Answer

2.5 Muscular Tissue

158. a – b + c + d + e +

159. a + b – c + d – e +

160. a – b – c + d + e +
Smooth muscle fibers are found in the iris of the eye and are responsible for controlling pupil size. The pupil is the opening in the center of the iris and as such has no smooth muscle fibers. Smooth muscle is found in the walls of blood vessels (with the exception of the capillaries). The smooth muscle in the skin is represented by the arrector pili and is also found in the walls of the blood vessels of the dermis. Smooth muscle is also found in the walls of the respiratory tract and in the walls of the gall bladder. Smooth muscle fibers are involuntary and are innervated by the autonomic nervous system. The cells of smooth muscles are spindle-shaped with fairly central elongated nuclei. The fibers lack cross-striations, though both actin and myosin have been isolated. The cytoplasm of smooth muscle fibers (sarcoplasm) is acidophilic. Unlike skeletal or cardiac muscle no system of sarcomeres is found.

161. a + b + c + d + e +

162. a + b – c + d + e +
Smooth muscle shows both rhythmic and tonic contraction and can participate in the peristaltic waves of contraction seen in the alimentary tract. The contractions of smooth muscle are relatively slow and sustained and require less energy expenditure than those of skeletal muscle. The impulses inducing smooth muscle contraction may come form parasympathetic nerves, hormones such as oxyton (as in uterin contraction), prostaglandins or even by stretching within the wall of an organ.

163. a + b + c + d – e +

164. a – b – c + d – e +

165. a – b – c – d + e –
The sheath surrounding smooth muscle cells is similar in structure and composition to the basal lamina of epithelial cells. It is formed by the cells themselves and contains non-fibers collagen. PAS-positive proteoglycans and associated reticular fibers, which can be demonstrated by impregnation with silver salts. The sheath is about 20-40 nm thick and is interrupted at intervals by gap junctions (nexuses). Unlike the endomysium of skeletal muscle, the sheath lacks blood vessels and cell bodies of connective tissue.

166. a + b + c + d + e –
At the electron microscope level after suitable fixation both thick and thin myofilaments are detectable in smooth muscle cells. Caveolae are found as invaginations of the sarcolemma. Golgi bodies are found close to the poles of the nuclei. Mitochondria and glycogen are found in smooth muscle, though sarcoplasmic reticulum is not well developed and has a very limited distribution.

167. a + b – c + d + e +

168. a + b + c + d + e +
Cardiac muscle is involuntary. Fibers are composed of chains of cells, which may branch. Cross-striations and sarcomeres are clearly seen in cardiac muscle. Nuclei are centrally located within the fibers, which contain abundant, large, well-developed mitochondria and glycogen deposits. Myoglobin is found in fairly large amounts in cardiac muscle. Lipofuscin,k which has a brown appearance in fresh cardiac muscle, is located maily close to the nucleus and increases in amount with advancing stage.

169. a + b – c – d + e +

170. a – b + c + d – e –
Intercalated disks are unique to cardiac muscle and should not be confused with the fibrocartilaginous intervertebral disks of the vertebral column. The intercalated disks are visible by light microscopy and are sites of local concentrations of calcium. In isolated hearts in culture kept in a calcium-free medium, the muscle cells come apart at the intercalated disks. The intercalated disks are found periodically and not between every sarcomere. At the electron microscope level they are seen to be zig-zag structure which have structures resembling desmosomes and also gap junctions.

171. a + b + c – d – e +
The cells of the conductive system of the heart are modified muscle cells called ‘Purkinje fibers’. In the area of the nucleus of these Purkinje fibers there is more sarcoplasm than in typical myocardial cells and glycogen is usually very abundant.

172. a – b + c + d – e –

173. a – b + c – d + e +
Impulse generation for myocardial contraction comes from the sinoatrial (SA) node, which is sometimes called theh ‘pacemaker’. This SA node is stimulated by the vagus nerve. The attrioventricular (AV) node, bundle of His and Purkinje fibers are all part of the conduction system. The cells of the sinoatrial node are modified cardiac muscle cells, which are embedded in a network of dense connective tissue.

174. a + b – c – d – e –
The cardiac valves are composed essentially of folds of the endocardium strengthened by a central flat sheet of dense collagenic connective tissue. The valves do not have an intrinsic blood supply, though some capillaries may be presented at their base.

175. a + b – c + d + e –
The heart skeleton is the central supporting tissue of the heart to which most of the muscle fibers are attached. It is composed mainly of dense connective tissue, which may in some places have cartilage-like (chondroid) tissue.

176. a – b – c + d – e –

177. a + b – c – d – e +

178. a – b – c – d + e +

179. a + b – c + d – e –
Sarcomeres are units between two Z-lines. The I-band of skeletal muscle is composed ofthin myofilaments of actin, which are connected to the Z-line. When voluntary muscle contracts, the myofilations retain their length, though because of sliding between each other, the sarcomere becomes thicker. Thus in electron micrographs of contracting muscle the Z-lines are brought closer together and the H-zone becomes smaller and eventually disappear.

180. a + b – c – d + e –

181. a + b – c – d + e +

182. a – b – c + d – e –
Myosin and actin are both structural proteins, Myosin is composed of light and heavy meromyosin and is the main compoenet of the A-(aniso-tropic) band. Actin is the main component of the I-band and is isotropic (non-birefringent). It is present in a globular form (G-actin) and also in a fibrous form (F-actin). Troponin acts as a calcium-binding protein in skeletal muscle.

183. a – b – c – d – e +

184. a + b + c + d + e –
Myoglobin is a protein found in skeletal and cardiac muscle and is responsible for the red color of muscle fibers. Myoglobin is typically found in the type I fibers of skeletal muscle (characteristics of slow-twitch, oxidative, mitochondria-rich fibers). Its importance lies in itsoxygen-binding capacity. Myoglobin should not be confused with hemoglobin of erythrocytes.

185. a + b + c – d + e +

186. a – b + c + d + e +

187. a + b + c + d + e +
The T-system of human skeletal muscle consists of tubular transverse invaginations of the sarcolemma. These T-tubules are found on the border between A- and I bands. The T-tubules are not visible by light microscopy. By electron microscopy the T-tubules are usually found associated with terminal swellings of the sarcoplasmic reticulum in the form of 'triads'. The T-system is important in the process of skeletal muscle contraction and involves a sequence of events including the depolarization of the sarcolemma and T-tubule membrane, transfer of the impulse to the terminal sacs of the associated sarcoplasmic reticulum, release of stored calcium to the sarcoplasm and its binding to troponin.

188. a + b + c + d + e +
The sarcoplasm of skeletal muscle may contain mitochondria, sarcoplasmic reticulum, glycogen, myoglobin and troponin.

189. a + b + c + d + e +
Red striated muscle fibers in comparison with white fibers have more mitochondria, succinic dehydrogenase activity, cytochrome enzyme activity and ATP-ase activity as well as more myoglobin. These red fibers are also referred to as slow twitch, oxidative fibers.

190. a – b – c + d + e +
Osteoclasts, foreign body giant cells and skeletal muscle fibers are all multinucleated.

191. a + b – c + d + e –
Myoepithelial cells are of ectodermal origin and are found surrounding secretory units of mammary and salivary glands, where they contraction causes secretion to be released into the central lumen or duct. Secretion from sebaceous glands is mainly due to contraction of associated arrector pili smooth muscle fibers.