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STUDY ON MUSCLE-CELL: SARCOLEMMA.

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On the conference of the European Meat Researchers in 1958 the questions on qualitative and quantitative connective tissue content of meat and meatproducts /1/ and in 1959 the relationship between the thickness of the striated muscle fibres and the quality of meat /2/ were discussed.

In this present study we give a brief account of our work regarding the finer structural conditions of muscle fibres, i.e. the characteristics of sarcolemma.

We took samples from the thigh muscle of beef about quarter of an hour after death. The muscles we cleaned totally from the visible fat and connective tissue elements and cut pieces of 3 - 5 mm length and disintegrated them in phisiological solution of sodium chloride utilizing a Waring blender. On the muscle fibre pieces at phase contrast - but also at normal - illumination strongly refractive

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concentric - formerly not observed - fibre structure was visible. This originally regular connective tissue "winding" /fig.1./ becomes loose according to the degree of the endured mechanical injuries /fig.2./, the circular fibres are slipping towards one and other /fig.3/, or the ruptured muscle fibril bundles escaps from the tight connective tissue grasp /fig.4/. The oroginally tight, helical fibres may be identified as the circlets of a broken spring /fig.5./ still endeavouring to hold together the cell-content, the fibrilmass, clearly visible on microscopic slides.

By thorough searching we could find in the homogenized mass, relatively intact tissue pieces resembling a somewhat damaged fine spring /fig.6./. In course of the mechanical treatment the muscle protoplasm was sweped away and the fine structure belonging undoubtedly to the cell remained "empty". The connection of these with the fibre cell is shown without doubt by such a not quite damaged muscle fibril bundle, where this fibril structure is good visible on the muscle cells still remaining together.

In thinking over our previous statements /3/ our now examinations affirm our supposition, that this concentric fibril structure is an integral part of the muscle cell. Assuming in case of striated muscle fibre

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the bipartite nature of cell membrane, divided into a structureless fine lipoprotein membrane and outside of it into a collagen fibril layer - so the observed circular fibre structure is out of doubt the later one. This brings us nearer to the opinion of some other authors, from which for instance Jones and Barer /4/, further Conte and Rieser /5/ failed to prove the collagen character of sarcolemma fibril structure, holding it only for a fine protein seath. Others, for instance Wang /6/ observe beside the effective homogen sarcolemma membrane also a fibril envelope; Rózsa, Szent-Györgyi and Wickoff /6/ although failed to confirm that the sarcolemma contains fine collagen or reticular fibres, but they observed under electronmicroscope fine granular spots, which they took for the attachement points of connective tissue fibrils, or myofibrils.

In consequence of our examinations - in case of cattle - we consider the question as settled, that is: outside of the structureless effective sarcolemma membrane lies the fibril structure shown by us. It must be considered whether the opinion of Rózsa et al. /6/ was right or not. According to their wiew the fibril threade belonging to the sarcolemma / the attachement points of which they thoght to discover/ do not belong to the muscle cell, but to the surrounding connective

tissue substance /endomysium/. Or should we consider this circular connective tissue fibril wire, slipping easily off or from the effective cell membrane in consequence of mechanical injuries, for strict belongings of the muscle cell. We think, the former opinion is the right one.

In our previous work /3/ we also tried to clear the nature of this fibrils. We wanted to demonstrate the collagen nature of the fibres by alcalic /o,2 n Sodium hydroxid/, resp. tartaric acid hydrolisis. In our recent experiments we also tried to form a clear opinion on the collagen, resp. elastic nature of the fibres. To this aim trypsin and /or/ pepsin digestion was used, taking into consideration that the peptic bonds of the collagen are broken down slowlier by trypsin as by pepsin /7/. We solved o, 5 g Pepsinum siccum in loo ml o,2 HCl and in this solution on 37 C^{o} we were able totally to dissolve the fibrous elements on the muscle cell pieces. The sarcoplasm as a granular, structureless material showed the contours of the muscle cell /fig.9./ On the other hand the solution of o,3 g Trypsinum siccum in loo ml $NaCO_3$ under similar conditions didn't digest these fibres /fig.lo./. On continuing the digesting experimente, the difference between the pepsin and trypsin preparates became indistinct

and after some hours both enzyme solved completely the tissue elements of the muscle cell pieces.

With differentiating staining methods we couldn't gain doubtless results. The Van-Gieson, Mallory or resorcin staining, which were technologically applicable with great difficulty, failed to ensure an exact differentiating.

We think that the circular fibril structure - though the active part of the sarcolemma - strictly does'nt belongs to the "sarcolemma proper", i.e. it has a loose bond with the cell membrane and concerning its origin it is rather a part of the connective tissue substance /perimisium/ surrounding the muscle cells.

The recognition of this failed up to now due to the fact, that the samples were taken a longer time after death and the hystological technology was unsuited to demonstrate the structure.

We continue our examination to clear the behaviour of these fibril structure of the muscle cell at various times after death and also to determine the muscle cell structure of various species of animals of various ages.

We made our former experiments and also this present work to clear the relationship between the finer hystological structure of meat and its quality.

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