



**Ouabain (g-Strophanthin)
„Milk for the ageing heart“**

by

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The *Strophanthus* genus of plants is found in tropical Africa and Asia. These are climbing plants which produce a milky exudate. For many hundreds of years the natives have made poisonous substances from the seeds of these plants, using them in particular when preparing arrowheads for hunting. These poisons are particularly effective because they can enter the bloodstream through the tiniest wounds in the skin and result in heart failure and death. In the middle of the 19th century Livingstone brought the first reports of these plant extracts to Europe, and it was his companion Kirk who drew the attention of doctors to the effects of the components on the heart. Soon a Scottish pharmacologist succeeded in isolating a water-soluble but extremely poisonous glycoside from the strophanthus seeds. There are different subspecies of strophanthus: *Strophanthus gratus*, of seeds from which g-strophanthin (also known as ouabain) is obtained, and *Strophanthus kombé*, from which comes k-strophanthin.

Cardiac glycosides

Together with other substances which affect the heart, strophanthin is numbered among the cardiac glycosides. Generally speaking, „cardiac glycosides“ are conceived as substances which are found in certain plants (species of *Scilla*, *Digitalis*, *Strophanthus* and *Convallaria*) as well as in the animal kingdom in certain types of toad. The cardiac glycosides have a common structure – that is to say, they consist of a basic steroid framework which is a compound of

an aglycon and a glycoside sugar.

Basically, these glycosides are products of the metabolic process which are produced by plants as well as the lower animals in order to protect themselves among other things against being devoured. Plants mainly produce cardiac glycosides of the cardenolide type, whilst animals additionally produce those of the bufadienolide type in their skin and salivary glands. One exception is the Mediterranean squill (*Scilla maritima*) which also has bufadienolides. In toads these bufadienolides probably also have the function of a hormone which intervenes to control the water and salt metabolism of these creatures. The concentration of bufadienolides varies in the skin of these partially amphibious creatures according to the humidity of their environment. In chemical terms, the two main groups of cardiac glycosides differ in this way: cardenolides have a 5-membered ring and bufadienolides have a 6-membered ring (see Fig. 1: *Chemical structures*). The glycoside sugar compounds can be of various types. Apart from

glucose, one finds rhamnose, xylose and also the less common hexulose and methyl ether. The sugar content basically determines the pharmacological behaviour of the glycoside. To date, over a hundred different compounds have been discovered which are to be numbered among the cardiac glycosides.

How they work

Cardiac glycosides have a positive inotropic and bradycardiac effect. They increase the output of the heart by inhibiting the Na⁺/K⁺ ATPase of the plasma membrane. This leads to a rise in the concentration of intracellular sodium, which by activating the Na⁺/Ca⁺⁺ interchanger leads in turn to an increase in the calcium activity in the cell. In concrete terms this means a strengthened contraction of the cardiac muscle (positive inotropic effect). At the same time the concentration of intracellular calcium automatically decreases, reducing the membrane's stationary potential, thus causing a drop in the rate of conduction (bradycardiac effect).

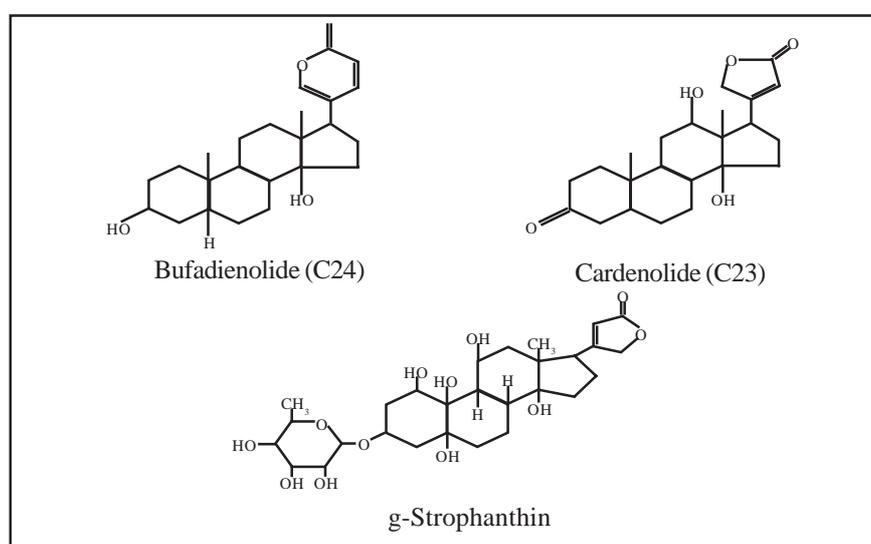


Fig. 1: *Chemical structures*

When very small doses of cardiac glycosides are administered, there is no positive inotropic effect; only the sodium pump (Na^+/K^+ ATPase) is stimulated, which explains the marvellous successes of homeopathic preparations with g-strophanthin.

The way cardiac glycosides work is basically fairly similar, but the various substances are very different in the way they behave within the organism. As a result, there are isomers of the same substances which have a very different effect. This particularly affects the absorption, distribution, excretion and even the duration of effectiveness within the body.

Strophanthin / digitalis

If derivatives of digitalis and strophanthin are compared, then the following differences can be determined:

1. Strophanthin takes effect more quickly than digitalis.
2. In the heart, Strophanthin has a shorter retention time than digitalis as well as a shorter subsidence rate.
3. The danger of accumulation in the heart is, therefore, considerably less, compared to digitalis.
4. Strophanthin has a predominantly systolic action, as opposed to the diastolic action of digitalis. This makes strophanthin an excellent remedy for patients with pronounced cardiac dilation

where no further improvement can be achieved due to a depression of the diastole.

5. Compared to digitalis, strophanthin has a greater effect in improving function in cases of insufficiency without hypertrophy, acute strain on a healthy heart (including cardiac failure following an operation), cardiasthenia as a result of myocarditis or in the course of infections including physiopyrexia, cardiasthenia caused by obesity, and particularly in cases of coronary sclerosis, making digitalis unsuccessful in these cases.

To generalise, one can say that strophanthin is still effective if digitalis fails to function, but according to more recent research, one must also say that strophanthin is already functioning in cases where digitalis is not yet active. Its use is above all, justified in cases of recent *Angina pectoris* with low levels of insufficiency.

g-Strophanthin – an endogenic hormone

Recent investigations have shown that the human body is capable of producing substances which have the structure of cardiac glycosides and also have an equivalent effect. Steroids, similar to digitalis, have even been found both in the urine of pregnant women and in the umbilical blood of healthy new-born babies where no previous digitalisation was administered.

Researchers in London discovered that when there is an increase in the volume of blood, an excess of sodium or hypertonia, a factor is introduced into the blood which inhibits the sodium pump. It is known as „endogenic digitalis“ and the level increases in cases of slight renal hypertonia. This factor is regarded as one of the causes of essential hypertension. Even more cardiotropic steroids were found during the search for favourable factors with essential hypertension which delays the sodium pump.

Ouabain (g-strophanthin) appears to be a cardiotonic steroid of the suprarenal gland and the hypothalamus which is involved in the regulation of the salt and water metabolism. It has been possible to demonstrate that the hypothalamus contains a substance which inhibits the sodium pump and is an isomer of ouabain. Other researchers were able to prove the presence of an ouabain isomer of this type in human blood. It was also possible to prove that the suprarenal gland produces ouabain (g-strophanthin) in the *zona fasciculata*. This production is stimulated by angiotensin II. From tests on the suprarenal gland in dogs, as well as measurements from human blood, it could be demonstrated and proven that in its stationary phases, ouabain is produced and then increased during circulatory efficiency. In the meantime we have also learnt that ouabain is linked with a specific binding protein in the blood which is how it is transported. This binding protein is produced predominantly in the reabsorbing epithelia of the gut, kidneys and lungs. Presumably



this bonding of the cardiac glycosides prevents inhibition of the sodium pump in these epithelia, so that the resorption processes in these epithelia, which are dependent on sodium⁺ ions, do not become inhibited; otherwise the result would be diarrhoea and a severe loss of the body's sodium content. This mechanism also explains, at least in part, the low level of resorption of strophanthin via the gastro-intestinal tract when taken orally. Ouabain is mainly excreted via the kidneys. If ouabain is prescribed over a long period of time, it becomes concentrated in the suprarenal gland and is presumably stored there. Conversely, this fact could mean that a lack of ouabain causes cardiasthenia, so that by prescribing the cardiac glycoside g-strophanthin it supports a weakness of the suprarenal gland and the heart secondarily. It could be found that this exhaustion of the suprarenal gland was a part cause of cardiasthenia in older people. With increasing age, it is known that the endocrine glands begin to show fatigue.

The fact that g-strophanthin is an endogenic substance, this of course also explains the good tolerance of this cardiac glycoside, its broad effective palette in a wide range of complaints linked to a disorder of the Na⁺/K⁺ ratio, the speed with which it takes effect because it is an endogenic hormone and its problem-free excretion via the kidneys.

All cardiac glycosides have the same low therapeutic breadth – i.e. there is a very small difference between a healing dose and a toxic

one. For the g-strophanthin described here, this means that even a very small dose, particularly if administered intravenously, has an optimum effect. Nevertheless, this type of prescription has fallen into oblivion because of „scientific“ controversy.

Homeopathy

Strophanthus is described in great detail in homeopathy. It has an effect on the heart, increases the systolic phase and lowers the heart rate. It is particularly advantageous when used in cases of oedema and in small doses for weak hearts. Strophanthus does not cause any stomach disorders, has no cumulative effect and is a more powerful diuretic than digitalis. It is safer for old people as it has no influence on the vasomotor nerves. It restores the elasticity of brittle blood vessels and is, therefore, particularly indicated in patients who have taken stimulants over a long period of time or who have an irritable heart caused by tobacco abuse, arteriosclerosis or thickening of the blood vessel walls as in old age. Strophanthus is indicated as a homeopathic remedy in cases of pneumonia and where the level of exhaustion is high as a result of post operative bleeding. This remedy is always beneficial if decompensation occurs following cardiomyoliposis, hives, anaemia with palpitations, breathlessness or cardiomyotoxicosis.

In the head region, the medicinal picture expresses itself in the form of pain in the temples with diplopia (double vision), weak eyesight, shining eyes, a red face and senile vertigo.

Nausea in the stomach region and a particular aversion to alcohol indicate strophanthus, whereby it can also be used particularly successfully in the treatment of dipsomania (periodically recurring excessive consumption of alcohol with intermediate periods of abstinence). Increased urine, similarly as with a sparse protein containing urine excretion, indicate strophanthus. In the female genitalia, menorrhagia, uterine bleeding and severe congestion in the womb as well as intense pain in the hips and upper thighs during the climacterium (menopause) also indicate strophanthus.

Dyspnoea (particularly when ascending e.g. climbing stairs), congestion of the lungs, pulmonary oedema, bronchial and cardiac asthma all call for the prescription of strophanthus. Urticaria, particularly in its chronic form, is symptomatic. In cases where the extremities are swollen or for patients with dropsy or anasarca, one should always consider strophanthus.

In comparison with homeopathic preparations, digitalis also has a slower effect than strophanthus. In addition, according to Boericke, when repertorising, one must also take into account the medicinal picture of *Phosphoricum acidum*.

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