

# PubChem

## Allantoin

<https://pubchem.ncbi.nlm.nih.gov/compound/allantoin> (accessed 12/01/2018)

### 8. Pharmacology and Biochemistry

<https://pubchem.ncbi.nlm.nih.gov/compound/allantoin#section=Pharmacology-and-Biochemistry>

#### 1. MeSH Pharmacological Classification

##### Dermatologic Agents

Drugs used to treat or prevent skin disorders or for the routine care of skin.  
[See a list of PubChem compounds matching this category.](#)

*from MeSH*

#### 2. Absorption, Distribution and Excretion

Allantoin administered to dogs orally as solid or solution was excreted in the urine to an extent of between 35 and 92 per cent within 24 hours. No allantoin was recovered either in urine or feces when given to rabbits orally. In man the recovery was 19 and 34 per cent in two individuals after massive doses. After intravenous administration recovery in the urine was practically quantitative with doses of 75 to 600 mgm. in the dog and in man. After 240 mgm. in man excretion continued for 72 hours. The results were similar after subcutaneous injection. [Uric acid](#) injected intravenously into a dog was converted into allantoin within two hours.

*Young EG et al; J Pharmacol Exptl Ther 81 (1): 1-9 (1944)*

*from HSDB*

#### 3. Metabolism/Metabolites

In humans, [uric acid](#) is the final breakdown product of unwanted purine nucleotides. [Uric acid](#) is the last stage in [purine](#) degradation, because humans lack the enzyme [uricase](#) which converts [uric acid](#) into allantoin.

Abstract: [PubMed](#)

*Hediger MA; Ther Umsch 61 (9): 541-5 (2004)*

*from HSDB*

Allantoin in the presence of [calcium](#) ions has been implicated as a potential toxic agent in Reye's syndrome. An investigation of possible alternative sources of allantoin in humans, which lack the enzyme [uricase](#), has been initiated. [Urate](#) is a strong reducing agent which can reduce cytochrome c nonenzymatically, with the concomitant production of CO<sub>2</sub> and H<sup>+</sup>. The stoichiometries measured for the various reactants and products were 1 [urate](#):2 cytochrome c:1 H<sup>+</sup>:1 CO<sub>2</sub>. The initial reaction rate depended on the concentrations of both [urate](#) and cytochrome c, with reaction kinetics that were first order with respect to [urate](#) and second order with respect to cytochrome c. The participation of [molecular oxygen](#) in this reaction could not be detected. The pH and ionic strength optima for this reaction were determined to be 9.5-10.5 and 10<sup>(-5)</sup> M, respectively. Based on the results reported here, the following

balanced equation can be written:  $\text{urate}^{-2} + 2 \text{ cytochrome c}^{+3} + 2 \text{ H}_2\text{O} \rightarrow \text{allantoin} + 2 \text{ cytochrome c}^{+2} + \text{H}^+ + \text{HCO}_3^-$ . /The authors/ propose that allantoin can be generated from the oxidation of [urate](#) by cytochrome c<sup>+3</sup>, and that this is a potential source of allantoin in human tissues.

Abstract: [PubMed](#)

*Martens ME et al; Arch Biochem Biophys 252 (1):91-6 (1987)*

*from HSDB*

[Uric acid](#) is the main nitrogenous waste product in birds but it is also known to be a potent antioxidant. Hominoid primates and birds lack the enzyme [urate](#) oxidase, which oxidizes [uric acid](#) to allantoin. Consequently, the presence of allantoin in their plasma results from non-enzymatic oxidation.

Abstract: [PubMed](#)

*Tsahar E et al; J Comp Physiol (B) 176 (7): 653-61 (2006)*

*from HSDB*

In most mammals [purine](#) degradation ultimately leads to the formation of allantoin. Humans lack the enzyme [uricase](#), which catalyzes the conversion of [uric acid](#) to allantoin.

Abstract: [PubMed](#)

*Masseoud D et al; Curr Pharm Des 11 (32): 4117-24 (2005)*

*from HSDB*

[Uric acid](#) ... acts as an antioxidant and /can/ react with biologically relevant oxidants to form allantoin. Therefore, measurement of allantoin in humans was proposed as a marker of oxidative stress. /The authors/ estimated allantoin in human plasma obtained from the patients with chronic renal failure before hemodialysis (n=30), patients with non-insulin dependent diabetes mellitus (n=30) and blood donors (n=30)... . The preliminary reference range of allantoin in a group of blood donors is 4.76+/-2.99 umol/L. In the patients with chronic renal failure and the patients with non-insulin dependent diabetes mellitus ... allantoin levels in plasma of (27.1+/-13.8) umol/L and (11.08+/-5.90) umol/L, respectively/ were found/. It seems that allantoin is a possible indicator of free radical damage in vivo.

Abstract: [PubMed](#)

*Kand'ar R et al; Clin Chim Acta 365 (1-2): 249-56 (2006)*

*from HSDB*

The concentrations of the major metabolites for [nitrogen](#) excretion and/or transport in maternal and fetal /rat/ blood and amniotic fluid during the last 2 days of gestation were investigated. [Alanine](#), [glutamine](#), [ammonia](#) and allantoin accumulated in amniotic fluid during late gestation. [Urea](#) concentrations increased in amniotic fluid though only during the last day of gestation, suggesting that [urea](#) is taken up by the mother through the amniotic membranes. [Glutamate](#) did not accumulate in amniotic fluid during late gestation although high concentrations of it were found in fetal blood in the same circumstances, suggesting the occurrence of a mechanism for preventing fetal [glutamate](#) disposal.

Abstract: [PubMed](#)

*Garcia MV et al; Biol Neonate 53 (5): 315-20 (1988)*

*from HSDB*

Fetal metabolic conversion and clearance of [hypoxanthine](#) was investigated in five pregnant rhesus monkeys. (14-C)[hypoxanthine](#) injected into the fetal

circulation disappeared rapidly and its metabolic break-down products [uric acid](#) and allantoin appeared in fetal plasma and erythrocytes. In amniotic fluid only [hypoxanthine](#) could be demonstrated. When (14-C)[hypoxanthine](#) was infused into the fetal circulation at a constant rate and metabolic conversion to [uric acid](#) and allantoin was inhibited with [allopurinol](#), a constant level of [hypoxanthine](#) was obtained within 30 min. No [uric acid](#) or allantoin was demonstrated, but [inosine monophosphate](#) and adenine nucleotides appeared in the fetal erythrocytes...

Abstract: [PubMed](#)

*van Kreel BK and Wallenburg HC; J Dev Physiol 2 (6): 365-72 (1980)*

*from HSDB*

... serum allantoin levels, oxidation products of [uric acid](#), /were measured/ as a marker of free radical generation in rheumatoid arthritis. Fasting blood samples were obtained from 21 rheumatoid patients and 15 healthy controls. ... The mean allantoin and [uric acid](#) levels and ratios in the patient group were 22.1 +/- 11.3, 280.5 +/- 65.0 and 8.0 +/- 3.7 uM, while in the control group they were 13.6 +/- 6.3, 278.3 +/- 53.6 and 4.9 +/- 2.1 uM, respectively.

Abstract: [PubMed](#)

*Yardim-Akaydin S et al; Free Radic Res 38 (6): 623-8 (2004)*

*from HSDB*

[Urate](#) oxidase (uricozyme) is an enzyme of non-human origin capable of oxidizing human [uric acid](#) to allantoin, a highly soluble product at renal tubule pH. /The authors/ report its efficacy in three patients with acute [urate](#) nephropathy due to tumor lysis in chronic lymphatic leukemia and high grade lymphoma. Two patients had an additional obstructive nephropathy due to ureteric [urate](#) crystals. An intravenous infusion (100 units/kg in 50 mL saline over 30 min) was given for between two and five consecutive days. All patients showed a rapid fall in serum [urate](#) levels with associated diuresis, correction of metabolic disturbance and full resolution of uremia within a week. The treatment was well tolerated and caused a rapid resolution of clinical symptoms in all cases.

Abstract: [PubMed](#)

*Leach M et al; Clin Lab Haematol 20 (3): 169-72 (1998)*

*from HSDB*

The increased production of reactive [oxygen](#) species (ROS) from activated neutrophils in Behcet's disease (BD) and recurrent aphthous stomatitis (RAS) may result in increased oxidative stress. [Uric acid](#) can react rapidly with neutrophil-derived ROS to form allantoin. The purpose of the study was to evaluate the serum levels of allantoin as a new marker of oxidative stress in BD compared with [malondialdehyde](#) (MDA) levels as a well-known marker. Blood samples were obtained from 23 BD patients, 22 RAS patients as positive controls, and 21 healthy controls. When compared to the healthy controls, /the authors/ found higher allantoin and MDA levels in the BD patients and higher MDA levels in the RAS patients. ... As allantoin is only a product of [uric acid](#) oxidation by reactive [oxygen](#) and [nitrogen](#) species, it may also be used as a marker of oxidative stress in BD.

Abstract: [PubMed](#)

*Yardim-Akaydin S et al; Scand J Rheumatol 35 (1): 61-4 (2006)*

*from HSDB*

Allantoin, the oxidation product of [uric acid](#) (UA), can be used as an in vivo marker of free radical generation. ...The study population was 20 infants of 24-30 weeks gestation, comprising 10 who subsequently developed chronic lung disease (CLD) and 10 without CLD. In the CLD infants, the plasma allantoin/UA ratio showed a significant increase after day 1 and continued to increase gradually to reach a peak on day 6 (6.5 +/- 4.1% for CLD and 2.1 +/- 0.9% for non-CLD infants). The allantoin/UA ratio in bronchoalveolar lavage fluid was also higher in CLD infants and the difference reached significance on days 4-6 (41.2 +/- 15.8% for CLD and 11.7 +/- 9.9% for non-CLD infants). ...

Abstract: [PubMed](#)

Ogihara T et al; *Biol Neonate* 73 (1): 24-33 (1998)

from HSDB

## 4. Human Metabolite Information

Chemical metabolite information from the Human Metabolome Database (HMDB). [Read more..](#)

### 1. Metabolite Description

Allantoin is a diureide of [glyoxylic acid](#) with the chemical formula C<sub>4</sub>H<sub>6</sub>N<sub>4</sub>O<sub>3</sub>. It is also called 5-ureidohydantoin, glyoxyldiureide, and 5-ureidohydantoin. It is a product of oxidation of [uric acid](#). It is a product of [purine](#) metabolism in most mammals except higher apes, and it is present in their urine. In humans, [uric acid](#) is excreted instead of allantoin. The presence of allantoin in the urine can be an indication of microbial overgrowth or it can be created via non-enzymatic means through high levels of reactive [oxygen](#) species. In this regard Allantoin is sometimes used as a marker of oxidative stress. Allantoin can be isolated from cow urine or as a botanical extract of the comfrey plant. It has long been used for its healing, soothing, and anti-irritating properties. Allantoin helps to heal wounds and skin irritations and stimulates the growth of healthy tissue. Allantoin can be found in anti-acne products, sun care products, and clarifying lotions because of its ability to help heal minor wounds and promote healthy skin. Allantoin is frequently present in toothpaste, mouthwash, and other oral hygiene products as well as shampoos, lipsticks, various cosmetic lotions and creams and other cosmetic and pharmaceutical products.