Apoptosis

Apoptosis is a distinctive form of cell death exhibiting specific morphological and biochemical characteristics, including cell membrane blebbing, chromatin condensation, genomic DNA fragmentation, and exposure of specific phagocytosis signaling molecules on the cell surface. Cells undergoing apoptosis differ from those dying through necrosis. Necrotic cells are usually recognized by the immune system as a danger signal and, thus, resulting in inflammation; in contrast, apoptotic death is quiet and orderly. There are two major pathways of apoptotic cell death induction: The intrinsic pathway, also called the Bcl-2-regulated or mitochondrial pathway, is activated by various developmental cues or cytotoxic insults, such as viral infection, DNA damage and growth-factor deprivation, and is strictly controlled by the BCL-2 family of proteins. The extrinsic or death-receptor pathway is triggered by ligation of death receptors (members of the tumor necrosis factor (TNF) receptor family, such as Fas or TNF receptor-1 (TNFR1)) that contain an intracellular death domain, which can recruit and activate caspase-8 through the adaptor protein Fas-associated death domain (FADD; also known as MORT1) at the cell surface. This recruitment causes subsequent activation of downstream (effector) caspases, such as caspase-3, -6 or -7, without any involvement of the BCL-2 family.

Studies suggest that alterations in cell survival contribute to the pathogenesis of a number of human diseases, including cancer, viral infections, autoimmune diseases, neurodegenerative disorders, and AIDS (acquired immunodeficiency syndrome). Treatments designed to specifically alter the apoptotic threshold may have the potential to change the natural progression of some of these diseases.
## Apoptosis Inhibitors & Modulators

<table>
<thead>
<tr>
<th>Compound</th>
<th>Cat. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>(2-Hydroxypropyl)-β-cyclodextrin (Hydroxypropyl betadex; Hyd roxypropyl-β-cyclodextrin; HP-β-CD)</td>
<td>HY-101103</td>
</tr>
<tr>
<td>(E)-[6]-Dehydroparadol</td>
<td>HY-77293</td>
</tr>
<tr>
<td>Adarotene (ST1926)</td>
<td>HY-14808</td>
</tr>
<tr>
<td>Apoptosis Activator 2</td>
<td>HY-18633</td>
</tr>
<tr>
<td>Baohuoside I (Icarin-II; Icariside-II)</td>
<td>HY-N0011</td>
</tr>
<tr>
<td>Betulin (Trochol)</td>
<td>HY-N0083</td>
</tr>
<tr>
<td>Betulinic acid (Lupatic acid; Betulic acid)</td>
<td>HY-10529</td>
</tr>
<tr>
<td>Bisdemethoxycurcumin (Curcumin III; Didemethoxycurcumin)</td>
<td>HY-N0007</td>
</tr>
<tr>
<td>Cholesterol myristate (Cholesterol myristate; Cholesterol tetradecanoate)</td>
<td>HY-N2338</td>
</tr>
<tr>
<td>Chondroitin sulfate (Chondroitin polysulfate)</td>
<td>HY-B2162</td>
</tr>
</tbody>
</table>

### Bioactivity

- **(2-Hydroxypropyl)-β-cyclodextrin**: (2-Hydroxypropyl)-β-cyclodextrin is a widely used drug delivery vehicle to improve the stability and bioavailability.

- **(E)-[6]-Dehydroparadol**: (E)-[6]-Dehydroparadol, extracted from patent US 9272994, compound d M15, shows growth inhibition and induction of apoptosis against human cancer cells with IC\textsubscript{50} values of 43.02 μM in HCT-116 cell and 41.59 μM in H-1299 cell, respectively.

- **Adarotene**: Adarotene is an effective apoptosis inducer, which surprisingly reduces DNA damage and exhibits a potent antiproliferative activity on a large panel of human tumor cells.

- **Apoptosis Activator 2**: Apoptosis Activator 2 is a potent apoptosis activator; increases procaspase-9 processing and subsequent caspase-3 activation.

- **Baohuoside I**: Baohuoside I (Icariside-II) is a component of Epimedium koreanum; a regulator of CXCR4 expression as well as function in cervical cancer and breast cancer cells; Apoptosis inducer.

- **Betulin**: Betulin (Trochol), is a sterol regulatory element-binding protein (SREBP) inhibitor with an IC\textsubscript{50} of 14.5 μM in K562 cell line.

- **Betulinic acid**: Betulinic acid is a natural pentacyclic triterpenoid, acts as an eukaryotic topoisomerase I inhibitor, acts as an IC\textsubscript{50} of 5 μM, and possesses anti-HIV, anti-malarial, anti-infl ammatory and anti-tumor properties.

- **Bisdemethoxycurcumin**: Bisdemethoxycurcumin(Curcumin III; Didemethoxycurcumin) is a natural derivative of curcumin with anti-inflammatory and anti-cancer activities.

- **Cholesterol myristate**: Cholesterol myristate is a natural steroid present in traditional Chinese medicine.

- **Chondroitin sulfate**: Chondroitin sulfate, one of five classes of glycosaminoglycans, has been widely used in the treatment of osteoarthritis. Chondroitin sulfate reduces inflammation mediators and the apoptotic process and is able to reduce protein production of inflammatory cytokines, iNOS and MMPs.

### Purity

- **(2-Hydroxypropyl)-β-cyclodextrin**: 95.40%
- **(E)-[6]-Dehydroparadol**: 98.87%
- **Adarotene**: 99.15%
- **Apoptosis Activator 2**: 97.06%
- **Baohuoside I**: 98.96%
- **Betulin**: 98.0%
- **Betulinic acid**: 98.58%
- **Bisdemethoxycurcumin**: 97.96%
- **Cholesterol myristate**: 98.0%
- **Chondroitin sulfate**: 94.30%

### Clinical Data

- **(2-Hydroxypropyl)-β-cyclodextrin**: No Development Reported
- **(E)-[6]-Dehydroparadol**: No Development Reported
- **Adarotene**: 1 g, 5 g, 10 g
- **Apoptosis Activator 2**: 10mM x 1mL in DMSO, 5 mg, 10 mg, 50 mg, 100 mg, 500 mg
- **Baohuoside I**: No Development Reported
- **Betulin**: 10mM x 1mL in DMSO, 5 mg, 10 mg, 50 mg, 100 mg, 200 mg
- **Betulinic acid**: Phase 2
- **Bisdemethoxycurcumin**: 10mM x 1mL in DMSO, 5 mg, 10 mg, 50 mg, 100 mg, 200 mg
- **Cholesterol myristate**: No Development Reported
- **Chondroitin sulfate**: 250 mg, 1 g

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**Bioactivity**: (2-Hydroxypropyl)-β-cyclodextrin is a widely used drug delivery vehicle to improve the stability and bioavailability.

**Clinical Data**: No Development Reported

**Size**: 1 g, 5 g, 10 g
Cisplatin  
(CDDP; cis-Diaminodichloroplatinum)  
Cat. No.: HY-17394

Bioactivity: Cisplatin is a potent inducer of growth arrest and/or apoptosis in most cell types.

Purity: 99.0%
Clinical Data: Launched
Size: 100 mg, 500 mg

Citric acid
Cat. No.: HY-N1428

Bioactivity: Citric acid is a weak organic tricarboxylic acid found in citrus fruits. Citric acid is a natural preservative and food tartness enhancer.

Purity: 98.0%
Clinical Data: Launched
Size: 10mM x 1mL in DMSO, 100 mg

Columbianadin
Cat. No.: HY-N0362

Bioactivity: Columbianadin, a natural coumarin from, is known to have various biological activities including anti-inflammatory and anti-cancer effects.

Purity: 99.85%
Clinical Data: No Development Reported
Size: 10mM x 1mL in DMSO, 5 mg, 10 mg, 25 mg, 50 mg

Costunolide  
((+)-Costunolide; Costus lactone; NSC 106404)  
Cat. No.: HY-N0036

Bioactivity: Costunolide, a sesquiterpene lactone, exhibits anti-inflammatory and anti-oxidant properties and mediates apoptosis.

Purity: 99.62%
Clinical Data: No Development Reported
Size: 10mM x 1mL in DMSO, 5 mg, 10 mg

Demethoxycurcumin  
(Curcumin II; Desmethoxycurcumin; Monod emethoxycurcumin)  
Cat. No.: HY-N0006

Bioactivity: Demethoxycurcumin (Curcumin II) is a major active curcuminoid; possesses anti-inflammatory properties; also exerts cytotoxic effects in human cancer cells via induction of apoptosis.

Purity: 99.09%
Clinical Data: No Development Reported
Size: 10mM x 1mL in DMSO, 5 mg, 10 mg, 50 mg

Desacetylcinobufotalin  
(Deacetylcinobufotalin)  
Cat. No.: HY-N0882

Bioactivity: Desacetylcinobufotalin is a natural compound; apoptosis inducer and shows the marked inhibition effect to HepG2 cells and the IC50 value is 0.0279μmol/mL.

Purity: >98%
Clinical Data: No Development Reported
Size: 5 mg, 10 mg

Ecteinascidin 770  
(Ecteinascidine 770; Et-770)  
Cat. No.: HY-101191

Bioactivity: Ecteinascidin 770 (ET-770) is a 1,2,3,4-tetrahydroisoquinoline alkaloid with potent anti-cancer activities; inhibits U373MG cells with an IC50 of 4.83 nM.

Purity: 98.82%
Clinical Data: No Development Reported
Size: 10mM x 1mL in DMSO, 1 mg

Elesclomol  
(STA-4783)  
Cat. No.: HY-12040

Bioactivity: Elesclomol is a novel potent oxidative stress inducer that elicits pro-apoptosis events among tumor cells.

Purity: 99.80%
Clinical Data: Phase 3
Size: 10mM x 1mL in DMSO, 5 mg, 10 mg, 50 mg, 100 mg

Epibrassinolide  
(24-Epibrassinolide; B1105; BP55)  
Cat. No.: HY-N0848

Bioactivity: Epibrassinolide is a natural brassinosteroid (BR) derivative, is a plant regulator with a similar structure to mammalian steroids. Epibrassinolide is a potential apoptotic inducer in various cancer cells without affecting the non-tumor cell growth.

Purity: 98.00%
Clinical Data: No Development Reported
Size: 10mM x 1mL in DMSO, 5 mg, 10 mg, 50 mg, 100 mg

Ginsenoside Rg6
Cat. No.: HY-N0907

Bioactivity: Ginsenoside Rg6 is the component isolated from notoginseng. Ginsenoside Rg6 inhibits TNF-α-induced NF-κB transcriptional activity with an IC50 of 29.34±2.22 μM in HepG2 cell line. Ginsenoside Rg6 also exhibits apoptosis-inducing effect.

Purity: >98%
Clinical Data: No Development Reported
Size: 5 mg, 10 mg
Ginsenoside Rh2
(20(S)-Ginsenoside Rh2; 20(S)-Rh2; Ginsenoside-Rh2)  
Cat. No.: HY-N0605


Purity: 98.0%
Clinical Data: No Development Reported
Size: 10mM x 1mL in DMSO, 5 mg, 10 mg

Ginsenoside Rh4
Cat. No.: HY-N0905

Bioactivity: Ginsenoside Rh4 is a rare saponin obtained from Panax notoginseng. Ginsenoside Rh4 activates Bax, caspase 3, <b>and</b> caspase 9. Ginsenoside Rh4 also induces autophagy.

Purity: 98.40%
Clinical Data: No Development Reported
Size: 10mM x 1mL in DMSO, 5 mg, 10 mg

Glycochenodeoxycholic acid
(Chenodeoxycholylglycine)  
Cat. No.: HY-N2334

Bioactivity: Glycochenodeoxycholic acid is a bile salt formed in the liver from chenodeoxycholate and glycine, used to induce hepatocyte apoptosis in research.

Purity: 98.0%
Clinical Data: No Development Reported
Size: 10mM x 1mL in DMSO, 10 mg

Iberin
Cat. No.: HY-101413

Bioactivity: Iberin, a sulfoxide analogue of sulforaphane, is a naturally occurring member of the isothiocyanate family. It inhibits cell survival with an IC50 of 2.3 μM in HL60 cell.

Purity: 98.00%
Clinical Data: No Development Reported
Size: 10mM x 1mL in DMSO, 2 mg

Isoalantolactone
((+)-Isoalantolactone; Isohelenin)  
Cat. No.: HY-N0780

Bioactivity: Isoalantolactone is an apoptosis inducer, which also acts as an alkylating agent.

Purity: 99.22%
Clinical Data: No Development Reported
Size: 10mM x 1mL in DMSO, 10 mg

Kinetin riboside
(N6-Furfuryladenosine)  
Cat. No.: HY-101055

Bioactivity: Kinetin riboside, a cytokinin analog, can induce apoptosis in cancer cells. It inhibits the proliferation of HCT-15 cells with an IC50 of 2.5 μM.

Purity: 99.02%
Clinical Data: No Development Reported
Size: 10mM x 1mL in DMSO, 100 mg

Meisoindigo
(Dian III; N-Methylisoindigotin; Natura-α)  
Cat. No.: HY-13680

Bioactivity: Meisoindigo(Natura-α; N-Methylisoindigotin; Dian III), a de rivative of Indigo naturalis, might induce apoptosis and myeloid differentiation of acute myeloid leukemia (AML).

Purity: 96.46%
Clinical Data: No Development Reported
Size: 10mM x 1mL in DMSO, 5 mg, 10 mg, 50 mg, 100 mg

Methyl protodioscin
(NSC-698790; Smilax saponin B)  
Cat. No.: HY-N0863

Bioactivity: Methyl protodioscin(NSC-698790) is a furostanol bisglycoside with antitumor properties; shows to reduce proliferation, cause cell cycle arrest.

Purity: 98.0%
Clinical Data: No Development Reported
Size: 10mM x 1mL in DMSO, 5 mg, 10 mg

Myricetin
(Cannabiscetin)  
Cat. No.: HY-15097

Bioactivity: Myricetin is a common plant-derived flavonoid with a wide range of activities including strong antioxidant, anticancer, anti-diabetic and anti-inflammatory activities.

Purity: 99.41%
Clinical Data: No Development Reported
Size: 10mM x 1mL in DMSO, 50 mg, 100 mg, 200 mg, 500 mg

NSC348884
Cat. No.: HY-13915

Bioactivity: NSC348884 is a nucleosom inhibitor disrupts oligomer formation and induces apoptosis, inhibits cell proliferation at an IC50 of 1.7-4.0 μM in distinct cancer cell lines.

Purity: 99.92%
Clinical Data: No Development Reported
Size: 10mM x 1mL in DMSO, 5 mg, 10 mg, 25 mg, 50 mg, 100 mg
Osajin
(CID 95168; NSC 21565)  
**Cat. No.: HY-N3125**

**Bioactivity:** Osajin is the major bioactive isoflavone present in the fruit of *Maclura pomifera* with antitumor, antioxidant and anti-inflammatory activities.

**Purity:** > 98%
**Clinical Data:** No Development Reported
**Size:** 5 mg

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Polydatin
(Piceid)  
**Cat. No.: HY-N0120A**

**Bioactivity:** Polydatin (Piceid), extracted from the roots of Polygonum cuspidatum Sieb, a widely used traditional Chinese remedy, possesses anti-inflammatory activity in several experimental models.

**Purity:** 98.42%
**Clinical Data:** Phase 2
**Size:** 10mM x 1mL in DMSO, 100 mg, 200 mg, 500 mg

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Sanguinarine chloride
(Pseudochelerythrine; Sanguinarium chloride)  
**Cat. No.: HY-N0052A**

**Bioactivity:** Sanguinarine chloride, a benzophenanthridine alkaloid derived from the root of Sanguinaria Canadensis, can stimulate apoptosis via activating the production of reactive oxygen species (ROS). Sanguinarine-induced apoptosis is associated with the activation of JNK and NF-kB.

**Purity:** 98.10%
**Clinical Data:** No Development Reported
**Size:** 10mM x 1mL in DMSO, 5 mg, 10 mg

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SMIP004  
**Cat. No.: HY-15694**

**Bioactivity:** SMIP004 is a novel inducer of cancer-cell selective apoptosis of human prostate cancer cells, it was found to downregulate SKP2 and to stabilize p27.

**Purity:** 98.81%
**Clinical Data:** No Development Reported
**Size:** 10mM x 1mL in DMSO, 5 mg, 10 mg, 50 mg, 100 mg

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Taurochenodeoxycholic acid
(12-Deoxycholyltaurine)  
**Cat. No.: HY-N2027**

**Bioactivity:** Taurochenodeoxycholic acid is one of the main bioactive substances of animals' bile acid.

**Purity:** 99.80%
**Clinical Data:** Launched
**Size:** 10mM x 1mL in DMSO, 50 mg

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Trabectedin
(Ecteinascidin 743; ET-743; Ecteinascidin)  
**Cat. No.: HY-50936**

**Bioactivity:** Trabectedin (Ecteinascidin-743 or ET-743) is a novel antitumor agent of marine origin with potent antitumor activity both in vitro and in vivo.

**Purity:** 99.83%
**Clinical Data:** Launched
**Size:** 1 mg

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Ubiquitin Isopeptidase Inhibitor I, G5
(NSC144303)  
**Cat. No.: HY-100738**

**Bioactivity:** Ubiquitin Isopeptidase Inhibitor I, G5 (NSC144303) is an apoptosis one-independent caspase and apoptosis activator with IC_{50} values of 1.76 and 1.6 μM in E1A and E1A/C9 DN cells, respectively.

**Purity:** 98.0%
**Clinical Data:** No Development Reported
**Size:** 10mM x 1mL in DMSO, 5 mg, 10 mg, 25 mg, 50 mg, 100 mg

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**Bioactivity:** PBOX 6 is a pyrrolo-1,5-benzoxazepine (PBOX) compound, acts as a microtubule-depolymerizing agent and an apoptotic agent.

**Purity:** 98.0%
**Clinical Data:** No Development Reported
**Size:** 10mM x 1mL in DMSO, 5 mg, 10 mg, 25 mg

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**Bioactivity:** Silvestrol aglycone, a aglycone of potential anticancer rocaglate derivative from Aglaia foaeodata, induces apoptosis in LNCaP cells through the mitochondrial/apoptosome pathway without activation of executioner caspase-3 or -7. 5'myc-UTR-LUC inhibitor (IC50 = 0.8 nM).

**Purity:** > 98%
**Clinical Data:** No Development Reported
**Size:** 5 mg, 10 mg

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**Bioactivity:** SMIP004 is a novel inducer of cancer-cell selective apoptosis of human prostate cancer cells, it was found to downregulate SKP2 and to stabilize p27.

**Purity:** 98.81%
**Clinical Data:** No Development Reported
**Size:** 10mM x 1mL in DMSO, 5 mg, 10 mg, 50 mg, 100 mg

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**Bioactivity:** Taurochenodeoxycholic acid is one of the main bioactive substances of animals' bile acid.

**Purity:** 99.80%
**Clinical Data:** Launched
**Size:** 10mM x 1mL in DMSO, 50 mg
<table>
<thead>
<tr>
<th><strong>Bioactivity:</strong></th>
<th>[6]-Gingerol is an active compound isolated from Ginger (<em>Zingiber officinale</em> Rosc), exhibits a variety of biological activities including anticancer, anti-inflammation, and anti-oxidation.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Purity:</strong></td>
<td>98.01%</td>
</tr>
<tr>
<td><strong>Clinical Data:</strong></td>
<td>No Development Reported</td>
</tr>
<tr>
<td><strong>Size:</strong></td>
<td>10 mM x 1 mL in DMSO, 5 mg, 10 mg, 25 mg, 50 mg, 100 mg</td>
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