1. Postmortem Changes

The various postmortem changes are of importance for the medical examiner and the forensic pathologist for several reasons:

- as certain or uncertain signs of death;
- as an instrument for limiting the time interval since death;
- as a means of recognizing manipulations on the body (changing its position, breaking postmortem rigidity);
- as an indicator of certain storage and environmental conditions (e.g. bright red postmortem lividity under low ambient temperatures, wrinkling of fingers, palms and feet in bodies recovered from water);
- as an indicator of intoxication (cherry red hypostasis in intoxications with carbon monoxide and sometimes also in deaths caused by hydrocyanic acid, brownish red hypostasis in methaemoglobinaemia, premature and particularly intensive rigor mortis in deaths caused by convulsants);
- as a correlate of the intravasal blood volume (sparse livor mortis in anemia);
- as cause of general changes so severe that identification by witnesses who knew the person becomes difficult or impossible;
- as effects of postmortem scavenging, this must be differentiated from pathological findings and antemortem injuries.

Traditionally, differentiation is made between supravital reactions and early, as well as late, postmortem changes.
1.1 Postmortem lividity

Postmortem lividity (livores mortis) refers to skin discolorations forming in the first few hours after cessation of circulation by hypostatic settling of the blood in the dependent areas of the body. They are patch-like at first and then flow together to form large skin discolorations, except in areas where the body is pressed against the underlying surface, or where clothes press against the skin. For several hours livores can be displaced easily and may shift if the position of the body is changed; later this is possible only in part or not at all. Within marked livores, punctiform to rice grain-sized haemorrhages (petechiae and ecchymoses ĭ "vibices") may occur in the skin. The intensity of postmortem lividity indicates whether the body was rich in blood or anemic. The color of postmortem lividity is also of diagnostic value; normally purple to greyish-violet (02-free Hb due to postmortem oxygen consumption), red in a cold environment (diffusion of oxygen from the air through the skin, intensive binding to haemoglobin under low temperatures); bright red in cases of CO intoxication and - less often - in cyanide poisoning.
1.2 Postmortem rigidity

After the initial flaccidity of the muscles, **postmortem rigidity** (rigor mortis) develops in the course of a few hours. The rigidity is due to a reduction of muscle elasticity in connection with postmortem cessation of energy metabolism. If the rigidity is broken mechanically within the first few hours after death (by moving the adjacent joints), it may reappear. Rigor disappears due to autolysis and is dependent on the ambient temperature (rapid disappearance in a warm, slow disappearance in a cold environment).

1.3 Drying

**Manifestations of drying** may develop quite early in the post-mortem period, not only in exposed parts (e.g. the cornea, if the eyelid is open, or the lips of an infant), but also after loss of epidermis.
1.4 Putrefaction

**Putrefaction** is usually regarded as one of the late postmortem changes, although it may begin in the first few days after death in an unrefrigerated environment. The biochemical processes underlying the changes of putrefaction are due to certain (anaerobic) bacteria and their enzymes respectively. They lead to the formation of gases in the tissues with subsequent bloating of the body, in particular the soft tissues of the face, the abdominal wall and the scrotum; the internal organs are interspersed with gas bubbles. The decomposition and putrefaction of proteins result in the formation of hydrogen sulphide, and, in its presence, green sulphhaemoglobin. Due to the spreading of bacteria along the blood vessels, the venous network becomes visible through the skin. Green discoloration of the skin normally begins in the right lower abdominal region (due to the vicinity to the bacteria-containing intestine). Finally, the entire skin including the hypostatic areas shows a discolored appearance. The epidermis becomes detached from the corium in a wail paper-like fashion ("skin slippage"); putrefactive liquid entering the interspace leads to the formation of vesicles of different sizes. The decomposition processes called "decay" follow putrefaction; this stage mostly involves aerobic bacteria.
1.5 Different type of putrefaction, animal scavenging

The formation of adipocere is a late postmortem change, which can be observed after a body has been immersed in water for at least several months or has been exposed to a moist environment. It is due to a transformation of body fat by hydrolysis and hydrogenation into an initially greyish-white, pasty and later solid mortar-like mass with the original shape of the body fat being largely retained.

In mummification, severe fluid loss occurs due to postmortem desiccation. It may be restricted to certain regions (face, hands, feet) or involve the body as a whole. Air-drying of soft tissues produces a leathery hardening and brownish-black discoloration. This condition may continue unchanged for long periods of time.

Postmortem scavenging is seen in many different manifestations depending i.a. on the following factors: climatic zone, season, local fauna, storage conditions (in air, in soil or in water), accessibility of the site to insects and other animals, state of clothing etc. For details, please refer to the pertinent special literature. In temperate climatic zones, fly maggots are among the most important destroyers of corpses: In case of massive infestation, they can effect partial skeletonization (especially in the facial area) after only a few days. Further potential causes of postmortem scavenging effects may be ants, beetles, rodents, foxes and carnivorous pets (cats, dogs). Of criminalistic significance is the differentiation of changes due to scavenging from antemortem injuries.