
MOL. WT.: 388
MELTING POINT: Acetate, 64–65°C
ORGANISM: *Axinella verrucosa* (Porifera)
REFERENCE: 298

$C_{27}H_{48}O_4$



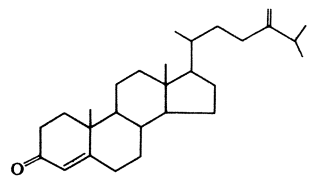
MOL. WT.: 436
MELTING POINT: 197–199.5°C; per Acetate, 137–138°C
$[\alpha]_D$: +45.7 SOLVENT: Me
SPECTRAL DATA: IR, PMR, Mass Spec
ORGANISM: *Asterias amurensis* Lutkin (Echinodermata)
REFERENCE: 211

$C_{28}H_{44}O$



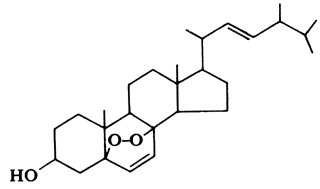
MOL. WT.: 396
SPECTRAL DATA: Mass Spec
ORGANISM: *Stelleta clarella* (Porifera)
REFERENCE: 381

$C_{28}H_{44}O$



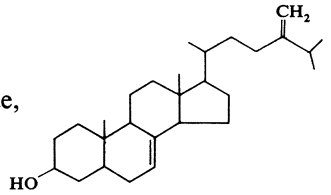
MOL. WT.: 396
MELTING POINT: 115°C
$[\alpha]_D$: +89.1 SOLVENT: Chf
SPECTRAL DATA: PMR, Mass Spec
ORGANISM: *Stelleta clarella* (Porifera)
REFERENCE: 381

$C_{28}H_{44}O_3$



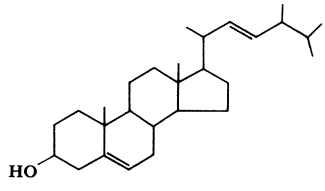
MOL. WT.: 428
MELTING POINT: 180–184°C; Acetate, 196–199°C
SPECTRAL DATA: IR, PMR, Mass Spec
ORGANISM: *Axinella cannabina* (Porifera)
REFERENCE: 130

$C_{28}H_{46}O$ Episterol



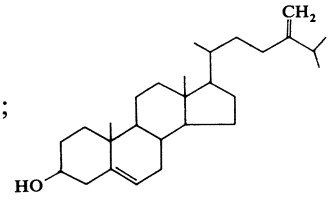
MOL. WT.: 398
MELTING POINT: 131°C; Acetate, 140°C; Benzoate, 160°C
$[\alpha]_D$: +6.0 SOLVENT: Chf
SPECTRAL DATA: IR, PMR
ORGANISM: *Pisaster ochraceus*, and *Asterias amurensis* Lutkin (Echinodermata)
REFERENCE: 43, 123, 254

$C_{28}H_{46}O$ Brassicasterol, Chondrillastanol, Poriferastanol



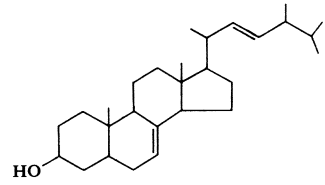
MOL. WT.: 398
MELTING POINT: 157–158°C; Acetate, 139–140°C; Benzoate, 111°C
$[\alpha]_D$: −39.4 SOLVENT: Chf
SPECTRAL DATA: Mass Spec
ORGANISM: *Stelleta clarella*, *Tethya aurantia*, *Lissodendoryx noxiosa*, *Haliclona permollis*, *Haliclona* sp., and *Chondrilla nucula* Schmidt (Porifera)
REFERENCE: 43, 381

$C_{28}H_{46}O$



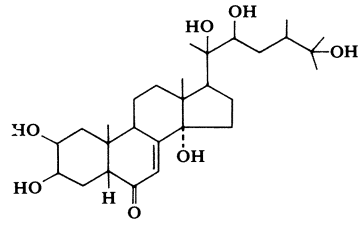
MOL. WT.: 398
MELTING POINT: 140–142°C; Acetate, 132–134°C; Benzoate, 148°C
$[\alpha]_D$: −3.95 SOLVENT: Chf
SPECTRAL DATA: IR, Mass Spec
ORGANISM: *Stelleta clarella*, *Tethya aurantia*, *Lissodendoryx noxiosa*, *Haliclona permollis*, *Haliclona* sp. (Porifera), *Palythoa* sp. (Coelenterata), *Saxidomus giganteus*, *Pecten caurinus*, *Cardium corbis*, *Modiolus demissus* (Mollusca)
REFERENCE: 125, 167, 192, 381

$C_{28}H_{46}O$ Stellasterol



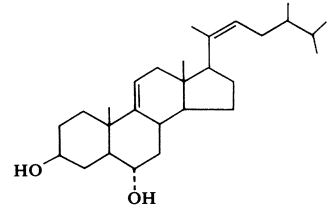
MOL. WT.: 398
MELTING POINT: 159–161°C; Acetate, 181–182°C
$[\alpha]_D$: +7.8 SOLVENT: Chf
ORGANISM: *Asterias amurensis* Lutkin (Echinodermata)
REFERENCE: 247

$C_{28}H_{46}O_2$ Callinecdysone B



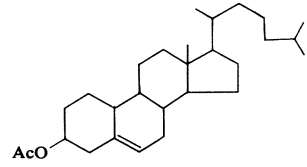
MOL. WT.: 494
ORGANISM: *Callinectes sapidus* (Arthropoda/Crustacea)
REFERENCE: 143

$C_{28}H_{46}O_2$



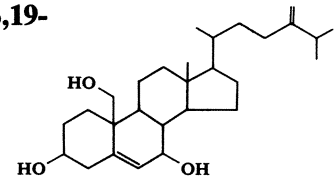
MOL. WT.: 414
ORGANISM: *Acanthaster planci* Linn. (Echinodermata)
REFERENCE: 386

$C_{28}H_{46}O_2$



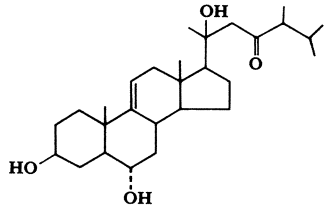
MOL. WT.: 414
SPECTRAL DATA: Mass Spec
ORGANISM: *Pseudoplexaura porosa* (Coelenterata)
REFERENCE: 342

$C_{28}H_{46}O_3$ 24-Methylenecholest-5-en-3β,7β,19-triol



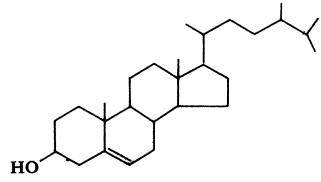
MOL. WT.: 430
MELTING POINT: 112–114°C
$[\alpha]_D$: +16 SOLVENT: Me
SPECTRAL DATA: IR, PMR, Mass Spec
ORGANISM: *Litophyton viridis* (Coelenterata)
REFERENCE: 50

$C_{28}H_{46}O_4$ Thornasterol B



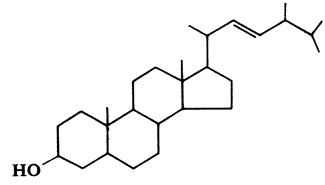
MOL. WT.: 446
MELTING POINT: Diacetate, 147–148°C
ORGANISM: *Acanthaster planci* Linn. (Echinodermata)
REFERENCE: 236

$C_{28}H_{48}O$ Campesterol



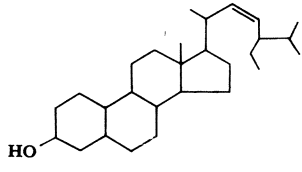
MOL. WT.: 400
MELTING POINT: 158°C; Acetate, 138°C; 3,5-Dinitrobenzoate, 203°C
$[\alpha]_D$: −33
SPECTRAL DATA: Mass Spec
ORGANISM: *Stelleta clarella*, and *Tethya aurantia* (Porifera)
REFERENCE: 144, 381

$C_{28}H_{48}O$ Neospongosterol



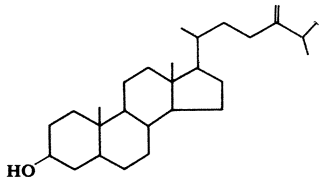
MOL. WT.: 400
MELTING POINT: 153°C; Acetate, 141–142°C; Benzoate, 146°C
$[\alpha]_D$: +10
ORGANISM: *Suberites compacta* (Porifera)
REFERENCE: 40

$C_{28}H_{48}O$



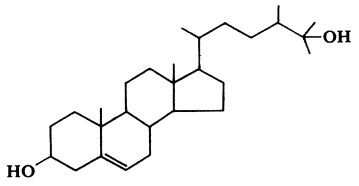
MOL. WT.: 400
MELTING POINT: Acetate, 116–117°C
ORGANISM: *Axinella polypoides* (Porifera)
REFERENCE: 299

$C_{28}H_{48}O$



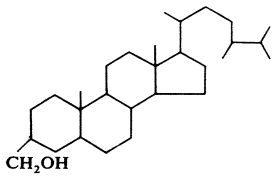
MOL. WT.: 400
MELTING POINT: 110–115°C; Acetate, 123–125°C
ORGANISM: *Hymeniacidon perleve* (Porifera)
REFERENCE: 119

$C_{28}H_{48}O_2$



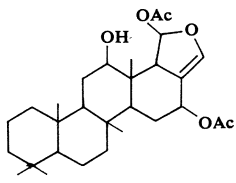
MOL. WT.: 416
MELTING POINT: 189.5–190.5°C; Acetate, 151–152°C
$[\alpha]_D$: −47.1
SPECTRAL DATA: IR, PMR, Mass Spec
ORGANISM: *Alcyonarian nephtea* (Coelenterata)
REFERENCE: 117

$C_{28}H_{50}O$



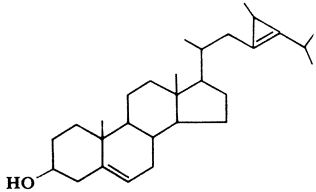
MOL. WT.: 402
MELTING POINT: Acetate, 84–86°C
SPECTRAL DATA: PMR, Mass Spec
ORGANISM: *Axinella verrucosa* (Porifera)
REFERENCE: 298

$C_{29}H_{44}O_6$ Heteronemin



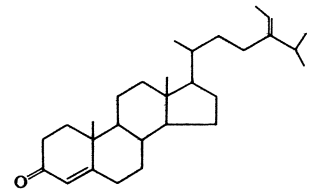
MOL. WT.: 488
MELTING POINT: 176.5–177°
SPECTRAL DATA: PMR, Mass Spec
ORGANISM: *Heteronema erecta* (Porifera)
REFERENCE: 224

$C_{29}H_{46}O$ Calysterol



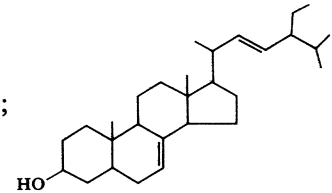
MOL. WT.: 410
MELTING POINT: 114–116°C; Acetate, 104–106°C
$[\alpha]_D$: −29.3
SPECTRAL DATA: IR, PMR, Mass Spec
ORGANISM: *Calyx nicaensis* (Porifera)
REFERENCE: 127

$C_{29}H_{46}O$



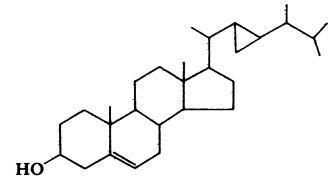
MOL. WT.: 410
MELTING POINT: 94–95°C
$[\alpha]_D$: +80 SOLVENT: Chf
SPECTRAL DATA: PMR, Mass Spec
ORGANISM: *Stelleta clarella* (Porifera)
REFERENCE: 381

$C_{29}H_{48}O$ Chondrillasterol



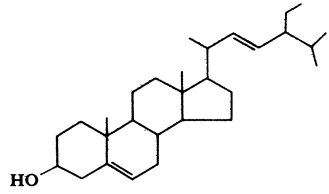
MOL. WT.: 412
MELTING POINT: 168–169°C; Acetate, 175–176°C; Benzoate, 194–195°C
$[\alpha]_D$: −1.1
ORGANISM: *Chondrilla nucula* Schmidt (Porifera)
REFERENCE: 43

$C_{29}H_{48}O$ 23-Demethyl-gorgosterol



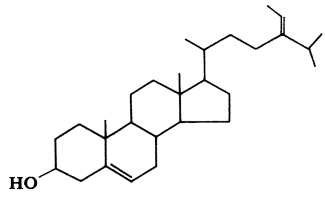
MOL. WT.: 412
MELTING POINT: 162–163°C
$[\alpha]_D$: −34.5
SPECTRAL DATA: PMR, Mass Spec
ORGANISM: *Gorgonia flabellum* L., and *Gorgonia ventibna* L. (Coelenterata)
REFERENCE: 118, 367

$C_{29}H_{48}O$



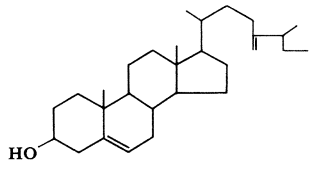
MOL. WT.: 412
SPECTRAL DATA: PMR, Mass Spec
ORGANISM: *Stelleta clarella*, *Tethya aurantia*, *Lissodendoryx noxiosa*, *Haliclona permollis*, and *Haliclona* sp. (Porifera)
REFERENCE: 381

$C_{29}H_{48}O$



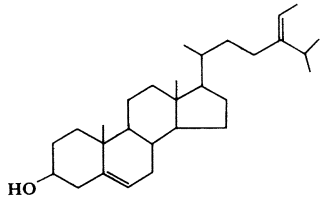
MOL. WT.: 412
MELTING POINT: 124°C
$[\alpha]_D$: −41.2 SOLVENT: Chf
SPECTRAL DATA: Mass Spec
ORGANISM: *Stelleta clarella, Tethya aurantia, Lissodendoryx noxiosa, Haliclona permollis,* and *Haliclona* sp. (Porifera)
REFERENCE: 381

$C_{29}H_{48}O$ 24,28-Didehydroaplysterol dsp-1



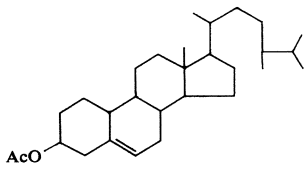
MOL. WT.: 412
MELTING POINT: 128–130°C; Acetate, 113–114°C
$[\alpha]_D$: −37 SOLVENT: Cte
SPECTRAL DATA: IR, PMR, Mass Spec
ORGANISM: *Aplysina* (or *Verongia*) *aerophoba* (Porifera)
REFERENCE: 110

$C_{29}H_{48}O$



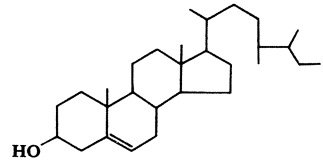
MOL. WT.: 412
MELTING POINT: 127–129°C
SPECTRAL DATA: Mass Spec
ORGANISM: *Stelleta clarella, Tethya aurantia, Lissodendoryx noxiosa, Haliclona permollis,* and *Haliclona* sp. (Porifera)
REFERENCE: 381

$C_{29}H_{48}O_2$



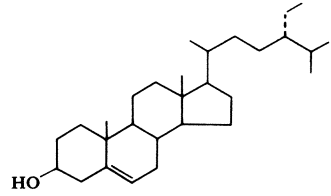
MOL. WT.: 428
SPECTRAL DATA: Mass Spec
ORGANISM: *Pseudoplexaura porosa* (Coelenterata)
REFERENCE: 342

$C_{29}H_{50}O$ Aplysterol



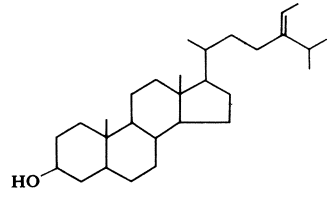
MOL. WT.: 414
MELTING POINT: 135–136°C; Acetate, 119–120°
$[\alpha]_D$: −25 SOLVENT: Chf
SPECTRAL DATA: PMR, Mass Spec
ORGANISM: *Aplysina* (or *Verongia*) *aerophoba* (Porifera)
REFERENCE: 110

$C_{29}H_{50}O$ β-Sitosterol



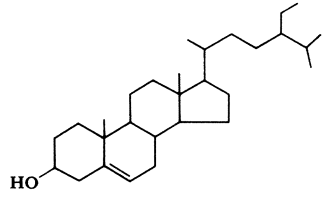
MOL. WT.: 414
MELTING POINT: 132°C
$[\alpha]_D$: −38.7
ORGANISM: *Verongia fistularis* (Porifera)
REFERENCE: 374, 377

$C_{29}H_{50}O$



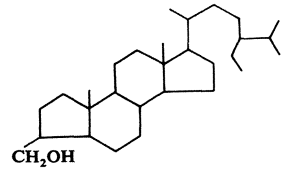
MOL. WT.: 414
ORGANISM: *Periphylla periphylla* (Coelenterata)
REFERENCE: 28

$C_{29}H_{50}O$ Clionasterol



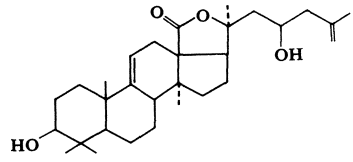
MOL. WT.: 414
MELTING POINT: 136°C; Propionate, 114–115°C; Acetate, 140–141°C; 3,5-Dinitrobenzoate, 202°C
$[\alpha]_D$: −34
SPECTRAL DATA: PMR, Mass Spec
ORGANISM: *Stelleta clarella*, *Lissodendoryx noxiosa* (Porifera), and *Xiphogergia* sp. (Coelenterata)
REFERENCE: 42, 153, 381

$C_{29}H_{52}O$



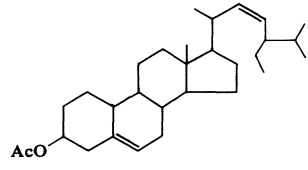
MOL. WT.: 416
MELTING POINT: Acetate, 86–88°C
ORGANISM: *Axinella verrucosa* (Porifera)
REFERENCE: 298

$C_{30}H_{46}O_4$



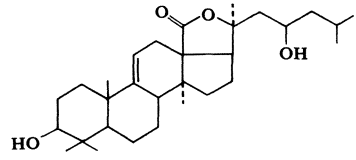
MOL. WT.: 470
MELTING POINT: 202–203°C
$[\alpha]_D$: +10.5 SOLVENT: Chf
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Thelonota ananas* Jaeger (Echinodermata)
REFERENCE: 225

$C_{30}H_{48}O_2$



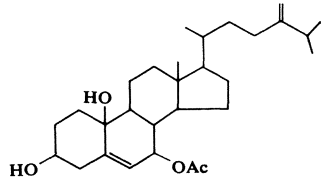
MOL. WT.: 440
ORGANISM: *Pseudoplexaura porosa* (Coelenterata)
REFERENCE: 342

$C_{30}H_{48}O_4$



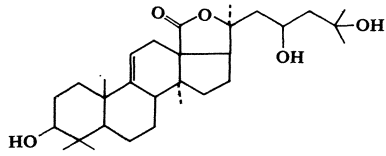
MOL. WT.: 472
MELTING POINT: 229–232°C
$[\alpha]_D$: +6.2 SOLVENT: Chf
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Thelonota ananas* Jaeger (Echinodermata)
REFERENCE: 225

$C_{30}H_{48}O_4$



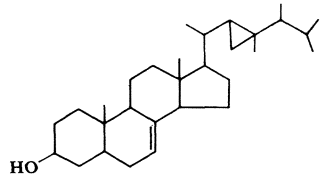
MOL. WT.: 472
MELTING POINT: Amorphous
$[\alpha]_D$: +53 SOLVENT: Me
SPECTRAL DATA: IR, PMR, Mass Spec
ORGANISM: *Litophyton viridis* (Coelenterata)
REFERENCE: 50

$C_{30}H_{48}O_5$



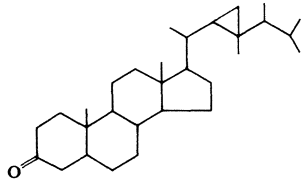
MOL. WT.: 488
MELTING POINT: 227–228°C
$[\alpha]_D$: −1.3 SOLVENT: Chf
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Thelonota ananas* Jaeger (Echinodermata)
REFERENCE: 225

$C_{30}H_{50}O$ Acanthasterol



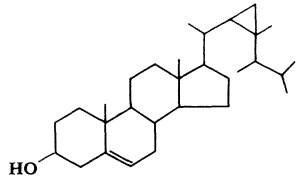
MOL. WT.: 426
MELTING POINT: 179–180°C; *p*-Bromobenzoate, 230–232°C; *p*-Iodobenzoate, 219–221°C
$[\alpha]_D$: +5 SOLVENT: Chf
SPECTRAL DATA: IR, PMR, Mass Spec
ORGANISM: *Acanthaster planci* Linn. (Echinodermata)
REFERENCE: 168, 384, 385

$C_{30}H_{50}O$ Gorgastanone



MOL. WT.: 426
MELTING POINT: 203–206°C
SPECTRAL DATA: Mass Spec
REFERENCE: 171

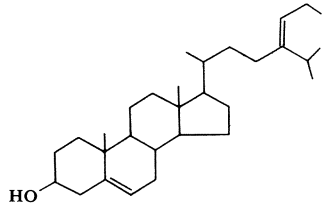
$C_{30}H_{50}O$ Gorgosterol



MOL. WT.: 426
MELTING POINT: 186.5–188°C; Dihydro, 188.5–192°C; 3β-Bromo, 159–160°C
$[\alpha]_D$: −45
SPECTRAL DATA: PMR, Mass Spec
ORGANISM: *Palythoa tuberculara* (Coelenterata)
REFERENCE: 167, 171, 280

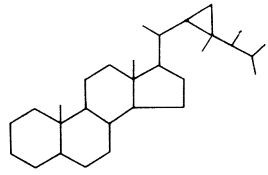
$C_{30}H_{50}O$

MOL. WT.: 426
SPECTRAL DATA: Mass Spec
ORGANISM: *Tethya aurantia* (Porifera)
REFERENCE: 381



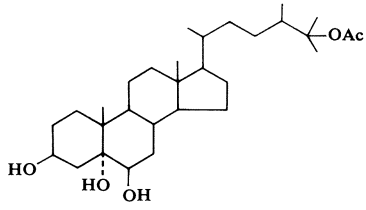
$C_{30}H_{52}$ Gorgostane

MOL. WT.: 412
MELTING POINT: 142–144°C
SPECTRAL DATA: Mass Spec
REFERENCE: 171



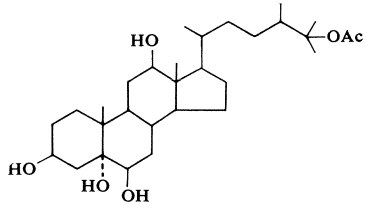
$C_{30}H_{52}O_5$

MOL. WT.: 492
MELTING POINT: 233–236°C
$[\alpha]_D$: −11 SOLVENT: Alc
SPECTRAL DATA: IR, PMR, Mass Spec
ORGANISM: *Sarcophyton elegans* Moser (Coelenterata)
REFERENCE: 303



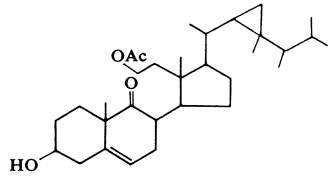
$C_{30}H_{52}O_6$

MOL. WT.: 508
MELTING POINT: 248–255°C (dec.)
$[\alpha]_D$: −9.4 SOLVENT: Me
SPECTRAL DATA: PMR, Mass Spec
ORGANISM: *Sarcophyton elegans* Moser (Coelenterata)
REFERENCE: 302

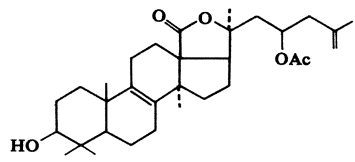


$C_{31}H_{52}O_4$

MOL. WT.: 488
ORGANISM: *Pseudopterogorgia americana* Gmelin (Coelenterata)
REFERENCE: 118

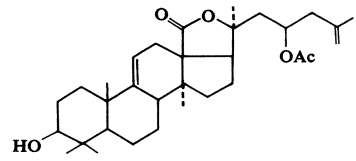


$C_{32}H_{48}O_5$



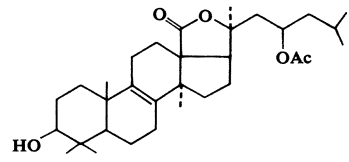
MOL. WT.: 512
MELTING POINT: 196–198°C
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Thelonota ananas* Jaeger (Echinodermata)
REFERENCE: 226

$C_{32}H_{48}O_5$



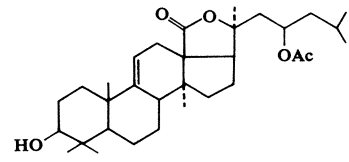
MOL. WT.: 512
MELTING POINT: 225–227°C
$[\alpha]_D$: −4 SOLVENT: Chf
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Thelonota ananas* Jaeger (Echinodermata)
REFERENCE: 225

$C_{32}H_{50}O_5$



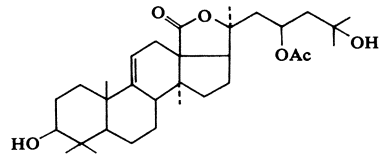
MOL. WT.: 514
MELTING POINT: 198–201°C
$[\alpha]_D$: +13.8 SOLVENT: Me
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Thelonota ananas* Jaeger (Echinodermata)
REFERENCE: 226

$C_{32}H_{50}O_5$



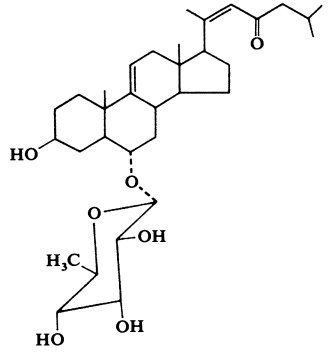
MOL. WT.: 514
MELTING POINT: 221–222°C
$[\alpha]_D$: −18 SOLVENT: Chf
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Thelonota ananas* Jaeger (Echinodermata)
REFERENCE: 225

$C_{32}H_{50}O_6$



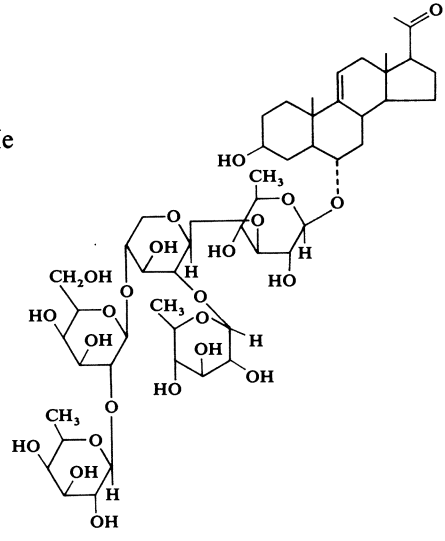
MOL. WT.: 530
MELTING POINT: 203–205°C
$[\alpha]_D$: −10 SOLVENT: Chf
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Thelonota ananas* Jaeger (Echinodermata)
REFERENCE: 225

$C_{33}H_{44}O_7$



MOL. WT.: 551
MELTING POINT: 127–130°C; Tetraacetate, 222–224°C
$[\alpha]_D$: −9.0 SOLVENT: Chf
SPECTRAL DATA: Mass Spec
ORGANISM: *Acanthaster planci* Linn. (Echinodermata)
REFERENCE: 382

$C_{50}H_{80}O_{24}$ dsp-1

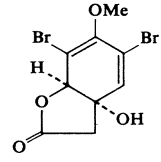


MOL. WT.: 1064
MELTING POINT: 264–265°C
$[\alpha]_D$: +22 SOLVENT: Aq Me
SPECTRAL DATA: IR
ORGANISM: *Acanthaster planci* Linn. (Echinodermata)
REFERENCE: 235

Chapter 11

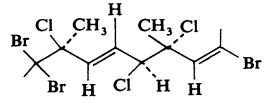
Terpenoids

$C_9H_8Br_2O_4$ Aeroplysinin-2



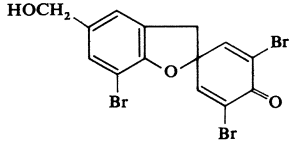
MOL. WT.: 340
MELTING POINT: 127–128°C
$[\alpha]_D$: +22 SOLVENT: MeOH
SPECTRAL DATA: UV, IR, PMR
ORGANISM: *Aplysina* (or *Verongia*) *aerophoba*, and *Ianthella* sp. (Porifera)
REFERENCE: 300

$C_{10}H_{12}Br_3Cl_3$



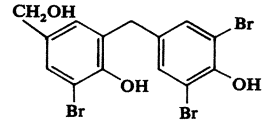
MOL. WT.: 478
MELTING POINT: 54°C
$[\alpha]_D$: −50.2
SPECTRAL DATA: PMR, Mass Spec
ORGANISM: *Aplysia californica* (Mollusca)
REFERENCE: 141

$C_{14}H_9Br_3O_3$ Thelepin



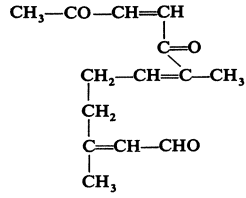
MOL. WT.: 465
MELTING POINT: 202–203°C (dec.); Acetate, 190°C
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Thelepus setosus* (Annelida)
REFERENCE: 179, 180

$C_{14}H_{11}Br_3O_3$ Thelephenol



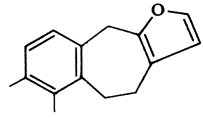
MOL. WT.: 467
MELTING POINT: 183–184°C
ORGANISM: *Thelepus setosus* (Annelida)
REFERENCE: 179, 180

$C_{14}H_{18}O_3$ Gyrinal



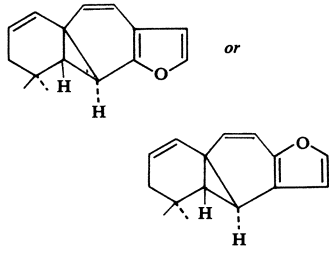
MOL. WT.: 234
SPECTRAL DATA: UV, PMR, Mass Spec
ORGANISM: *Gyrinidae* (Arthropoda/Insecta)
REFERENCE: 362

$C_{15}H_{16}O$ Pallescensin E



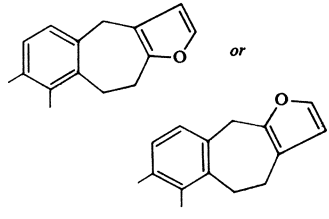
MOL. WT.: 212
MELTING POINT: oil
SPECTRAL DATA: UV, PMR, Mass Spec
ORGANISM: *Disidea pallescens* (Porifera)
REFERENCE: 86

$C_{15}H_{16}O$ Spiniferin-1



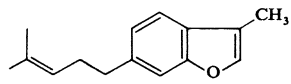
MOL. WT.: 212
MELTING POINT: Oil
$[\alpha]_D$: −4.2
SPECTRAL DATA: UV, PMR, Mass Spec
ORGANISM: *Pleraplysilla spinifera* (Porifera)
REFERENCE: 98

$C_{15}H_{16}O$ Spiniferin-2



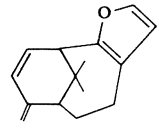
MOL. WT.: 212
MELTING POINT: Oil
$[\alpha]_D$: 0
SPECTRAL DATA: UV, PMR, Mass Spec
ORGANISM: *Pleraplysilla spinifera* (Porifera)
REFERENCE: 98

$C_{15}H_{18}O$ Furvoventalene



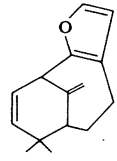
MOL. WT.: 214
MELTING POINT: Liquid
SPECTRAL DATA: UV, PMR, Mass Spec
ORGANISM: *Gorgonia ventalina* (Coelenterata)
REFERENCE: 433

$C_{15}H_{18}O$ Pallescensin C



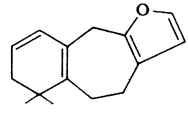
MOL. WT.: 214
MELTING POINT: Oil
$[\alpha]_D$: +424
SPECTRAL DATA: UV, IR, Mass Spec
ORGANISM: *Disidea pallescens* (Porifera)
REFERENCE: 85

$C_{15}H_{18}O$ Pallescensin D



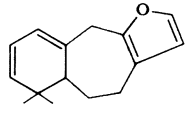
MOL. WT.: 214
MELTING POINT: Oil
$[\alpha]_D$: −45.3
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Disidea pallescens* (Porifera)
REFERENCE: 85

$C_{15}H_{18}O$ Pallescensin F



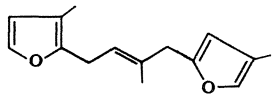
MOL. WT.: 214
MELTING POINT: Oil
SPECTRAL DATA: UV, PMR, Mass Spec
ORGANISM: *Disidea pallescens* (Porifera)
REFERENCE: 86

$C_{15}H_{18}O$ Pallescensin G



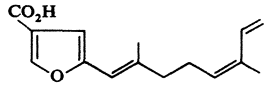
MOL. WT.: 214
MELTING POINT: Oil
$[\alpha_D]$: −289
SPECTRAL DATA: UV, PMR, Mass Spec
ORGANISM: *Disidea pallescens* (Porifera)
REFERENCE: 86

$C_{15}H_{18}O_2$ Longifolin



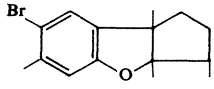
MOL. WT.: 230
ORGANISM: *Pleraplysilla spinifera* (Porifera)
REFERENCE: 98

$C_{15}H_{18}O_3$



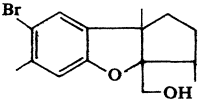
MOL. WT.: 246
MELTING POINT: 99–100°C
$[\alpha]_D$: 0
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Sinularia gonatodes* (Coelenterata)
REFERENCE: 102

$C_{15}H_{19}BrO$ Aplysin



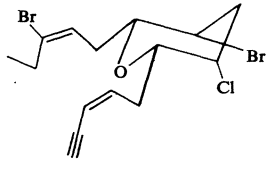
MOL. WT.: 295
MELTING POINT: 85–86°C
$[\alpha]_D$: −85.4
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Aplysia kurodai* (Mollusca)
REFERENCE: 453

$C_{15}H_{19}BrO_2$ Aplysinol



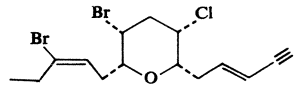
MOL. WT.: 311
MELTING POINT: 158–160°C
$[\alpha]_D$: −55.6
SPECTAL DATA: UV, IR, PMR,
ORGANISM: *Aplysia kurodai* (Mollusca)
REFERENCE: 453

$C_{15}H_{19}Br_2ClO$ Dactylene



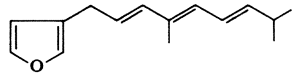
MOL. WT.: 411
MELTING POINT: 62–63°C
$[\alpha]_D$: −36 SOLVENT: Chf
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Aplysia dactylomela* (Mollusca)
REFERENCE: 291

$C_{15}H_{19}Br_2ClO$ Isodactylyne



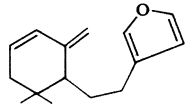
MOL. WT.: 412
MELTING POINT: Oil
$[\alpha]_D$: −8.06 SOLVENT: Chf
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Aplysia dactylomela* (Mollusca)
REFERENCE: 421

$C_{15}H_{20}O$ Dehydrodendrolasin



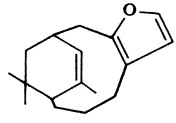
MOL. WT.: 216
MELTING POINT: Oil
$[\alpha]_D$: 0
SPECTRAL DATA: UV, PMR, Mass Spec
ORGANISM: *Pleraplysilla spinifera* (Porifera)
REFERENCE: 99

$C_{15}H_{20}O$ Pallescensin-2



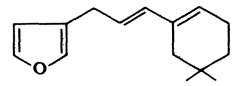
MOL. WT.: 216
MELTING POINT: Oil
$[\alpha]_D$: +39.5
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Disidea pallescens* (Porifera)
REFERENCE: 87

$C_{15}H_{20}O$ Pallescensin B



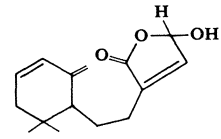
MOL. WT.: 216
MELTING POINT: Oil
$[\alpha]_D$: +62.6
SPECTRAL DATA: UV, PMR, Mass Spec
ORGANISM: *Disidea pallescens* (Porifera)
REFERENCE: 85

$C_{15}H_{20}O$ Pleraplysillin



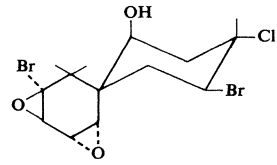
MOL. WT.: 216
MELTING POINT: Oil
$[\alpha]_D$: 0
SPECTRAL DATA: UV, PMR, Mass Spec
ORGANISM: *Pleraplysilla spinifera* (Porifera)
REFERENCE: 99

$C_{15}H_{20}O_3$ Pallescensin-3



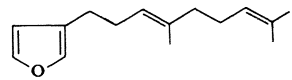
MOL. WT.: 248
MELTING POINT: Oil
SPECTRAL DATA: UV, IR, PMR
ORGANISM: *Disidea pallescens* (Porifera)
REFERENCE: 87

$C_{15}H_{21}Br_2ClO_3$ Prepacifenol



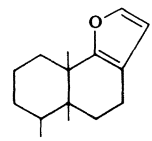
MOL. WT.: 445
MELTING POINT: 98–99°C; *p*-Bromobenzoate, 297–298.5°C
SPECTRAL DATA: IR, PMR, Mass Spec
ORGANISM: *Aplysia californica* (Mollusca)
REFERENCE: 142

$C_{15}H_{22}O$ Dendrolasin



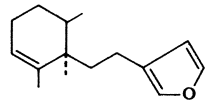
MOL. WT.: 218
MELTING POINT: Oil
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Oligoceras hemorrhages* (Spongida)
REFERENCE: 422

$C_{15}H_{22}O$ Microcionin-1



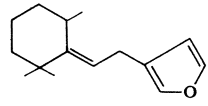
MOL. WT.: 218
MELTING POINT: Oil
$[\alpha]_D$: +7
SPECTRAL DATA: UV, PMR, Mass Spec
ORGANISM: *Microciona toxystila* (Porifera)
REFERENCE: 84

$C_{15}H_{22}O$ Microcionin-2



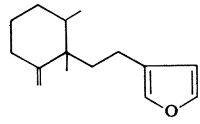
MOL. WT.: 218
MELTING POINT: Oil
$[\alpha]_D$: −58.3
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Microciona toxystila* (Porifera)
REFERENCE: 84

$C_{15}H_{22}O$ Microcionin-3



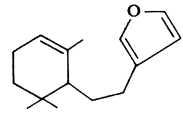
MOL. WT.: 218
MELTING POINT: Oil
$[\alpha]_D$: +36.5
SPECTRAL DATA: UV, PMR, Mass Spec
ORGANISM: *Microciona toxystila* (Porifera)
REFERENCE: 84

$C_{15}H_{22}O$ Microcionin-4



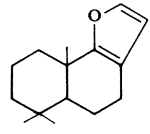
MOL. WT.: 218
MELTING POINT: Oil
$[\alpha]_D$: +98.3
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Microciona toxystila* (Porifera)
REFERENCE: 84

$C_{15}H_{22}O$ Pallescensin-1



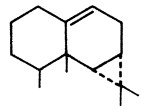
MOL. WT.: 218
MELTING POINT: Oil
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Disidea pallescens* (Porifera)
REFERENCE: 87

$C_{15}H_{22}O$ Pallescensin A



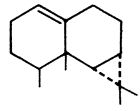
MOL.WT.: 218
MELTING POINT: Oil
SPECTRAL DATA: UV, PMR, Mass Spec
ORGANISM: *Disidea pallescens* (Porifera)
REFERENCE: 85

$C_{15}H_{24}$ 9-Aristolene



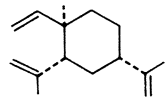
MOL. WT.: 204
$[\alpha]_D$: +80.9
SPECTRAL DATA: PMR, Mass Spec
ORGANISM: *Pseudopterogorgia americana* Gmelin (Coelenterata)
REFERENCE: 434

$C_{15}H_{24}$ 1(10)-Aristolene



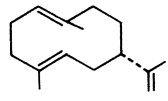
MOL. WT.: 204
$[\alpha]_D$: −78.5
SPECTRAL DATA: PMR, Mass Spec
ORGANISM: *Pseudopterogorgia americana* Gmelin (Coelenterata)
REFERENCE: 434

$C_{15}H_{24}$ (+)-β-Elemene



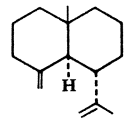
MOL. WT.: 204
$[\alpha]_D$: +15.1
SPECTRAL DATA: Mass Spec
ORGANISM: *Eunicea mammosa* Lamouroux (Coelenterata)
REFERENCE: 435

$C_{15}H_{24}$ (−)-Germacrene-A



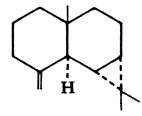
MOL. WT.: 204
$[\alpha]_D$: −3.2
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Eunicea mammosa* Lamouroux (Coelenterata)
REFERENCE: 435

$C_{15}H_{24}$ β-Gorgonene



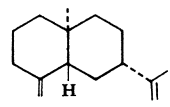
MOL. WT.: 204
MELTING POINT: $AgNO_3$ complex, 132.5–133.5°C
$[\alpha]_D$: +13.9
SPECTRAL DATA: IR, PMR, Mass Spec
ORGANISM: *Pseudopterogorgia americana* Gmelin (Coelenterata)
REFERENCE: 434

$C_{15}H_{24}$ (+)-γ-Maaliene



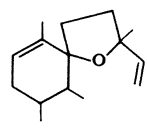
MOL. WT.: 204
MELTING POINT: Diol, 141–142°C
$[\alpha]_D$: +10.9 SOLVENT: He
SPECTRAL DATA: PMR, Mass Spec
ORGANISM: *Pseudopterogorgia americana* Gmelin (Coelenterata)
REFERENCE: 434

$C_{15}H_{24}$ (−)-β-Selinene



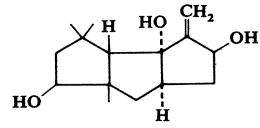
MOL. WT.: 204
ORGANISM: *Eunicea mammosa* Lamouroux (Coelenterata)
REFERENCE: 435

$C_{15}H_{24}O_2$ Dactyloxene B



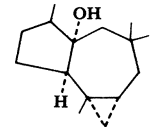
MOL. WT.: 236
MELTING POINT: Oil
$[\alpha]_D$: +106 SOLVENT: Chf
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Aplysia dactylomela* (Mollusca)
REFERENCE: 366

$C_{15}H_{24}O_3$ $\Delta^{9(12)}$-Capnellene-3β,8β,10α-triol



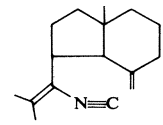
MOL. WT.: 252
MELTING POINT: 114–117°C; Diacetate, 91°C
$[\alpha]_D$: +2 SOLVENT: Chf
SPECTRAL DATA: IR, PMR, Mass Spec
ORGANISM: *Capnella imbricata* (Coelenterata)
REFERENCE: 210

$C_{15}H_{26}O$ Africanol



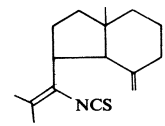
MOL. WT.: 222
MELTING POINT: 58–60°C
$[\alpha]_D$: +59.5 SOLVENT: Chf
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Lemnalia africana* (Coelenterata)
REFERENCE: 412

$C_{16}H_{23}N$ Axisonitrile-4



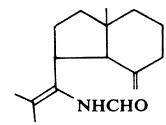
MOL. WT.: 229
MELTING POINT: 56–58°C
$[\alpha]_D$: 51.4 SOLVENT: Chf
SPECTRAL DATA: IR, PMR, Mass Spec
ORGANISM: *Axinella cannabina* (Porifera)
REFERENCE: 195

$C_{16}H_{23}NS$ Axisothiocyanate-4



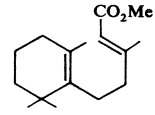
MOL. WT.: 261
$[\alpha]_D$: 35.9 SOLVENT: Chf
SPECTRAL DATA: IR, PMR, Mass Spec
ORGANISM: *Axinella cannabina* (Porifera)
REFERENCE: 195

$C_{16}H_{25}NO$ Axamide-4



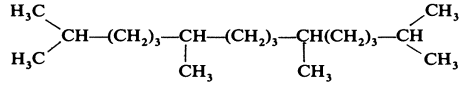
MOL. WT.: 247
MELTING POINT: 81–84°C
$[\alpha]_D$: +63.3
SPECTRAL DATA: IR, PMR, Mass Spec
ORGANISM: *Axinella cannabina* (Porifera)
REFERENCE: 195

$C_{16}H_{26}O_2$ Methyl *trans*-monocyclofarnesate



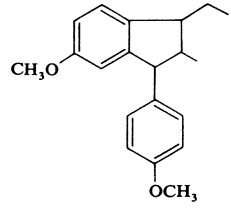
MOL. WT.: 250
MELTING POINT: Oil (Acid 113–111°C)
SPECTRAL DATA: IR, PMR, Mass Spec
ORGANISM: *Halichondria panicea* (Porifera)
REFERENCE: 91

$C_{19}H_{40}$ Pristane



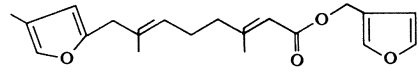
MOL. WT.: 268
MELTING POINT: Oil
REFERENCE: 25

$C_{20}H_{24}O_2$ Metanethole



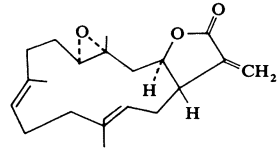
MOL. WT.: 296
MELTING POINT: 135°C
ORGANISM: *Spheciospongia vesparia* (Porifera)
REFERENCE: 41

$C_{20}H_{24}O_4$ Pleraplysillin-2



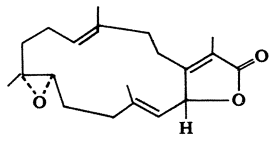
MOL. WT.: 328
MELTING POINT: Oil
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Pleraplysilla spinifera* (Porifera)
REFERENCE: 90

$C_{20}H_{28}O_3$ Lobophytolide



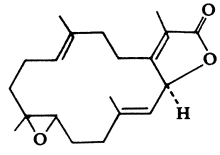
MOL. WT.: 316
MELTING POINT: 137–138°C
$[\alpha]_D$: +7 SOLVENT: Chf
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Lobophytum cristagalli* von Marenzeller (Coelenterata)
REFERENCE: 413

$C_{20}H_{28}O_3$ Sarcophine



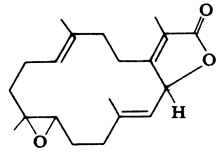
MOL. WT.: 316
MELTING POINT: 133–134°C
$[\alpha]_D$: +92 SOLVENT: Chf
SPECTRAL DATA: IR, PMR, Mass Spec
ORGANISM: *Sarcophytum glaucum* (Coelenterata)
REFERENCE: 46, 312

$C_{20}H_{28}O_3$



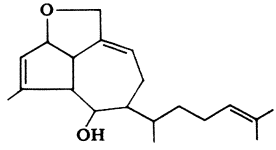
MOL. WT.: 316
MELTING POINT: 70°C
$[\alpha]_D$: −16 SOLVENT: MeOH
ORGANISM: *Sarcophytum glaucum* (Coelenterata)
REFERENCE: 215

$C_{20}H_{28}O_3$



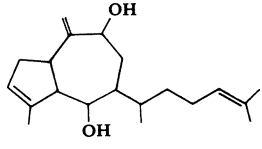
MOL. WT.: 316
MELTING POINT: Oil
SPECTRAL DATA: IR, PMR, Mass Spec
ORGANISM: *Sarcophytum glaucum* (Coelenterata)
REFERENCE: 215

$C_{20}H_{30}O_2$ Dictyol A



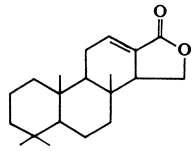
MOL. WT.: 302
MELTING POINT: 84–86°C
$[\alpha]_D$: +79.6 SOLVENT: Chf
SPECTRAL DATA: PMR, Mass Spec
ORGANISM: *Aplysia depilans* (Mollusca)
REFERENCE: 295

$C_{20}H_{30}O_2$ Dictyol B



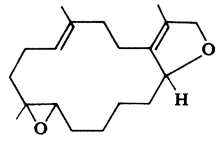
MOL. WT.: 302
MELTING POINT: 112–115°C
$[\alpha]_D$: +76 SOLVENT: Chf
SPECTRAL DATA: PMR, Mass Spec
ORGANISM: *Aplysia depilans* (Mollusca)
REFERENCE: 295

$C_{20}H_{30}O_2$ Isoagatholactone



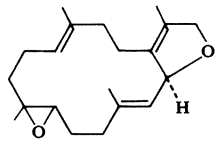
MOL. WT.: 302
MELTING POINT: 153–155°C
$[\alpha]_D$: +6.3
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Spongia officinalis obliqua* (Porifera)
REFERENCE: 82

$C_{20}H_{30}O_2$



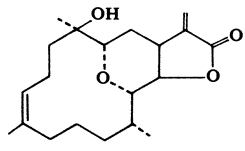
MOL. WT.: 302
MELTING POINT: Oil
$[\alpha]_D$: +40 SOLVENT: Me
SPECTRAL DATA: IR, PMR, Mass Spec
ORGANISM: *Sarcophytum glaucum* (Coelenterata)
REFERENCE: 215

$C_{20}H_{30}O_2$



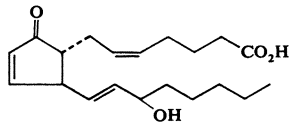
MOL. WT.: 302
MELTING POINT: Oil
SPECTRAL DATA: IR, Mass Spec
ORGANISM: *Sarcophytum glaucum* (Coelenterata)
REFERENCE: 215

$C_{20}H_{39}O_4$ Eunicin



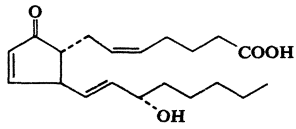
MOL. WT.: 334
BIOACTIVITY: Antibacterial
MELTING POINT: 155°C; Iodoacetate, 149–150°C
$[\alpha]_D$: −89
SPECTRAL DATA: IR
ORGANISM: *Eunicea mammosa* Lamouroux (Coelenterata)
REFERENCE: 189, 431

$C_{20}H_{30}O_4$ (15R)-15-Hydroxy-9-oxo-5-*cis*-10,13-*trans*-prostatrienoic acid



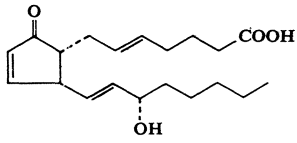
MOL. WT.: 334
ORGANISM: *Plexaura homomalla* (Coelenterata)
REFERENCE: 432

$C_{20}H_{30}O_4$ (15S)-15-Hydroxy-9-oxo-*cis*-10,13-*trans*-prostatrienoic acid



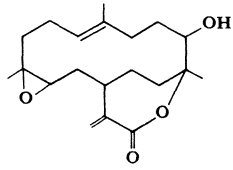
MOL. WT.: 334
ORGANISM: *Plexaura homomalla* (Coelenterata)
REFERENCE: 369

$C_{20}H_{30}O_4$ (15S)-15-Hydroxy-9-oxo-5-*trans*-10,13-*trans*-prostatrienoic acid



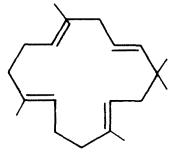
MOL. WT.: 334
MELTING POINT: Oil
$[\alpha]_D$: +128 SOLVENT: Chf
SPECTRAL DATA: UV
ORGANISM: *Plexaura homomalla* (Coelenterata)
REFERENCE: 56

$C_{20}H_{30}O_4$ Sinulariolide



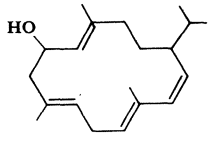
MOL. WT.: 334
MELTING POINT: 170–173°C
$[\alpha]_D$: +76 SOLVENT: Me
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Sinularia flexibilis* (Coelenterata)
REFERENCE: 414

$C_{20}H_{32}$ Flexibilene



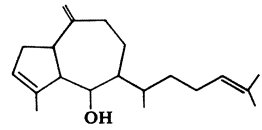
MOL. WT.: 272
MELTING POINT: Oil
$[\alpha]_D$: 0
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Sinularia flexibilis* (Coelenterata)
REFERENCE: 178

$C_{20}H_{32}O$ 6-Isopropyl-3,9,13-trimethylcyclotetradec-2,7,9,12-tetraene-1-ol



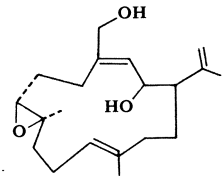
MOL. WT.: 288
MELTING POINT: 143–145°C
SPECTRAL DATA: Mass Spec
ORGANISM: *Sarcophytum glaucum* (Coelenterata)
REFERENCE: 215

$C_{20}H_{32}O$ Pachydictyol A



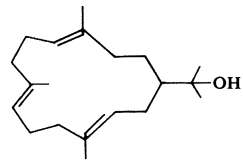
MOL. WT.: 288
MELTING POINT: Oil
$[\alpha]_D$: +104
SPECTRAL DATA: Mass Spec
ORGANISM: *Aplysia depilans* (Mollusca)
REFERENCE: 295

$C_{20}H_{32}O_3$ Asperdiol



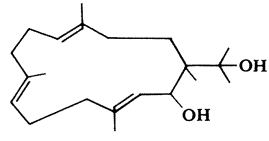
MOL. WT.: 320
MELTING POINT: 109–110°C
$[\alpha]_D$: −87 SOLVENT: Chf
SPECTRAL DATA: IR, PMR, Mass Spec
ORGANISM: *Eunicea asperula, Eunicea tourneforti* (Coelenterata)
REFERENCE: 429

$C_{20}H_{34}O$ Nephthenol



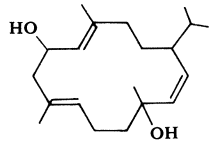
MOL. WT.: 290
MELTING POINT: Oil
SPECTRAL DATA: IR, PMR, Mass Spec
ORGANISM: *Nephthea* sp. (Coelenterata)
REFERENCE: 368

$C_{20}H_{34}O_2$ 2-Hydroxynephthenol



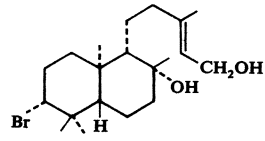
MOL. WT.: 306
MELTING POINT: 98–99°C
$[\alpha]_D$: −104 SOLVENT: Chf
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Litophyton viridis* (Coelenterata)
REFERENCE: 411

$C_{20}H_{34}O_2$ 6-Isopropyl-3,9,13-trimethylcyclotetradec-2,7,12-triene-1,9-diol



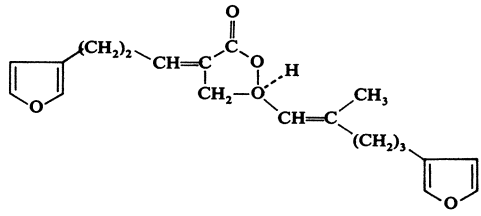
MOL. WT.: 306
MELTING POINT: Oil
SPECTRAL DATA: IR, PMR
ORGANISM: *Sarcophytum glaucum* (Coelenterata)
REFERENCE: 215

$C_{20}H_{35}BrO_2$ Aplysin-20



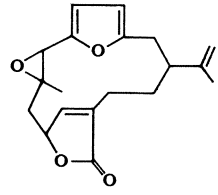
MOL. WT.: 387
MELTING POINT: 146–147°C; Acetate, 59–62°C
$[\alpha]_D$: −78.1 SOLVENT: MeOH
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Aplysia kurodai* (Mollusca)
REFERENCE: 289, 452

$C_{21}H_{24}O_4$ Nitenin



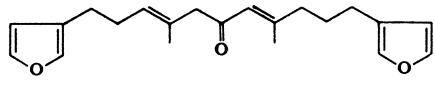
MOL. WT.: 340
MELTING POINT: Oil; Niteninic Acid, 89–95°C
$[\alpha]_D$: −45.4 SOLVENT: Chf
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Spongia nitens* (Porifera)
REFERENCE: 136

$C_{21}H_{24}O_6$ Pukalide



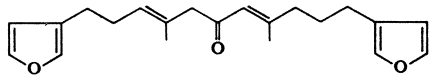
MOL. WT.: 372
MELTING POINT: 204–206°C
$[\alpha]_D$: +44 SOLVENT: Chf
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Sinularia abrupta* (Coelenterata)
REFERENCE: 301

$C_{21}H_{26}O_3$ Furospongin-2



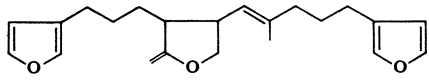
MOL. WT.: 326
MELTING POINT: Oil
$[\alpha]_D$: 0
SPECTRAL DATA: UR, IR, PMR, Mass Spec
ORGANISM: *Spongia officinalis obliqua*, and *Hippospongia communis* (Porifera)
REFERENCE: 96

$C_{21}H_{26}O_3$ Isofurospongin-2



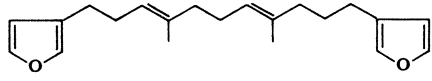
MOL. WT.: 326
MELTING POINT: Oil
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Spongia officinalis obliqua*, and *Hippospongia communis* (Porifera)
REFERENCE: 96

$C_{21}H_{26}O_4$ Dihydronitenin



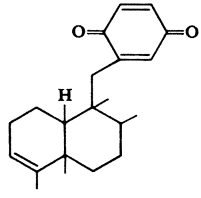
MOL. WT.: 342
MELTING POINT: Oil
$[\alpha]_D$: −25.2 SOLVENT: Chf
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Spongia nitens* (Porifera)
REFERENCE: 136

$C_{21}H_{28}O_2$ Anhydrofurospongin-1



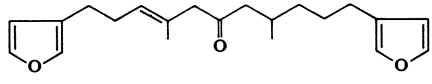
MOL. WT.: 312
MELTING POINT: Oil
$[\alpha]_D$: 0
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Spongia officinalis obliqua*, and *Hippospongia communis* (Porifera)
REFERENCE: 96

$C_{21}H_{28}O_2$ Avarone



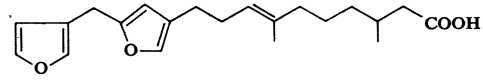
MOL. WT.: 312
MELTING POINT: Oil
SPECTRAL DATA: UV, IR
ORGANISM: *Disidea avora* (Porifera)
REFERENCE: 297

$C_{21}H_{28}O_3$ Dihydrofurospongin-2



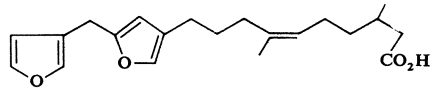
MOL. WT.: 328
MELTING POINT: Oil
$[\alpha]_D$: 0.91 SOLVENT: Chf
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Spongia officinalis obliqua*, and *Hippospongia communis* (Porifera)
REFERENCE: 96

$C_{21}H_{28}O_4$ Ircinin-3



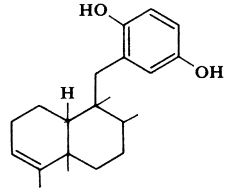
MOL. WT.: 344
MELTING POINT: Oil (isolated as methyl ester)
$[\alpha]_D$: +2.1 SOLVENT: Chf
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Ircinia oros* (Porifera)
REFERENCE: 93

$C_{21}H_{28}O_4$ Ircinin-4



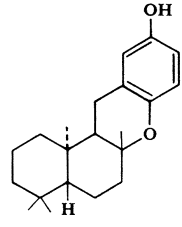
MOL. WT.: 344
MELTING POINT: Oil (isolated as methyl ester)
$[\alpha]_D$: −1.7 SOLVENT: Chf
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Ircinia oros* (Porifera)
REFERENCE: 93

$C_{21}H_{30}O_2$ Avarol



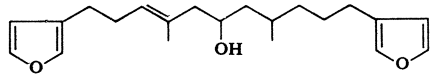
MOL. WT.: 314
MELTING POINT: 148–150°C
$[\alpha]_D$: 6.1 SOLVENT: Chf
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Disidea avora* (Porifera)
REFERENCE: 111, 297

$C_{21}H_{30}O_2$ ent-Chromazonarol



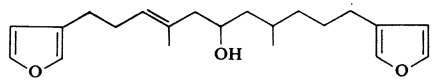
MOL. WT.: 314
MELTING POINT: Gum; Acetate, 118–121°C
$[\alpha]_D$: +39 SOLVENT: Chf
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Disidea pallescens* (Porifera)
REFERENCE: 88

$C_{21}H_{30}O_3$ Furospongin-1



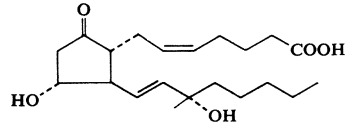
MOL. WT.: 330
MELTING POINT: 35°C
$[\alpha]_D$: +8.8 SOLVENT: Chf
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Spongia officinalis obliqua*, and *Hippospongia communis* (Porifera)
REFERENCE: 96, 97

$C_{21}H_{30}O_3$ Tetrahydrofurospongin-2



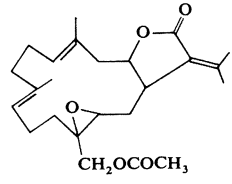
MOL. WT.: 330
MELTING POINT: Oil
$[\alpha]_D$: 0 SOLVENT: Chf
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Spongia officinalis obliqua*, and *Hippospongia communis* (Porifera)
REFERENCE: 96

$C_{21}H_{34}O_5$ (15S)-11,15-Dihydroxy-9-oxo-5-*cis*-13-*trans*-prostadienoic acid



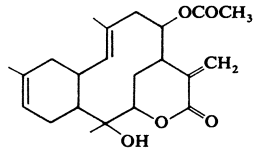
MOL. WT.: 366
ORGANISM: *Plexaura homomalla* (Coelenterata)
REFERENCE: 369

$C_{22}H_{30}O_5$ Lobolide



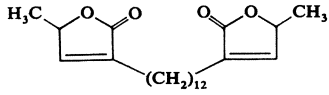
MOL. WT.: 374
MELTING POINT: 114–115°C
$[\alpha]_D$: −58 SOLVENT: Chf
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Lobophytum* sp. (Coelenterata)
REFERENCE: 214

$C_{22}H_{32}O_5$ Crassin Acetate



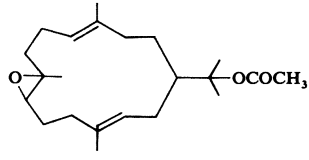
MOL. WT.: 376
BIOACTIVITY: Antibiotic
MELTING POINT: 144–145.5°C
ORGANISM: *Pseudoplexaura porosa*, *Pseudoplexaura crassa*, and *Pseudoplexaura wagenaari* (Coelenterata)
REFERENCE: 190, 427

$C_{22}H_{34}O_4$ Ancepsenolide



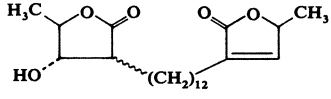
MOL. WT.: 362
MELTING POINT: 91.5–92°C
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Pterogorgia anceps* Pallas, and *Xiphigorgia anceps* (Coelenterata)
REFERENCE: 363

$C_{22}H_{36}O_3$ Epoxynephthenol Acetate



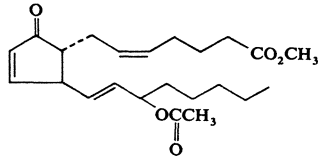
MOL. WT.: 348
MELTING POINT: Oil
$[\alpha]_D$: −20.7
SPECTRAL DATA: UV, IR, PMR
ORGANISM: *Nephthea* sp. (Coelenterata)
REFERENCE: 368

$C_{22}H_{36}O_5$ Hydroxyancepsenolide



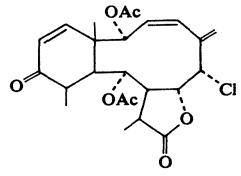
MOL. WT.: 380
MELTING POINT: 122.5–123.7°C; Acetate, 68.3–70.3°C
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Pterogorgia anceps* Pallas (Coelenterata)
REFERENCE: 365

$C_{23}H_{24}O_5$ Methyl (15R)-15-hydroxy-5-*cis*-10,13-*trans*-prostatrienoate 15-acetate



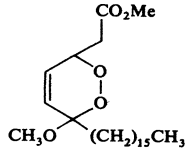
MOL. WT.: 380
SPECTRAL DATA: IR, PMR, Mass Spec
ORGANISM: *Plexaura homomalla* (Coelenterata)
REFERENCE: 432

$C_{24}H_{29}O_8Cl$ Ptilosarcenone



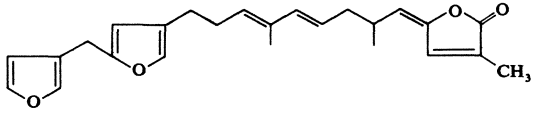
MOL. WT.: 480
SPECTRAL DATA: UV, IR, PMR
ORGANISM: *Ptilosarcus gurneyi* (Gray) (Coelenterata)
REFERENCE: 446

$C_{24}H_{44}O_5$ Chondrillin



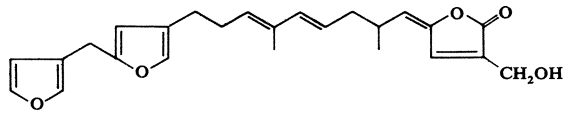
MOL. WT.: 412
MELTING POINT: 30°C
SPECTRAL DATA: PMR, Mass Spec
ORGANISM: *Chondrilla* sp. (Porifera)
REFERENCE: 437

$C_{25}H_{28}O_4$ Icrinolide



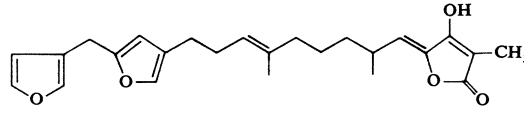
MOL. WT.: 382
MELTING POINT: Oil
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Thorecta marginalis* (Porifera)
REFERENCE: 223

$C_{25}H_{28}O_5$ 24-Hydroxyircinolide



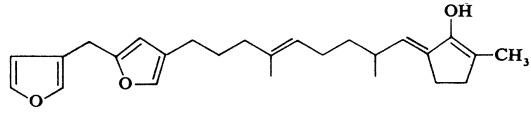
MOL. WT.: 408
MELTING POINT: Oil
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Thorecta marginalis* (Porifera)
REFERENCE: 223

$C_{25}H_{30}O_5$ Ircinin-1



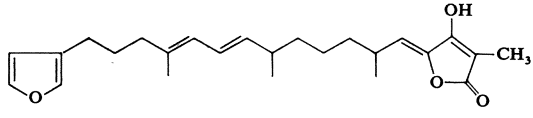
MOL. WT.: 410
MELTING POINT: Oil
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Ircinia oros* (Porifera)
REFERENCE: 95

$C_{25}H_{30}O_5$ Ircinin-2



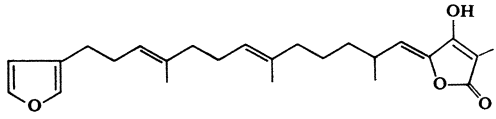
MOL. WT.: 410
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Ircinia oros* (Porifera)
REFERENCE: 95

$C_{25}H_{34}O_4$ Fasciculatin



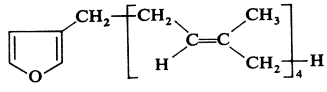
MOL. WT.: 398
MELTING POINT: Oil
$[\alpha]_D$: −15.60 SOLVENT: Chf
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Ircinia fasciculata* (Porifera)
REFERENCE: 66

$C_{25}H_{34}O_4$ Variabilin



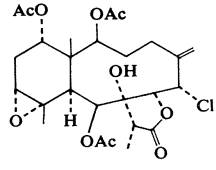
MOL. WT.: 398
MELTING POINT: Oil
SPECTRAL DATA: UV, IR, PMR
ORGANISM: *Ircinia variabilis* Schmidt (Porifera)
REFERENCE: 139

$C_{25}H_{58}O$ Furospinosulin-1



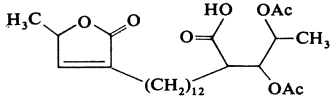
MOL. WT.: 354
MELTING POINT: Oil
SPECTRAL DATA: UV, PMR, Mass Spec
ORGANISM: *Ircinia spinosula* (Porifera)
REFERENCE: 94

$C_{26}H_{35}O_{10}Cl$ Stylatulide



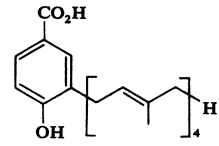
MOL. WT.: 542
MELTING POINT: 179–181°C
$[\alpha]_D$: +65
SPECTRAL DATA: IR, PMR
ORGANISM: *Stylatula* sp. (Coelenterata)
REFERENCE: 445

$C_{26}H_{42}O_8$ 2-(13-Carboxy-14,15-diacetoxy-hexadecanyl)-2-penten-4-olide



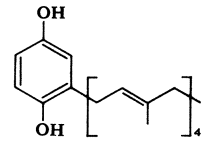
MOL. WT.: 482
BIOACTIVITY: Antibiotic
MELTING POINT: 81–82.9°C
$[\alpha]_D$: −8.3 SOLVENT: Chf
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Pterogorgia quadalupensis* (Coelenterata)
REFERENCE: 364

$C_{27}H_{38}O_3$ 9-Hydroxy-3-tetrapyrenylbenzoic acid



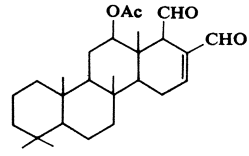
MOL. WT.: 410
MELTING POINT: 61–63°C
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Ircinia muscarum* (Porifera)
REFERENCE: 92

$C_{27}H_{40}O_2$ 2-Tetraprenyl-1,4-benzoquinone



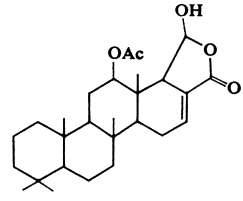
MOL. WT.: 396
MELTING POINT: 47–48°C
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Ircinia muscarum* (Porifera)
REFERENCE: 92

$C_{27}H_{40}O_4$ Scalaradiol



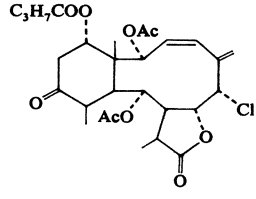
MOL. WT.: 428
MELTING POINT: 111–113°C
$[\alpha]_D$: +47.3 SOLVENT: MeOH
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Cacospongia mollior* (Porifera)
REFERENCE: 90

$C_{27}H_{40}O_5$ Scalarin



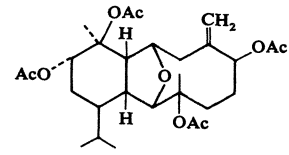
MOL. WT.: 444
MELTING POINT: 133–135°C
$[\alpha]_D$: +43.2 SOLVENT: Chf
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Cacospongia scalaris* (Porifera)
REFERENCE: 131

$C_{28}H_{37}O_{10}Cl$ Ptilosarcone



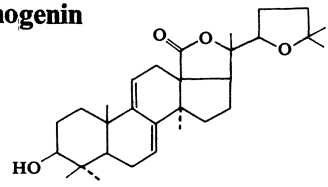
MOL. WT.: 568
MELTING POINT: Glass
SPECTRAL DATA: UV, IR, PMR
ORGANISM: *Ptilosarcus gurneyi* (Gray) (Coelenterata)
REFERENCE: 446

$C_{28}H_{42}O_9$ Eunicellin



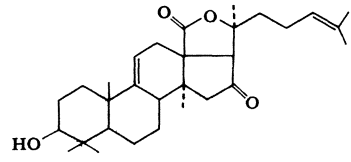
MOL. WT.: 522
MELTING POINT: 186–188°; Dibromide, 211–213°C
$[\alpha]_D$: −36
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Eunicella stricta* (Coelenterata)
REFERENCE: 228

$C_{30}H_{44}O_4$ 17-Desoxy-22,25-oxidoholothurinogenin



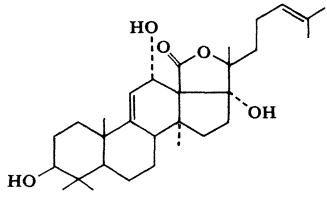
MOL. WT.: 468
MELTING POINT: 285.8–286.4°C; Acetate, 266.2–266.5°C
$[\alpha]_D$: −9.3 SOLVENT: Chf
ORGANISM: *Actinopyga agassizi* and *Holothuria polii* (Echinodermata)
REFERENCE: 77, 169

$C_{30}H_{44}O_4$ Stichopogenin A_2



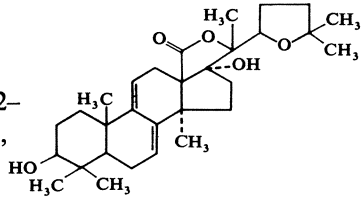
MOL. WT.: 468
MELTING POINT: 238–240°C; Monoacetate, 216–219°C
$[\alpha]_D$: −48 SOLVENT: Chf
SPECTRAL DATA: IR, PMR
ORGANISM: *Stichopus japonicus* Selenka (Echinodermata)
REFERENCE: 115, 408

$C_{30}H_{44}O_5$ 12α-Hydroxy-7,8-dihydro-24,25-dehydroholothurinogenin



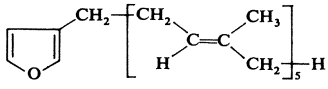
MOL. WT.: 484
MELTING POINT: Diacetate, 240–243°C
ORGANISM: *Actinopyga agassizi* (Echinodermata)
REFERENCE: 78

$C_{30}H_{44}O_5$ 22,25-Oxido-holothurinogenin



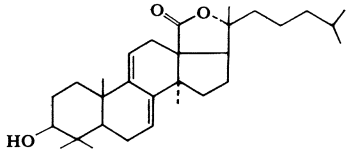
MOL. WT.: 484
MELTING POINT: 315.2–315.8°C; Acetate, 289.2–289.6°C; 3,5-Dinitrobenzoate, 300–301°C
$[\alpha]_D$: −21.2 SOLVENT: Chf
SPECTRAL DATA: UV, IR
ORGANISM: *Actinopyga agassizi* and *Holothuria polii* (Echinodermata)
REFERENCE: 77, 169

$C_{30}H_{46}O$ Furospinosulin-2



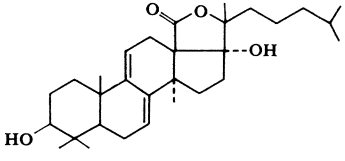
MOL. WT.: 422
MELTING POINT: Oil
SPECTRAL DATA: UV, PMR, Mass Spec
ORGANISM: *Ircinia spinosula* (Porifera)
REFERENCE: 94

$C_{30}H_{46}O_3$ Seychellogenin



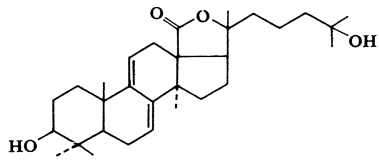
MOL. WT.: 454
MELTING POINT: 234–238°C; Acetate, 211–213°C
$[\alpha]_D$: −7
SPECTRAL DATA: UV, IR
ORGANISM: *Bohadschia koellikeri* (Echinodermata)
REFERENCE: 349

$C_{30}H_{46}O_4$ Holothurinogenin



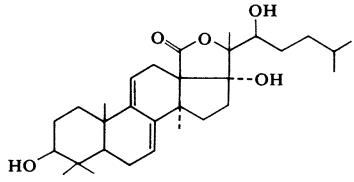
MOL. WT.: 470
MELTING POINT: 277°C; 3-Acetate, 254–257°C
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Holothuria polii* (Echinodermata)
REFERENCE: 169

$C_{30}H_{46}O_4$ Koellikerigenin



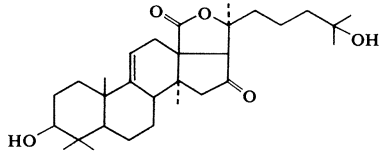
MOL. WT.: 470
MELTING POINT: 213–214°C; Monoacetate, 213–216°C
$[\alpha]_D$: −8
SPECTRAL DATA: UV, IR
ORGANISM: *Bohadschia koellikeri* (Echinodermata)
REFERENCE: 349

$C_{30}H_{46}O_5$ Griseogenin



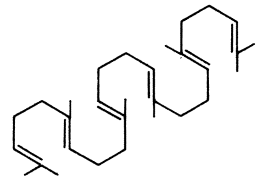
MOL. WT.: 486
MELTING POINT: 285–287°C; Diacetate, 259–261°C
$[\alpha]_D$: −22 SOLVENT: Chf
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Haloderima grisea* L. and *Holothuria polii* (Echinodermata)
REFERENCE: 169, 416

$C_{30}H_{46}O_5$ Holotoxinogenin [Stichopogenin A_4, 3β,20ξ,25-trihydroxy-16-oxolanost-9(11)-ene-18-carboxylic acid lactone (18 → 20)]



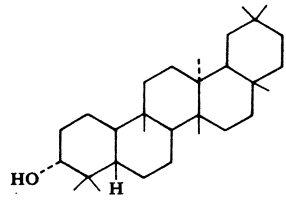
MOL. WT.: 486
MELTING POINT: 238–241°C; Acetate, 221–223°C; Diacetate, 212–216°C
$[\alpha]_D$: −97.6 SOLVENT: MeOH
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Stichopus chloronotus* Brandt and *Stichopus japonicus* Selenka (Echinodermata)
REFERENCE: 115, 238, 408

$C_{30}H_{50}$ *trans*-Squalene



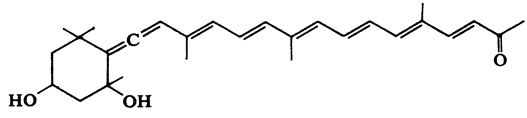
MOL. WT.: 410
ORGANISM: *Ircinia spinosula* (Porifera)
REFERENCE: 94

$C_{30}H_{52}O$ Tetrahymanol



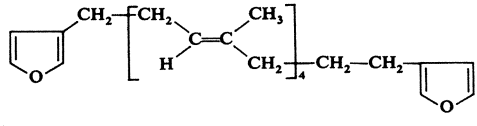
MOL. WT.: 428
MELTING POINT: 312.5–314.5°C; Acetate, 303–305°C
SPECTRAL DATA: PMR
ORGANISM: *Tetrahymena pyriformis* (Protozoa)
REFERENCE: 284

$C_{31}H_{42}O_3$ Paracentione



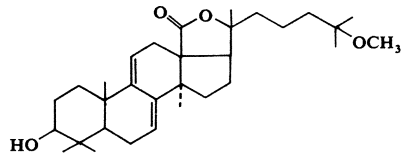
MOL. WT.: 462
MELTING POINT: 147–149°C; Acetate
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Paracentrotus lividus* Lam. (Echinodermata)
REFERENCE: 155

$C_{31}H_{44}O_2$ Difurospinosulin



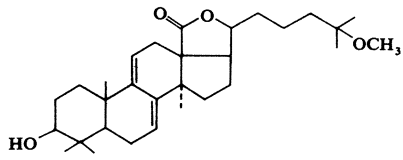
MOL. WT.: 448
MELTING POINT: Oil
SPECTRAL DATA: UV, PMR, Mass Spec
ORGANISM: *Ircinia spinosula* (Porifera)
REFERENCE: 94

$C_{31}H_{48}O_4$ 25-Methoxy-17-desoxyholothurinogenin



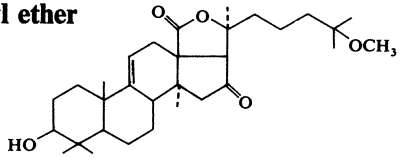
MOL. WT.: 484
MELTING POINT: 242–245°C; 3-Acetate, 220°C
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Holothuria polii* (Echinodermata)
REFERENCE: 169

$C_{31}H_{48}O_4$ Ternaygenin



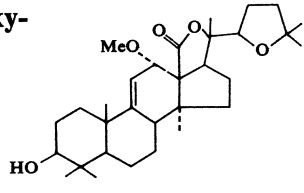
MOL. WT.: 484
MELTING POINT: 239–242°C
$[\alpha]_D$: +2
SPECTRAL DATA: UV, IR
ORGANISM: *Bohadschia koellikeri* (Echinodermata)
REFERENCE: 349

$C_{31}H_{48}O_5$ Holotoxinogenin 25-methyl ether



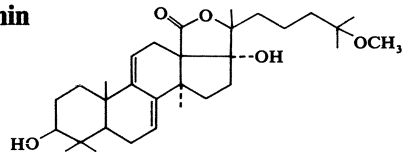
MOL. WT.: 500
MELTING POINT: 236–238°C; Acetate, 230–233°C
$[\alpha]_D$: −125 SOLVENT: Me
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Stichopus japonicus* Selenka (Echinodermata)
REFERENCE: 408

$C_{31}H_{48}O_5$ 12α-Methoxy-7,8-dihydro-17-desoxy-22,25-oxidoholothurinogenin



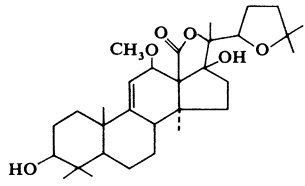
MOL. WT.: 500
MELTING POINT: Acetate, 205–208°C
ORGANISM: *Actinopyga agassizi* (Echinodermata)
REFERENCE: 78

$C_{31}H_{48}O_5$ 25-Methoxyholothurinogenin (Praslinogenin)



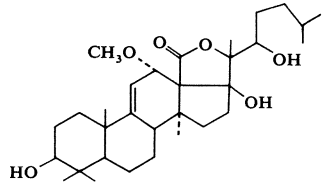
MOL. WT.: 500
MELTING POINT: 290–291.5°C; Monoacetate, 271–274°C
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Holothuria polii* and *Bohadschia koellikeri* (Echinodermata)
REFERENCE: 169, 415

$C_{31}H_{48}O_6$ 12β-Methoxy-7,8-dihydro-22,25-oxido-holothurinogenin



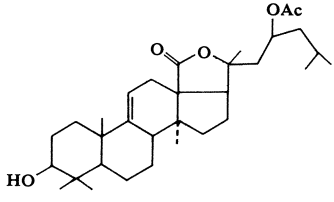
MOL. WT.: 516
MELTING POINT: Acetate, 273°C
ORGANISM: *Actinopyga agassizi* (Echinodermata)
REFERENCE: 78

$C_{31}H_{50}O_6$ 12β-Methoxy-7,8-dihydro-22-hydroxyholothurinogenin



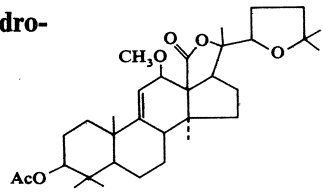
MOL. WT.: 518
ORGANISM: *Actinopyga agassizi* (Echinodermata)
REFERENCE: 78

$C_{32}H_{50}O_5$ 23ξ-Acetoxy-17-deoxy-7,8-dihydroholothurinogenin



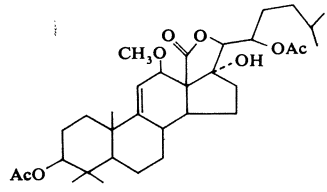
MOL. WT.: 514
MELTING POINT: 223–224°C; Me Acetate, 192–194°C
$[\alpha]_D$: −20 SOLVENT: Chf
SPECTRAL DATA: IR, PMR, Mass Spec
ORGANISM: *Stichopus chloronotus* Brandt (Echinodermata)
REFERENCE: 350

$C_{33}H_{50}O_6$ **17-Desoxy-12β-methoxy-7,8-dihydro-22,25-oxidoholothurinogenin-3-acetate**



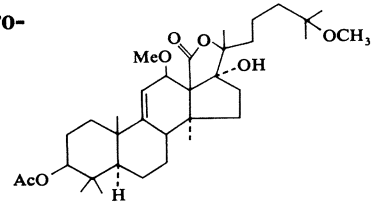
MOL. WT.: 542
MELTING POINT: 281–282°C
$[\alpha]_D$: −45 SOLVENT: Chf
SPECTRAL DATA: UV, IR, PMR
ORGANISM: *Actinopyga agassizi* (Echinodermata)
REFERENCE: 79

$C_{33}H_{54}O_8$ **12β-Methoxy-7,8-dihydroholothurinogenin-3,22-diacetate**



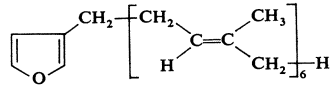
MOL. WT.: 578
MELTING POINT: 310°C
SPECTRAL DATA: UV, IR, PMR
ORGANISM: *Actinopyga agassizi* (Echinodermata)
REFERENCE: 79

$C_{34}H_{54}O_7$ **12β,25-Dimethoxy-7,8-dihydroholothurinogenin-3-acetate**



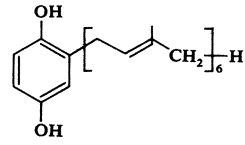
MOL. WT.: 574
MELTING POINT: 272–273°C
$[\alpha]_D$: −51 SOLVENT: Chf
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Actinopyga agassizi* (Echinodermata)
REFERENCE: 79

$C_{35}H_{54}O$ **Furospinosulin-3**



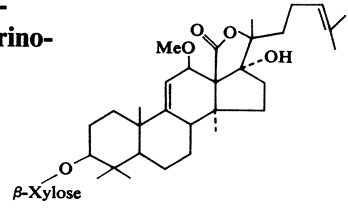
MOL. WT.: 490
MELTING POINT: Oil
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Ircinia spinosula* (Porifera)
REFERENCE: 94

$C_{36}H_{54}O_2$ 2-Hexapyrenyl-1,4,quinol



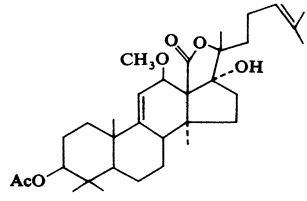
MOL. WT.: 518
MELTING POINT: Oil
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Ircinia spinosula* (Porifera)
REFERENCE: 94

$C_{36}H_{57}O_{10}$ 3β-Xyloside-12β-methoxy-7,8-dihydro-24,25-dehydroholothurinogenin



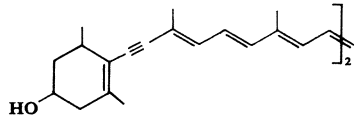
MOL. WT.: 649
SPECTRAL DATA: IR, PMR
ORGANISM: *Actinopyga agassizi* (Echinodermata)
REFERENCE: 78

$C_{37}H_{50}O_6$ 12β-Methoxy-7,8-dihydro-24,25-dehydroholothurinogenin-3-acetate



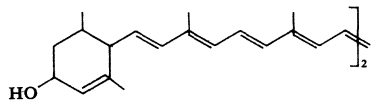
MOL. WT.: 590
MELTING POINT: 245–247°C
$[\alpha]_D$: −53 SOLVENT: Chf
SPECTRAL DATA: IR, PMR
ORGANISM: *Actinopyga agassizi* (Echinodermata)
REFERENCE: 79

$C_{38}H_{48}O_2$ Alloxanthin (Cynthiaxanthin, pectenoxanthin)



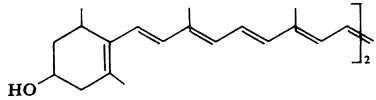
MOL. WT.: 536
MELTING POINT: 188–190°C; Diacetate, 154–156°C
SPECTRAL DATA: UV, IR, PMR
ORGANISM: *Halocynthia papillosa* (Chordata/Tunicata)
REFERENCE: 67

$C_{38}H_{48}O_2$ Lutein (Xanthophyll)



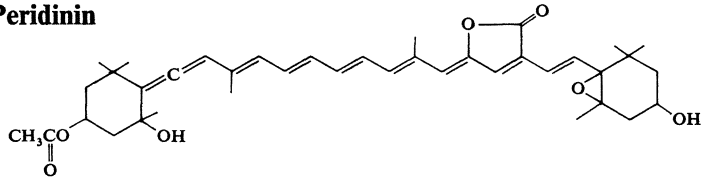
MOL. WT.: 536
ORGANISM: *Chrysophrys major* Temminck (Chordata/Pisces)
REFERENCE: 216, 217, 218

$C_{38}H_{52}O_2$ Zeaxanthin



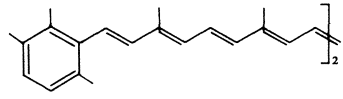
MOL. WT.: 540
ORGANISM: *Chrysophrys major* Temminck (Chordata/Pisces)
REFERENCE: 216

$C_{39}H_{50}O_7$ Peridinin



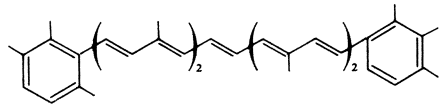
MOL. WT.: 630
MELTING POINT: 107–109°C
SPECTRAL DATA: UV, PMR, Mass Spec
ORGANISM: *Anthopleura xanthogrammica* (Coelenterata), *Cachonina niei* (Pyrrophyta), and *Amphidinium operculatum* (Protozoa)
REFERENCE: 401

$C_{40}H_{48}$ Isorenieratene



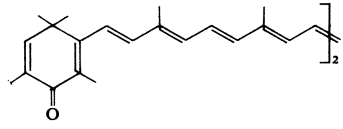
MOL. WT.: 528
MELTING POINT: 199°C
SPECTRAL DATA: UV, IR
ORGANISM: *Reniera japonica* (Porifera)
REFERENCE: 447, 449, 451

$C_{40}H_{48}$ Renieratene



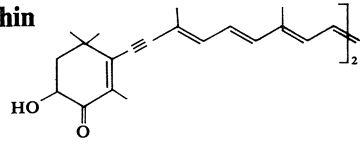
MOL. WT.: 528
MELTING POINT: 185°C
SPECTRAL DATA: UV, IR
ORGANISM: *Reniera japonica* (Porifera)
REFERENCE: 448, 449, 450, 451

$C_{40}H_{48}O_4$ Astacin



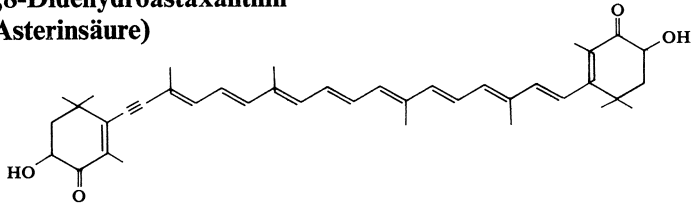
MOL. WT.: 592
ORGANISM: *Chrysophrys major* Temminck (Chordata/Pisces)
REFERENCE: 216

$C_{40}H_{48}O_4$ 7,7′8,8′-Tetradehydroastaxanthin



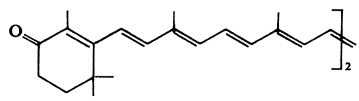
MOL. WT.: 592
MELTING POINT: 210°C
SPECTRAL DATA: UV, PMR, Mass Spec
ORGANISM: *Asterias rubens* (Echinodermata)
REFERENCE: 148

$C_{40}H_{50}O_4$ 7,8-Didehydroastaxanthin (Asterinsäure)



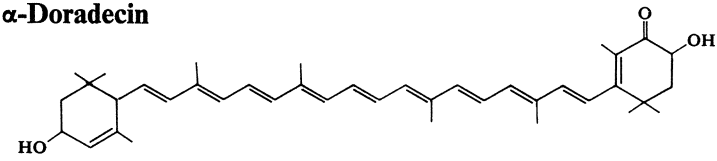
MOL. WT.: 594
ORGANISM: *Asterias rubens* (Echinodermata)
REFERENCE: 148

$C_{40}H_{52}O_2$ Cantharanthin (β-Carotene-4,4′-dione)



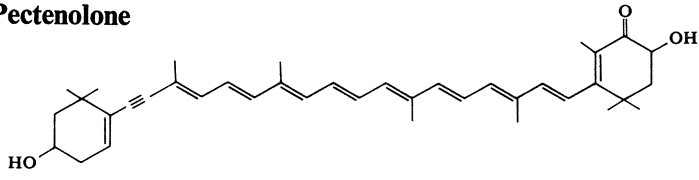
MOL. WT.: 564
SPECTRAL DATA: UV
ORGANISM: *Stichopus japonicus* Selenka (Echinodermata)
REFERENCE: 290

$C_{40}H_{52}O_3$ α-Doradecin



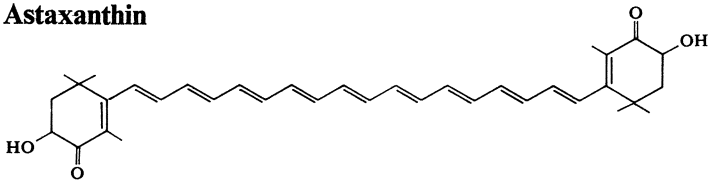
MOL. WT.: 580
ORGANISM: *Chrysophrys major* Temminck and *Crassius auratus* (Chordata/Pisces)
REFERENCE: 216, 217, 218

$C_{40}H_{52}O_3$ Pectenolone



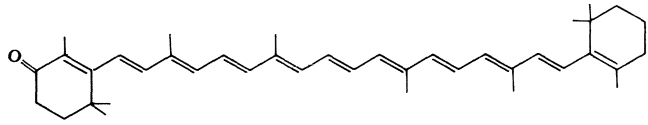
MOL. WT.: 580
ORGANISM: *Pecten maximus* (Mollusca) and *Halocynthia papillosa* (Chordata/Tunicata)
REFERENCE: 67

$C_{40}H_{52}O_4$ Astaxanthin



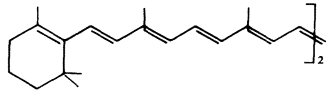
MOL. WT.: 596
MELTING POINT: Diacetate 198–199°C
REFERENCE: 67

$C_{40}H_{54}O$ Echinenone



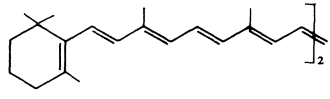
MOL. WT.: 550
MELTING POINT: 192–193°C
SPECTRAL DATA: UV
ORGANISM: *Chrysophrys major* Temminck (Chordata/Pisces) and *Hymeniacidon sanguineum* Grant (Porifera)
REFERENCE: 114, 216

$C_{40}H_{56}$ α-Carotene



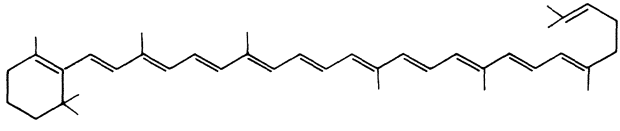
MOL. WT.: 536
MELTING POINT: 185°C
SPECTRAL DATA: UV
ORGANISM: *Chrysophrys major* Temminck (Chordata/Pisces) and *Reniera japonica* (Porifera)
REFERENCE: 114, 216, 451

$C_{40}H_{56}$ β-Carotene



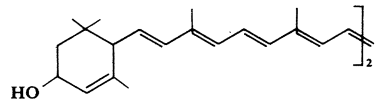
MOL. WT.: 536
MELTING POINT: 183°C
SPECTRAL DATA: UV
ORGANISM: *Chrysophrys major* Temminck (Chordata/Pisces), *Reniera japonica*, and *Hymeniacidon sanguineum* Grant (Porifera)
REFERENCE: 114, 216, 451

$C_{40}H_{56}$ γ-Carotene



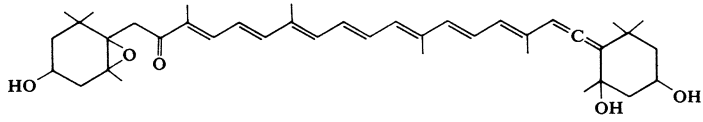
MOL. WT.: 536
MELTING POINT: 176–177°C
SPECTRAL DATA: UV
ORGANISM: *Hymeniacidon sanguineum* Grant (Porifera)
REFERENCE: 114

$C_{40}H_{56}O_2$ 3,3′-Dihydroxy-ε-carotene



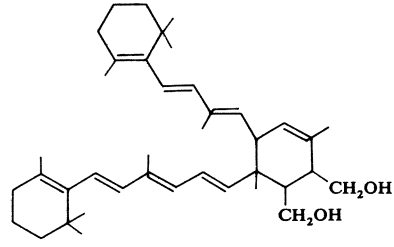
MOL. WT.: 568
ORGANISM: *Chrysophrys major* Temminck (Chordata/Pisces)
REFERENCE: 216

$C_{40}H_{56}O_5$ Fucoxanthinol



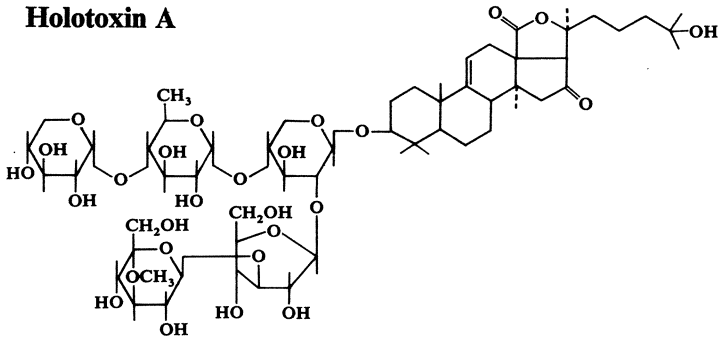
MOL. WT.: 616
MELTING POINT: 134–138°C
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Paracentrotus lividus* Lam. (Echinodermata)
REFERENCE: 155

$C_{40}H_{60}O_2$ Provitamine A (Kitol)



MOL. WT.: 572
MELTING POINT: 135–136°C; Diacetate, 150–151°C
$[\alpha]_D$: −2.6 SOLVENT: Chf
SPECTRAL DATA: IR, PMR
REFERENCE: 160

$C_{65}H_{106}O_{27}$ **Holotoxin A**

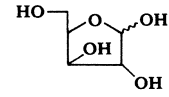


MOL. WT.: 1318
MELTING POINT: 248–250°C
SPECTRAL DATA: UV, IR
ORGANISM: *Stichopus japonicus* Selenka (Echinodermata)
REFERENCE: 237

Chapter 12

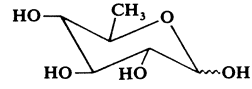
Carbohydrates

$C_5H_{10}O_5$ D-Xylose



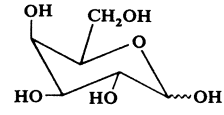
MOL. WT.: 150
MELTING POINT: 148–151°C
ORGANISM: *Stichopus japonicus*, *Holothuria tabulosa*, and *Actinopyga agassizi* (Echinodermata)
REFERENCE: 22, 76, 79, 116, 170

$C_6H_{12}O_5$ D-Quinovose (6-Deoxy-D-Glucose, D-Glucomethylose, Glumethylose)



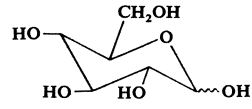
MOL. WT.: 164
MELTING POINT: 146°C
ORGANISM: *Holothuria tabulosa* and *Actinopyga agassizi* (Echinodermata)
REFERENCE: 22, 76, 79, 170

$C_6H_{12}O_6$ D-Galactose



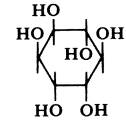
MOL. WT.: 180
MELTING POINT: 165–168°C
ORGANISM: *Stichopus japonicus* Selenka (Echinodermata)
REFERENCE: 116

$C_6H_{12}O_6$ D-Glucose



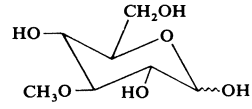
MOL. WT.: 180
MELTING POINT: 146°C
ORGANISM: *Actinopyga agassizi*, *Stichopus japonicus* Selenka, and *Holothuria tabulosa* (Echinodermata)
REFERENCE: 22, 76, 79, 116, 170

$C_6H_{12}O_6$ Inositol



MOL. WT.: 180
MELTING POINT: 247–248°C
$[\alpha]_D$: +65
ORGANISM: *Calyx nicacensis* and *Geodia gigas* (Porifera)
REFERENCE: 10, 16

$C_7H_{14}O_6$ 3-Methoxy-D-Glucose (3-*O*-Methyl-glucose)

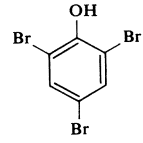


MOL. WT.: 194
ORGANISM: *Actinopyga agassizi*, *Stichopus japonicus* Selenka, and *Holothuria tabulosa* (Echinodermata)
REFERENCE: 22, 76, 79, 116, 170

Chapter 13

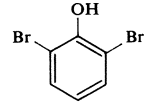
Phenols, Quinones, and Related Compounds

$C_6H_3Br_3O$ 2,4,6-Tribromophenol



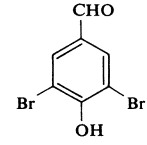
MOL. WT.: 331
MELTING POINT: 95°C
SPECTRAL DATA: UV, PMR, Mass Spec
ORGANISM: *Phoronopsis viridis* Hilton (Phoronidea)
REFERENCE: 380

$C_6H_4Br_2O$ 2,6-Dibromophenol



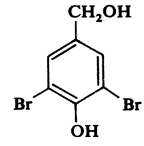
MOL. WT.: 252
MELTING POINT: 51–52°C
SPECTRAL DATA: UV, PMR, Mass Spec
ORGANISM: *Balanoglossus biminiensis* (Chordata/Hemichordata) and *Phoronopsis viridis* Hilton (Phoronidea)
REFERENCE: 24, 380

$C_7H_4Br_2O_2$ 3,5-Dibromo-4-hydroxybenzaldehyde



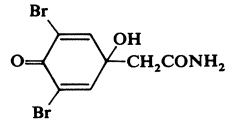
MOL. WT.: 280
MELTING POINT: 182–186°C
ORGANISM: *Thelepus setosus* (Annelida)
REFERENCE: 179, 180

$C_7H_6Br_2O_2$ 3,5-Dibromo-4-hydroxybenzyl alcohol



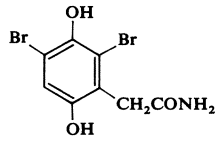
MOL. WT.: 282
MELTING POINT: 115–116°C
ORGANISM: *Thelepus setosus* (Annelida)
REFERENCE: 179, 180

$C_8H_7Br_2NO_3$ 3-Acetamido-2,6-dibromo-3-hydroxy-2,6-cyclohexadiene-1-one



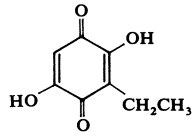
MOL. WT.: 325
BIOACTIVITY: Antibiotic
MELTING POINT: 193–195°C (dec.); Acetate, 185°C
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Verongia fistularis* and *Verongia cauliformis* (Porifera)
REFERENCE: 374, 375

$C_8H_7Br_2NO_3$ 2,6-Dibromo-3-acetamidohydroquinone



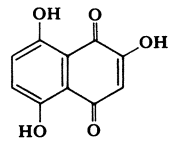
MOL. WT.: 325
MELTING POINT: 170–172°C
SPECTRAL DATA: UV, IR, Mass Spec
ORGANISM: *Verongia aurea* Hyatt (Porifera)
REFERENCE: 252

$C_8H_8O_4$ 2,5-Dihydroxy-3-ethylbenzoquinone



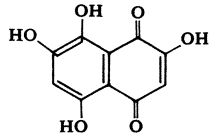
MOL. WT.: 168
MELTING POINT: 130–145°C
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Echinothrix diadema* Linn. (Echinodermata)
REFERENCE: 308

$C_{10}H_6O_5$ Naphthopurpurin



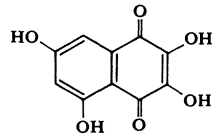
MOL. WT.: 206
MELTING POINT: 200–210°C
SPECTRAL DATA: UV
ORGANISM: *Echinothrix diadema* Linn. and *Echinothrix calamaris* Pallis (Echinodermata)
REFERENCE: 308, 390

$C_{10}H_6O_6$ 2,7-Dihydroxynaphthazarin



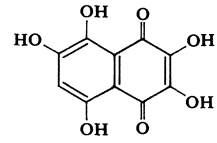
MOL. WT.: 222
MELTING POINT: 265–275°C; 2,7-Dimethoxy, 273-275°C
ORGANISM: *Echinothrix diadema* Linn. and *Echinothrix calamaris* Pallis (Echinodermata)
REFERENCE: 308

$C_{10}H_6O_6$ Spinochrome B



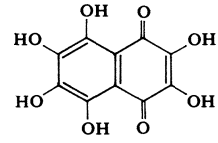
MOL. WT.: 222
MELTING POINT: 325–330°C; 2,3-Dimethoxy-7-hydroxy-juglone, 204–205°C; Leucoacetate, 242°C; Trimethyl Ether, 112°C; Tetramethyl Ether, 130–130.5°C; Tetra-acetate, 157°C
SPECTRAL DATA: UV
ORGANISM: *Echinothrix diadema* Linn., *Echinothrix calamaris* Pallis, *Salmacis sphaeroides*, *Paracentrotus lividus* Lam., *Echinus esculentus*, *Strongylocentrotus sulcherrimus*, and *Anthocidaris cassispina* (Echinodermata)
REFERENCE: 164, 308, 390

$C_{10}H_6O_7$ Spinochrome D



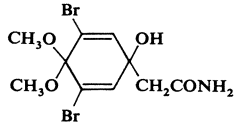
MOL. WT.: 238
MELTING POINT: 285–290°C; Penta-acetate, 179–180°C; 2,3,6-Trimethoxynaphthazarin, 161–162°C
SPECTRAL DATA: UV, IR
ORGANISM: *Echinothrix diadema* Linn. and *Echinothrix calamaris* Pallis (Echinodermata)
REFERENCE: 21, 308, 390

$C_{10}H_6O_8$ Spinochrome E



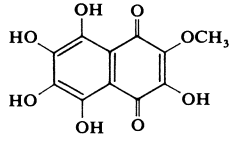
MOL. WT.: 254
MELTING POINT: 320°C; Hexa-acetate, 192°C; Leucoocta-acetate, 265°C
SPECTRAL DATA: UV
ORGANISM: *Psammechinus miliaris* Gmelin (Echinodermata)
REFERENCE: 396

$C_{10}H_{13}Br_2NO_4$ **3-Acetamido-2,6-dibromo-3-hydroxy-1,1-dimethoxycyclohexa-2,6-diene**



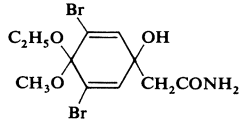
MOL. WT.: 371
MELTING POINT: 191°C; Acetate, 184°C
SPECTRAL DATA: IR, PMR, Mass Spec
ORGANISM: *Verongia fistularis* and *Verongia cauliformis* (Porifera)
REFERENCE: 374, 377

$C_{11}H_8O_8$ **Namakochrome**



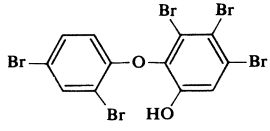
MOL. WT.: 268
MELTING POINT: 218°C; Penta-acetyl, 158–163°C
SPECTRAL DATA: UV, IR
ORGANISM: *Polycheira rufescens* (Echinodermata)
REFERENCE: 310, 311

$C_{11}H_{15}Br_2NO_4$



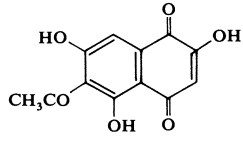
MOL. WT.: 385
SPECTRAL DATA: Mass Spec
ORGANISM: *Verongia* sp. (Porifera)
REFERENCE: 20

$C_{12}H_5Br_5O_2$ **1,2,3,1′,3′-Pentabromo-5-hydroxphenyl ether**



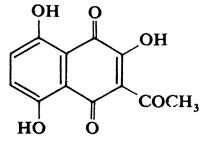
MOL. WT.: 581
MELTING POINT: 185–186°C
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Disidea herbacea* (Porifera)
REFERENCE: 376

$C_{12}H_8O_6$ **2,7-Dihydroxy-6-acetyljuglone**



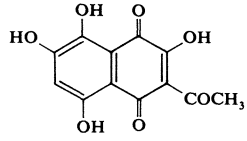
MOL. WT.: 248
MELTING POINT: 215°C (dec.)
SPECTRAL DATA: Mass Spec
ORGANISM: *Echinothrix diadema* Linn. and *Echinothrix calamaris* Pallis (Echinodermata)
REFERENCE: 31, 308

$C_{12}H_8O_6$ 2-Hydroxy-3-acetylnaphthazarin



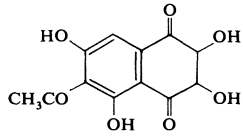
MOL. WT.: 248
MELTING POINT: 163–164°C (dec.)
ORGANISM: *Echinothrix diadema* Linn. and *Echinothrix calamaris* Pallis (Echinodermata)
REFERENCE: 31, 308

$C_{12}H_8O_7$ Spinochrome A



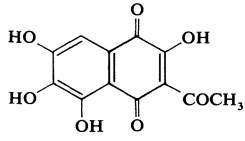
MOL. WT.: 264
MELTING POINT: 192–193°C
SPECTRAL DATA: UV, PMR, Mass Spec
ORGANISM: *Echinothrix diadema* Linn., *Echinothrix calamaris* Pallis, and *Paracentrotus lividus* Lam. (Echinodermata)
REFERENCE: 31, 74, 75, 308

$C_{12}H_8O_7$ Spinochrome G



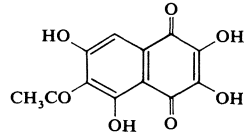
MOL. WT. 264
MELTING POINT: >360°C
SPECTRAL DATA: UV, PMR, Mass Spec
REFERENCE: 162

$C_{12}H_8O_7$ Spinochrome S



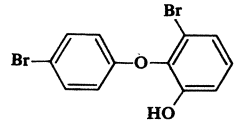
MOL. WT.: 264
MELTING POINT: 275–280°C (dec.)
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Salmacis sphaeroides* (Echinodermata)
REFERENCE: 163

$C_{12}H_8O_7$ 2,3,7-Trihydroxy-6-acetyljuglone



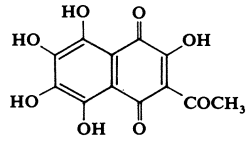
MOL. WT.: 264
MELTING POINT: 245–255°C; 2,3-Dimethoxy-7-hydroxy-6-acetyljuglone, 134–135°C
SPECTRAL DATA: UV, Mass Spec
ORGANISM: *Echinothrix diadema* Linn. and *Echinothrix calmaris* Pallis (Echinodermata)
REFERENCE: 162, 308

$C_{12}H_8Br_2O_2$ 4′,6-Dibromo-2-hydroxydiphenyl ether



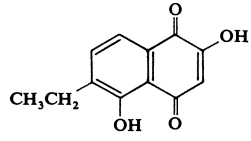
MOL. WT.: 344
MELTING POINT: 95–98°C
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Disidea herbacea* (Porifera)
REFERENCE: 376

$C_{12}H_8O_8$ Spinochrome C



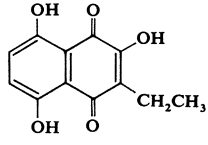
MOL. WT.: 280
MELTING POINT: 246–248°C; Trimethylether, 116–117°C
SPECIAL DATA: UV, IR, PMR
ORGANISM: *Echinometra oblonga*, *Echinothrix diadema* Linn., and *Echinothrix calamaris* (Echinodermata)
REFERENCE: 75, 308

$C_{12}H_{10}O_4$ 2-Hydroxy-6-ethyljuglone



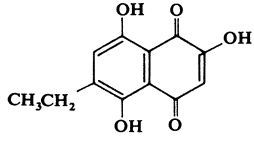
MOL. WT.: 218
MELTING POINT: 219–220°C
ORGANISM: *Echinothrix calamaris* Pallis (Echinodermata)
REFERENCE: 308

$C_{12}H_{10}O_5$ 2-Hydroxy-3-ethylnaphthazarin



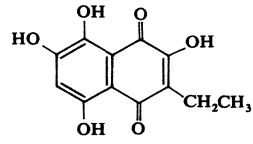
MOL. WT.: 234
MELTING POINT: 185–186°C
ORGANISM: *Ophiocoma erinaceus* and *Ophiocoma insularia* (Echinodermata)
REFERENCE: 389

$C_{12}H_{10}O_5$ 2-Hydroxy-6-ethylnaphthazarin



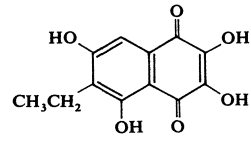
MOL. WT.: 234
MELTING POINT: 204–204.5°C
ORGANISM: *Echinothrix calamaris* Pallis (Echinodermata)
REFERENCE: 308

$C_{12}H_{10}O_6$ 2,7-Dihydroxy-3-ethylnaphthazarin



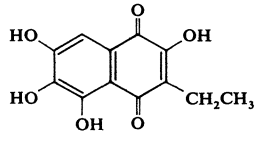
MOL. WT.: 250
MELTING POINT: 190–192°C; 2,7-Dimethoxy, 145–147°C; 7-Methoxy, 230–232°C
ORGANISM: *Echinothrix diadema* Linn. and *Echinothrix calamaris* Pallis (Echinodermata)
REFERENCE: 308

$C_{12}H_{10}O_6$ 2,3,7-Trihydroxy-6-ethyljuglone



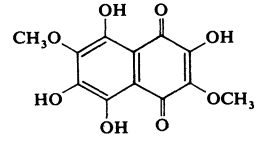
MOL. WT.: 250
MELTING POINT: 265–269°C (dec.); Trimethylether, 113–114°C
SPECTRAL DATA: UV, PMR, Mass Spec
ORGANISM: *Echinothrix diadema* Linn. and *Echinothrix calamaris* Pallis (Echinodermata)
REFERENCE: 308

$C_{12}H_{10}O_6$ 2,6,7-Trihydroxy-3-ethyljuglone



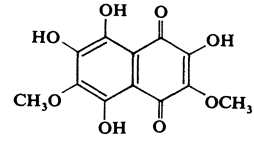
MOL. WT.: 250
MELTING POINT: 220–226°C
ORGANISM: *Ophiocoma erinaceus* and *Ophiocoma insularia* (Echinodermata)
REFERENCE: 389

$C_{12}H_{10}O_8$ 2,6-Dihydroxy-3,7-dimethoxynaphthazarin



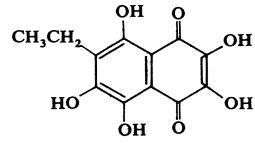
MOL. WT.: 282
MELTING POINT: 252–254°C
ORGANISM: *Acanthaster planci* Linn. (Echinodermata)
REFERENCE: 389

$C_{12}H_{10}O_8$ 2,7-Dihydroxy-3,6-dimethoxynaphthazarin



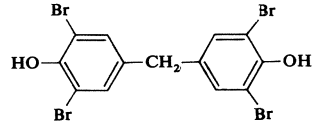
MOL. WT.: 282
MELTING POINT: 218–219°C
ORGANISM: *Acanthaster planci* Linn. (Echinodermata)
REFERENCE: 389

$C_{12}H_{12}O_7$ Echinochrome A



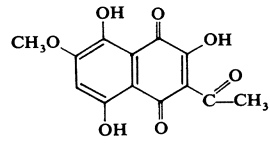
MOL. WT.: 268
MELTING POINT: 222–223°C; 2,3,6-Trimethoxy, 131–132°C; 3,7-Dimethoxy, 152–154°C
SPECTRAL DATA: UV
ORGANISM: *Echinothrix diadema* Linn. and *Echinothrix calamaris* Pallis (Echinodermata)
REFERENCE: 254, 308

$C_{13}H_8Br_4O_2$ Bis-(3,5-dibromo-4-hydroxyphenyl)-methane



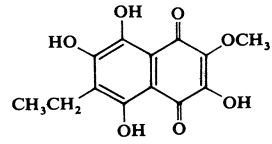
MOL. WT.: 516
MELTING POINT: 230–232°C
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Thelepus setosus* (Annelida)
REFERENCE: 179

$C_{13}H_{10}O_7$ 2-Hydroxy-3-acetyl-7-methoxy-naphthazarin



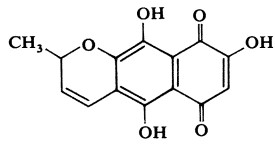
MOL. WT.: 278
MELTING POINT: 246–248°C
ORGANISM: *Ophiocoma erinaceus* and *Ophiocoma insularia* (Echinodermata)
REFERENCE: 389

$C_{13}H_{12}O_7$ 6-Ethyl-2,7-dihydroxy-2-methoxy-naphthazarin



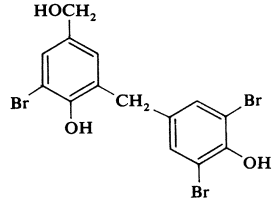
MOL. WT.: 280
MELTING POINT: 202–204°C
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Diadema antillarum* (Echinodermata)
REFERENCE: 288

$C_{14}H_{10}O_6$ 2-Methyl-8-hydroxy-2H-pyrano(3,2-g)-naphthazarin



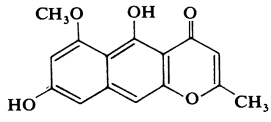
MOL. WT.: 274
MELTING POINT: 165–172°C (dec.)
SPECTRAL DATA: UV, PMR, Mass Spec
ORGANISM: *Echinothrix diadema* Linn. and *Echinothrix calamaris* Pallis (Echinodermata)
REFERENCE: 307

$C_{14}H_{11}Br_3O_3$



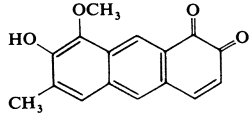
MOL. WT.: 467
MELTING POINT: 180–182°C
ORGANISM: *Thelepus setosus* (Annelida)
REFERENCE: 180

$C_{15}H_{12}O_5$ Anhydrofonsecin



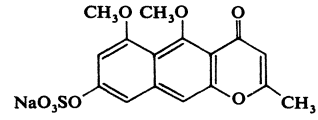
MOL. WT.: 272
MELTING POINT: 268°C
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Comantheria perplexa* (Echinodermata)
REFERENCE: 229

$C_{16}H_{12}O_4$ Hallachrome



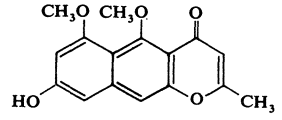
MOL. WT.: 268
MELTING POINT: 224–226°C (dec.); Leucotriacetate, 148–149°C; Acetate, 194–196°C
SPECTRAL DATA: UV, PMR, Mass Spec
ORGANISM: *Halla parthenopeia* (Annelida)
REFERENCE: 345

$C_{16}H_{13}NaO_8S$ Sodium comantheryl sulfate



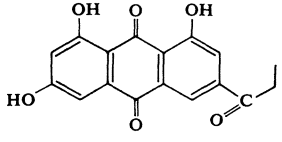
MOL. WT.: 388
SPECTRAL DATA: UV, IR, PMR
ORGANISM: *Comantheria perplexa* (Echinodermata)
REFERENCE: 229

$C_{16}H_{14}O_5$ Comantherin



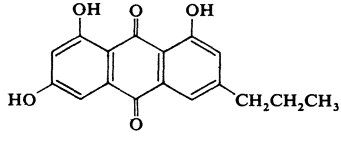
MOL. WT.: 286
MELTING POINT: 272°C; Acetate, 220°C; Methyl ether, 187–189°C and 178–179°C
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Comantheria perplexa* (Echinodermata)
REFERENCE: 229

$C_{17}H_{12}O_6$ 3-Propionyl-1,6,8-trihydroxy-9,10-anthraquinone



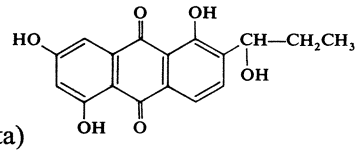
MOL. WT.: 312
MELTING POINT: 265–266°C
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Comanthus bennetti* (Echinodermata)
REFERENCE: 30, 343

$C_{17}H_{14}O_5$ 3-Propyl-1,6,8-trihydroxy-9,10-anthraquinone



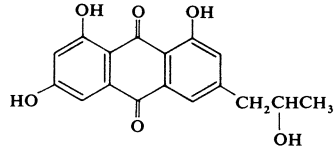
MOL. WT.: 298
MELTING POINT: 219–221°C
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Comanthus bennetti* (Echinodermata)
REFERENCE: 30

$C_{17}H_{14}O_6$



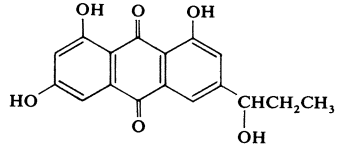
MOL. WT.: 314
SPECTRAL DATA: UV, IR, Mass Spec
ORGANISM: *Comanthus bennetti* (Echinodermata)
REFERENCE: 30

$C_{17}H_{14}O_6$ **Isochodoptilometrin**



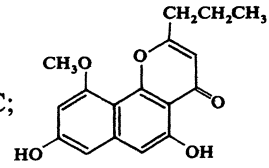
MOL. WT.: 314
MELTING POINT: 275–277°C; 6-Methyl ether, 196–197°C; Tetra-acetate, 161–162°C; Dimethyl ether, 136–137°C; Trimethyl ether, 162–163°C
SPECTRAL DATA: UV, IR
ORGANISM: *Ptilometra australis* Wilton (Echinodermata)
REFERENCE: 343

$C_{17}H_{14}O_6$ **S(—)-1,6,8-Trihydroxy-3-(1-hydroxypropyl)-anthraquinone (Rhodoptilometrin)**



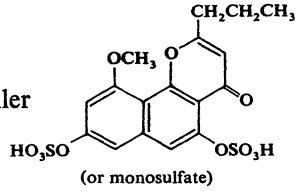
MOL. WT.: 314
MELTING POINT: 217–218°C; Tetra-acetate, 156–157°C; 6-Methyl ether, 197–198°C; Tetramethyl ether, 195–195.5°C; Leucotriacetyl trimethyl ether, 204–206°C
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Ptilometra australis* Wilton and *Comanthus bennetti* (Echinodermata)
REFERENCE: 30, 343

$C_{17}H_{16}O_5$ Comaparvin



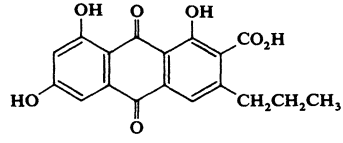
MOL. WT.: 300
MELTING POINT: 232–233°C (dec.); Acetate, 185–186°C; Dimethyl ether, 142–143°C
SPECTRAL DATA: UV, IR, Mass Spec
ORGANISM: *Comanthus parvicirrus timorensis* J. Müller (Echinodermata)
REFERENCE: 395

$C_{17}H_{16}O_{11}S_2$ Comaparvin-3,6-disulfate ester



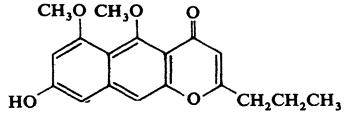
MOL. WT.: 460
ORGANISM: *Comanthus parvicirrus timorensis* J. Müller (Echinodermata)
REFERENCE: 395

$C_{18}H_{14}O_7$ Ptilometric acid



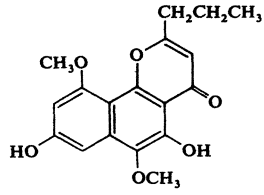
MOL. WT.: 342
MELTING POINT: 298–299°C; Triacetate, 194–195°C; Trimethyl ether; Methyl ester, 155–156°C
SPECTRAL DATA: UV, IR
ORGANISM: *Ptilometra australis* Wilton and *Tropiometra afra* Hartlaub (Echinodermata)
REFERENCE: 343

$C_{18}H_{18}O_5$ Neocemantherin



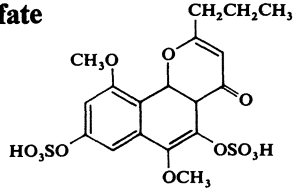
MOL. WT.: 314
MELTING POINT: 237°C (dec.); Acetate, 178–179°C; Methyl ether, 155–157°C
SPECTRAL DATA: IR, PMR, Mass Spec
ORGANISM: *Comantheria perplexa* (Echinodermata)
REFERENCE: 229

$C_{18}H_{18}O_6$ 5-Methoxy-comaparvin



MOL. WT.: 330
MELTING POINT: 200–201.5°C; Dimethyl ether, 93–94°C; Methyl ether, 120–121°C; Monoacetate, 190–191°C; Diacetate, 171–173°C
SPECTRAL DATA: UV, IR, Mass Spec
ORGANISM: *Comanthus parvicirrus timorensis* J. Müller (Echinodermata)
REFERENCE: 395

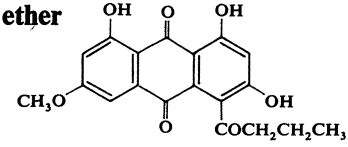
$C_{18}H_{18}O_{12}S_2$ 5-Methoxy-comaparvin 3,6-disulfate ester



(or monosulfate)

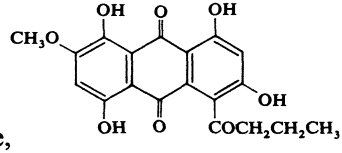
MOL. WT.: 490
ORGANISM: *Comanthus parvicirrus timorensis* J. Müller (Echinodermata)
REFERENCE: 395

$C_{19}H_{16}O_7$ Rhodocomatulin 6-monomethyl ether



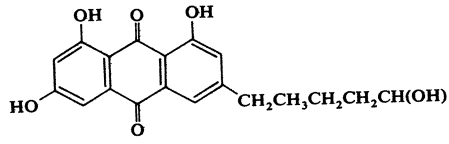
MOL. WT.: 356
MELTING POINT: 250–252°C (dec.); Triacetate, 194–196°C
SPECTRAL DATA: UV, IR
ORGANISM: *Comatula pectinata* Linn. and *Comatula cratera* Clark (Echinodermata)
REFERENCE: 404

$C_{19}H_{16}O_8$ Rubrocomatulin monomethyl ether



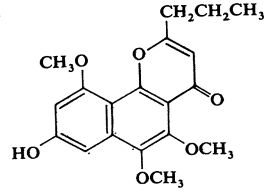
MOL. WT.: 372
MELTING POINT: 298–299°C (dec.); Tetra-acetate, 203–205°C; Pentamethyl ether, 152–153.5 and 214–215°C
ORGANISM: *Comatula pectinata* Linn. and *Comatula cratera* Clark (Echinodermata)
REFERENCE: 344

$C_{19}H_{18}O_6$



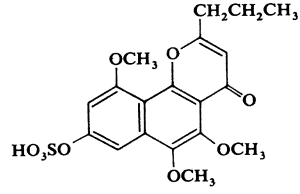
MOL. WT.: 342
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Comanthus bennetti* (Echinodermata)
REFERENCE: 30

$C_{19}H_{20}O_6$ **5-Methoxycomaparvin 6-Methyl ether**



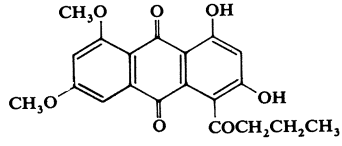
MOL. WT.: 344
MELTING POINT: 221–222°C; Methyl ether, 93–94°C; Acetate, 129–130°C
SPECTRAL DATA: UV, IR, Mass Spec
ORGANISM: *Comanthus parvicirrus timorensis* J. Müller (Echinodermata)
REFERENCE: 395

$C_{19}H_{20}O_9S$ **5-Methoxycomaparvin 6-Methyl ether 3-sulfate ester**



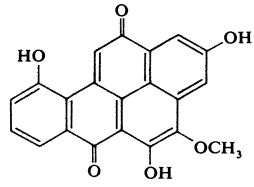
MOL. WT. 424
ORGANISM: *Comanthus parvicirrus timorensis* J. Müller (Echinodermata)
REFERENCE: 395

$C_{20}H_{18}O_7$ **Rhodocomatulin 6,8-dimethyl ether**



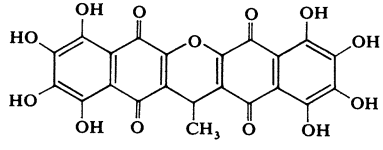
MOL. WT.: 370
MELTING POINT: 229.5–230.5°C; Diacetate, 199.5–201°C; Monobromide 222.5–223.5°C; Dimethanesulfonyl ester, 248–250°C; Oxime, 225°C
SPECTRAL DATA: UV, IR
ORGANISM: *Comatula pectinata* Linn. and *Comatula cratera* Clark (Echinodermata)
REFERENCE: 404

$C_{21}H_{12}O_6$ Arenicochrome



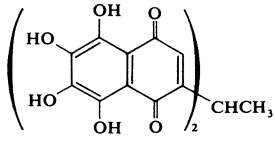
MOL. WT.: 360
MELTING POINT: Triacetate, 210–211°C
SPECTRAL DATA: IR
ORGANISM: *Arenicola marina* (Annelida)
REFERENCE: 309

$C_{22}H_{12}O_{13}$ Anhydroethylidene-3,3′-bis-(2,6,7-trihydroxynaphthazarin)



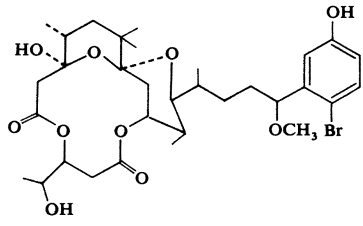
MOL. WT.: 484
MELTING POINT: 253–256°C
SPECTRAL DATA: UV, IR, Mass Spec
ORGANISM: *Spatangus purpurens* (Echinodermata)
REFERENCE: 288

$C_{22}H_{14}O_{14}$ Ethylidene-3,3′-bis(2,6,7-trihydroxy-naphthazarin)



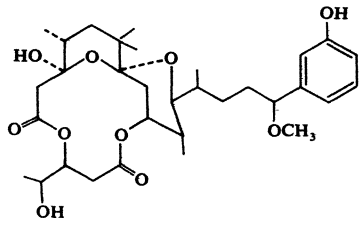
MOL. WT.: 502
MELTING POINT: 155–157°C
SPECTRAL DATA: UV, IR, PMR
ORGANISM: *Spatangus purpurens* (Echinodermata)
REFERENCE: 288

$C_{32}H_{47}BrO_{10}$ Aplysiatoxin



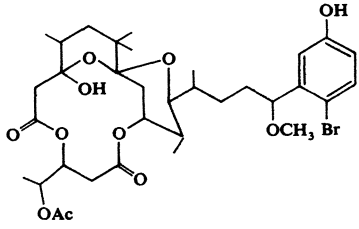
MOL. WT.: 671
BIOACTIVITY: LD_{100} 0.3 mg/kg (mouse)
MELTING POINT: Oil
SPECTRAL DATA: UV, PMR, Mass Spec
ORGANISM: *Stylocheilus longicauda* (Quoy and Gaimard) (Mollusca)
REFERENCE: 219, 220

$C_{32}H_{48}O_{10}$ Debromoaplysiatoxin



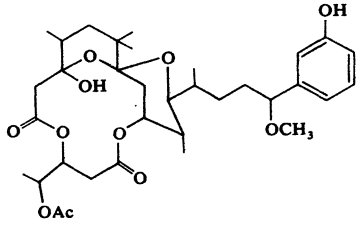
MOL. WT.: 592
MELTING POINT: Oil
SPECTRAL DATA: PMR, Mass Spec
ORGANISM: *Stylocheilus longicauda* (Quoy and Gaimard) (Mollusca)
REFERENCE: 219, 220

$C_{34}H_{49}BrO_{11}$



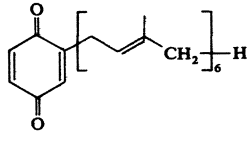
MOL. WT.: 713
ORGANISM: *Stylocheilus longicauda* (Quoy and Gaimard (Mollusca)
REFERENCE: 219, 220

$C_{34}H_{50}O_{11}$



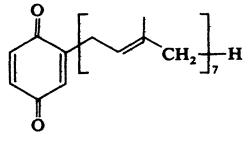
MOL. WT.: 634
ORGANISM: *Stylocheilus longicauda* (Quoy and Gaimard) (Mollusca)
REFERENCE: 219, 220

$C_{36}H_{52}O_2$ 2-Hexapyrenyl-1,4-benzoquinone



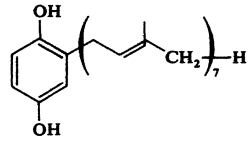
MOL. WT.: 516
MELTING POINT: Oil
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Ircinia spinosula* (Porifera)
REFERENCE: 94

$C_{41}H_{60}O_2$ 2-Heptapyrenyl-1,4-benzoquinone



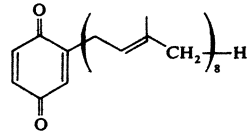
MOL. WT.: 584
MELTING POINT: Oil
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Ircinia spinosula* (Porifera)
REFERENCE: 94

$C_{41}H_{62}O_2$ 2-Heptapyrenyl-1,4-quinol



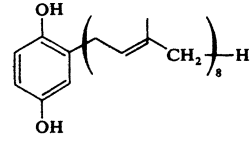
MOL. WT.: 586
MELTING POINT: Oil
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Ircinia spinosula* (Porifera)
REFERENCE: 94

$C_{46}H_{68}O_2$ 2-Octapyrenyl-1,4-benzoquinone



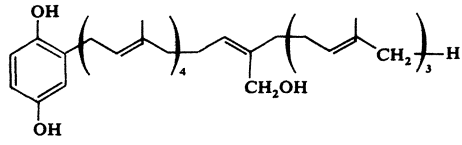
MOL. WT.: 652
MELTING POINT: Oil
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Ircinia spinosula* (Porifera)
REFERENCE: 94

$C_{46}H_{70}O_2$ 2-Octapyrenyl-1,4-quinol



MOL. WT.: 654
MELTING POINT: Oil
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Ircinia spinosula* (Porifera)
REFERENCE: 94

$C_{46}H_{70}O_3$ 25-Hydroxymethyl-2-octapyrenyl-1,4-quinol

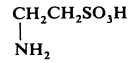


MOL. WT.: 670
MELTING POINT: Oil
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Ircinia spinosula* (Porifera)
REFERENCE: 94

Chapter 14

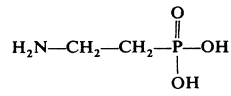
Amino Acids

$C_2H_7NO_3S$ Taurine (2-Aminoethanesulfonic acid)



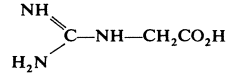
MOL. WT.: 125
MELTING POINT: 328°C
SPECTRAL DATA: PMR
ORGANISM: *Calyx nicacensis*, *Geodia gigas* (Porifera), *Turbo stenogyrus*, and *Macrocallista nimbosa* (Mollusca)
REFERENCE: 10, 16, 339

$C_2H_8NO_3P$ 2-Aminoethyl-phosphonic acid



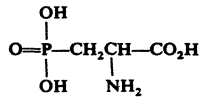
MOL. WT.: 125
MELTING POINT: 280–281°C (dec.)
SPECTRAL DATA: IR
ORGANISM: *Anthopleura elegantissima* and *Metridium dianthus* (Coelenterata)
REFERENCE: 242, 346

$C_3H_7N_3O_2$ Glycocyamine (Guanidoacetic acid)



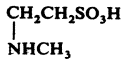
MOL. WT.: 117
MELTING POINT: 280–284°C; Hydrochloride, 200°C (dec.)
ORGANISM: *Anthopleura japonica* Verrill and *Hippospongia equina* (Coelenterata)
REFERENCE: 14, 283

$C_3H_8NO_5P$ α-Amino-β-phosphonopropionic acid



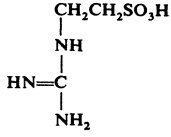
MOL. WT.: 169
ORGANISM: *Zoanthus sociatus* and *Tetrahymena pyriformis* (Protozoa)
REFERENCE: 240

$C_3H_9NO_3S$ Monomethyltaurine



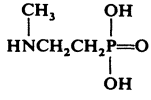
MOL. WT.: 139
MELTING POINT: 241–242°C
ORGANISM: *Calyx nicacensis* (Porifera)
REFERENCE: 16

$C_3H_9N_3O_3S$ Taurocyamine



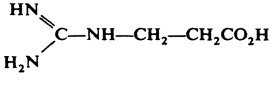
MOL. WT.: 167
ORGANISM: *Calyx nicacensis* (Porifera)
REFERENCE: 16

$C_3H_{10}NO_3P$ 2-Methylamino-ethylphosphonic acid



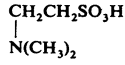
MOL. WT.: 139
MELTING POINT: 291°C (dec.)
ORGANISM: *Anthopleura xanthogrammica* (Coelenterata)
REFERENCE: 241

$C_4H_9N_3O_2$ β-Guanidinopropionic acid



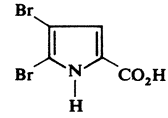
MOL. WT.: 131
MELTING POINT: 209–211°C
ORGANISM: *Anthopleura japonica* Verrill (Coelenterata)
REFERENCE: 283

$C_4H_{11}NO_3S$ Dimethyltaurine



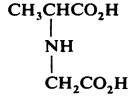
MOL. WT.: 153
MELTING POINT: 315–316°C
ORGANISM: *Calyx nicacensis* (Porifera)
REFERENCE: 16

$C_5H_3Br_2NO_2$ 4,5-Dibromopyrrole-2-carboxylic acid



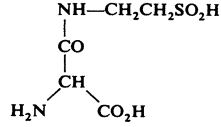
MOL. WT.: 269
MELTING POINT: 148°C
SPECTRAL DATA: IR, Mass Spec
ORGANISM: *Agelas oroides* (Porifera)
REFERENCE: 147

$C_5H_9NO_4$ Strombine



MOL. WT.: 147
MELTING POINT: Hydrochloride, 131°C
ORGANISM: *Strombus gigas* (Mollusca)
REFERENCE: 354

$C_5H_{10}N_2O_5S$ Arcamine

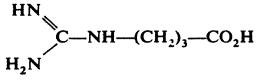


MOL. WT.: 210
SPECTRAL DATA: Mass Spec
ORGANISM: *Arca zebra* (Mollusca)
REFERENCE: 354

$C_5H_{11}NO_2$

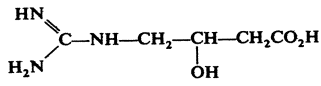
MOL. WT.: 117
MELTING POINT: ~310°C; $HAuCl_4$ complex, 224°C; Hydrobromide, 233°C (dec.)
ORGANISM: *Geodia gigas* (Porifera)
REFERENCE: 2

$C_5H_{11}N_3O_2$ γ-Guanidino-butyric acid



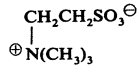
MOL. WT.: 145
MELTING POINT: Hydrochloride, 184°C
ORGANISM: *Anthopleura japonica* Verrill (Coelenterata)
REFERENCE: 283

$C_5H_{11}N_3O_3$ γ-Guanidino-β-hydroxybutyric acid



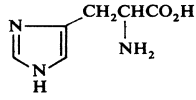
MOL. WT.: 161
MELTING POINT: 237°C
ORGANISM: *Anthopleura japonica* Verrill (Coelenterata)
REFERENCE: 283

$C_5H_{13}NO_3S$ Taurobetaine



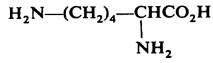
MOL. WT.: 167
MELTING POINT: >300°C
ORGANISM: *Geodia gigas* (Porifera)
REFERENCE: 5, 10

$C_6H_9N_3O_2$ Histidine



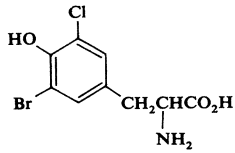
MOL. WT.: 155
MELTING POINT: 287°C (dec.); Dihydrochloride, 245°C
$[\alpha]_D$: +40.2
ORGANISM: *Hippospongia equina* (Porifera)
REFERENCE: 14

$C_6H_{14}N_2O_2$ Lysine



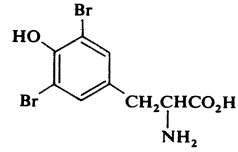
MOL. WT.: 146
MELTING POINT: 224–225°C (dec.)
$[\alpha]_D$: +14.6 SOLVENT: Aq
ORGANISM: *Hippospongia equina* (Porifera)
REFERENCE: 14

$C_9H_9BrClNO_3$ 3-Bromo-5-Chlorotyrosine



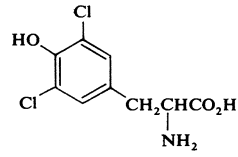
MOL. WT.: 295
ORGANISM: *Limulus polyphemus* L. (Arthropoda/Crustacea)
REFERENCE: 436

$C_9H_9Br_2NO_3$ 3,5-Dibromotyrosine



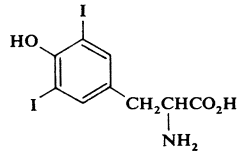
MOL. WT.: 339
MELTING POINT: 242–245°C
$[\alpha]_D$: −5.5 SOLVENT: 1N HCl
SPECTRAL DATA: Mass Spec
ORGANISM: *Spongia officinalis obliqua* (Porifera) and *Limulus polyphemus* L. (Arthropoda/Crustacea)
REFERENCE: 1, 15, 282, 436

$C_9H_9Cl_2NO_3$ 3,5-Dichlorotyrosine



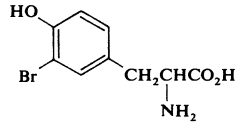
MOL. WT.: 250
ORGANISM: *Limulus polyphemus* L. (Arthropoda/Crustacea)
REFERENCE: 436

$C_9H_9I_2NO_3$ 3,5-Diiodotyrosine



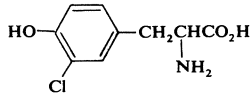
MOL. WT.: 433
MELTING POINT: 204°C
$[\alpha]_D$: +2.6 SOLVENT: Dil. HCl
ORGANISM: *Spongia officinalis obliqua* (Porifera)
REFERENCE: 1, 15, 282, 438

$C_9H_{10}BrNO_3$ 3-Bromotyrosine



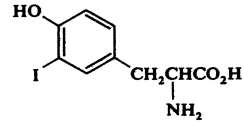
MOL. WT.: 260
SPECTRAL DATA: Mass Spec
ORGANISM: *Limulus polyphemus* L. (Arthropoda/Crustacea)
REFERENCE: 436

$C_9H_{10}ClNO_3$ 3-Chlorotyrosine



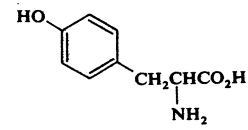
MOL. WT.: 215
SPECTRAL DATA: Mass Spec
ORGANISM: *Limulus polyphemus* L. (Arthropoda/Crustacea)
REFERENCE: 436

$C_9H_{10}INO_3$ 3-Iodotyrosine



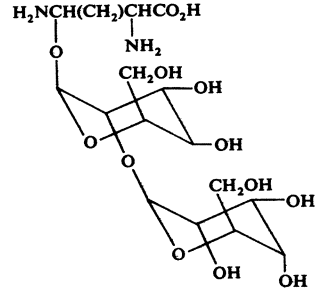
MOL. WT.: 307
ORGANISM: *Spongia officinalis obliqua* (Porifera)
REFERENCE: 282

$C_9H_{11}NO_3$ Tyrosine



MOL. WT.: 181
MELTING POINT: 342–344°C (dec.)
$[\alpha]_D$: −13.2 SOLVENT: 3N NaOH
ORGANISM: *Spongia officinalis obliqua* (Porifera)
REFERENCE: 282

$C_{18}H_{34}N_2O_{13}$ *O*-α-D-Glucopyranosyl-(1 → 2)-*O*-β-D-galactopyranosyloxy-(1 → 5)-L-Lysine

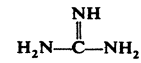


MOL. WT.: 486
$[\alpha]_D$: +42 SOLVENT: Aq
SPECTRAL DATA: PMR, Mass Spec
ORGANISM: *Hippospongia gossypina* (Porifera), *Metridium dianthus* (Coelenterata), and *Thyone briareus* (Echinodermata)
REFERENCE: 205, 221

Chapter 15

Amines and Nitrogen Heterocyclic Compounds

CH_5N_3 Guanidine



MOL. WT.: 59
MELTING POINT: ~50°C; Picrate, 333°C
ORGANISM: *Hippospongia equina* (Porifera)
REFERENCE: 2, 14

C_2H_7N Dimethylamine

$(CH_3)_2NH$

MOL. WT.: 45
MELTING POINT: 7.4°C (b.p.)
ORGANISM: *Hippospongia equina* (Porifera)
REFERENCE: 14

C_2H_7N Ethylamine

$CH_3CH_2NH_2$

MOL. WT.: 45
MELTING POINT: 16.6°C (b.p.); Hydrochloride, 108°C
ORGANISM: *Hippospongia equina* (Porifera)

C_3H_9N Propylamine

$CH_3CH_2CH_2NH_2$

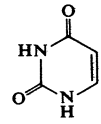
MOL. WT.: 59
MELTING POINT: 48.7°C (b.p.)
ORGANISM *Hippospongia equina* (Porifera)
REFERENCE: 14

C_3H_9N Trimethylamine

$(CH_3)_3N$

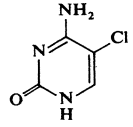
MOL. WT.: 59
MELTING POINT: 3.5°C (b.p.); Hydrochloride, 275°C
ORGANISM: *Calyx nicacensis* (Porifera)
REFERENCE: 16

$C_4H_4N_2O_2$ Uracil



MOL. WT.: 112
MELTING POINT: 335°C
ORGANISM: *Cryptotethia crypta* (Porifera)
REFERENCE: 36

$C_4H_4ClN_3O$ 5-Chlorocytosine



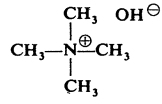
MOL. WT.: 145
SPECTRAL DATA: UV, Mass Spec
REFERENCE: 281

$C_4H_{12}N_2$ Putrescine

$H_2N—(CH_2)_4—NH_2$

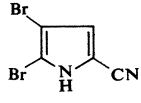
MOL. WT.: 88
MELTING POINT: 27–28°C
ORGANISM: *Hippospongia equina* (Porifera)
REFERENCE: 14

$C_4H_{13}NO$ Tetramine



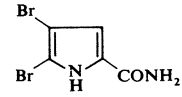
MOL. WT.: 91
MELTING POINT: 63°C
ORGANISM: *Actinia equina* (Mollusca)
REFERENCE: 3, 287

$C_5H_2Br_2N_2$



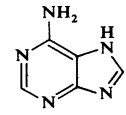
MOL. WT.: 250
MELTING POINT: 172–173°C
SPECTRAL DATA: IR, Mass Spec
ORGANISM: *Agelas oroides* (Porifera)
REFERENCE: 147

$C_5H_4Br_2N_2O$



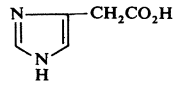
MOL. WT.: 268
MELTING POINT: 164–166°C
SPECTRAL DATA: UV, IR, Mass Spec
ORGANISM: *Agelas oroides* (Porifera)
REFERENCE: 147

$C_5H_5N_5$ Adenine



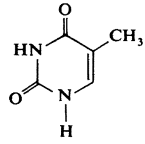
MOL. WT.: 135
MELTING POINT: 360–365°C; Picrate, 277°C
ORGANISM: *Geodia gigas* (Porifera)
REFERENCE: 12

$C_5H_6N_2O_2$



MOL. WT.: 126
MELTING POINT: 222°C (dec.); Ethyl ester, 115–117°C
ORGANISM: *Hippospongia equina* (Porifera)
REFERENCE: 14

$C_5H_6N_2O_2$ Thymine

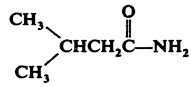


MOL. WT.: 126
MELTING POINT: 321°C
ORGANISM: *Cryptotethia crypta* (Porifera)
REFERENCE: 36

$C_5H_9N_3$ Histamine

MOL. WT.: 111
MELTING POINT: 83–84°C; Dipicrate, 241°C;
Monopicrate, 160–162°C;
Dihydrochloride, 244–246°C
ORGANISM: *Octopus apollyon*, *Octopus bimaculatus*, *Actinia equina* (Mollusca), *Calliactis parasitica*, *Metridium senile* (Coelenterata), *Geodia gigas* (Porifera), and *Anemonia sulcata* (Coelenterata)
REFERENCE: 7, 13, 287

$C_5H_{11}NO$



MOL. WT.: 101
MELTING POINT: 132–134°C
SPECTRAL DATA: IR, PMR, Mass Spec
ORGANISM: *Thelepus setosus* (Annelida)
REFERENCE: 179

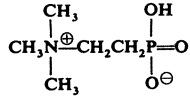
$C_5H_{11}NS_2$ Nereistoxin (4-Dimethylamino-1,2-dithiolane)

MOL. WT.: 149
BIOACTIVITY: Neurotoxin
MELTING POINT: 178–180°C
ORGANISM: *Lumbriconereis heteropoda* (Annelida)
REFERENCE: 319

$C_5H_{13}N$ Isoamylamine

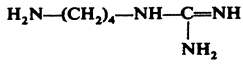
MOL. WT.: 87
MELTING POINT: 95°C (b.p.)
ORGANISM: *Hippospongia equina* (Porifera)
REFERENCE: 14

$C_5H_{14}NO_3P$ 2-Trimethylaminoethylphosphonic acid betaine



MOL. WT.: 167
MELTING POINT: 252°C (dec.)
ORGANISM: *Anthopleura xanthogrammica* (Coelenterata)
REFERENCE: 241

$C_5H_{14}N_4$ Agmatine

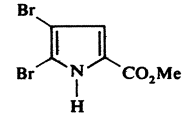


MOL. WT.: 130
MELTING POINT: Picrate, 235–236°C; Sulfate, 229°C
ORGANISM: *Anthopleura japonica* Verrill (Coelenterata) and *Geodia gigas* (Porifera)
REFERENCE: 13, 283

$C_5H_{15}NO_2$ Choline

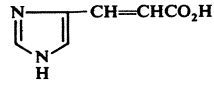
MOL. WT.: 121
ORGANISM: *Hippospongia equina* (Porifera)
REFERENCE: 14

$C_6H_5Br_2NO_2$



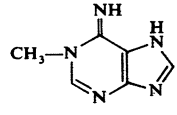
MOL. WT.: 283
MELTING POINT: 159–160°C
SPECTRAL DATA: Mass Spec
ORGANISM: *Agelas oroides* (Porifera)
REFERENCE: 147

$C_6H_6N_2O_2$ Imidazolyl acrylic acid (urocanic acid)



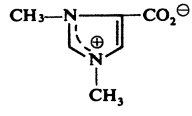
MOL. WT.: 138
MELTING POINT: 175–176°C; Dihydrate, 225°C
ORGANISM: *Hippospongia equina* (Porifera)
REFERENCE: 14

$C_6H_7N_5$ 1-Methyl-adenine (Spongopurine)



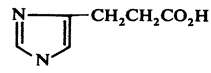
MOL. WT.: 149
MELTING POINT: Picrate, 255–257°C
SPECTRAL DATA: IR
ORGANISM: *Geodia gigas* (Porifera)
REFERENCE: 4, 8, 13

$C_6H_8N_2O_2$ 1,3-Dimethylimidazole-4-carboxylic acid betaine (Norzooanemonin)



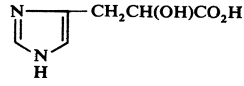
MOL. WT.: 140
MELTING POINT: 260–263°C
SPECTRAL DATA: IR, PMR, Mass Spec
ORGANISM: *Pseudopterogorgia americana* Gmelin (Coelenterata)
REFERENCE: 430

$C_6H_8N_2O_2$



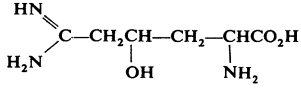
MOL. WT.: 140
MELTING POINT: 206–208°C; Anilide, 190–191°C
ORGANISM: *Hippospongia equina* (Porifera)
REFERENCE: 14

$C_6H_8N_2O_3$ Imidazolyl lactic acid



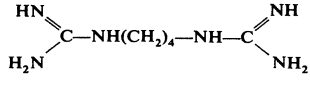
MOL. WT.: 156
MELTING POINT: 222°C; Ethyl ester, 118–119°C
ORGANISM: *Hippospongia equina* (Porifera)
REFERENCE: 14

$C_6H_{14}N_4O_3$ γ-Hydroxyarginine



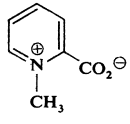
MOL. WT.: 190
MELTING POINT: Hydrochloride, 190–191°C
$[\alpha]_D$: +6.3 SOLVENT: 2.5N HCl
ORGANISM: *Anthopleura japonica* Verrill (Coelenterata)
REFERENCE: 283

$C_6H_{16}N_6$ Arcaine



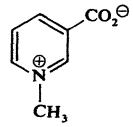
MOL. WT.: 172
MELTING POINT: Sulfate, 291°C (dec.); Picrate, 251–254°C (dec.)
ORGANISM: *Arca noar* (Mollusca)
REFERENCE: 348

$C_7H_7NO_2$ Homarine (*N*-Methyl-picolinic acid)



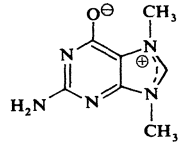
MOL. WT.: 137
MELTING POINT: Hydrochloride, 170–175°C
SPECTRAL DATA: UV
ORGANISM: *Calyx nicacensis* (Porifera)
REFERENCE: 16, 158

$C_7H_7NO_2$ Trigonelline (*N*-Methyl-nicotinic acid)



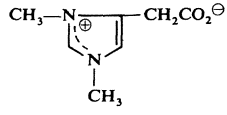
MOL. WT.: 137
MELTING POINT: 230–233°C; Hydrochloride, 258–259°C; Picrate, 204–205°C
ORGANISM: *Calyx nicacensis* (Porifera)
REFERENCE: 16

$C_7H_9N_5O$ 2-Amino-6-hydroxy-7,9-dimethylpurine betaine (Herbipoline)



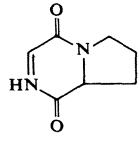
MOL. WT.: 179
MELTING POINT: 315°C; Picrate, 292–295°C
SPECTRAL DATA: IR
ORGANISM: *Geodia gigas* (Porifera)
REFERENCE: 6, 9, 11, 12, 53

$C_7H_{10}N_2O_2$ 1,3-Dimethyl-imidazole-4-acetic acid betaine (Zooanemonine)



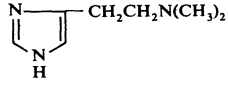
MOL. WT.: 154
MELTING POINT: $HAuCl_4$ Complex Hydrochloride
ORGANISM: *Hippospongia equina* (Porifera)
REFERENCE: 9, 14

$C_7H_{10}N_2O_2$ 3,6-Dioxo-hexahydropyrrolo-[1,2-a]-pyrazine



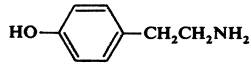
MOL. WT.: 154
MELTING POINT: 216–218°C
SPECTRAL DATA: Mass Spec
ORGANISM: *Luidia clathrata* (Echinodermata)
REFERENCE: 340

$C_7H_{13}N_3$ Dimethyl histamine



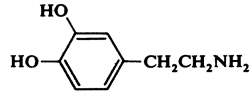
MOL. WT.: 139
MELTING POINT: $HAuCl_4$ complex 198°C
ORGANISM: *Geodia gigas* (Porifera)
REFERENCE: 2

$C_8H_{11}NO$ Tyramine



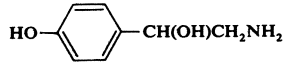
MOL. WT.: 137
MELTING POINT: 164–165°C
REFERENCE: 122

$C_8H_{11}NO_2$ Dopamine



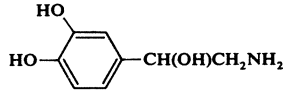
MOL. WT.: 153
ORGANISM: *Octopus apollyon* and *Octopus bimaculatus* (Mollusca)
REFERENCE: 174

$C_8H_{11}NO_2$ Octopamine



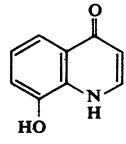
MOL. WT.: 153
MELTING POINT: Hydrochloride, 177–179°
ORGANISM: *Octopus apollyon* and *Octopus bimaculatus* (Mollusca)
REFERENCE: 122, 174

$C_8H_{11}NO_3$ Norepinephrine



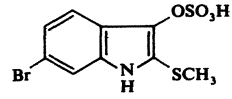
MOL. WT.: 169
MELTING POINT: 216.5–218°C (dec.); Hydrochloride, 145.2–146.4°C
$[\alpha]_D$: −37.3 SOLVENT: 1M HCl
ORGANISM: *Octopus apollyon* (Mollusca), *Hydra littoralis* (Coelenterata), *Octopus bimaculatus* (Mollusca), and *Sycon (scypha) ciliatum* (Porifera)
REFERENCE: 277, 444

$C_9H_7NO_2$



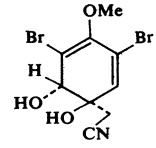
MOL. WT.: 161
MELTING POINT: 300°C
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Octopus dofleini* Martini (Mollusca)
REFERENCE: 391

$C_9H_8BrNO_4S_2$ 6-Bromo-2-methyl-thioindoxyl sulfate



MOL. WT.: 338
MELTING POINT: Ag Salt, 118–120°C
ORGANISM: *Dicathais orbita* Gmelin (Mollusca)
REFERENCE: 27

$C_9H_9Br_2NO_3$ (+)-Aeroplysinin-1

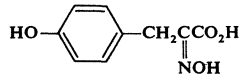


MOL. WT.: 339
MELTING POINT: 120°C; Diacetate, 114°C
$[\alpha]_D$: +186 SOLVENT: MeOH
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Aplysina* (or *Verongia*) *aerophoba* (Porifera), and *Ianthella* sp. (Porifera)
REFERENCE: 106, 133, 134, 153

$C_9H_9Br_2NO_3$ (−)-Aeroplysinin-1

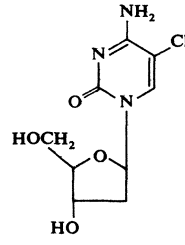
MOL. WT.: 339
MELTING POINT: 112–116°C
$[\alpha]_D$: −198 SOLVENT: An
SPECTRAL DATA: IR, PMR
ORGANISM: *Ianthella ardis* (Porifera)
REFERENCE: 106, 133, 134, 153

$C_9H_9NO_4$ 4-Hydroxyphenyl-pyruvic acid oxime



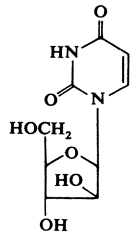
MOL. WT.: 195
SPECTRAL DATA: UV, PMR
ORGANISM: *Hymeniacidon sanguinea* (Porifera)
REFERENCE: 89

$C_9H_{12}ClN_3O_4$ 5-Chlorodeoxycytidine



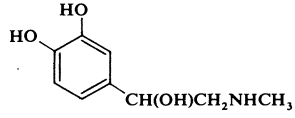
MOL. WT.: 261
SPECTRAL DATA: Mass Spec
ORGANISM: Salmon Sperm (Chordata/Pisces)
REFERENCE: 281

$C_9H_{12}N_2O_6$ 1-β-D-Arabinofuranosyluracil (Spongouridine)



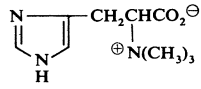
MOL. WT.: 244
MELTING POINT: 226–228°C
SPECTRAL DATA: UV
ORGANISM: *Cryptotethia crypta* (Porifera)
REFERENCE: 36, 55

$C_9H_{13}NO_3$ Epinephrine



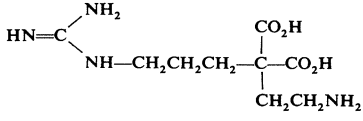
MOL. WT.: 183
MELTING POINT: 211–212°C
$[\alpha]_D$: −53.5 SOLVENT: 0.5N HCl
ORGANISM: *Sycon* (or *Scypha*) *ciliatum* (Porifera), *Octopus apollyon*, *Octopus bimaculatus* (Mollusca), and *Hydra littoralis* (Coelenterata)
REFERENCE: 277, 444

$C_9H_{15}N_3O_2$ Hercynine



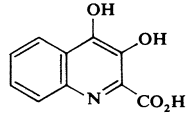
MOL. WT.: 197
MELTING POINT: 224–228°C (dec.); $HAuCl_4$ complex, 184°C; Dipicrate, 213–214°C
ORGANISM: *Hippospongia equina* (Porifera)
REFERENCE: 14

$C_9H_{18}N_4O_4$ Octopine



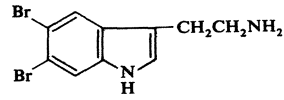
MOL. WT.: 246
MELTING POINT: 281–282°C; Picrate, 225°C
$[\alpha]_D$: +20.94 SOLVENT: Aq
REFERENCE: 18

$C_{10}H_7NO_4$ 3,4-Dihydroxyquinoline-2-carboxylic acid



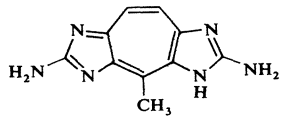
MOL. WT.: 205
MELTING POINT: 253–254°C (dec.)
SPECTRAL DATA: UV, IR, Mass Spec
ORGANISM: *Aplysina* (or *Verongia*) *aerophoba* (Porifera)
REFERENCE: 126

$C_{10}H_{10}Br_2N_2$ 3-(2-Aminoethyl)-5,6-dibromoindole



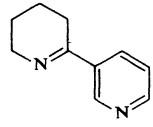
MOL. WT.: 318
MELTING POINT: 110–120°C
SPECTRAL DATA: UV, PMR, Mass Spec
ORGANISM: *Polyfibrospongia maynardii* Hyatt (Porifera)
REFERENCE: 424

$C_{10}H_{10}N_6$ Parazoanthoxanthin A



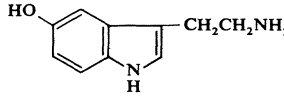
MOL. WT.: 214
MELTING POINT: >310
SPECTRAL DATA: PMR
ORGANISM: *Parazoanthus axinellae* (Coelenterata)
REFERENCE: 70

$C_{10}H_{12}N_2$ Anabaseine[2-(3-pyridyl)-3,4,5,6-tetrahydropyridine]



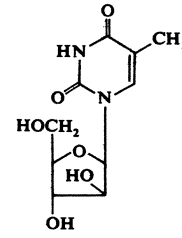
MOL. WT.: 160
BIOACTIVITY: Neurotoxin
MELTING POINT: Picrate, 172–175°C
SPECTRAL DATA: UV, PMR, Mass Spec
ORGANISM: *Paranemertes peregrina* Coe (Nemertinea)
REFERENCE: 227

$C_{10}H_{12}N_2O$ Serotonin (5-Hydroxytryptamine)



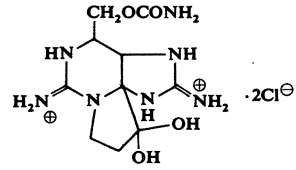
MOL. WT.: 176
BIOACTIVITY: Vasoconstrictor
MELTING POINT: Hydrochloride, 167–168°C
ORGANISM: *Octopus apollyon*, *Octopus bimaculatus*, *Octopus vulgaris* (Mollusca), *Physalia* sp., *Hydra oligactis*, *Hydra littoralis* (Coelenterata), and *Sycon* (or *Scypha*) *ciliatum* (Porifera)
REFERENCE: 122, 243, 277

$C_{10}H_{14}N_2O_6$ 1-β-D-Arabinosylthymine (Spongothymidine)



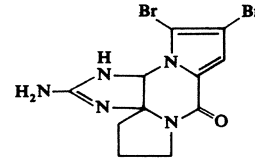
MOL. WT.: 258
MELTING POINT: 246–247°C; Tribenzoate, 190–191°C; Tri-*p*-bromobenzoate, 251–252°C
$[\alpha]_D$: +80; +92 SOLVENT: 8% NaOH; Py
ORGANISM: *Cryptotethia crypta* (Porifera)
REFERENCE: 36, 37, 38

$C_{10}H_{17}N_7O_3 \cdot 2HCl$ Saxitoxin



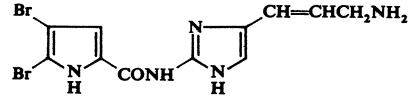
MOL. WT.: 283
MELTING POINT: Dihydrochloride
$[\alpha]_D$: +130
SPECTRAL DATA: PMR
ORGANISM: *Gonyaulax catenella* and *Gonyaulax tamarensis* (Protozoa)
REFERENCES: 314, 358, 359, 371, 443

$C_{11}H_{11}Br_2N_5O$ Dibromophakellin



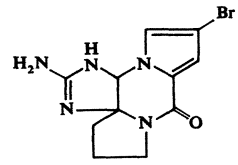
MOL. WT.: 389
MELTING POINT: 237–245°C (dec.); Monoacetate, 240–250°C
$[\alpha]_D$: −203
SPECTRAL DATA: UV, IR, Mass Spec
ORGANISM: *Phakellia flabellata* (Porifera)
REFERENCE: 373

$C_{11}H_{11}Br_2N_5O$ Oroidin



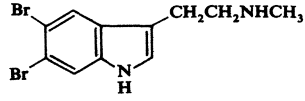
MOL. WT.: 389
MELTING POINT: *N*-Acetate, 256–258°C; Dihydro-*N*-Acetate, 244–247°C
SPECTRAL DATA: UV, IR
ORGANISM: *Agelas oroides* (Porifera)
REFERENCE: 147

$C_{11}H_{12}BrN_5O$ 4-Bromophakellin



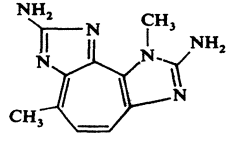
MOL. WT.: 310
MELTING POINT: 170–180°C (dec.)
ORGANISM: *Phakellia flabellata* (Porifera)
REFERENCE: 373

$C_{11}H_{12}Br_2N_2$ 2-*N*-Methylamino-3-(ethyl)-indole



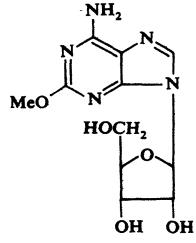
MOL. WT.: 332
BIOACTIVITY: Antibiotic
MELTING POINT: 132–134°C
SPECTRAL DATA: UV, PMR, Mass Spec
ORGANISM: *Polyfibrospongia maynardii* Hyatt (Porifera)
REFERENCE: 424

$C_{11}H_{12}N_6$ 3-Norpseudozoanthoxanthin



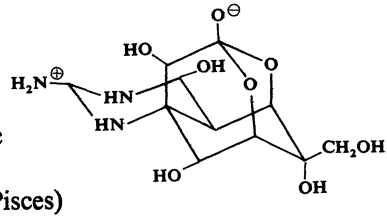
MOL. WT.: 228
MELTING POINT: 230°C (dec.)
SPECTRAL DATA: UV, PMR, Mass Spec
ORGANISM: *Epizoanthus arenaceus* (Arthropoda/Crustacea)
REFERENCE: 71

$C_{11}H_{15}N_5O_5$ Spongosine



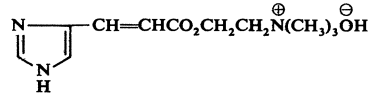
MOL. WT.: 297
MELTING POINT: 192–193°C
$[\alpha]_D$: −42.5 SOLVENT: 8% NaOH
ORGANISM: *Cryptotethia crypta* (Porifera)
REFERENCE: 35, 38, 45

$C_{11}H_{17}N_3O_8$ Tetrodotoxin



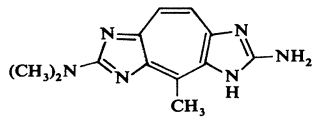
MOL. WT.: 319
MELTING POINT: >220°C; Picrate, >200°C
$[\alpha]_D$: −8.64 SOLVENT: Dil. HOAc
SPECTRAL DATA: UV
ORGANISM: *Spheroides rubripes* (Chordata/Pisces)
REFERENCE: 161

$C_{11}H_{19}N_3O_3$ Murexine Urocanylcholine



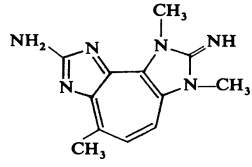
MOL. WT.: 241
MELTING POINT: Picrate, 218–221°C
ORGANISM: *Murex trunculus*, *Murex grandaris*, and *Murex erinaceus* (Mollusca)
REFERENCE: 121

$C_{12}H_{14}N_6$ Parazoanthoxanthin D



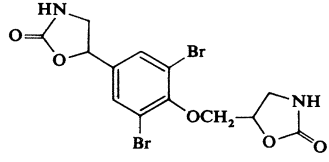
MOL. WT.: 242
MELTING POINT: 303–304°C
SPECTRAL DATA: UV, IR, Mass Spec
ORGANISM: *Parazoanthus axinellae* (Coelenterata)
REFERENCE: 70

$C_{12}H_{14}N_6$ Pseudozoanthoxanthin



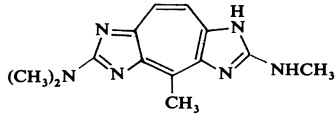
MOL. WT.: 242
MELTING POINT: >310°C
SPECTRAL DATA: UV, PMR, Mass Spec
ORGANISM: *Epizoanthus arenaceus* (Arthropoda/Crustacea)
REFERENCE: 71

$C_{13}H_{12}Br_2N_2O_5$ LL-PAA216



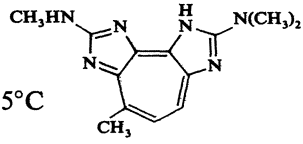
MOL. WT.: 452
MELTING POINT: 222–225°C
$[\alpha]_D$: +8.9 SOLVENT: MeOH
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Verongia lacunosa* (Porifera)
REFERENCE: 49

$C_{13}H_{16}N_6$ Epizoanthoxanthin A



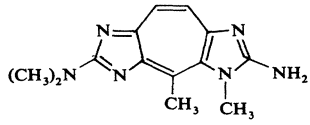
MOL. WT.: 256
MELTING POINT: 191–192°C
SPECTRAL DATA: UV, PMR
ORGANISM: *Epizoanthus arenaceus* (Arthropoda/Crustacea)
REFERENCE: 71

$C_{13}H_{16}N_6$ Paragracine



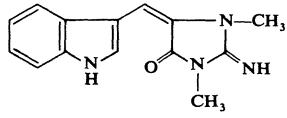
MOL. WT.: 256
MELTING POINT: 258–262°C (dec.); Acetate, 233–235°C
SPECTRAL DATA: UV, PMR, Mass Spec
ORGANISM: *Parazoanthus gracilis* Lwowsky (Coelenterata)
REFERENCE: 250

$C_{13}H_{16}N_6$ Zoanthoxanthin (2-Amino-3,4-dimethyl-6-dimethylamino-3H-1,3,5,7-tetra-azacyclopent[f]azulene)



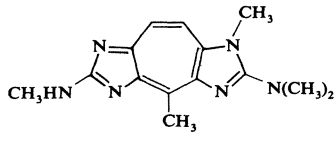
MOL. WT.: 256
MELTING POINT: 275–276°C
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Parazoanthus axinellae* (Coelenterata)
REFERENCE: 68, 69

$C_{14}H_{14}N_4O$ Aplysinopsin



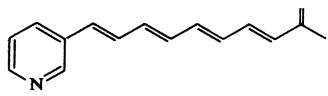
MOL. WT.: 254
MELTING POINT: 232–233°C; Diacetate, 217–220°C
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Thorecta* sp. and *Verongia spengelii* (Porifera)
REFERENCE: 222

$C_{14}H_{18}N_6$ Epizoanthoxanthin B



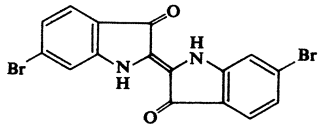
MOL. WT.: 270
MELTING POINT: Amph.
SPECTRAL DATA: UV, PMR, Mass Spec
ORGANISM: *Epizoanthus arenaceus* (Arthropoda/Crustacea)
REFERENCE: 71

$C_{15}H_{15}NO$ Navenone A



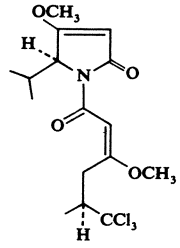
MOL. WT.: 225
MELTING POINT: 144–145°C
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Navanax inermis* (Cooper) (Mollusca)
REFERENCE: 392

$C_{16}H_8Br_2N_2O_2$ 6,6′-Dibromo-indigotin



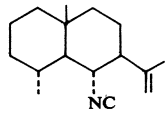
MOL. WT.: 420
MELTING POINT: *N,N′*-Diacetyl 306°C
ORGANISM: *Dicathais orbita* Gmelin (Mollusca)
REFERENCE: 27

$C_{16}H_{22}Cl_3NO_4$ Dysidin



MOL. WT.: 397
MELTING POINT: 127–129°C
$[\alpha]_D$: +141 SOLVENT: Chf
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Dysidea herbacea* (Porifera)
REFERENCE: 184

$C_{16}H_{25}N$ Acanthellin-1

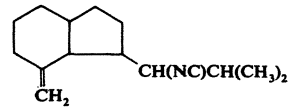


MOL. WT.: 231
BIOACTIVITY: Antibacterial
MELTING POINT: Oil
$[\alpha]_D$: −41.2
SPECTRAL DATA: IR, PMR, Mass Spec
ORGANISM: *Acanthella acuta* (Platyhelminthes)
REFERENCE: 296

$C_{16}H_{25}N$ Acanthellin-2

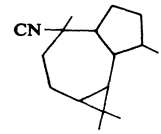
MOL. WT.: 231
MELTING POINT: Oil
$[\alpha]_D$: −24.1
SPECTRAL DATA: IR, Mass Spec
ORGANISM: *Acanthella acuta* (Platyhelminthes)
REFERENCE: 296

$C_{16}H_{25}N$ Axisonitrile-1



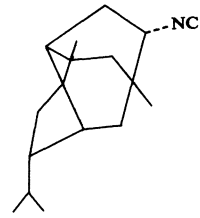
MOL. WT.: 231
MELTING POINT: 43–45°C
$[\alpha]_D$: +22.6 SOLVENT: Chf
SPECTRAL DATA: IR, PMR, Mass Spec
ORGANISM: *Axinella cannabina* (Porifera)
REFERENCE: 65

$C_{16}H_{25}N$ Axisonitrile-2



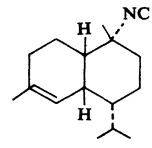
MOL. WT.: 231
MELTING POINT: Oil
$[\alpha]_D$: +29 SOLVENT: Chf
SPECTRAL DATA: IR, PMR, Mass Spec
ORGANISM: *Axinella cannabina* (Porifera)
REFERENCE: 129

$C_{16}H_{25}N$ 9-Isocyanopupukeanane



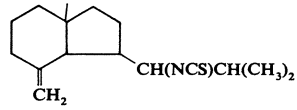
MOL. WT.: 231
MELTING POINT: Oil
$[\alpha]_D$: −9 SOLVENT: Cte
SPECTRAL DATA: IR, PMR, Mass Spec
ORGANISM: *Phyllidia varicosa* (Mollusca) and *Hymeniacidon* sp. (Porifera)
REFERENCE: 60

$C_{16}H_{25}N$



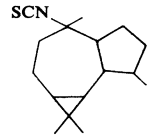
MOL. WT.: 231
MELTING POINT: 40–42°C
$[\alpha]_D$: −75 SOLVENT: Cte
SPECTRAL DATA: IR, PMR
ORGANISM: *Halichondria* sp. (Porifera)
REFERENCE: 47, 57, 58

$C_{16}H_{25}NS$ Axisothiocyanate-1



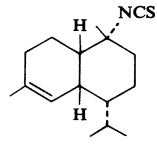
MOL. WT.: 263
MELTING POINT: Oil
$[\alpha]_D$: +5.9 SOLVENT: Chf
SPECTRAL DATA: IR, PMR, Mass Spec
ORGANISM: *Axinella cannabina* (Porifera)
REFERENCE: 65

$C_{16}H_{25}NS$ Axisothiocyanate-2



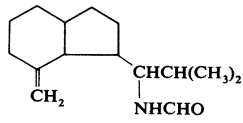
MOL. WT.: 263
MELTING POINT: Oil
$[\alpha]_D$: +12.8
SPECTRAL DATA: IR, PMR, Mass Spec
ORGANISM: *Axinella cannabina* (Porifera)
REFERENCE: 128

$C_{16}H_{25}NS$



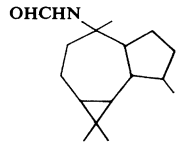
MOL. WT.: 263
MELTING POINT: Oil
$[\alpha]_D$: −63 SOLVENT: Cte
SPECTRAL DATA: UV, IR
ORGANISM: *Halichondria* sp. (Porifera)
REFERENCE: 57, 58, 59

$C_{16}H_{27}NO$ Axamide-1



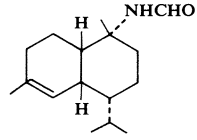
MOL. WT.: 249
MELTING POINT: Oil
$[\alpha]_D$: +10
SPECTRAL DATA: IR, PMR, Mass Spec
ORGANISM: *Axinella cannabina* (Porifera)
REFERENCE: 128

$C_{16}H_{27}NO$ Axamide-2



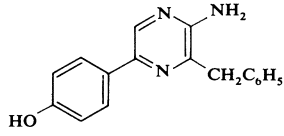
MOL. WT.: 249
MELTING POINT: Oil
$[\alpha]_D$: 37.5
SPECTRAL DATA: IR, PMR, Mass Spec
ORGANISM: *Axinella cannabina* (Porifera)
REFERENCE: 128

$C_{16}H_{27}NO$



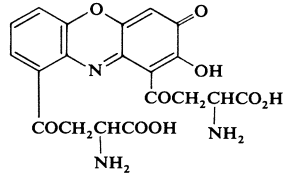
MOL. WT.: 249
$[\alpha]_D$: −50 SOLVENT: Cte
SPECTRAL DATA: IR, PMR, Mass Spec
ORGANISM: *Halichondria* sp. (Porifera)
REFERENCE: 57, 58, 59

$C_{17}H_{15}N_3O$ Aequorin



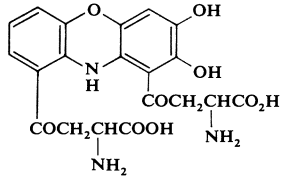
MOL. WT.: 277
MELTING POINT: 217–219°C
SPECTRAL DATA: UV, PMR, Mass Spec
ORGANISM: *Aequorea* sp. (Coelenterata)
REFERENCE: 234

$C_{20}H_{17}N_3O_9$ Xanthommatin



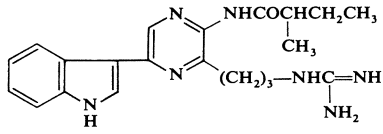
MOL. WT.: 443
SPECTRAL DATA: UV
ORGANISM: *Octopus vulgaris*, *Sepia officinalis*, *Loligo vulgaris*, and *Homarus gammarus* (Mollusca)
REFERENCE: 53, 61

$C_{20}H_{19}N_3O_9$ Dihydroxanthommatin



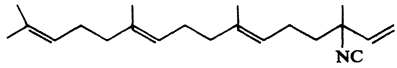
MOL. WT.: 445
MELTING POINT: >350°C
SPECTRAL DATA: UV, IR
ORGANISM: *Octopus vulgaris*, *Sepia officinalis*, *Loligo vulgaris*, and *Homarus gammarus* (Mollusca)
REFERENCE: 48, 61

$C_{21}H_{28}N_7O$ Oxyluciferin



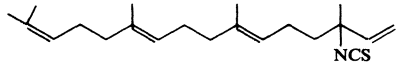
MOL. WT.: 394
MELTING POINT: 140–148°C
ORGANISM: *Cypridina hilgendorfii* (Arthropoda/Crustacea)
REFERENCE: 387

$C_{21}H_{33}N$ 3-Isocyano-3,7,11,15-tetramethyl-1,6,10,14-hexadecatetraene



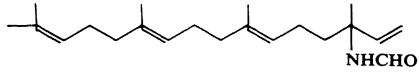
MOL. WT.: 299
MELTING POINT: Oil
$[\alpha]_D$: +15 SOLVENT: Cte
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Halichondria* sp. (Porifera)
REFERENCE: 58, 59

$C_{21}H_{33}NS$ 3-Isothiocyano-3,7-11,15-tetramethyl-1,6,10,14-hexadecatetraene



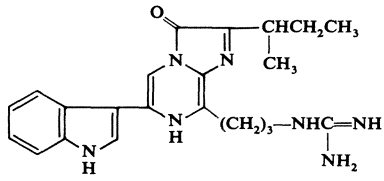
MOL. WT.: 331
ORGANISM: *Halichondria* sp. (Porifera)
REFERENCE: 58, 59

$C_{21}H_{35}NO$ 3,7,11,15-Tetramethyl-1,6,10,14-hexadecatetraene-3-formamide



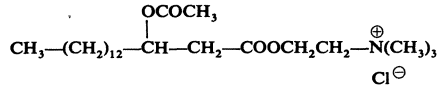
MOL. WT.: 317
MELTING POINT: Oil
SPECTRAL DATA: IR, Mass Spec
ORGANISM: *Halichondria* sp. (Porifera)
REFERENCE: 58, 59

$C_{22}H_{27}N_7O$ Luciferin



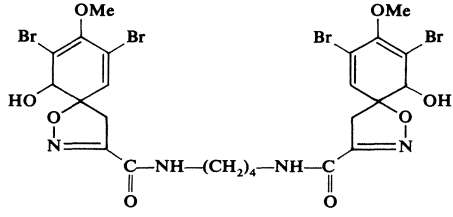
MOL. WT.: 405
MELTING POINT: 182–195°C
ORGANISM: *Cypridina hilgendorfii* (Arthropoda/Crustacea)
REFERENCE: 387

$C_{23}H_{46}ClNO_4$ Pahutoxin



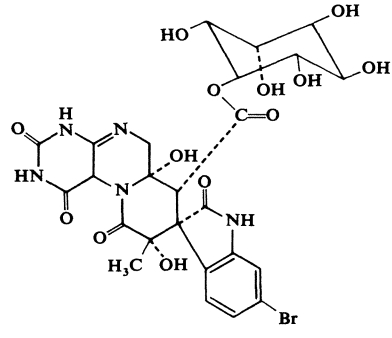
MOL. WT.: 436
BIOACTIVITY: Haemolytic
MELTING POINT: 74–75°C
$[\alpha]_D$: +3.05 SOLVENT: Me
ORGANISM: *Ostracion lentiginosus* (Chordata/Pisces)
REFERENCE: 51

$C_{24}H_{26}Br_4N_4O_8$ Aerothionin



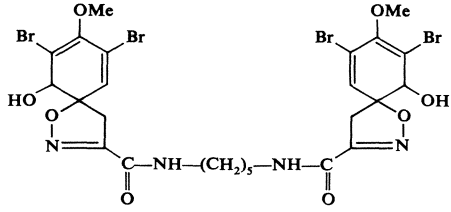
MOL. WT.: 818
MELTING POINT: 134–137°C; Diacetate, 206–208°C
$[\alpha]_D$: +252 SOLVENT: An
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Verongia thiona* and *Aplysina* (or *Verongia*) *aerophoba* (Porifera)
REFERENCE: 135, 305

$C_{25}H_{26}BrN_5O_{13}$ Surugatoxin



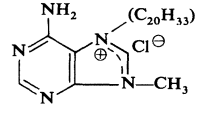
MOL. WT.: 684
MELTING POINT: >300°C
SPECTRAL DATA: UV, IR
ORGANISM: *Babylonia japonica* (Mollusca)
REFERENCE: 251

$C_{25}H_{28}Br_4N_4O_8$ Homoaerothionin



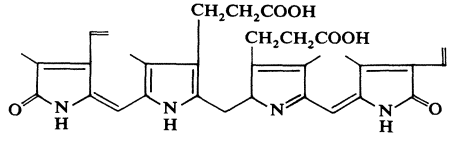
MOL. WT.: 832
MELTING POINT: Amph. Solid Diacetate, 166–167°C
SPECTRAL DATA: PMR
ORGANISM: *Verongia thiona* and *Aplysina* (or *Verongia*) *aerophoba* (Porifera)
REFERENCE: 132, 305

$C_{26}H_{40}ClN_5$ Agelasine



MOL. WT.: 458
MELTING POINT: 197–200°C (dec.)
SPECTRAL DATA: UV, IR, PMR, Mass Spec
ORGANISM: *Agelas dispar* Duchassaing and Michelotti (Porifera)
REFERENCE: 109

$C_{33}H_{36}N_4O_6$ Biliverdin IX,α

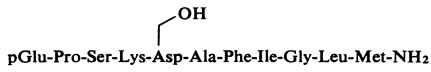


MOL. WT.: 584
SPECTRAL DATA: UV, Mass Spec
ORGANISM: *Heliopora coerulea* Pall. (Coelenterata)
REFERENCE: 351

$C_{45}H_{59}N_{11}O_{11}$ pGlu-Leu-Asn-Phe-Ser-Pro-Gly-Trp-NH_2

MOL. WT.: 929
ORGANISM: *Pandalus borealis* (Arthropoda/Crustacea)
REFERENCE: 146

$C_{54}H_{85}N_{13}O_{15}S$ Eledoisin



MOL. WT.: 1187
BIOACTIVITY: Hypotensive, 3–30 mg/kg
MELTING POINT: 230°C
$[\alpha]_D$: −44 SOLVENT: 95% HOAc
ORGANISM: *Eledone moschata* and *Eledone aldrovandi* (Mollusca)
REFERENCE: 120

$C_{207}H_{398}N_{57}O_{102}$ Anthopleurin-A

Asp-Asp-Asp-Asp-Thr-Thr-Thr-Ser-Ser-Ser-Ser-Ser-Ser-Glu-Pro-Pro-Pro-Pro-Gly-Gly-Gly-Gly-Gly-Gly-Gly-Gly-Ala-Cys-Cys-Cys-Cys-Cys-Cys-Val-Val-Ile-Leu-Leu-Leu-Leu-Tyr-Lys-Lys-His-His-Arg-Trp-Trp-Tyr-$(NH_3)_3$

MOL. WT.: 5086
BIOACTIVITY: Positive Inotropic Effect
ORGANISM: *Anthopleura xanthogrammica* (Brandt) (Coelenterata)
REFERENCE: 315

22,000–24,000 Protein

BIOACTIVITY: Toxin
ORGANISM: *Octopus dofleini* Martini (Mollusca)
REFERENCE: 399

Subject Index

Section B

B. Marine Animal Components

Molecular Weights

A. Plants

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