1. SEMI-SOLID DRUG FORMULATIONS

These are intended for application on skin or mucosa. The base is either simple or composite, with or without dissolved or dispersed active ingredients. They include ointments, creams, pastes, and gels. Active drugs contained in these formulations act on the surface of the skin, sometimes in deeper tissues.

1.1. OINTMENTS (UNGUENTA)

Ointments are typical semisolid preparations. When applied on open wounds or severely damaged skin, they must be sterile.

Ointments are composed of active ingredients and simple or composite ointment bases. The active ingredients can be dissolved, emulsified, or dispersed in a suspension.

**Ointment bases** should be homogenous (any precipitates are a sign of poor quality). The components of the ointment can be of animal, plant, or mineral origin. Animal and plant fat (usually triacylglycerols) are better absorbed and are closer in their chemical composition to the grease on human skin. Their disadvantage is that they lack long-term stability and go bad even when stabilised.

The components can be, and most often are, combined into composite ointment bases.

These can be divided into hydrophilic (mixing with water) and hydrophobic (mixing easily with oil, unable or almost unable to mix with water).

- Hydrophobic includes yellow petroleum jelly (mineral jelly, Vaseline) (vaselinum flavum) and its purified white form (vaselinum album). It’s a mixture of saturated hydrocarbons from oil. We also use solid and liquid paraffin (paraffinum solidum, paraffinum liquidum), stabilized pork fat (adeps suillus stabilisatus), silicone oil (Lukooil 200), and white and yellow beeswax (cera alba, cera flava). They are compatible with most drugs.

- Hydrophobic emulsions are water-in-oil type, using something like wax from sheep wool (cera lanae hydrosa, with 25% water) as an emulsifier. An example of a composite base is the factory-made Synderman, which contains yellow petroleum jelly, liquid paraffin, and wax from sheep wool. Another example is the simple ointment (Ung. simplex), which contains pork fat, white beeswax, and cetyl alcohol. We use Unguentum ophthalmicum simplex as a base for eye ointments (also called Oculentum simplex). These bases are suitable for preparations of most dermatologic formulations. Cooling ointment is very popular, called Unguentum leniens in Latin
(cera alba, cetaceum – spermaceti [a whale oil extract], helianthi oleum, ricini oleum, natrii tetraboras, aqua purificata, geranii etheroleum)

- Hydrophilic ointments are composites of the basic Unguentum macrogoli (macrogol = polyethylene glycol) or Carbopol
- Hydrophilic emulsions are of the type oil-in-water. These include Ung. emulsificans anionicus, Ung. emulsificans nonionicus, Aquasorb, Neoaquasorb (factory made).

Some of the active ingredients that can be dissolved, emulsified, or suspended in the ointment base include:

- Salicylic acid (acidum salicylicum) – in a concentration of 2% - 5% it has disinfectant and keratoplastic effects, i.e. promotes skin growth. In higher concentrations, from 10% - 20%, it is keratolytic (breaks down skin) and is usually applied on thick skin such as calluses or warts
  Be careful when applying on large surface areas (be especially careful in children) or on pathologically changed skin (such as burns), because the absorption will be great enough to produce systemic effects, and can lead to intoxication
- Boric acid (acidum boricum) in a concentration of 5% - 10% works as a mild disinfectant and promotes epithelialization
- Coal tar (lithanthracis pix, genitiv picis) in concentrations of 3%, 5% or 10% is used for chronic eczema or as an exfoliant
  Coal tar is very popular in dermatology, probably because (among other reasons) patients covered in tar don’t consider the original skin changes to be so bad. Not only does it look bad and smell bad, it also causes the skin to become photosensitive, and if it gets absorbed it can be nephrotoxic.

The composition of the ointment base greatly influences the properties of the final product. This means we can have ointments that are protective (coat the skin and work on the surface) or penetrating (working on the deeper layers of the skin). We also choose the base depending on the physical and chemical properties of the drug; not all drugs and bases can be combined.

Drugs contained in the ointments can penetrate deep into the skin. They also soften keratinized skin, scales, and scabs, and facilitate their removal. Ointments are not suitable for application to wet areas, including weeping wounds or intertriginous spaces, and are very difficult to remove from hair (hydrophilic creams or gels are preferable for hair, because they can be washed out). Simply applying ointments onto the skin, and not covering the area with a bandage, allows the ointment to only work on the surface. However, massaging ointment into the skin allows it to penetrate deeper, and covering it with an airtight bandage will lead to vasodilatation and better penetration. This bandage is left on the skin for 24-48 hours. It is used in treatment of severe conditions, where a simple application of ointment is insufficient.
Prescription of ointments is similar to prescription of other non-divided forms, such as solutions for example. The total amount prescribed will depend on the target surface area (for face 5 – 15g, both hands 25 – 50g, both arms, lower limbs or larger areas of the torso 100 – 200 g). The subscription will contain the line *Misce fiat unguentum* (mix to form an ointment), the ointment can then be dispensed in a cup (*olla*) or metal tube (*tuba metallica*).

Example: prescription of Ondřej's ointment for treatment of sore skin:

Rp.

\[
\begin{align*}
&\text{Acidi salicylici} & 1,0 \\
&\text{Lavandulae etherolei} & 2,0 \\
&\text{Syndermani} & \\
&\text{Vaselini flavi} & \text{aa ad} 100,0 \\
&\text{M. f. ung.} & \\
&\text{D. ad ollam} & \\
&\text{S. Apply to affected areas}
\end{align*}
\]

**1.2. CREAMS (CREMORES)**

By mixing 10% or more water into an ointment base (using an emulsifier), we get a cream. Greasy creams (known as “night creams” in cosmetics) are from emulsions of the water-in-oil type. Non-greasy creams (“day creams”) are from oil-in-water emulsions. The greasy bases are, for example, *Cremor leniens* (*cera alba, cetaceum, glyceroli monostearas, helianthi oleum, ricini oleum, propylis gallas, aqua purificata, geranii etheroleum*) or the cooling *Cremor refrigerans*. Hydrophilic bases include Ambiderman, Neoaquasorb, and others.

Creams are easily washed away with water, so they are suitable for application into hairy areas of the body and intertriginous spaces.

The prescription is the same as for ointments, except that we write *Misce fiat cremor*.

Example: prescription for calming cream (using the officinal name)

Rp.

\[
\begin{align*}
&\text{Cremoris refrigerantis} & 100,0 \\
&\text{D. ad tubam metallicam} & \\
&\text{S. Calming cream} & \\
&\text{Children's body lotion:} &
\end{align*}
\]
1.3. PASTES (PASTAE)

Pastes are thick or thin malleable suspensions. Unlike creams or ointments, they contain a large percentage of solid elements (from 25% - 50%). The elements used most often are zinc oxide (zinci oxidum), talcum powder (talcum), starch (amylum), or calcium carbonate (calcii carbonas). We usually use Zinci oxidi pasta as a base for pastes in prescriptions. Depending on the proportions of liquid and solid components, we can categorize the paste as thin (cooling) or thick.

Pastes are thicker and drier than ointments. They are permeable; thanks to this, they macerate (soften up the skin) less, and are better tolerated in acute skin conditions than ointments. Drugs contained in pastes penetrate less and have weaker action than the same concentration of that drug would have in an ointment. Thick pastes can also be used to protect the skin bordering an ulcer from maceration from the exudate of the ulcer. They are applied in thicker layers, and their effect can be enhanced by covering with an airtight bandage.

The active ingredients used in pastes are approximately the same as those used in ointments.

The prescription will contain the line M. f. pasta.

Example: prescription for tar paste.

Rp.

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lithanthracis picis</td>
<td>5,0</td>
</tr>
<tr>
<td>Zinci oxidi pastae</td>
<td>ad 100,0</td>
</tr>
</tbody>
</table>

M. f. pasta
D. ad ollam
S. Apply in thin layer onto affected areas.

1.4. GELS

Gels are composed of liquids and gelling agents, and they form a thin layer when applied to the skin or mucosa. They can be hydrophilic or hydrophobic. Gels are a component of some
ointments. Drugs intended for application into the hair (or onto hairy parts of the body) are often made in gel form. One example of a gel is Polysan, made of magnesium hydroxide and with anti-inflammatory, cooling, and astringent effects.

Outside of dermatology, gel preparations containing anaesthetics are used for local surface anaesthesia (for example, Mesocaine gel contains trimecaine). Gels containing NSAIDs such as diclofenac (Voltaren, Veral), ibuprofen (Dolgit, Ibalgin), indomethacin, and others are also very popular. They can penetrate the skin and get into deeper structures such as muscles and joints. Given this penetration, they will have systemic absorption and therefore systemic side effects.