G63 Experimental Evaluation of Rigor Mortis Nysten's Law: Does it Apply to Rats?

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The learning objective consists in presenting the development of the intensity of rigor mortis in the different parts of the body of rats.

In 1811, the French physician and chemist P.H. Nysten published the first scientific description of rigor mortis. The law named after him states that "Cadaveric rigidity affects successively the masticatory muscles, those of the face and the neck, those of the trunk and arms and finally those of the lower limbs." It is often added that resolution occurs in the same order. The development of rigor mortis is thus descending, a finding thought to be related to the varying distances between the different muscles and the central nervous system. However, Nysten himself noticed that the destruction of the CNS did not affect the order of the development of rigidity.

In 1917, Naumann confirmed the descending development of rigor mortis, but he also noticed that in some special cases (e.g., in weak individuals, or those diminished by illness), rigidity may show an ascending pattern.

However, in 1950 Shapiro contested Nysten's statement: "it is difficult to understand why a physico-chemical process which takes place in recently dead tissues should follow the sequence usually described. It appears more likely that, because we are dealing with a physicochemical process in what is virtually a lump of clay, this will take place simultaneously in all the recently dead muscles."

Some years ago, we developed a method to increase our understanding of rigor mortis through the objective measurement of the intensity of cadaveric rigidity in rats. The principle of the method is to determine the force required to cause a movement of small amplitude (4 mm) in the limb under examination. Since the movement doesn't break rigor mortis, serial measurements can be conducted. Our apparatus measures the resistance caused by rigor mortis in the knee and hip joints of rats. This method has been used in the past to evaluate the influence of several pre-mortem and post-mortem factors (i.e., body weight, muscular mass, age, physical exercise, ambient temperature, various causes of death, electrocution) on the development of rigor mortis.

In our present investigation, we tried to determine the validity of Nysten's law in the case of rats. For this purpose, we adapted our method to perform parallel measurements in the masticatory muscles, the neck, the front limbs and the hind limbs in rats, respecting the same principles of measurements.

Experimentation:

Animals: male albino rats, weighing approx. 300 g.

Measurement time points: 10 min, 1h, 2h, 3h, 4h, 5h, 6h, 8h, 12h, 16h and 24 post-mortem.

Results:

Group No 1: hind limbs.

The maximal values of the intensity of rigor mortis were reached at 5 hours post-mortem with a plateau of the intensity between 5 and 8 hours post-mortem, followed by the resolution of rigor mortis.

Group No 2: front limbs.

The time course of the intensity of rigor mortis was practically the same as in the hind limbs in spite of the fact that the muscular mass of the hind limbs was 2.89 times greater than that of the front limbs.

Group No 3: neck.

The maximal values of the intensity of rigor mortis were reached at 3 hours post-mortem in the muscles of the neck. The resolution began at 6 hours postmortem.

Group No 4: masticatory muscles

In the masticatory muscles the maximal values were reached at 2 hours post-mortem. The resolution began at 8 hours postmortem.

Conclusion: The intensity of rigor mortis reaches maximal values significantly earlier in the masticatory muscles and in the muscles of the neck as compared to the front and hind limbs in rats. Consequently, Nysten's law seems to apply to rats as far the onset of rigor mortis is concerned.

Rigor Mortis, Nysten Law, Rats

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