General Pharmacology
Introduction

From the fact mentioned that pharmacon can mean both medicine and poison, it follows that what we ingest does not always result in the desired effect, the primary effect, but can also result in unwanted side effects on the basis of which we classify that substance as toxic (poisonous).

The primary effect is, therefore, understood to be the desired effect, the effect intended. Side effects are those effects which are not intended, but do occur. Every healing or pleasure substance has side-effects. That this distinction is relative can be illustrated by the substance promethazine, better known under the trade name Phenergan. This drug is used to counteract allergies such as hay fever, but it also induces drowsiness. If the doctor prescribes it for hay fever, its drowsiness effect is the sideeffect. However, if Phenergan is used as a tranquilizer, drowsiness is the primary effect and the antiallergic effect is the sideeffect.

When taking medicine we must always ask ourselves if its healing properties outweigh its sideeffects or the risk of possible sideeffects. Take, for example, aspirin. Does its use as a painkiller, almost always effective, outweigh the risk of gastric hemorrhage, a sideeffect in one out of every thousand users.

It is possible to administer a substance at such a small dosage that no effect whatsoever occurs. A larger dosage will bring about the effect wanted, while an even larger dosage will bring about a toxic effect. The difference between the minimum effective dosage and the maximum dosage whereby no toxic symptoms occur is called the **therapeutic width.**

Finally, administration of a substance can also induce a number of effects which have nothing whatsoever to do with the pharmacological properties of the substance; these are the placebo effects.

Pharmaceutical nomenclature

First of all substances have their chemical name, which gives the chemical composition of that drug. Since these names are generally very long and complicated they are also given a shorter, international name, a generic name. Finally, the manufacturer gives the product a trade name. This naming process means that it is possible for a substance to be known under many different trade names. Trade names are always indicated by the sign R inside a circle, following the name.

Several examples:

chemical name: alphamethylphenylethylamine generic name: amphetamine

trade name: Dexedrine

chemical name: 3,4,5trimethoxybenzoylmethylreserpat generic name: reserpine trade name: Serpasil, Banasil, Alserin, Raupoid, etc.

Pharmacokinetics

This is the branch that is concerned with how a pharmacon acts after it is introduced into the body. This is firstly dependent on the way in which it was administered; this can be:

- enteral: by way of the intestine
- oral, per os: by way of the mouth, swallowing sublingual: beneath the tongue, sucking
- rectal: by way of the anus (suppository) parenteral: by injection through the skin
- intracutaneous: within the skin
- subcutaneous: beneath the skin
- intramuscular: within the muscles intravenous: within a vein
- intraperitoneal: within the peritoneal cavity intracardiac: within the heart
- inhalation: drawing into the lungs (smoking)
- transcutaneous: absorption through the skin (bandage)

The most important aspect of administration per os is that when the substance has been absorbed into the blood of the gastrointestinal tract it goes on to the liver. One important function of the liver is to break down foreign substances and/or prepare them for elimination by the kidneys by changing them chemically. This process is called biotransformation. Biotransformation reduces the effect of many substances when taken per os. This is not the

case with smoking or shooting up, which means that in these cases the effect is much stronger. Another way to avoid biotransformation in the liver is by rectal or sublingual administration (the nitrobate in angina pectoris) as the blood vessels from the mouth and rectum do not first lead to the liver.

Another factor influencing the strength of the effect lS that it is not so much the amount of the substance in the blood (concentration in the blood) that determines the severity of the effect, but rather how quickly that concentration rises. A substance administered per os is absorbed slowly by the blood; its concentration in the blood rises slowly. With shooting up or smoking, concentration in the blood rises rapidly to very rapidly, causing a much stronger effect.

Blood transports the substance administered to the place where it is to have its effect. Whether the substance is easily soluble in water, or in fat is also important. If a substance is easily soluble in water, it mixes well with the blood; if it is easily soluble in fat, it mixes less easily, but stores well in the adipose tissue for later use.

Substances are also broken down. Although the liver is often mentioned in this context, the breakdown of enzymes also takes place elsewhere in the body. An enzyme is a substance that causes a chemical reaction to occur without being changed itself. Outside the medical world this reaction is called catalysation; a substance that has such a function is called a catalyst. Of importance in this connection is that some substances (also medicines) can speed up or slow down the breakdown process. In cases of combined usage this can lead to a lowered or heightened effect. Examples of this are:

- rifampicine (an antibiotic which is also used in tuberculosis cases): speeds up methadone breakdown, which reduces its effect; methaqualone (a sleepinducing drug): slows down the breakdown of many substances (including opiates), which heightens their effect.

An important concept with this is **halflife,** which is the amount of time the body needs to eliminate half of the substance present as measured by its concentration in the blood.

The substances, whether biotransformed or not, are then excreted again, usually with the urine. Substances can also be excreted with the feces, sweat, saliva, tears and mother's milk. If they are gasforming, they can be exhaled by the lungs.

- Agonist antagonist

Pharmaca are administered for their effect. They have that effect because they react with special molecules, called receptors. The pharmacon is then an **agonist** with regard to a specific receptor. Other substances can have the opposite effect; these latter are referred to as the **antagonists.**
An example of this is the agonist morphine of which nalorphine is the antagonist that counteracts the effects of morphine. It often

'happens that the antagonists 'fight' with the agonists for an effect on the receptor; we then speak of **competitive antagonists.** This in contrast to situations in which the antagonist blocks the receptor just like that: we then speak of noncompetitive blocking. In the first case, the receptor blockade can be lifted again by a higher dosage of the agonist, in the second case it cannot.