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***Symphytum officinale***  
**Common Comfrey**

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# 1. Introduction

The later part of the Twentieth Century saw the medical profession and the general public alike turn its back more and more on the natural remedies provided by Mother Earth and in my opinion rely too much on pharmaceuticals. Whether this is an issue of convenience or monetary gain is another topic in its own right.

I firmly believe that we should take a step back to nature and rediscover the natural benefits of herbal and holistic medicine. A thought captured beautifully in the following quote:

"Until man duplicates a blade of grass, nature can laugh at his so-called scientific knowledge. Remedies from chemicals will never stand in favour compared with the products of nature, the living cell of the plant, the final result of the rays of the sun, the mother of all life" - Edison (1).

There are countless natural herbal remedies known to man, some well known and some not so much. Millions of people around the world are living in pain or discomfort which could be treated by a healthy mixture of holistic treatments and a healthier diet which is not being suggested to them and as a result are relying on ineffective and possibly harmful drugs or invasive and unnecessary surgery.

The use of holistic and herbal remedies has long been a part of my life having been brought up by a Father who is one of the World's most renowned holistic therapists. Although he works solely with holistic medicine he does have a conventional medical background and therefore has a balanced view on both sides' strengths and weaknesses. His view has taught me the importance of a broader medical view or understanding and not be limited by only one school of thought. The gap between holistic and western medicine is ever expanding but the only true medicine is a marriage between the two. As it is accurately described in this quote:

"Botany and medicine came down the ages hand in hand until the seventeenth century; then both arts became scientific, their ways parted, and no new herbals were compiled. The botanical books ignored the medicinal properties of plants and the medical books contained no plant lore" - Lyle (2).

Holistic medicine is a very broad topic with many fields and I have chosen to write about a medicinal herb.

I have singled out the plant comfrey (*Symphytum officinale*) to discuss at length which was used for many years by people to aid, amongst other things the healing of bones. In clinical practice this has seen remarkable effects on certain ailments but it has been overshadowed in recent years by for example the lesser effective plant Arnica.

Comfrey is a herb which can be used both internally and externally. Like all other medicines only people with medical knowledge should use Comfrey as an internal treatment as excessive use can be liver toxic. This effect, or side-effect, was found during medical trials in the 1970's and has been a major topic of discussion amongst herbalists, holistic therapists and conventional therapists in the years that followed. It has come to a point that some countries like USA and Australia have banned Comfrey-products intended for oral administration from the market. What interest me are the criteria (and intentions) used during these trials, and if there are other trials done with different results or criteria that might have been missed by the public eye.

## 2. Taxonomy and Description

### 2.1 Taxonomy

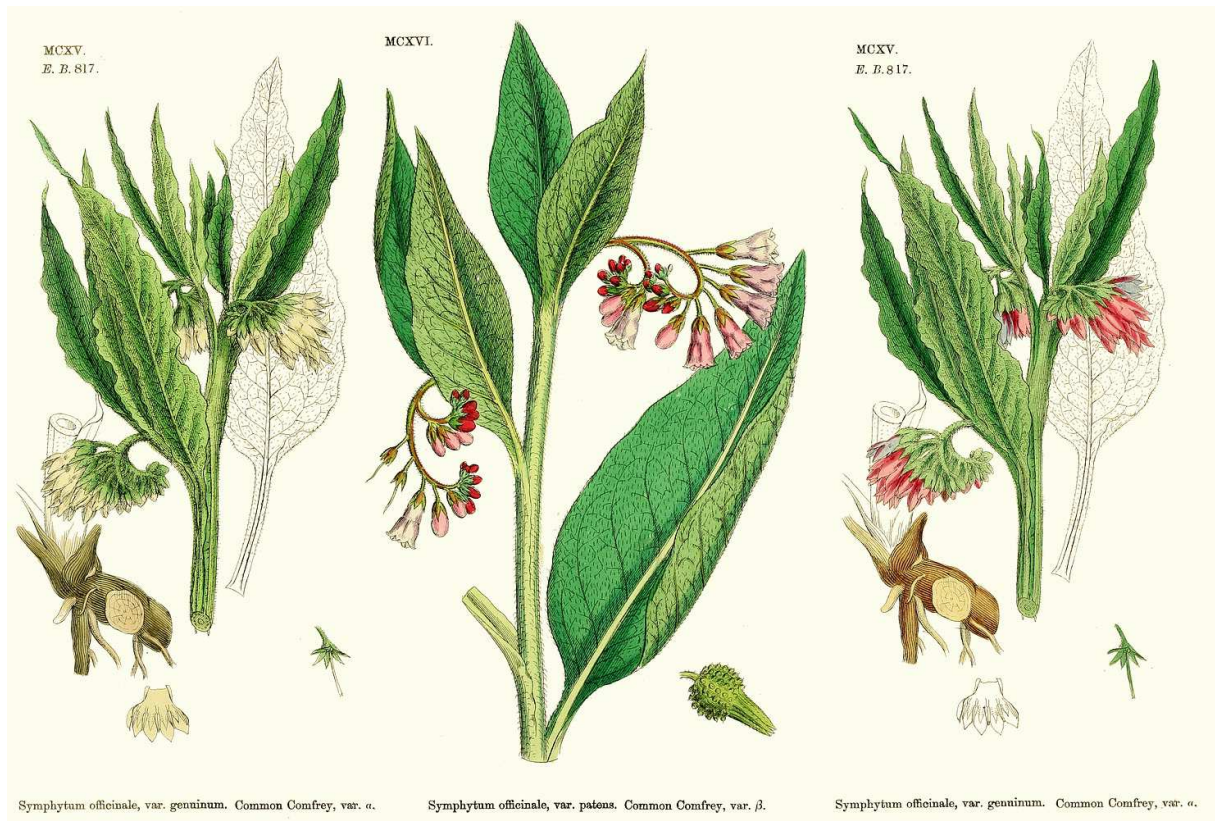
**Table 1. Taxonomy of *Symphytum officinale* after Integrated Taxonomic Information System (ITIS) (3):**

Kingdom	Plantae	Plants
Sub-kingdom	Viridaeplantae	Green plants
Infra-kingdom	Streptophyta	Land plants
Division	Tracheophyta	Vascular plants, tracheophytes
Sub-division	Spermatophytina	Spermatophytes, seed plants, phanérogames
Infra-division	Angiospermae	Flowering plants, angiosperms, plantas com flor, angiosperma, plantes à fleurs, angiospermes, plantes à fruits
Class	Magnoliopsidae	
Super-order	Asteranae	
Order	Boraginales	
Family	Boraginaceae	Borage, bourraches
Genus	<i>Symphytum L.</i>	Comfrey
Species	<i>Symphytum officinale L.</i>	Common comfrey

Plantae are multicellular organisms that produce their own food, carbohydrates, by the process of photosynthesis. According to the new classification of Kingdom Plantae it includes the divisions tracheophytes, bryophytes and algae. Tracheophytes and bryophytes occur on land and develop embryo (Embryophyta) while algae occur mostly in water and do not have an embryo stage. Tracheophytes (vascular plants) are divided into two further sub-divisions, pteridophytes (seed-less plants) and spermatophytes (plants that produce seeds) (4).

The family Boraginaceae consists of trees, herbs and shrubs often with coarsely hairy herbage. The leaves are mostly alternate and simple, stipules are absent and the flowers are almost always bisexual and actinomorphic (5).

**Caption 1. *Symphytum officinale* (3 varieties) after Delta Database (6):**



## 2.2 Description

Common comfrey is an erect perennial plant native to Europe and Asia, but now found in the wild worldwide. The height can reach up to 1,2 meters. Comfrey grows very well in damp and rich meadows especially along riverbanks.

The stem is hollow, erect and contains mucilage. It is covered with stiff hairs that can cause irritation or even itching if it comes in contact with bare skin.

The leaves are growing alternating around the stem and are thick, broad and veined, and can be up to 25 cm long and with a pointed end. These are also covered with stiff hairs. The top is dark green and it is light green underneath. The base and lower leaves are ovate-lanceolate originating from a petiole. From the axils of the upper leaves, small bell-like flowers grow in a cluster of 15-20. The color is mauve to purple and bloom in May to July. They are hanging in a 2-fayed cyme. The calyx and corolla of comfrey is fused. The calyx has five tips and the corolla is cylindrical with a tube with five angles and a border with five tips as well. The tips are revolute and you

can find five spike-shaped plates in the tube-mouth. Comfrey flowers have five stamens and one style, and the ovary has four valves. The fruit is composed of four smooth and shiny nutlets.

The root is branching and large, blackish on the outside, and whitish creamy on the inside with mucilage (7).

**Caption 2. *Symphytum officinale* (8):**



**Caption 3. Comfrey leaf (9):**





**Caption 4. Comfrey flower, violet (10):**



**Caption 5. Comfrey, with fruits (11):**



**Caption 6. Comfrey stalk (12):**



## **3. Habitat**

### **3.1 Native**

Common comfrey is native to western Asia and Europe it is found in damp places along rivers and streams, in ditches by roads, in fields, pastures and on damp grassland. Now it has spread far and wide in the whole temperate region of North America as well and is often found in gardens. The plant prefers a deep, rich soil, and is usually absent from drier habitats (13).

### **3.2 Cultivation**

Comfrey requires deep, but not necessarily good, soil for cultivation. It needs this depth of soil as it drives its roots deep down to obtain trace elements as well as calcium and phosphorous. It is not too sensitive to the pH in the soil, but thrives best at a pH of 6.0 to 7.0. It thrives best in full sun, but can also be content with a partly shady area. To obtain the highest possible production, it should be planted in moist and fertile soil, but can adapt easily to many kinds of conditions and due to its root system it is quite resistant to drought. Comfrey plants can last for more than two decades if sufficient weed control and soil fertility are maintained, and if each plant is planted three to four feet from each other. Its propagation is maintained mostly by division and not with spreading of seeds.

Comfrey contain high amount of protein and obtain its nitrogen from the soil, so this nutrient must be added through fertilization and composting. It is also recommended as a fertilizer in itself due to its carbon to nitrogen ratio at 14 to 1 (14).

According to Coe's Comfrey (15) this herb can be planted any time that the soil can be worked, and in warmer climate this means that it can be planted during the whole year. In this climate harvesting can also be carried out during the entire year, sometimes up to 12 cuttings can be made.

It is emphasized to plant comfrey in "fertile holes" for the establishment of the root-system, this means that we need to dig holes 3 feet apart and fill them about half full with manure and then soak with water. We also need to add powdered limestone

if the soil is too acidic. Other elements we can add are compost, rock phosphate and trace minerals. Then the area is ready for setting the plants. If the preparation is done well, the plants will survive both cold winters and hot summers. For optimal results, keep weeds and grass out of the comfrey plantings, feed them with manure or other natural fertilizers and cut them monthly to stimulate new growth.

If we wish to grow comfrey indoors, we set them in an appropriate size pot (minimum 4 liters). If we use 3-4 year old plants, we can continuously harvest small leaves the whole year round.

**Caption 7. Comfrey on allot (16):**



## 4. Chemical Composition

Some of the compounds in comfrey are: Allantoin Caffeic acid, some pyrrolizidine alkaloids, Mucilage, Rosmarinic- and Tannic acids (Table2.)

**Table 2. Chemical composition of Comfrey after Cornell University (17):**

Acetylcopsamine (PA)	Roots and leaves
Allantoin	Leaf: 13,000 ppm, root: 6,000 – 8,000 ppm
Caffeic acid	Roots
Echimidine (PA)	Roots and leaves
Heliosupine (PA)	Roots and leaves
Intermedine (PA)	Roots and leaves
Lasiocarpine (PA)	Roots and leaves
Lycopsamine (PA)	Roots and leaves
Mucilage	Roots: 290,000 ppm
Rosmarinic acid	Leaf: 5,000 ppm
Symphytine (PA)	Roots and leaves
Tannic acid	Plant: 80,000 – 90,000 ppm

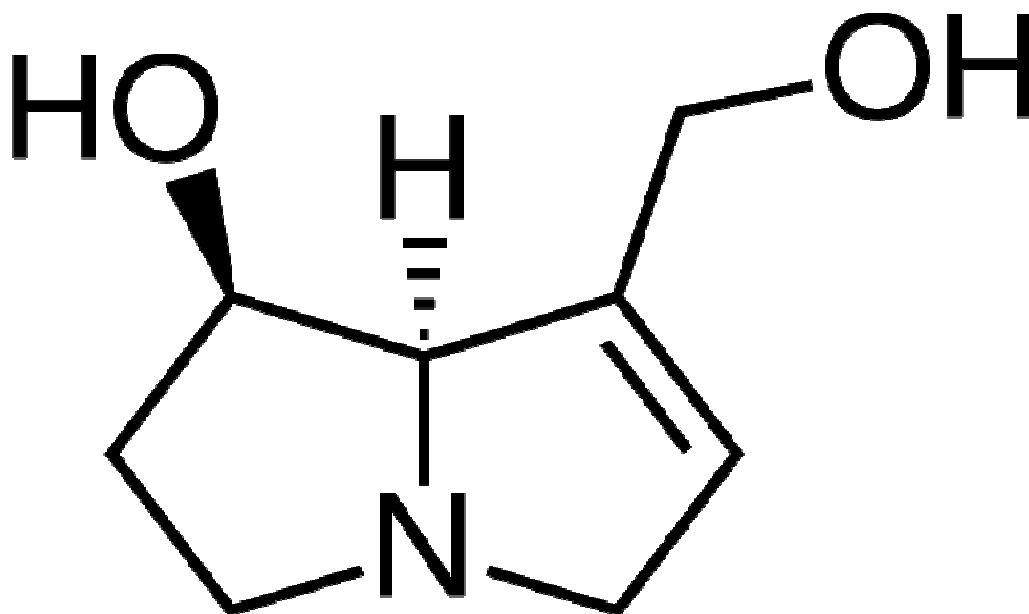
Abbreviation: PA: pyrrolizidine alkaloid

### 4.1 Alkaloids

#### 4.1.1 Definition of Pyrrolizidine Alkaloids

“Complex molecules named for their inclusion of a pyrrolizidine nucleus: a pair of linked pyrrole rings. Each pyrrole can be diagramed as five-sided structure with four carbons and one nitrogen forming the ring. Pyrroles are incorporated into the chlorophyll molecule; the biological role of PAs in plants remains unknown“ (18).

### 4.1.2 General Chemical Structure of Pyrrolizidine Alkaloids



### 4.1.3 Physical Reactions to Pyrrolizidine Alkaloids

When ingested in doses of 10-20 mg, toxic PAs may cause the following acute reactions in the liver: enlargement of the cells and their nuclei, disturbances of the metabolism that may lead to functional loss, cell destruction and fatty degeneration.

Smaller doses of the most toxic PAs, of around 10 micrograms or less over a long period of time may cause cirrhosis.

In both acute and chronic responses, veno-occlusive liver disease may develop.

The main site of toxic responses to the PAs is the liver, but a few PAs may act on other organ systems which may be due to their long half-life, letting them have time to migrate to the other parts of the body before further metabolism.

The PAs, which have low toxicity in their original form, are metabolized in the liver and may become toxic metabolites, depending on the PA and on the particular condition of the liver enzymes (19).

Highly reactive pyrroles, the toxic metabolites, which are a result of microsomal enzyme-action in the liver, may cause damage at chromosomal level. PA metabolites may overflow the lung fluids if the liver becomes damaged and causes further damage in the lungs, resulting in pulmonary oedema and pleural effusions, and when there has been extreme contamination with PA, the result may be fatal (20).

#### **4.1.4 Pyrrolizidine Alkaloids in Comfrey**

The PA content of comfrey was determined by Couet et al. (21). The roots proved to have a range of 1400-8300 ppm, while the leaves have from 15-55 ppm. In Germany an evaluation of 300 comfrey roots was carried out and the PA range was found to be 450-5990 ppm (22). An investigation of commercial comfrey products (23) proved that the PA content varied: none was detected in 2 products, a range of 0.2-220 ppm among 8 other products, and one with 1520 ppm (a comfrey root product). For an individual to ingest a dose of 1 mg per day, 0.7 grams of a herb at 1,520 ppm would be needed, which is the amount which can be found in three 250 mg capsules, with this in mind it would be safe to consider this a dangerous dosage.

Some products available on the market which have less than 1 ppm or even no detectable PAs may be considered safe to use. Preparation type can also be considered variables in safety. A decoction of comfrey leaf and its root will lower PA levels by 75-95%, while other levels and types of toxic PAs can be found in various other species.

The common comfrey contains intermedine, lycopsamine, symphytine, echimidine and symlandine. The total content of PAs in common comfrey found in the leaves is 0.02-0.18% and in the roots is 0.25-0.29% (24).

#### 4.1.5 Difference in Toxicity and Mutagenicity of Different PAs

During the last two decades concerns have been raised over people who take herbal preparations on a regular basis, over months or even years, that they may have accumulated PAs. Although it is not proven to have an accumulative effect in the liver or any other parts of the body, long-term use of doses that will not give any acute responses may increase the possibility for liver disease including liver cancer.

Laboratory studies show that some of the PAs have a high capacity for mutagenicity in tests carried out using fruit flies and bacteria. However, a carcinogenic potential may be indicated in humans. In a study carried out using fruit flies a potential mutagenic level of 16 PAs were rated in order of toxicity as follows (25):

*senkirkine* > *monocrotaline* > *seneciophylline* > *senecionine* > *7-acetylintermedine* > *heliotrine* > *retrorsine* > *7-acetyllycopsamine* > ***symphytine*** > *jacoline* > ***symlandine*** > ***intermedine*** > *indicine* > ***lycopsamine*** > *indicine N-oxide* > *supinine*

Senkirkine has the highest mutagenic potential of all the tested PAs, while supinine had no detectable mutagenic activity level. Indicine N-oxide is an antitumor agent which is currently being investigated for its properties in the treatment of brain tumors. According to European Food Safety Authority (26) the cyclic diester PAs (eg. senkirkine) are the most toxic, non-cyclic diesters (eg. symphytine) are intermediate and the monoesters (eg. lycopsamine and supinine) are the least toxic. They also confirm the rated order of toxicity mentioned earlier (27).

Despite laboratory findings, including mutagenic activity adducts of PAs and their metabolites in tissue of test animals, and induction of cancer in animals (some PAs cause hemangioendothelial sarcomas in rats), the potential carcinogenic effects on humans have been questioned. In a recent review of PAs in the human diet (28), the authors concluded with: "while humans face the risk of veno-occlusive diseases and childhood cirrhosis, PAs are not carcinogenic to humans."

## 4.2 Nutrients

The other nutrients in common comfrey include: proteins, carbohydrates, fats, fiber, minerals and vitamins (Table 3.).

**Table 3. Nutrient content of common comfrey and its biological functions (29, 30, 31, 32):**

NUTRIENT	PLANT-PART / %	BIOLOGICAL FUNCTIONS
Protein	Root / 9.4 %	Essential nutrient. Proteins are building blocks for all tissues and are also needed for basic functions in an organism. It can also be used as a source of fuel.
Carbohydrate	Root / 75.9 %	Major energy source for humans and animals, produced in plants by photosynthesis.
Fat	Root / 1.7 %	Fuel for the body, transport of fat soluble vitamins, energy storage, healthy skin and hair.
Fiber	Root / 7.2 %	Essential for healthy digestion.
Calcium	Root / 1.1 %	Blood-clotting (factor IV), muscle- and nerve irritability, enzyme activation, bone constituent.
Potassium	Root / 1.6 %	Osmotic pressure, action potential.
Phosphorous	Root / 0.2 %	Bone formation, teeth, buffer, ATP (energy transport), constituent of DNA.
Silicic Acid	Leaf / 4.0 %	Structure in mucopolysaccharides, nails, connective tissue and believed to excrete aluminium from the body.
Asparagine	Root / 1-3 %	Non-essential amino acid, prevent the nervous system from being over- or under excited.
Magnesium	Root / 0.17 %	Bone formation, teeth, muscle- and nerve irritability, enzyme activator.
Iron	Root / 0.08 %	Constituent of hemo- and myoglobin, respiratory chain, cytochrome p450, enzymes.
Vitamin A	Leaf / 0.63 %	Vision, bone development, cartilage, skin, mucus membrane, epithelium, spermatogenesis, implantation.
Vitamin B12	Leaf	Nucleic acid synthesis, folic acid, choline, methionine and succinate synthesis.
Vitamin C	Root / 0.013 %	Bone, cartilage, connective tissue, gums, iron transport and antioxidant.
Vitamin E	Leaf	Antioxidant, inhibit myo-degeneration, free radical scavenging.
Beta Carotene	Plant / 0.07 %	Protect bio-membranes, stimulate the immune-system, progesterone synthesis and anticancerous.



## **4.3 Tannins**

### **4.3.1 Medical Definition of Tannin**

“any of various soluble astringent complex phenolic substances of plant origin used in tanning, dyeing, the making of ink, and in medicine as astringents and formerly in the treatment of burns” (33).

### **4.3.2 Properties of Tannins**

In addition to already established properties, like antioxidant activity and the ability to bind to proteins, metallic ions and large molecules, tannins have the ability to counteract free radicals, prevent apoptosis and have anti tumor properties. They also have activities inhibiting anti-EVB, anti-MRSA and anti-plasmin (34).

## **4.4 Mucilage**

### **4.4.1 Medical Definition of Mucilage**

“1: a gelatinous substance of various plants (as legumes or seaweeds) that contains protein and polysaccharides and is similar to plant gums”

“2: an aqueous usually viscid solution (as of a gum) used in pharmacy as an excipient and in medicine as a demulcent” (35).

### **4.4.2 Uses for Mucilage**

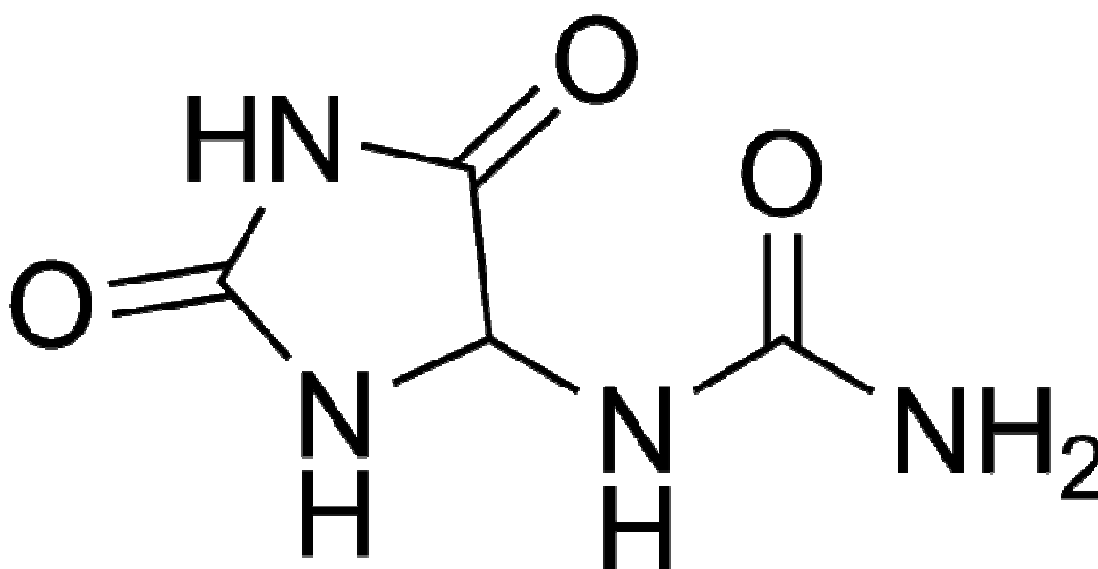
According to the article “Mucilaginous plants and their uses in medicine” many plants and herbs throughout the world contain easily releasable mucilage in the seeds, bark or tissue. One major function is as a healing agent in both conventional and traditional medicine. Many of these have been studied by pharmacologist and found to have many biologically active ingredients. The common usage is the benefit they have on burns, ulcers and wounds, and even on external and internal irritations, and inflammations in the gastro intestinal tract including dysentery and diarrhea (36).

## 4.5 Allantoin

### 4.5.1 Medical Definition of Allantoin

“a chemical compound (5-ureidohydantoin),  $C_4H_6N_4O_3$ , that occurs as a white crystallizable substance found in many plants and in the allantoic and amniotic fluids and fetal urine of primates. It is also present in the urine of mammals other than primates as a product of purine metabolism. The substance, which can be produced synthetically by the oxidation of uric acid, was once used to promote tissue growth in the treatment of suppurating wounds and ulcers” (37).

### 4.5.2 Chemical Structure of Allantoin



### 4.5.3 Properties of Allantoin

#### **Dermatological properties**

Allantoin is a non-toxic agent used in the manufacture of veterinary and cosmetic products. It is anti-irritating, keratolytic, healing and moisturizing. Allantoin stimulates

the proliferation of cells resulting in healthy tissue formation. Allantoin is effective at quite low concentrations, 0.1% up to 2%, acting as a chemical debrider, cleaning up the necrotic and scaling tissue areas. Allantoin is found naturally in fetal Allantoic fluid, comfrey roots, wheat germ, rice bran, the urine of dogs and pregnant women, in earthworms and as an organic component of many soil types.

### **Allantoin and derivatives**

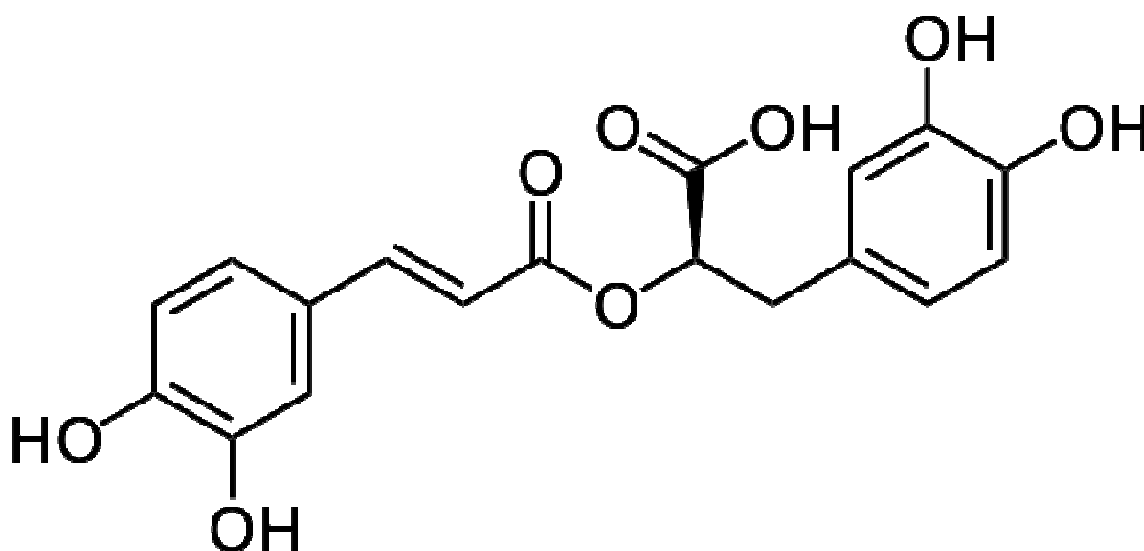
Allantoin's amphoteric qualities allow it to be combined with many chemical compounds to produce salts and other complexes. This leads to increased synergism and also a decrease in possible side effects, toxic properties and irritation. The new complexes and salts have been proven to possess useful properties used in skin therapy treatment.

### **Use of Allantoin**

Allantoin is used in the treatment of many skin conditions including ulcers, wound, scalds, burns and sunburns, carbuncles, acne and skin eruptions, fissures and abrasions, impetigo, eczema, psoriasis (38).

## **4.6 Rosmarinic Acid**

### **4.6.1 Chemical Structure of Rosmarinic Acid**



## 4.6.2 Properties of Rosmarinic Acid

Rosmarinic acid is commonly found in species of the *Boraginaceae* plants, it is an ester of caffeic acid and 3,4-dihydroxyphenyllactic acid. Rosmarinic acid has a number of fascinating biological functions, including anti-inflammatory, antiviral, antioxidant and antibacterial. The use of herbs, spices and medicinal plants is healthy and beneficial for humans and animals due to their rosmarinic acid content. For the plant itself it acts as part of its natural defenses (39).

According to another web article about phytochemicals rosmarinic acid's antioxidant function is stronger than that of vitamin E. It also prevents attack from free radicals, thus decreasing the risk of cancer and atherosclerosis.

Research conducted by Sanbongi C et al (40) indicated that oral ingestion of rosmarinic acid is effective against allergic asthma.

Conditions such as cataract, cancer and peptic ulcers can also be treated with rosmarinic acid.

Rosmarinic acid was also shown to suppress synovitis in mice and is effective as a treatment against rheumatoid arthritis in a study carried by Youn J et al. (41). The mode of action is to prevent activation of immune cells, avoiding swelling and oedema (42).

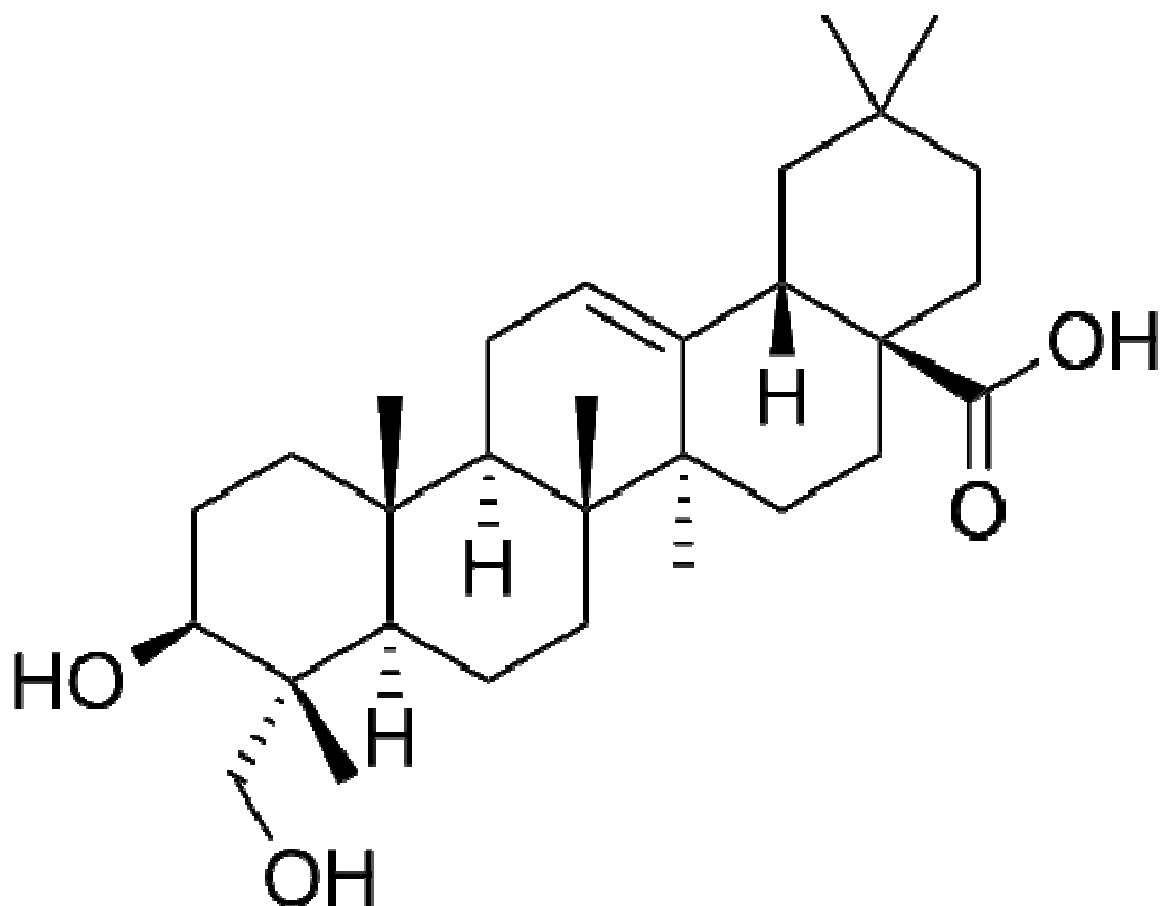
In a current trial about Alzheimer's disease rosmarinic acid has proven to prevent amyloid aggregation in vitro and in animal models it has shown to delay the progress of this disease (43).

## 4.7. Triterpenes

### 4.7.1 Definition of Triterpenes

"Hydrocarbons or their derivatives formed by the condensation of six isoprene units (equivalent to three terpene units) and containing, therefore, 30 carbon atoms; squalene, certain steroids, cardiac glycosides" (44).

### 4.7.2 Chemical Structure of Triterpenes



### 4.7.3 Properties of Triterpenes

One of the triterpene found in common comfrey is the oleanolic acid (45). It has been found to have many interesting properties. Among them is the inhibition of cellular inflammation and protection against oxidative stress (46). These more or less non-toxic triterpenes also have anti-viral and anti-tumor effect and exhibit hepatoprotective properties (47).

## 5. History of *Symphytum officinale*

The use of comfrey as a herbal remedy dates back as far as 400 BC. It was known by more common names such as “knit bone”, “consolida”, “bruisewort”, “healing herb” and “knit back”. These names derived from comfreys best known ability to heal broken bones, sprains and wounds.

The more commonly used name in English, comfrey, originates from the Latin word “con firma”, which means grow together and the Genus name “*Symphytum*” originates from the Greek words “symphyo”, which means to make grow together, “phyton” which means plant, and “officinale”, meaning used in medicine.

The earliest remedies using comfrey were created from only the root, with Herodotus, the Greek historian recording its use in his books and recommending it to stem sever bleeding and bronchial afflictions (48).

By the second Century BC, Nicander the Greek physician noted that comfrey was a remedy for poisons in his herbal *Alexipharmica* and Galen (49) also wrote of its healing properties in the early years of the First Century.

Dioscorides, who was employed as Nero’s chief medical advisor for the Roman army, prescribed comfrey for broken bones, wound healing, respiratory and gastric problems. The well known Greek physician documented his findings of properties of herbal remedies in five volumes of work through intensive travelling with the Roman army. Comfrey was documented in volume four of his works (50).

In a book called *The Natural History* (Latin, *Naturalis Historia*), which is supposed to contain all ancient knowledge, the Roman naturalist, Pliny the Elder documented known uses of *Allum*, the name by which the Romans knew comfrey. He experimented and documented many uses and the preparation of comfrey for both internal and external use as well as its adhesive qualities. Preparation of the remedy for internal use involved taking the root of the plant and crushing it and mixing it with water or decoction, which is a method of extracting oils by boiling; this would then be taken with wine. A final faster method for repertory ailments would be to chew the root. They used these remedies for the internal treatment of kidney

disease, stomach and intestinal cramps, diarrhoea and lung disease such as lung bleeding. It is not specified in the book if preparation was different for external use but it does state that it was used to treat sprains, contusions, fractured bones and aid wound healing (51).

In the second Century the further cultivation and development of the uses of comfrey have been credited to many religious orders that cultivated the plants within the grounds of monasteries and were used to heal the wounds of soldiers during extended periods of war. They would also mix the herb with honey and vinegar to be drunk to aid stomach ailments (52).

By the Middle Ages the use of comfrey was spreading and Swiss physician Paracelsus noted that the adhesive quality of the root, which when mashed into a poultice and spread on a muslin cloth would set fast to form a solid cast around a torn ligament, sprain or a broken bone (53).

There was no let up in the popularity and use of comfrey and by the 16<sup>th</sup> Century the herb was a mainstay plant of most gardens and was grown by everyone from peasants to the King himself. However a more recognised way of making a tea from the herb began to see popularity. The tea was recommended by Michael Castleman for the treatment of broken bones (54) and according to Turners herbal (55) in 1568 against lung bleeding.

From the turn of the 17<sup>th</sup> Century the leaves from the plant began to find their way into teas although herbalists of the time still recommended the root more for both internal and external treatments. English herbalist Nicholas Culpeper recommended the herb for all previously known remedies as well as gout, hemorrhoids, fever, gangrene and menstrual problems (56).

By 1640 King James I had employed herbalist John Parkinson to advice on all areas of herbal remedies which made the remedies a more accepted and mainstream therapy. In his book Theatre of Plants Parkinson described using comfrey in tea form from the leaves to reduce fevers, as one expectorant for internal lung problems and as a syrup from the root for all other internal ailments. Like Paracelsus before him, Parkinson also noted that the adhesive quality of the gummy

root were good at mending a tear in flesh or for setting broken bones by forming a cast (57).

Comfrey has been used over the ages for more than just herbal remedies with farmers cultivating it in mass for feed for their livestock. It was also used in everyday diet in soups and salads and was even used as a substitute for gum Arabic the stamp glue which was difficult to find sometimes.



## **6. Today's Uses in Different Forms**

Herbal therapy is the oldest form of therapy we have and it dates back thousands of years. During the inquisition and the witch-hunts most of the knowledge of folk medicine in Europe was unfortunately lost. Today we are, to a large degree, rediscovering these secrets. Fortunately over the years more and more research has been conducted into herbal therapy mechanisms especially in Germany and France. The medicine can be given as a feed additive, a tea from the fresh or dried herb, can be used in creams or tinctures and prepared as a homeopathic remedy.

Pharmaceutical manufacturers, in order for them to create a patentable drug for profit, extract the main active ingredient from botanicals. By not using the entire composition of the plant some of the effects will be lost. This is not considered herbal therapy and the given compound only acts only as a regular drug. When the whole herb is used it seems like the effect is somewhat different than if we give the pure compound. The effect of a plant seems to be more holistic and works more regulatory in the organism. Herbs stimulate the body's own healing mechanisms in a similar way to acupuncture or homeopathy. Herbs that possess such specific regulatory mechanisms is most often botanicals which are partly poisonous, foul tasting, bitter or possess special properties such as a high content of essential oils (58).

### **6.1 Fresh and Dried Herb**

#### **6.1.1 Medical Uses**

Comfrey leaves can be prepared for external use either as a moist medicinal compress or warm poultice. As a compress it is usually used to treat swellings, bruises and sprains and in poultice form for gangrenous and ill-conditioned ulcers as well as abscesses and wound healing. This is also known to ease swelling and relieve pain.

Comfrey's reputation as a vulnerary is backed up by its ability to aid the reduction of swelling in the area surrounding a fracture, enabling broken bones to knit together more rapidly. This is attributed to the Allantoin it contains.

Dried leaves can be prepared in the form of an infusion or tea to be taken internally. A large amount of chopped comfrey leaves should be placed in a container of water and weighed down to keep submerged. This should be covered and left for three weeks to infuse. Tea should be made by diluting, one part 'tea' with ten parts of comfrey.

### **6.1.2 Research Using the Plant Comfrey**

There has been many in-vivo trials and investigations carried out into the use of comfrey leaves or roots, and several have also been made solely with extracted pyrrolizidine alkaloids, mainly symphytine or echimidine. All of the trials have used rats as their animal model. I have singled out one of the most extensive trials done in the late 1970's.

In a long-term investigation into the hepatic toxicity and carcinogenesis of comfrey, either the leaves or the root were used. The test animals were young rats. The rats fed with leaves received it at 8-33% of their diet and the rats fed with roots received it at 1-8% of their diet. This diet was kept for 179 to 600 days. They also used a control group. At the end of the investigation, all groups fed comfrey showed an increased incidence of liver tumors, 96% of the tumors detected were proven to be benign (59).

### **6.1.3 Agricultural Uses**

Comfrey can be used as an antifungal spray for plants and crops as researched by V. A. Karavaev et al. in Moscow, Russia. In a study published in 2001 the researchers discovered that by mixing Aqueous Extracts from medicinal comfrey leaves and cowparsnip they could create a spray which when applied to wheat seedlings dramatically inhibited the growth of the molds *Erysiphe graminisconidia* and uredospores of *Puccinia graminis*. It was found that the antifungal activity was

due to the level of phenolic compounds. This has action on the fungi and also activates the natural defense of the host (60).

We are now talking about comfrey as a fertilizer. Due to comfrey's high potassium and nitrogen content it can be added to compost to speed up decomposition or added to mulch to feed plants such as tomatoes, legumes, peppers, cucumbers and soft fruits. It can be also used around berry bushes, increasing crop sizes and also deterring slugs from the plant. Some plants do not thrive in such high levels of potassium so it can be mixed in with other organic matter to reduce the levels. Adding decayed leaves to loam and sand can also be used as a top dressing for grass by sprinkling it over a lawn (61).

## **6.2 Tincture**

### **6.2.1 How to Make a Tincture**

Both fresh and dried herbs can be used in the process of making a tincture. If there are fresh herbs available, the ratio used between herb and solvent (alcohol) is usually 1:2 and if dried herbs are used, the ratio is usually 1:4.

The herb material is finely chopped and put into a container. The container should be filled with herbs at about  $\frac{1}{2}$  to  $\frac{3}{4}$  depending on dryness and amount of root/leaf ratio. Then alcohol is poured over the material and the container is completely covered. This is stored in a dark and cool place, and regularly checked for about 6-8 weeks, to ensure that not too much of the alcohol has evaporated as mold will develop. The last step is to strain the tincture and bottle it for storage.

### **6.2.2 Research Using Comfrey Tincture**

A much debated topic is comfrey's relationship with cancer. In a short-term carcinogenesis model study published in 2010, a 10% tincture was given orally to rats with induced cancer by the resistant hepatocyte model (RHM) three times a week for thirty days. When investigated both macroscopically and microscopically a

reduction was found in the number of pre-neoplastic lesions, there was also a reduction in mitotic figures and other cancer indicating parameters. The study concluded that *Symphytum officinale* has both quantitative and qualitative anti-cancer potential (62).

Another study determined that comfrey tincture made from the whole plant has a significant cytostatic and mitoinhibitory effect on HeLa neoplastic cells. They believe this effect is majorly due to the phenolic acids, especially rosmarinic acid (63).

## **6.3 Cream**

### **6.3.1 How to Make a Cream or Ointment**

Comfrey cream or ointment can be a cleaner and easier to store method of treating pain, arthritis, wounds, bruises, insect bites, dry skin conditions and scar tissue, for rubbing in to tight muscles and even as a hemorrhoid cream. To prepare the ointment first you must wash and dry the herb and then chop it. Take petroleum jelly or a wax and melt in a bowl over a pan of boiling water. When the wax or petroleum jelly is molten add the chopped herb and allow simmering for one hour. The next step is to strain the mixture through a muslin cloth or bag into a clean container with great care as the mixture will be very hot. Once the mixture had cooled down the container may be sealed and stored for up to three months in the refrigerator or cold larder.

### **6.3.2 Research Using Comfrey Cream or Ointments**

In a double blind randomized placebo controlled multi center trial carried out by B M Giannetti et al. a test was carried out to show the benefits of comfrey ointment over a placebo ointment with subjects suffering from acute back pain. The study carried out over a 5 day period used 120 subjects with an average age of 36.9 years. During four visits the verum or placebo ointment was applied to the patients

three times a day in a dosage of 4 g of ointment per application. The outcome of the test decreased pain in the verum group by 95.2% and 37.8% in the placebo group. The results of the test were clear in that the comfrey extract ointment was remarkably potent and had a significant effect on back pain. The speed at which relief from pain was achieved was also noticeably fast (64).

In an eight day double-blind study into acute ankle sprains, 142 people with an average age of 31.8 years were treated with comfrey ointment or a placebo. In the subjects treated with comfrey ointment, the measurement of swelling, pain and mobility showed a significant improvement over the subjects' treated with the placebo (65).

A double-blind study into patients with painful osteoarthritis of the knee was undertaken over a three week period using 153 women and 67 men with an average age of 57.9 years. The ointment was applied twice a day in two doses of 3g on each occasion. The results of the test including, mobility of the knee, quality of life and clinical global impression showed that there were significant differences between the two groups of patients over the course of the treatment according to the physicians and the patients themselves (66).

Finally in a more recent trial, two creams made from two different concentrations of comfrey were tested on fresh abrasions using 278 patients, 25% of which were under 20 years old. The creams contained 10% comfrey in the verum and 1% comfrey in the placebo and this was also a randomized double blind study. There were no adverse reactions during the trial from either group and the conclusion was there were great healing properties and it was safe to use on children (67).

As well as its medicinal used comfrey cream is also used as a cosmetic, reducing fine lines and wrinkles. Comfrey contains mucilage and allantoin. The mucilage soothes and softens skin while the allantoin helps to promote cell regeneration (68).

## **6.4 Homeopathy**

### **6.4.1 Father of Homeopathy**

The word homeopathy is derived from the Greek word Homoios which means similar and patos. The basic principles of homeopathy are from the Latin “similia similibus curentur” and translated this means with similar, similar shall be healed.

The thought process behind similar heals similar has been around for thousands of years but the first person to organise a therapy system using homeopathy was the German Doctor Samuel Hahnemann in the late 1700s. Unhappy with the medicine practiced in his time Hahnemann began experimenting with the effects substances had on healthy people and endeavored to deduce which ailments they could cure and one of the first substances Hahnemann investigated was cinchona bark.

### **6.4.2 Manufacture of Remedies**

The potentiating (dilution) techniques that Hahnemann perfected are still in use today. To create a homeopathic remedy a base alcohol is mixed with a macerated plant or part of a plant to form a tincture. This tincture is left to stand for three weeks in dark environment in order to prevent any light source from affecting the chemical properties of the final solution. After the three weeks the solids are strained out of the solution. The potentiating process or dilution process is carried out by adding a ratio of nine parts sterile water to one part tincture in a relatively large volume container. The container is then shaken with impact for three minutes to create small air bubbles which forms a surface tension between the liquid and the air and it is thought that this is the point where the potentiation process occurs.

Following the shaking process the solution is left to stand for a few minutes and this is what is known as D1 potency (Diluted once). The most common remedies in use are D6, D12 and D30. To achieve these potencies the mixture must be diluted in a ratio of one part from the previous dilution to nine parts of sterile water except for the final potentiation which should be one part from the previous dilution and nine parts alcohol in order to preserve the homeopathic remedy.

### 6.4.3 Description of *Symphytum* in the Homeopathic Materia Medica

Homeopathic Materia medica is an encyclopaedia listing thousands of substances and plants used in homeopathic remedies and descriptions of their properties and uses.

*Symphytum* (symph):

“(Comfrey-Knitbone): The root contains a crystalline solid, which stimulates the growth of epithelium on ulcerated surfaces. It may be administered internally in the treatment of gastric and duodenal ulcers. Also in gastralgia, and externally in pruritus ani. Injuries to sinews, tendons and the periosteum. Acts on joints generally. Neuralgia of knee. Of great use in wounds penetrating to perineum and bones, and in non-union of fractures; irritable stump after amputation, irritable bone at point of fracture. Psoas abscess. pricking pain and soreness of periosteum.

Head: Pain in occiput, top and forehead; changing places. Pain comes down bone of nose. Inflammation of inferior maxillary bone, hard, red, swelling.

Eye: pain in eye after a blow of an obtuse body. For traumatic injuries of the eyes no remedy equals this.

Relationship: Compare: ARN.; CALC. PHOS.

Dose: Tincture.

Externally as a dressing for sores and ulcers and pruritus ani” (69).

### 6.4.4 Research Using Homeopathic *Symphytum officinale*

In a trial published in 2010 about the effect of homeopathic *Symphytum officinale*, titanium rods were implanted into the tibia of adult rats and the following growth around them was monitored. The conclusion was that, especially in the early

stages of osseointegration, the bone formation was increased significantly in the animals given the homeopathic treatment (70).

The use of the herb *Symphytum officinale* has been discussed over the past decades due to its potential toxicity via pyrrolizidine alkaloids, but there are no reports about hepatotoxicity or any adverse effects using a homeopathic formulation. On the other hand there are some reports about its value on bone repair.

A trial with the aim of comparing the efficacy of homeopathic remedy compared to the actual herb started on April 1st 2012 with a duration of two years is in progress. The test animals are operated on to create a defect on their tibia. Then they are divided into three groups: group one will be treated orally with a homeopathic remedy, group two will be given the actual herb and group three will receive placebo. The regeneration will be evaluated with immunohistochemistry and microscopy (71).

## 6.5 Testimonials

The most remarkable example I can remember using *Symphytum* was the case of a young boy who, after a motorcycle accident had a fracture that would not heal for three years. When he met me he had gotten an appointment for amputation in six weeks time. I injected 1ml of *Symphytum* D6 around the fracture, after just a few days the whole area started to itch and when he visited the hospital six weeks later for the amputation the fracture was as good as healed.

*Symphytum* is the remedy which has baffled me the most in its healing effects.

(Are Thoresen – Veterinaermedisin, Third edition 2011)

After having used leaves from comfrey to treat wounds and minor injuries, moldy yeast infections around the fetlock-joint etc. for some years, I was advised from my veterinarian to start using comfrey tincture manufactured by a herbalist. It all started with a horse that had large wounds and abrasions on the medial side of one of the hind legs. Due to this horse's hot temperament, it was very difficult to use leaves for its treatment. With the help of a spray bottle we could easily treat this



horse and the effect was bafflingly quick and the result impressive. After this we always have a bottle ready to use in the stable for small wounds, blisters, cuts, moldy sores around the fetlock etc.

We have not tried this internally on our horses, but when I recently had heart-surgery I was advised to take 3-4 ml of comfrey tincture, together with 3-4 ml Echinacea, three days pre-op and three days post-op. I followed this advice and feel that it had a good effect.

When it comes to the length of the treatment period and healing time it may vary with the individual horse and the extent of injury, but it is seldom more than 2-3 days of treatment. The results are more or less amazing – and completely without side-effects!

(Lars O. Romtveit, professional horserace trainer, March 2013)

I was about 13 years old and played at a cemetery with some friends. One head-stone fell over on top of my leg and I sustained several fractures. The fractures were set at the hospital and I wore a cast for many weeks. The fractures healed as they should but my wounds, and the area around them developed gangrene due to local circulatory failure. My surgeons were scared that they had to amputate my leg at the knee.

Luckily, at the time, my neighbor who was a holistic doctor and was growing a herbal garden, helped me by putting fresh comfrey leaves directly on the skin under my cast. My wounds healed nicely and still today I feel grateful to him for saving my leg. I have full use of my leg today and only a few scares to prove my story.

(Nicolai A. Girlando, July 2013)

I am a violin-player and I am absolutely dependent on my hands and fingers for my job.

One evening I was cooking for some friends, I cut my left index finger quite deeply. This could have turned out to become a big problem as I was to play in a concert five days later.

I had previously heard about the fantastic effect of comfrey cream on wounds and cuts and rushed off to the nearby health-store.

I put on a generously amount of cream and wrapped my finger in gauze. After just an hour the finger stopped throbbing with pain and the next day when I checked

the cut it had closed quite remarkably. I kept putting on cream for the next couple of days and by the day I was playing in the concert, the wound was totally gone, and I had full use of my finger-tip.

Now comfrey cream is a vital part of my medicine cabinet.

(Frida Alnæs, violinplayer February 2013).

In November 2012, some friends and I went hiking in the forest near Adyliget, Budapest, and we came across a male wild boar. One of the dogs, Nena, attacked the boar, and was severely injured. We rushed her to FelicaVet animal clinic on the Buda-side.

The skin on the right side of her abdomen was ripped open and she had pockets all the way up to the dorsal midline.

After the surgery, the surgeon told me that Nena would with all likelihood develop necrosis due to decreased blood-supply to the injured area and extensive removal of damaged skin, and that I would have to prepare for secondary healing and large scars.

I applied dried comfrey leaves twice daily on top of the injury and also around it where the expected necrosis would develop. At the first check-up the surgeon was very surprised how fast it healed, and that there were no signs of necrosis or changes in colour, and that I should continue doing what I was doing.

After 10 days, the wound was completely healed, no necrosis had developed, and the skin was nicely reattached to the underlying tissues.

(Eve Maria Thoresen, veterinary student, 03<sup>rd</sup> Sep 2013)

## 7. Discussion

According to its long historical use and documentation, it is clear that comfrey has unique healing properties when it comes to broken bones, wounds and even internal irritations and inflammations. In modern times focus on safety and side-effects have come more and more into play and that is why several trials and investigations has been carried out to determine comfrey's properties in this area. The main focus of these investigations has been on the content and effect of the pyrrolizidine alkaloids. In my opinion the majority of the research presented in the literature has a very limited value to determine the therapeutic and safety indexes in animals and humans. This is due to some of the following reasons:

- In many of the trials, only the isolated pyrrolizidine alkaloid is administered to the animal model, and this does not reflect the holistic effect of the whole plant. Some research even suggest that other constituents in comfrey, for example the anti-oxidants and proteins, is likely to protect against the toxicity
- The main animal model used in these trials were rats. It is proven that rats are highly sensitive to PAs, while other species, such as sheep, are resistant to it. To get a clear indication of toxicity to any given species, that species has to be the animal model used.
- Also the dosage used in most of these trials has been too high. In the trial already mentioned the administered level of comfrey leaves was from 8-33% of the rats' diet. The average weight of the rats were 100g and rats eat 10g/day. Average PA content in the leaves of common comfrey is between 4,5 – 60 microgram/g. As comfrey is a medicinal plant, we have to dose it accordingly.
- The duration of the administration is also a factor. Some of the test groups were fed comfrey leaves for almost two years. Most medicines are designed to be administered only for the duration of an injury or illness. This is also true for potent medicinal plants.

Most drugs on the marked today, both over the counter and prescription drugs, have side effects if it is taken in excess or on a long-term basis. So in all medical trials, we strive to find the therapeutic index of the investigated compound, which

amount is safe, which duration can it be safely used and for which kind of conditions. The latter is a topic that is approached differently in holistic medicine compared to conventional medicine. In the conventional way of thinking, the main focus is on the symptoms. Two individuals with the same set of symptoms are usually treated in very similar fashions. Medication is given, or even surgery is performed, to take away these symptoms. If the patient has eczema, medication is administered to eradicate the symptom. In the holistic method of thinking, the symptoms are recognized, but the therapist strives to see even deeper, to see the subtle qualities in the symptoms and also to make use of other diagnostic tools like pulse diagnosis (originating from the traditional Chinese medicine), because the ultimate goal is to realize the weak processes that cause these symptoms. Is the eczema hot or cold? Moist or dry? These are indications of which bodily process is deficient and specific medication (e.g. herb) is given to stimulate this specific process.

Comfrey is known for its property as a healing agent, and can be applied topically on wounds, rashes and inflammations. It is also known for accelerating the healing time of broken bones and can be applied topically above the injured area or even injected around the fracture, either as a homeopathic remedy or maybe even as a tincture. In holistic medicine, comfrey is considered to be an herb that has incredible liver stimulating properties. What this means is, if the therapist find that the patient has a weakened or deficient liver process, comfrey may be used to stimulate the liver back to full capacity. This brings me back to the long-term study where rats were fed comfrey in excess dose. If comfrey really is an incredible liver stimulator, or a hepato-protective agent as the word used in conventional medicine, no wonder all the rats developed tumors in the liver. Cancerous growth is the manifestation of excess or over-stimulated process, and in this trial they stimulated the liver with a highly potent herb in excess dose over an excess period of time.

I believe that comfrey is a wonderful medicinal plant, with as much future as it has a past, but in the future new criteria for trials must be designed. In these trials we have to show respect for the plant and use it as a whole. By taking it apart we may lose the synergism between the different constituents. We must also think of comfrey as a drug and administer it in the lowest doses possible for therapeutic gain and that also applies for the length of treatment.

## 8. Summary

*Symphytum officinale*, or common comfrey, is a member of the Boraginaceae family that consists mainly of shrubs, trees and herbs. It is a perennial herb that thrives best in moist soil but with plenty of sun. It can grow to a height of more than one meter and have long leaves with coarse hairs. The flowers are usually purple and are blooming in May to July.

For cultivation it requires deep soil for the root system and for the best possible harvest, we need to provide fertilization and make sure the pH level is between 6 and 7.

Comfrey has been considered a powerful healing agent throughout history and these properties can be attributed to constituents like allantoin, mucilage and rosmarinic acid. Allantoin is known for its healing, keratolytic and cell-proliferating abilities. It is often used as a debrider in the medical profession and an important constituent in cosmetics. Mucilage is an excellent agent on burns and ulcers, and also shows great benefits against inflammations in the gastro intestinal tract. Rosmarinic acid has proven to be a good anti-viral, anti-bacterial and anti-inflammatory agent in several investigations.

Due to good nutritional value with high protein, carbohydrates, minerals and vitamins, comfrey has been used as a forage plant, but after investigations into the effect of another constituent, pyrrolizidine alkaloids, cautions have been raised regarding this plant, and several countries have banned the internal use of it. This is due to some of the PAs toxic effect on the liver leading to for example functional loss, veno-occlusive liver disease or liver tumors.

Throughout the ages comfrey has been mentioned or described as a great healing agent in many herbariums, medical publications and botany books. One of the first literary works that mentions comfrey, as a medicinal herb, is "The Histories" by Herodotus dating back to 400 BC. In all these publications its ability for healing fractures, sprains and wounds and also internal ulcers is described.

Even today we still know the abilities of comfrey, but in the last few decades it has mostly been used by holistic therapist and not by conventional therapists. The major reason is due to the increasing use of pharmaceuticals, but also due to the possible side effects of PAs. Several trials and investigations have been carried out into the

toxic effects of oral administration of comfrey. The result from most of these trials has shown that PAs are hepato-toxic, but it seems like the results have questionable value do to extreme over-dosage. In other trials, especially with short-term administration, the opposite results are achieved, and comfrey has shown to have anti-neoplastic potential. On the other hand, it has shown to have valuable therapeutic effects on back-pain, sprains and external injuries.

There are hundreds of testimonials available online and in books which highlight the healing capabilities of comfrey and the confidence many people still show in it. In the chapter testimonials I have outlined some, which were sent to me personally for the purpose of this thesis and also a personal experience I encountered while writing this thesis.

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