# Forensic Science session 2

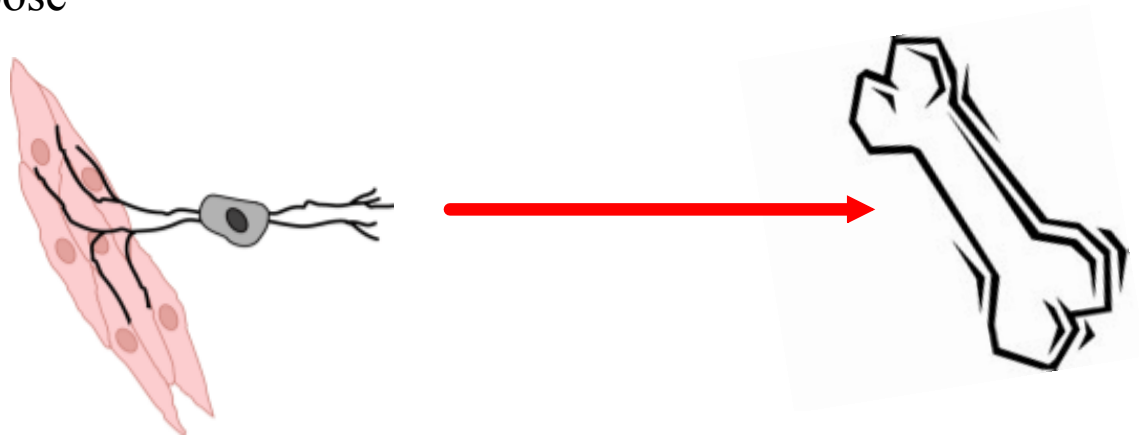
# Rigor Mortis

**http://chemistry.about.com/cs/biochemistry/a/aa061903a.htm**

A few hours after a person or animal dies, the joints of the body stiffen and become locked in place. This stiffening is called *rigor mortis*. Depending on temperature and other conditions, rigor mortis lasts approximately 72 hours. The phenomenon is caused by the skeletal muscles partially contracting. The muscles are unable to relax, so the joints become fixed in place

About.com : Chemistry

More specifically, what happens is that the membranes of muscle cells become more permeable to calcium ions. Living muscle cells expend energy to transport calcium ions to the outside of the cells. The calcium ions that flow into the muscle cells promote the cross-bridge attachment between actin and myosin, two types of fibers that work together in muscle contraction. The muscle fibers ratchet shorter and shorter until they are fully contracted or as long as the neurotransmitter acetylcholine and the energy molecule adenosine triphosphate (ATP) are present. However, muscles need ATP in order to release from a contracted state (it is used to pump the calcium out of the cells so the fibers can unlatch from each other). ATP reserves are quickly exhausted from the muscle contraction and other cellular processes. This means that the actin and myosin fibers will remain linked until the muscles themselves start to decompose



# As a Forensic Science tool

Rigor mortis can be used to help estimate time of death. The onset of rigor mortis may range from 10 minutes to several hours, depending on factors including temperature (rapid cooling of a body can inhibit rigor mortis, but it occurs upon thawing). Maximum stiffness is reached around 12-24 hours post mortem. Facial muscles are affected first, with the rigor then spreading to other parts of the body. The joints are stiff for 1-3 days, but after this time general tissue decay and leaking of lysosomal intracellular digestive enzymes will cause the muscles to relax. It is interesting to note that meat is generally considered to be more tender if it is eaten after rigor mortis has passed.

# Livor Mortis

**http://www.ancientsites.com/aw/Post/358734**

By the end of the 1600s, Europe was beginning to record its first criminal autopsies, describing, among other things, the lungs of deliberately smothered children -- which were noted to be fluid-filled and speckled with blood. These are the same signs that a forensic pathologist sees today at autopsy.

The French developed the concept of **lividity**, or ***livor mortis***, from the French *liviere*, "to turn blue." This is the gradual deoxygenation and gravitational settling of the blood that begins as soon as lungs and heart cease their motions

The color progression of lividity begins with the proverbial pallor of death, as blood begins to drain out of the upper surfaces of the body. Fifteen to twenty minutes after death, an experienced observer can see the first diffuse blotches as they appear on the underside of the body. The seepage also becomes visible in dependent areas such as earlobes and skin folds. Within an hour or two, the telltale discoloration becomes obvious to even the untrained eye, even in a person who is dark-skinned. The pink color of early livor gradually darkens to a dull, bruiselike red before progressing through shades of purple and blue as oxygen gradually disappears from the blood.

## Has the dead person been moved from the scene?

The lividity is not yet "fixed," or permanent. Press your thumb against an area of livor in the first hours after death, and it will blanch. Similarly, should you move the body during this period, the blood-settling patterns will shift, though perhaps not completely, for livor's fixation is gradual. A body dead in a kitchen chair at 5 p.m., then undressed and tucked into bed at 8 p.m. may retain the faintly blanched impressions of contact points between the body and unyielding surfaces such as the back of that chair or a tight waistband, thus allowing the trained observer to notice that something is amiss.

By ten hours past death, the color has become fully fixed. The body has now cooled to the point where the fatty lining of the blood vessels congeals, pinching shut the tiny capillaries near the body surface. The dark stain of blood seepage can no longer escape inward when pressed, nor will it resettle, even partially, when the body is shifted. Moving a body once livor has fully set leaves behind a stark and permanent imprint of its original position

# Algor Mortis (body temperature)

**http://www.deardeath.com/after_death.htm**

After death, body temperature declines progressively until it reaches the temperature of its surroundings. This process generally takes about 8 to 12 hours on the skin, but the centre of the body takes about three times as long to cool. This fact can be used to estimate time of death. However, many factors may influence the rate of heat loss and this is only an estimate. After the onset of putrefaction (about two days after death) the body temperature will increase again, due to the metabolic activity of the bacteria and other decomposing organisms

## http://www.dplylemd.com/Articles/timelydeath.html

The timing of death is both an art and a science.
Unless the death is witnessed, it is impossible to determine the exact time of death. The Medical Examiner (ME) can only “estimate” the approximate time of demise. It is important to note that this “estimated time of death” can vary greatly from the “legal” time of death, which is the time recorded on the death certificate, or the “physiologic” time of death, which is when vital functions actually cease. The “legal” time of death is the time the body was discovered or the time a doctor or other qualified person pronounced the victim dead. These “times of death” may differ by days, weeks, even months, if the body is not found until well after “physiologic” death has occurred. For example, if a serial killer kills a victim in July, but the body is not discovered until October, the “physiologic” death took place in July, but the “legal” death is marked as October. The ME’s “estimated time of death” would be July.
That said, the ME can estimate the “physiologic” time of death with some degree of accuracy. He uses the decompositional changes that occur in the human body after death to help him in this endeavor. These changes consist of measuring the drop in body temperature, the degree of rigidity (rigor mortis), the degree of discoloration (livor mortis or lividity), the stage of body decomposition, stomach contents, and other factors. Bodies found in water present special problems in this regard.

Body Temperature:
Normal body temperature during life is 98.6 degrees F ($37^0$C). After death, the body loses heat progressively until it equilibrates with that of the surrounding medium. The rate of this heat loss is approximately 1.5 degrees per hour until the environmental temperature is attained, then it remains stable. Obviously, this measure is greatly effected by location. A body in the snow in Minnesota in January and one in a Louisiana swamp in August will lose heat a widely divergent rates. These factors must be considered in any "estimate" of time of death. The criminalist who processes the scene should take a body temperature and measure the temperature of the surrounding medium--air, water, snow, earth (if the body is buried). Ideally, the body temperature is taken rectally. Obviously, the sooner after death the body is found, the more accurately time of death can be assessed by this method. Once the body reaches ambient temperature, all bets are off.