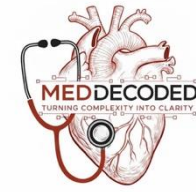


بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ



HISTOLOGY

Final | Lecture 11

وَلَقَدْ خَلَقْنَا الْإِنْسَانَ وَنَعَلَهُمَّا تَوْسُوسًا بِهِ نَفْسُهُ وَنَحْنُ أَقْرَبُ إِلَيْهِ مِنْ حَبْلِ الْوَرِيدِ

Muscle Tissue lab

Written and reviewed by : Daren Alhababseh

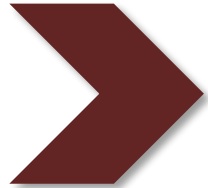
Rand Alkhateeb



Color coding used in the modified:



Black: the original slides



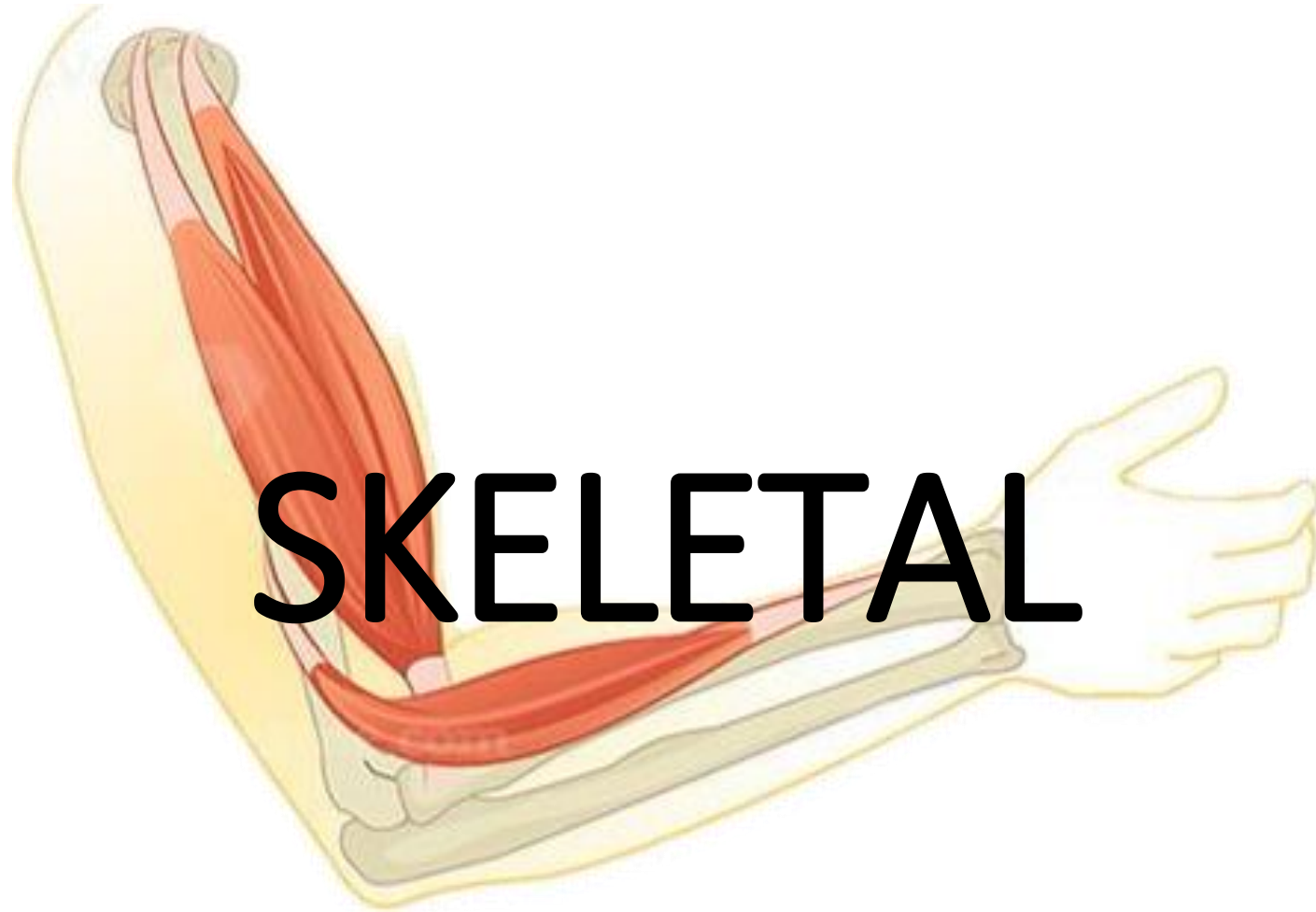
Maroon: the doctor's explanation/words



Gray: additional information and explanation

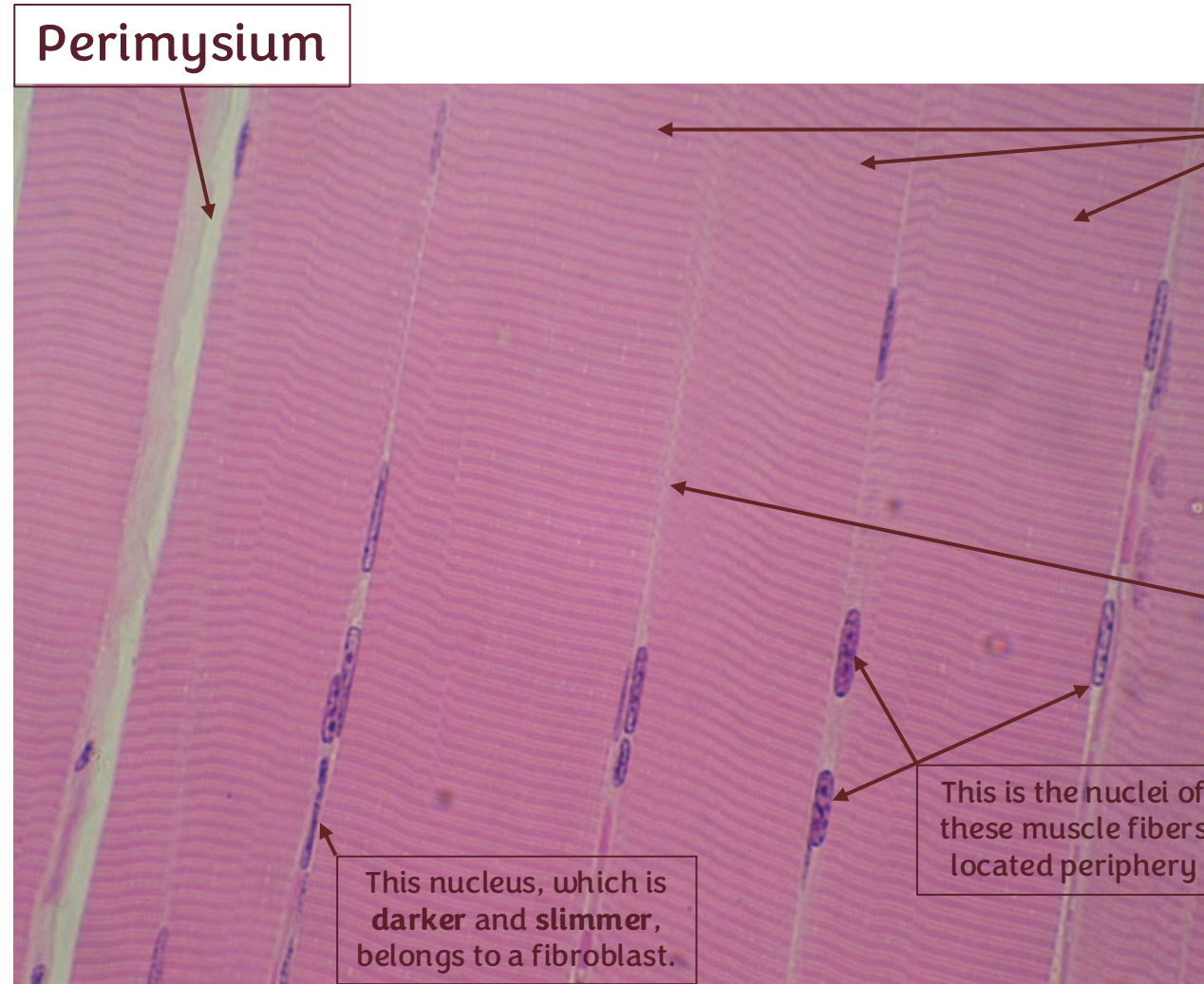


Red: important information



SKELETAL

Longitudinal section (LS) of skeletal muscle.



we can identify a number of muscle fibers lying side by side, and we can also see the nuclei of these muscle fibers located peripherally.

in this longitudinal section, we can see some skeletal muscle fibers bands.

As you can see, this is the boundary between one muscle fiber and another.

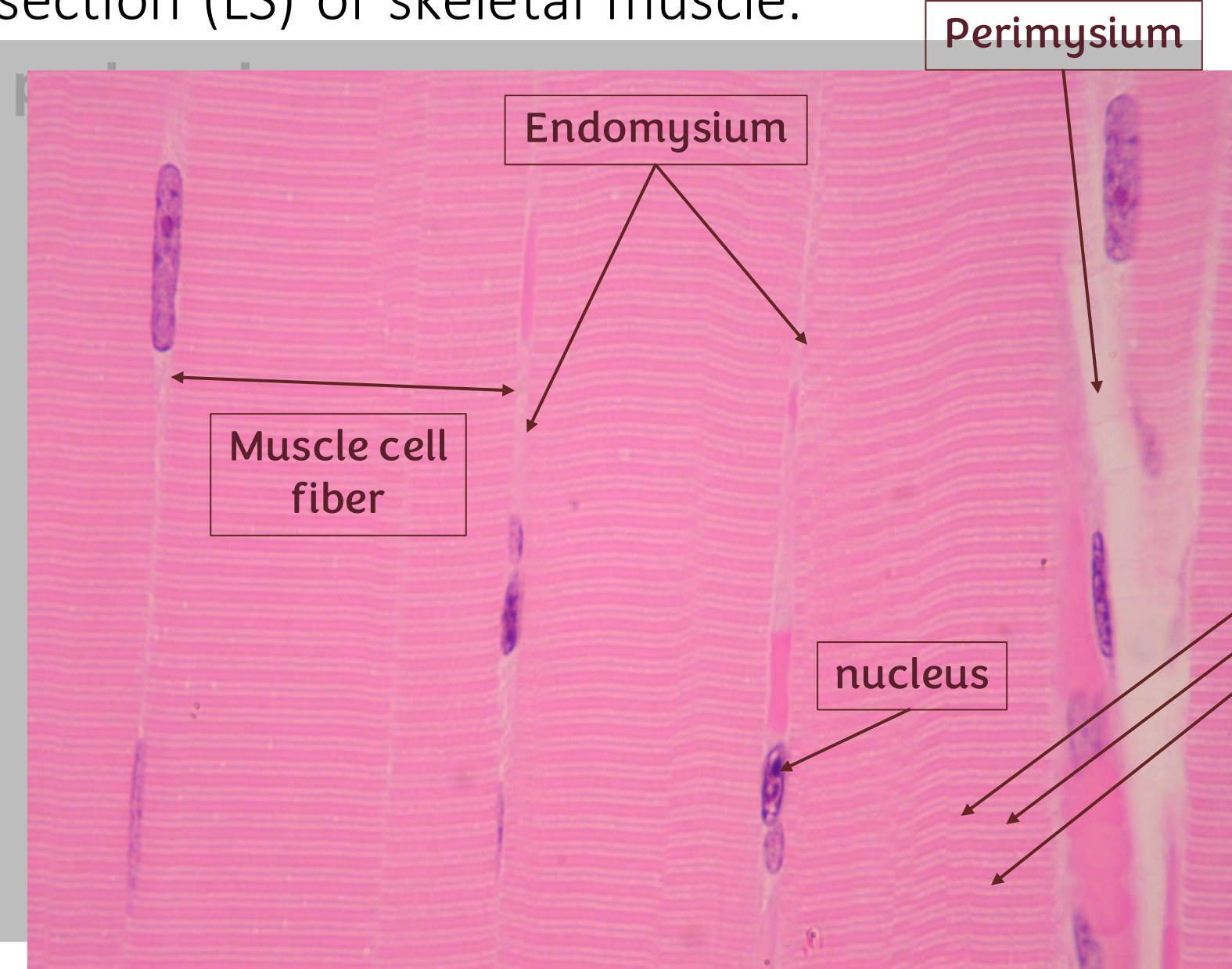
In this region here, we would expect to find the **endomysium**, which is the innermost connective tissue covering of skeletal muscle fibers, and it is mainly composed of delicate reticular fibers.

This nucleus, which is **darker and slimmer**, belongs to a fibroblast.

This is the nuclei of these muscle fibers located periphery

Stained with H&E and viewed using a bright-field microscope.

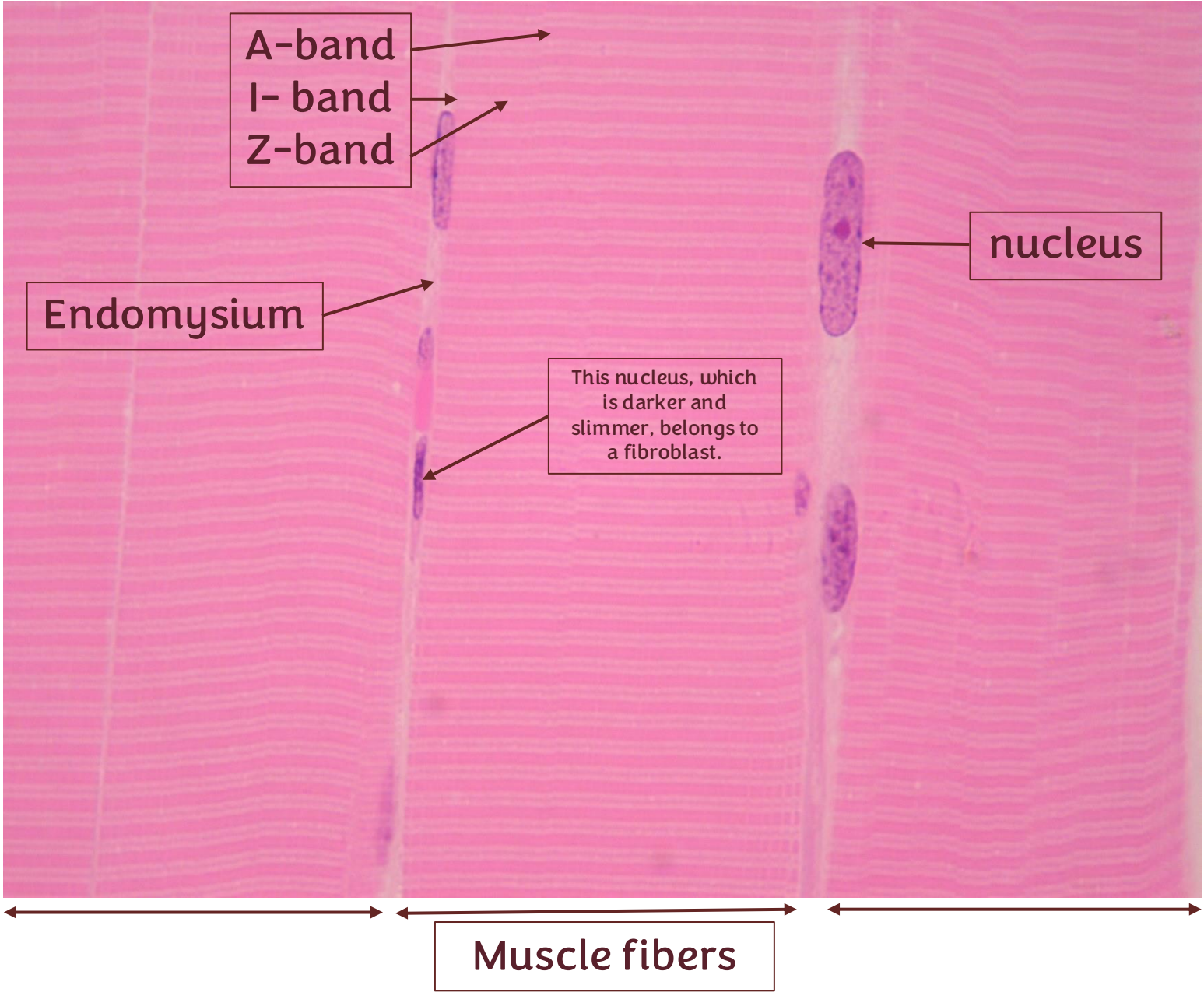
Longitudinal section (LS) of skeletal muscle.



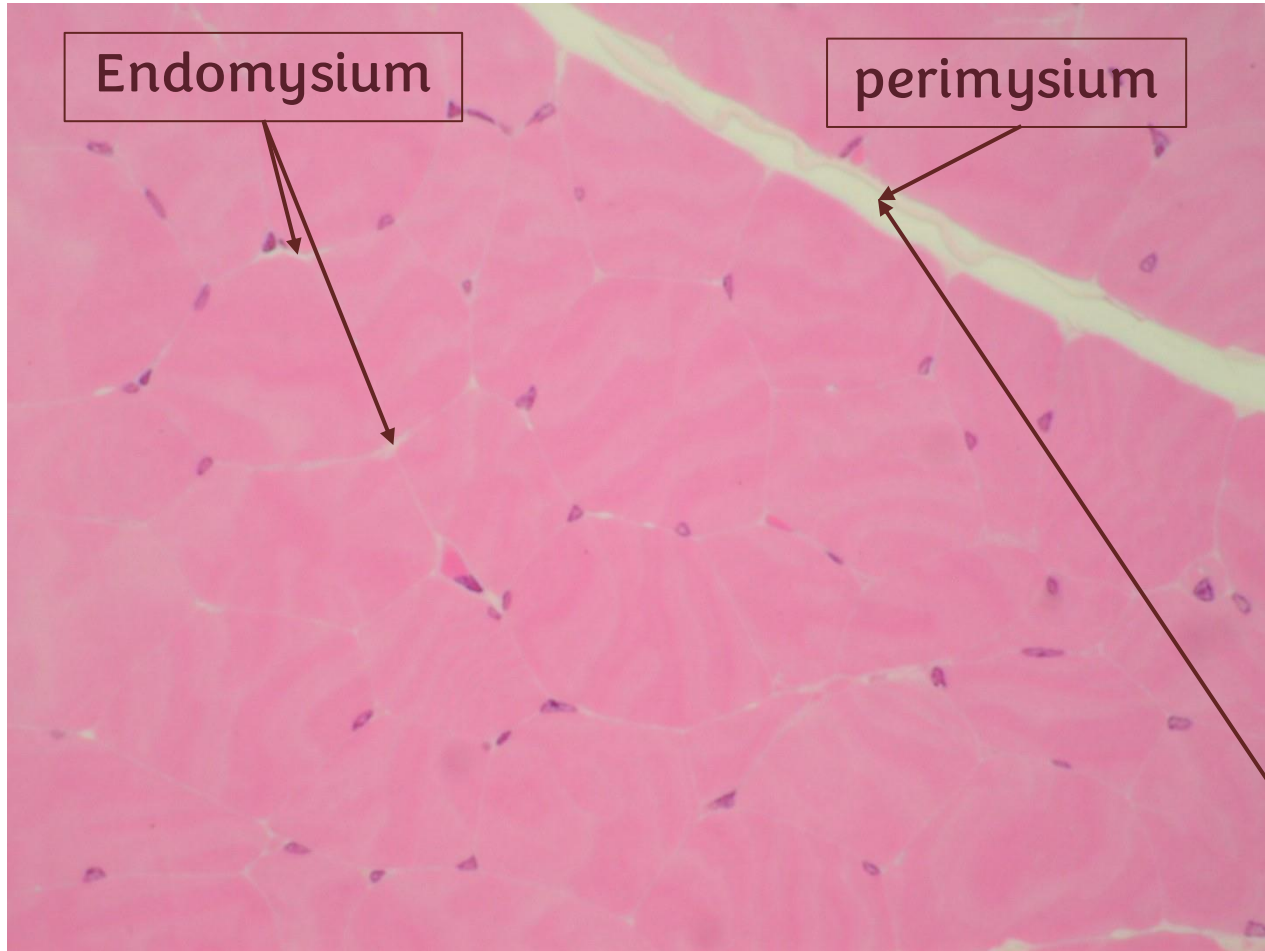
If we want to visualize the endomysium, we have to use special stains. Silver stains can be used, and PAS stain may also help in visualizing the reticular fibers. With higher magnification and better resolution, the reticular fibers can be seen more clearly.

A band : darker region
I band : lighter region
Z discs In the center of the I band

Longitudinal section (LS) of skeletal muscle.



Cross section (CS) of skeletal muscle.



Here, we no longer see the striations, so this is definitely a cross section of muscle tissue. It could be skeletal, cardiac, or smooth muscle, so how can we identify it?

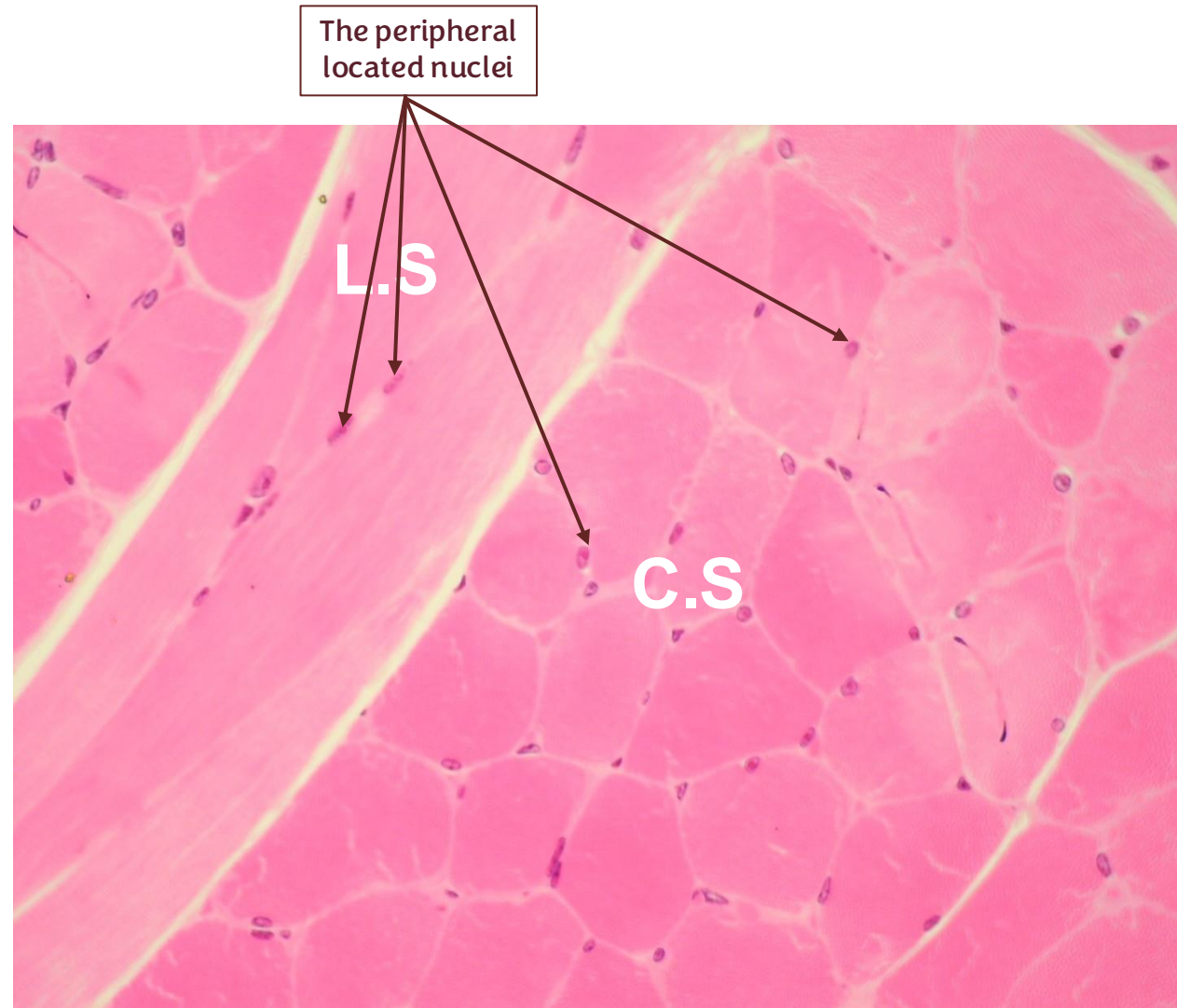
There are several features that help us:

- *Skeletal muscle fibers are wider than the other muscle types.
- *The nuclei are located peripherally and that something doesn't happen in the cardiac and smooth muscles.
- *Cardiac and smooth muscles usually have centrally located nuclei.
- *The fibers here are tightly packed and compact.

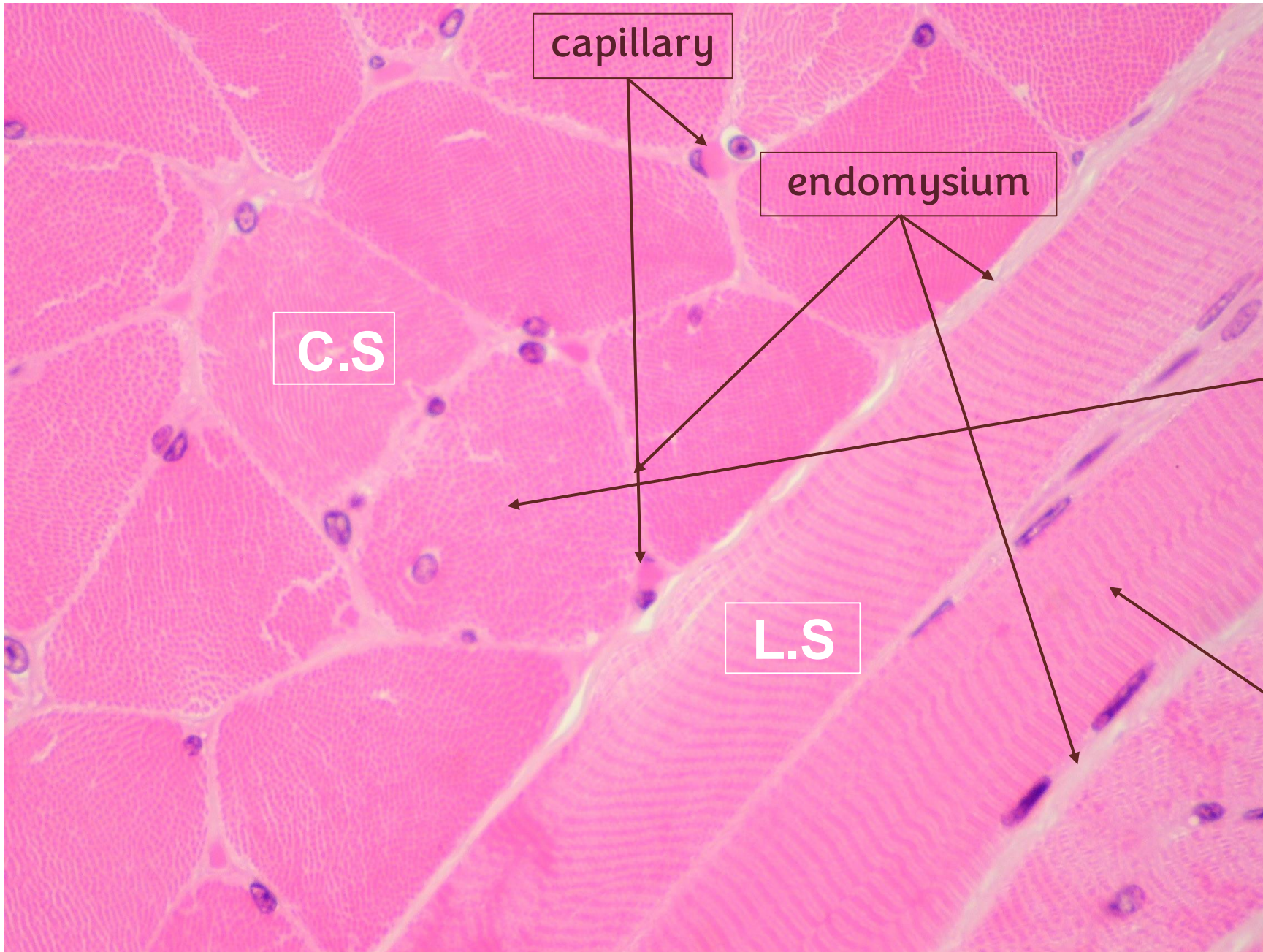
Based on the size of the fibers, the peripheral location of the nuclei, and the compact appearance of the tissue, this is definitely a cross section of skeletal muscle. A similar section in cardiac or smooth muscle would appear much looser than this.

Now, this **gap** over there is usually where the perimysium is located, which is the connective tissue covering that surrounds the muscle fascicles.

C.S& L.S skeletal(e.g Tongue)



Look here, the cross section is quite clear in this area, and the staining here is darker, so we can see the muscle fibers tightly packed together, with the peripherally located nuclei as well, this is not a feature we observe in either cardiac nor smooth muscle.



we can see a cross section, and if we look more closely, it appears somewhat granular.

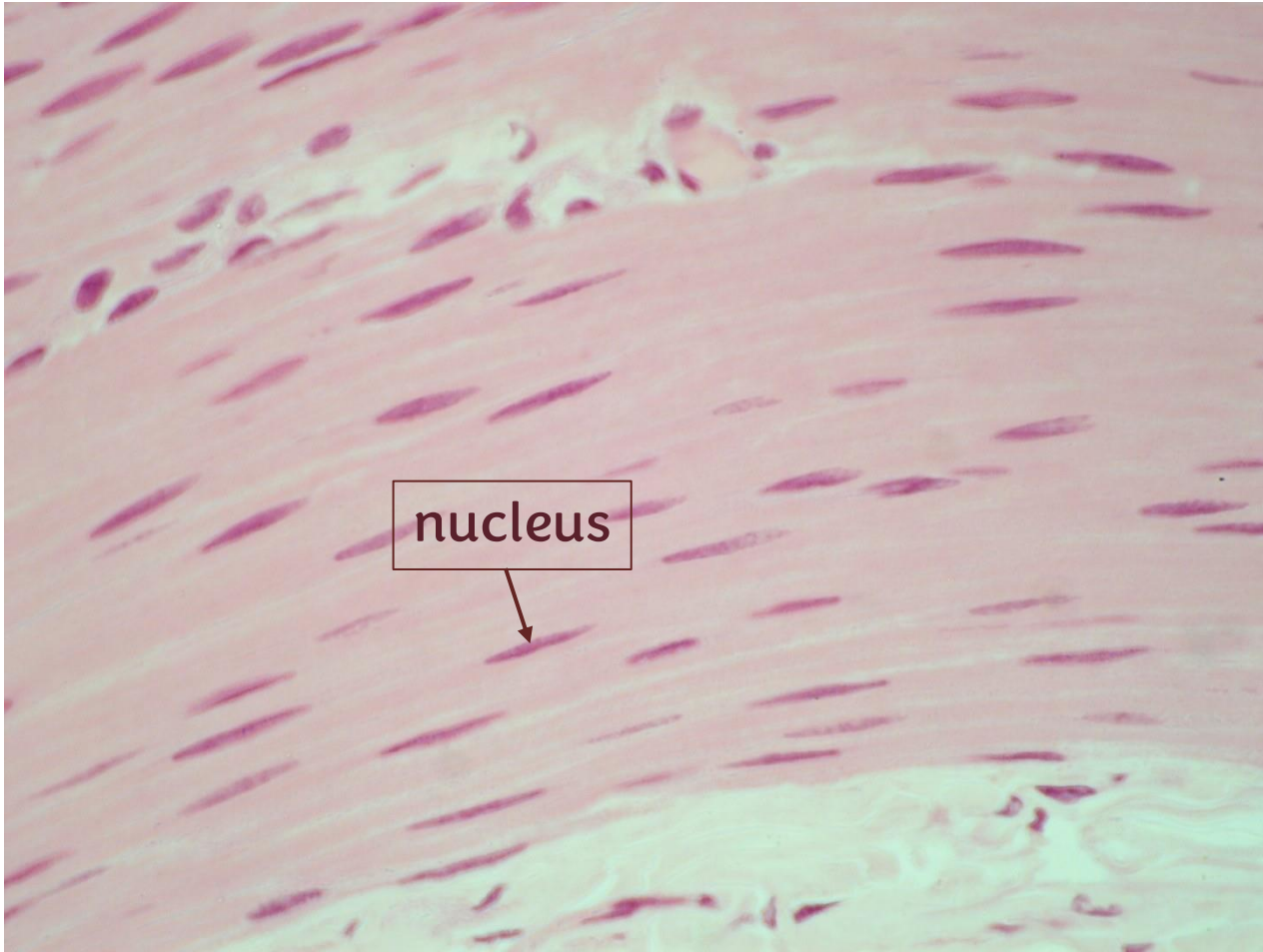
-What is this granular appearance in skeletal muscle?

This granular appearance is due to the myofilaments, which occupy most of the sarcoplasm of the skeletal muscle fiber.

In other areas , we can also observe a longitudinal section, where the striations of the skeletal muscle are clearly visible



Longitudinal section (LS)- Smooth muscle



Stained with H&E

Smooth muscle, as you can see, in a longitudinal section we usually observe the full length of the nuclei and sometimes the full length of the cells as well. These cells are typically long and spindle-shaped, and they run side by side in a more or less continuous fashion.

So, how can I tell that this is a longitudinal section of smooth muscle rather than skeletal muscle?

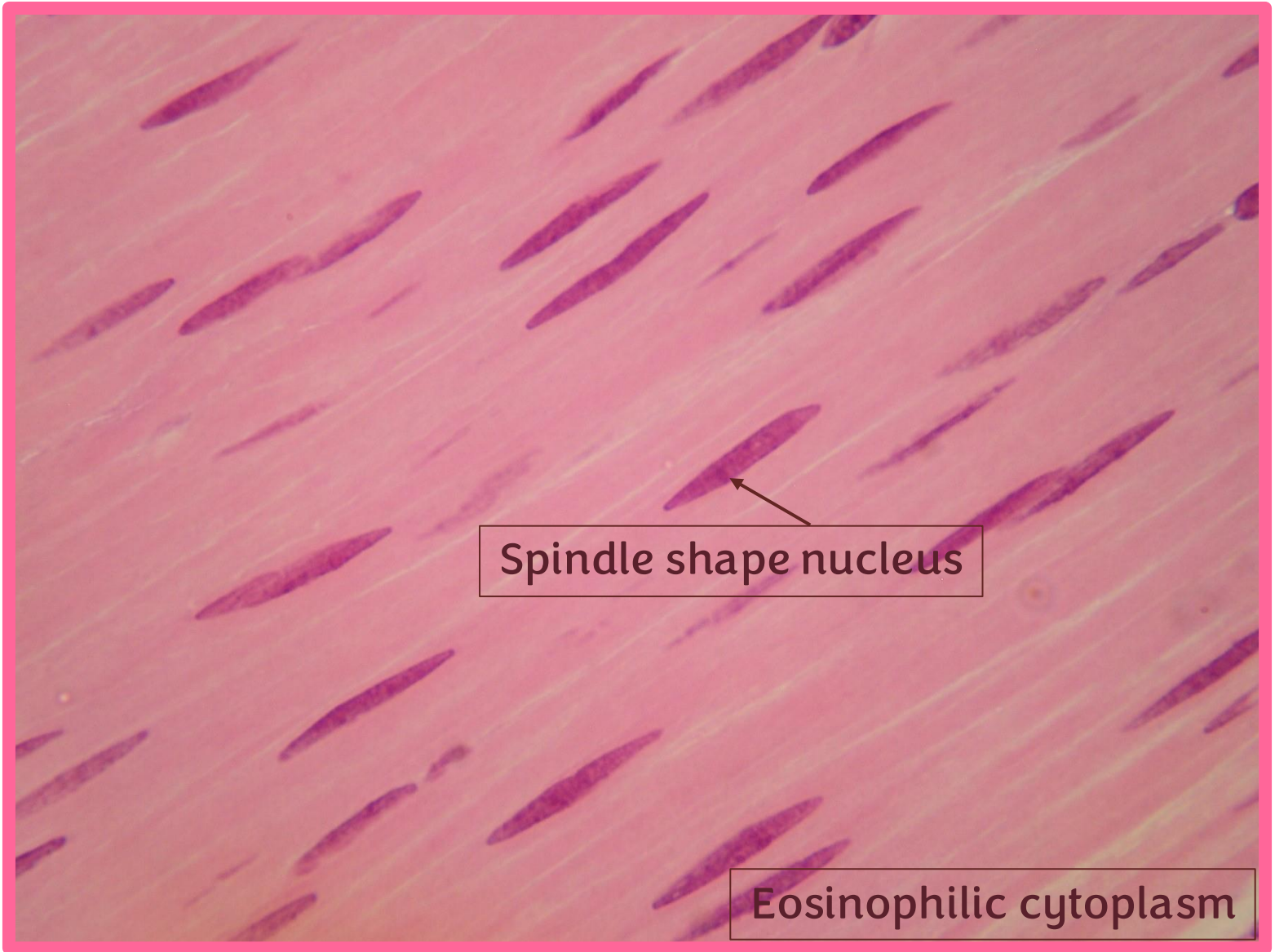
There are a few important clues:

- *There are no striations present here.
- *The nuclei are centrally located and appear throughout the cells, rather than being restricted to the periphery.

These features help identify this tissue as smooth muscle.

Longitudinal section (LS)- Smooth muscle

The cells are meeting end-to-end & they communicate through gap junctions which facilitate the transfer of action potential between the cells so they can contract simultaneously



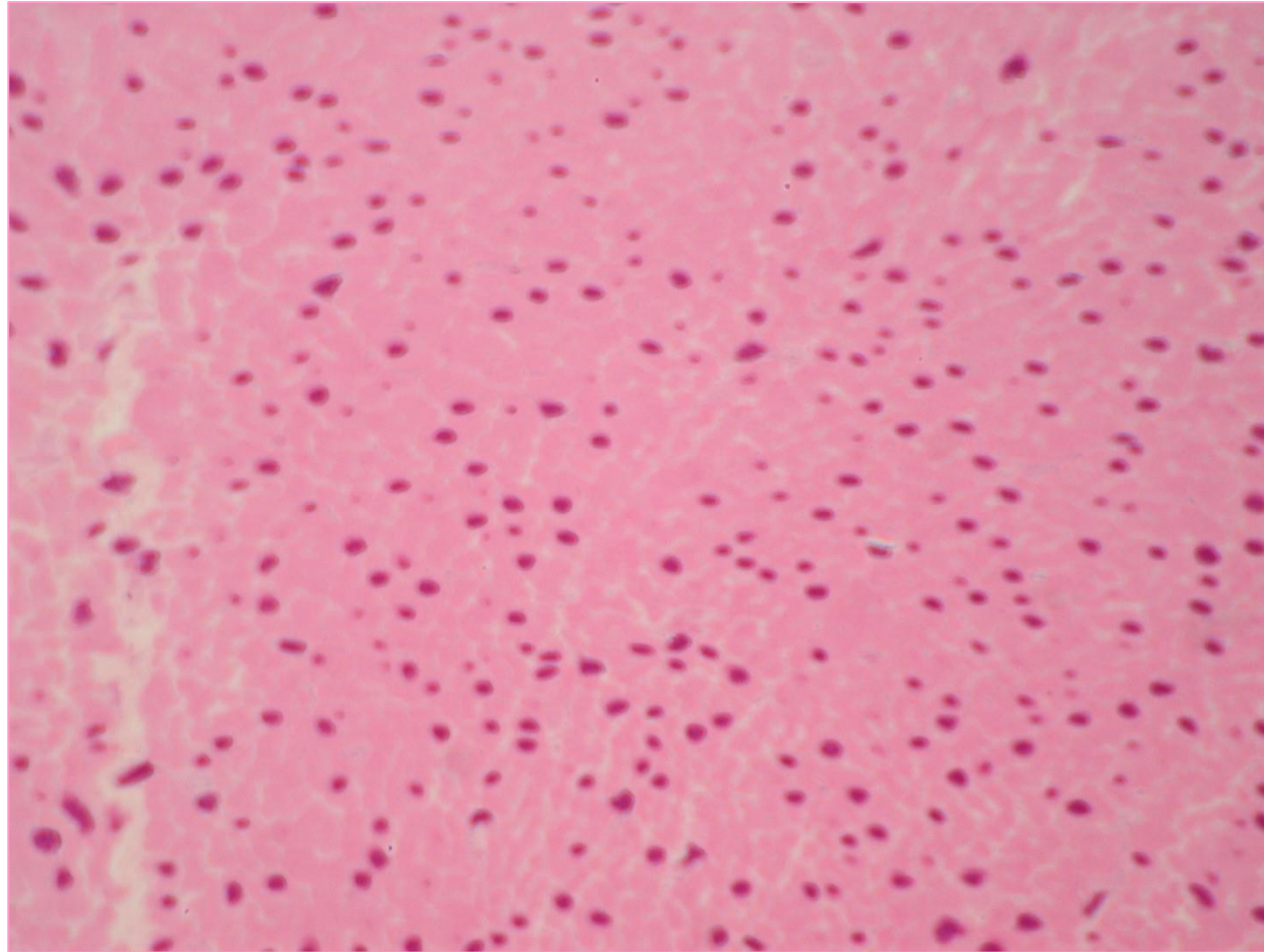
Spindle shape nucleus

Eosinophilic cytoplasm

Cross section (CS)- Smooth muscle

Longitudinal section :
nuclei are in spindle
shape and much longer

Cross section: nuclei
appear tiny and circular,
we can see much more
nuclei in a cross section &
they are centrally located



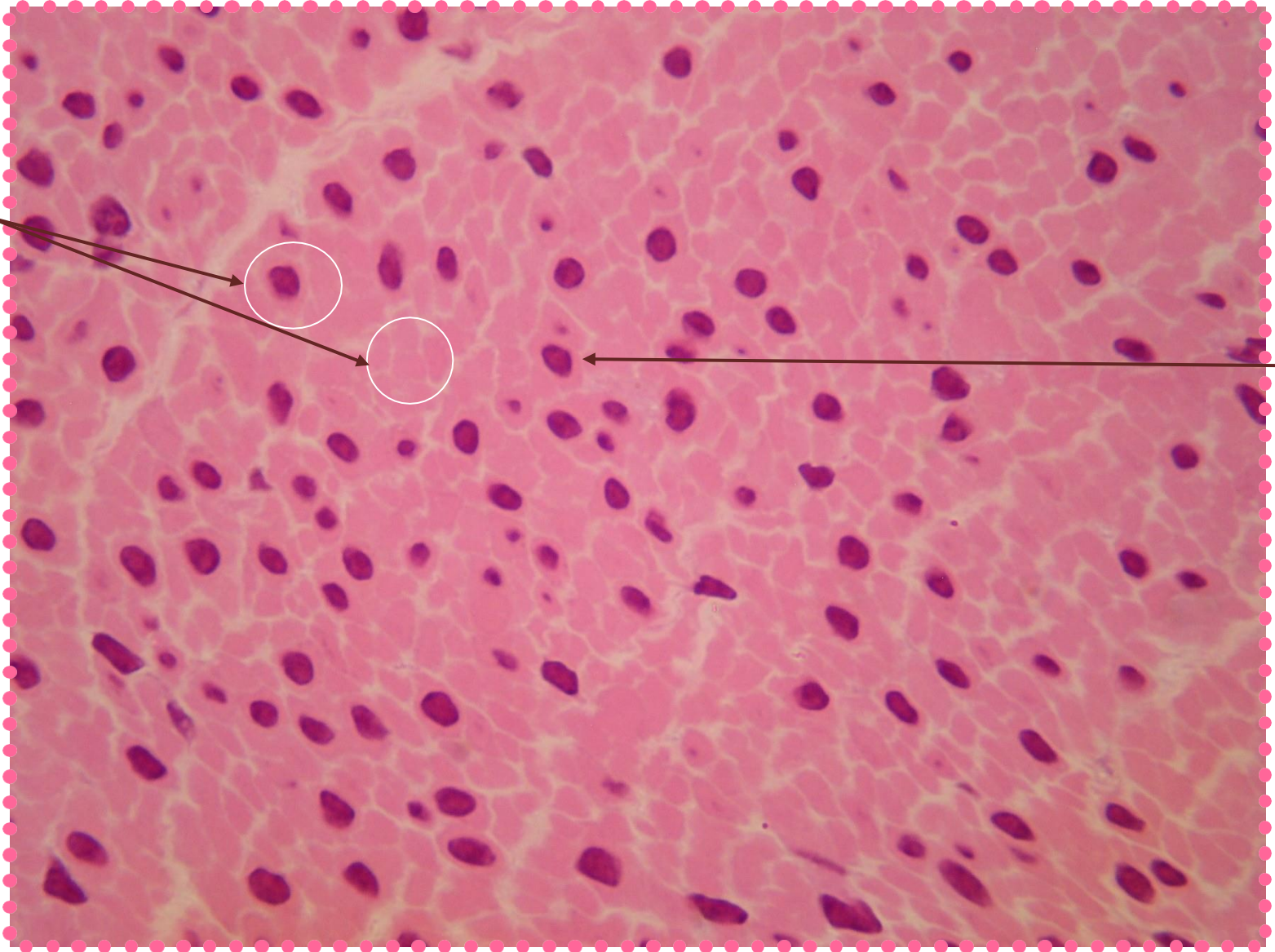
Cross section (CS)- Smooth muscle

This time with higher magnification

Why don't we see a nucleus in every single cell?

These smooth muscle cells are quite long, so the section may pass through different parts of the cell. It may pass through the center of the cell, where the nucleus is located, and in that case we can see the nucleus in its largest dimension. On the other hand, the section may pass through the tapered ends of the cell, where we may only see a thin basophilic region, or it may not pass through the nucleus at all.

That is why some areas appear as if they contain only cytoplasm without a visible nucleus. However, all of these structures still belong to smooth muscle cells.

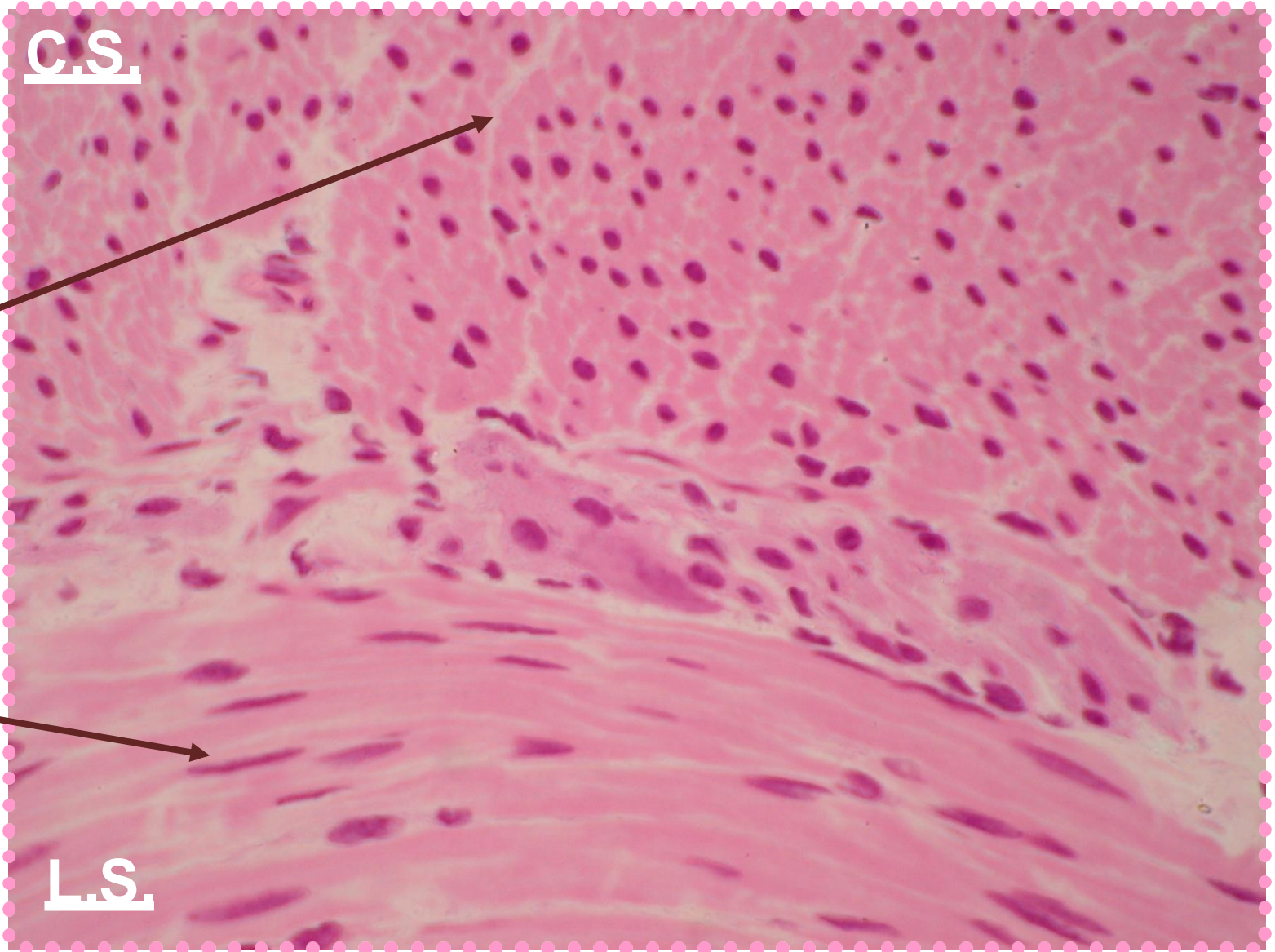


Pay attention to the proportion between the nucleus and the cytoplasm here; the nucleus occupies a relatively small portion of the cell. Similarly, when we compare the nuclei of skeletal muscle fibers with the sarcoplasm of those cells, we can see that the nuclei are much smaller than the surrounding sarcoplasm.

The nuclei in the cross section appear circles inside their cytoplasm , and I don't have a nuclei in every single cytoplasm .

Endomysium

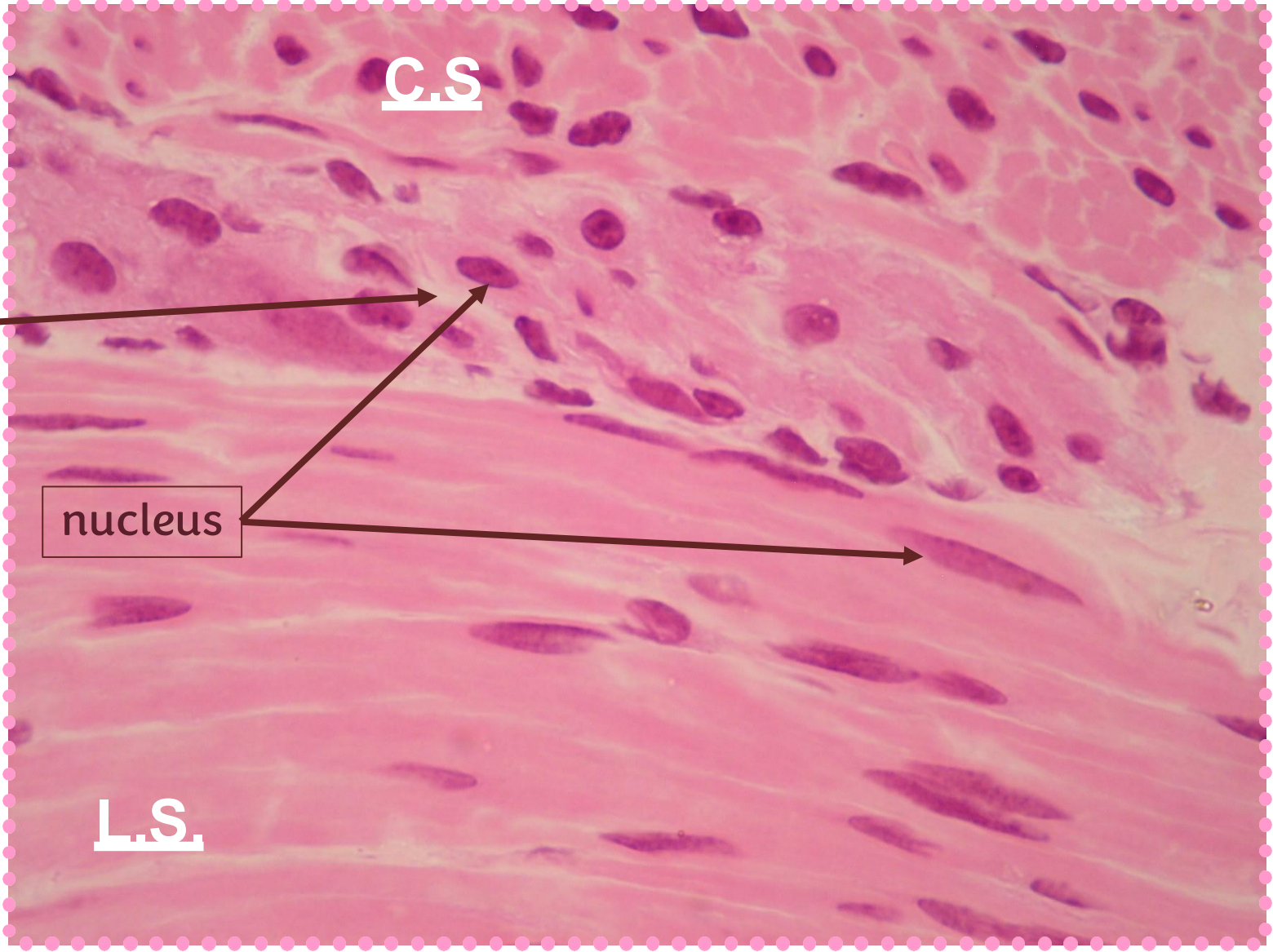
Long , spindle-shaped nuclei , running in stream faschion



Same as before but
with higher
magnification

Endomysium

nucleus



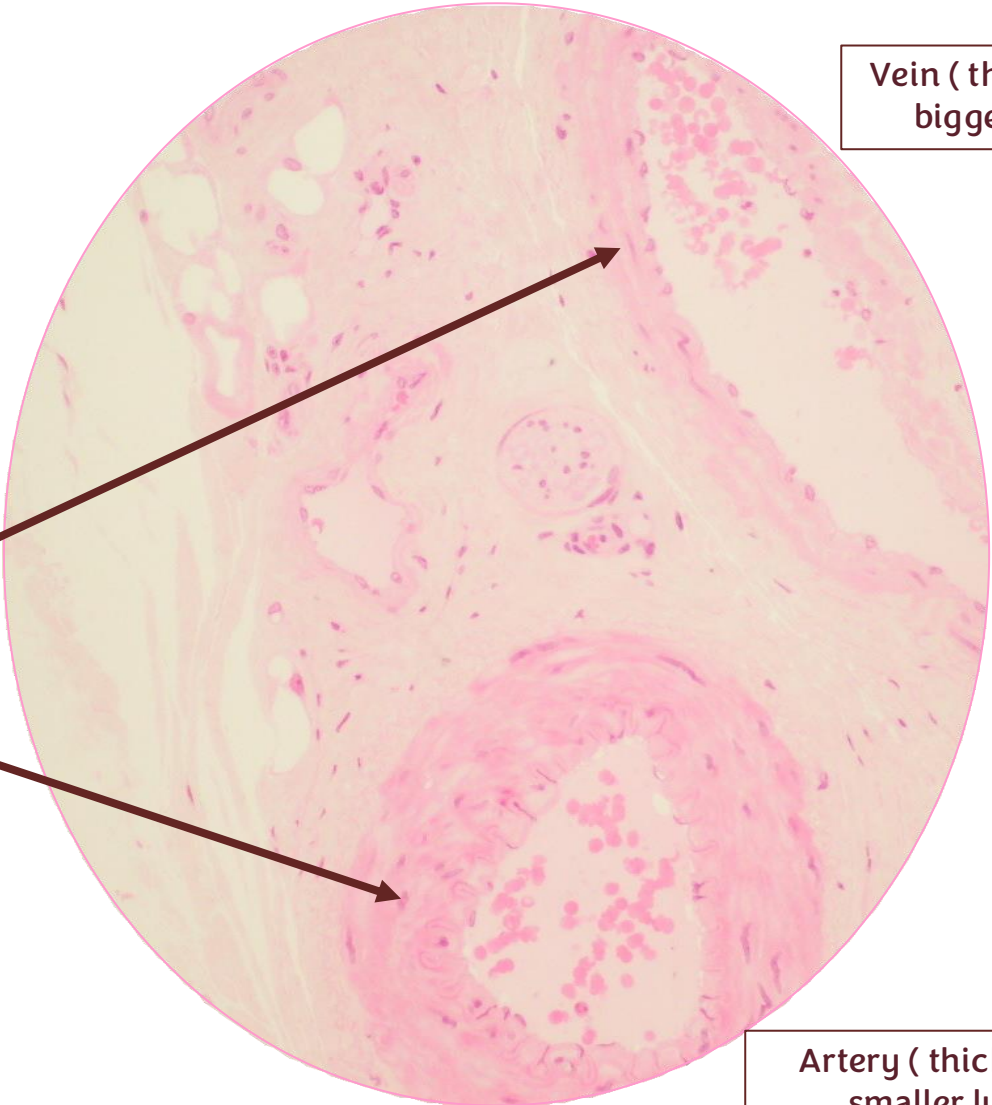
C.S

L.S

Wall of blood vessel

Vessels : artery & vein

Smooth muscle cells are running circularly into the walls of the blood vessels (longitudinal)



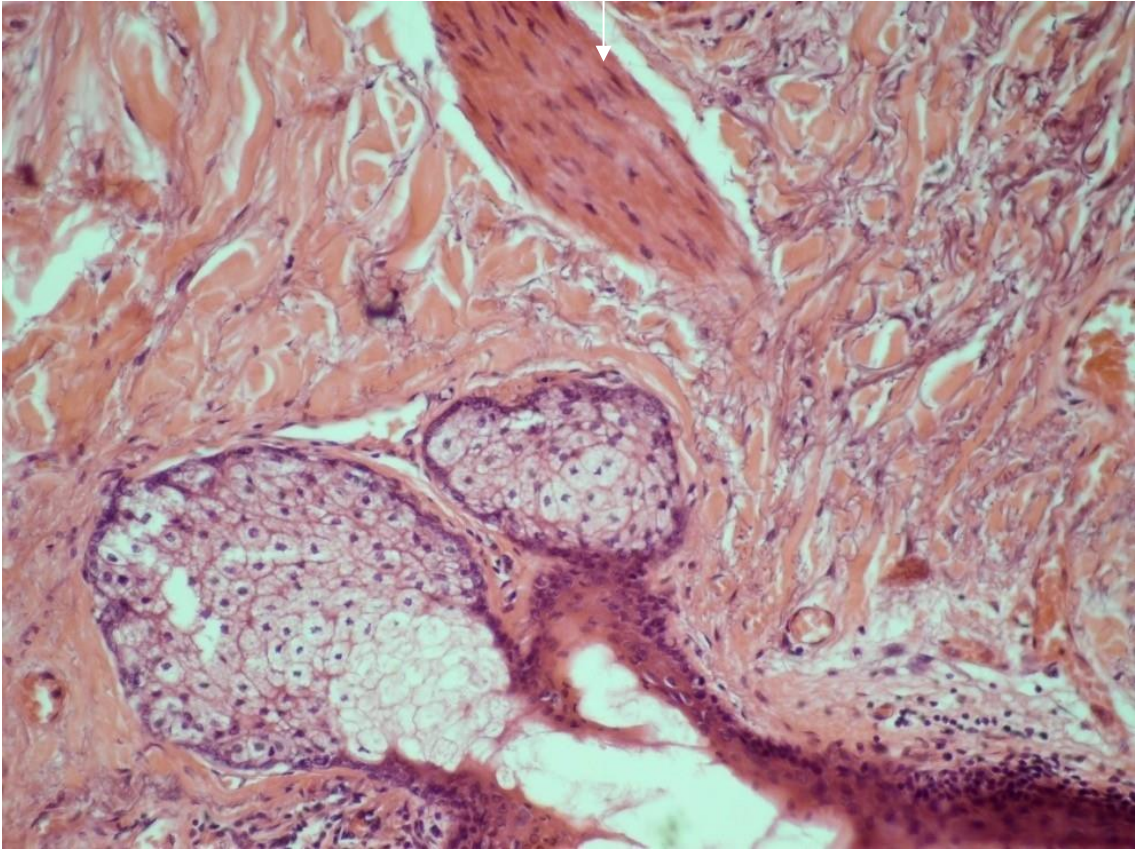
Vein (thinner wall & bigger lumen)

Artery (thicker wall & smaller lumen)

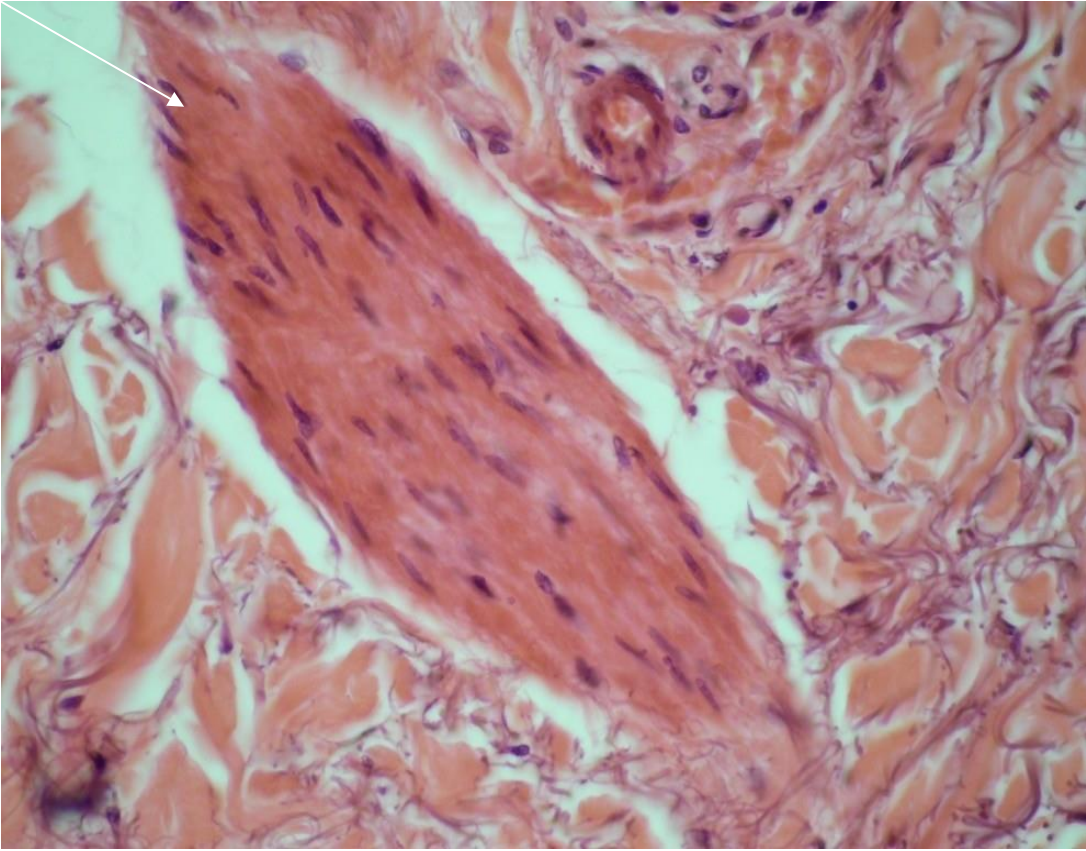
Arrector pili muscle -thin skin

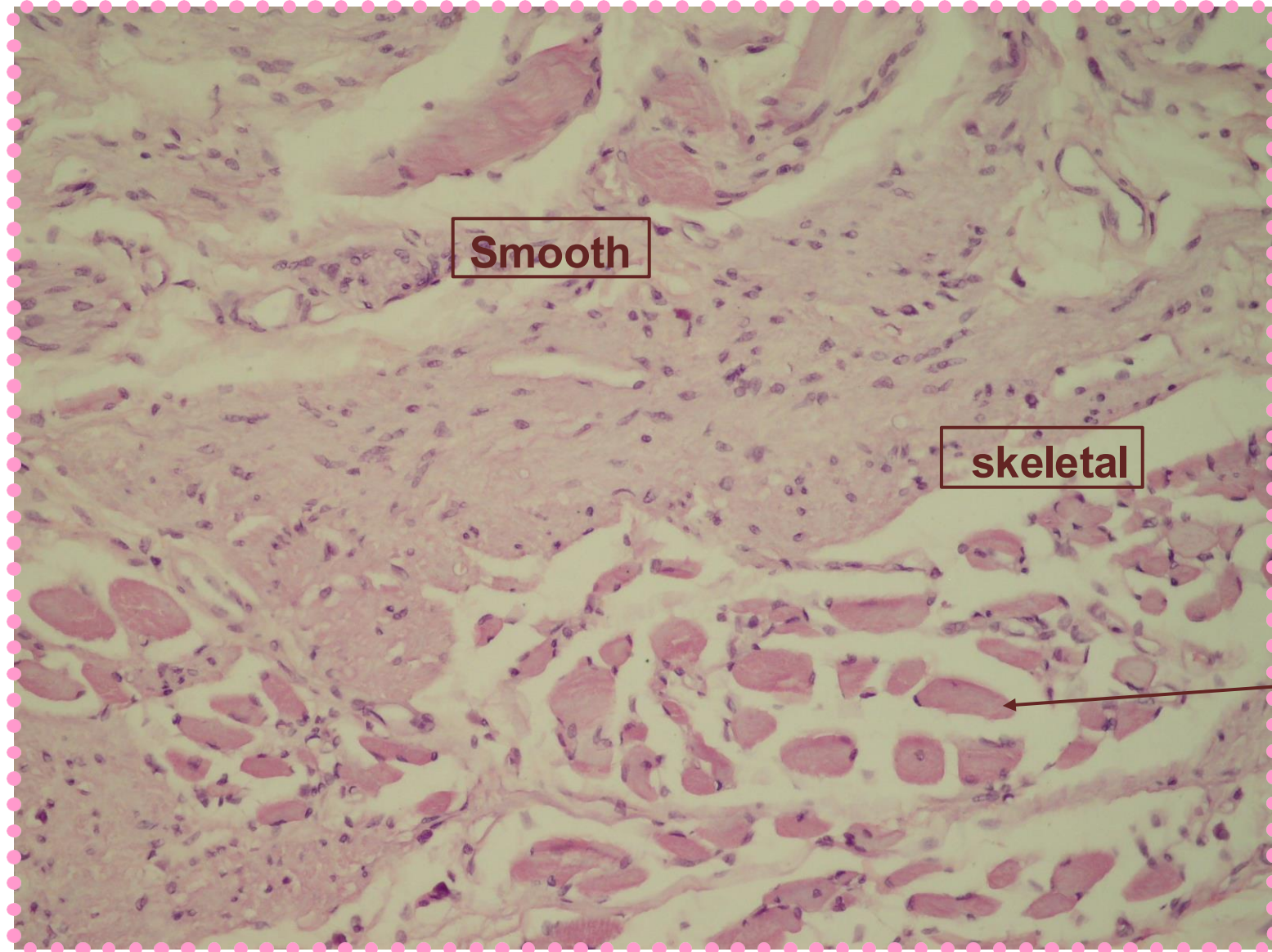
Tiny smooth muscles that associated with the hair follicles

Longitudinal section through the arrector pili muscle



Sebaceous gland





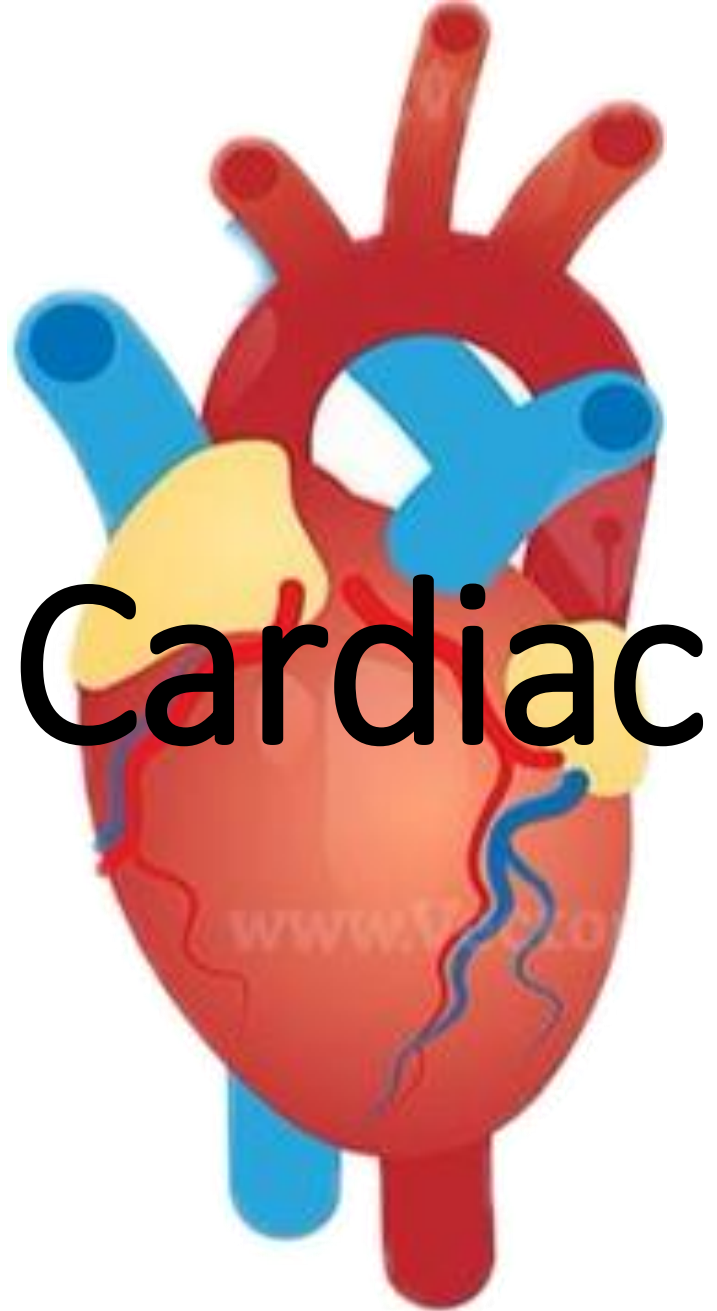
Smooth

skeletal

The cut through the smooth muscle fibers is mostly longitudinal

Skeletal :
peripheral nuclei
The size of the cell is big

Cross view



Cardiac

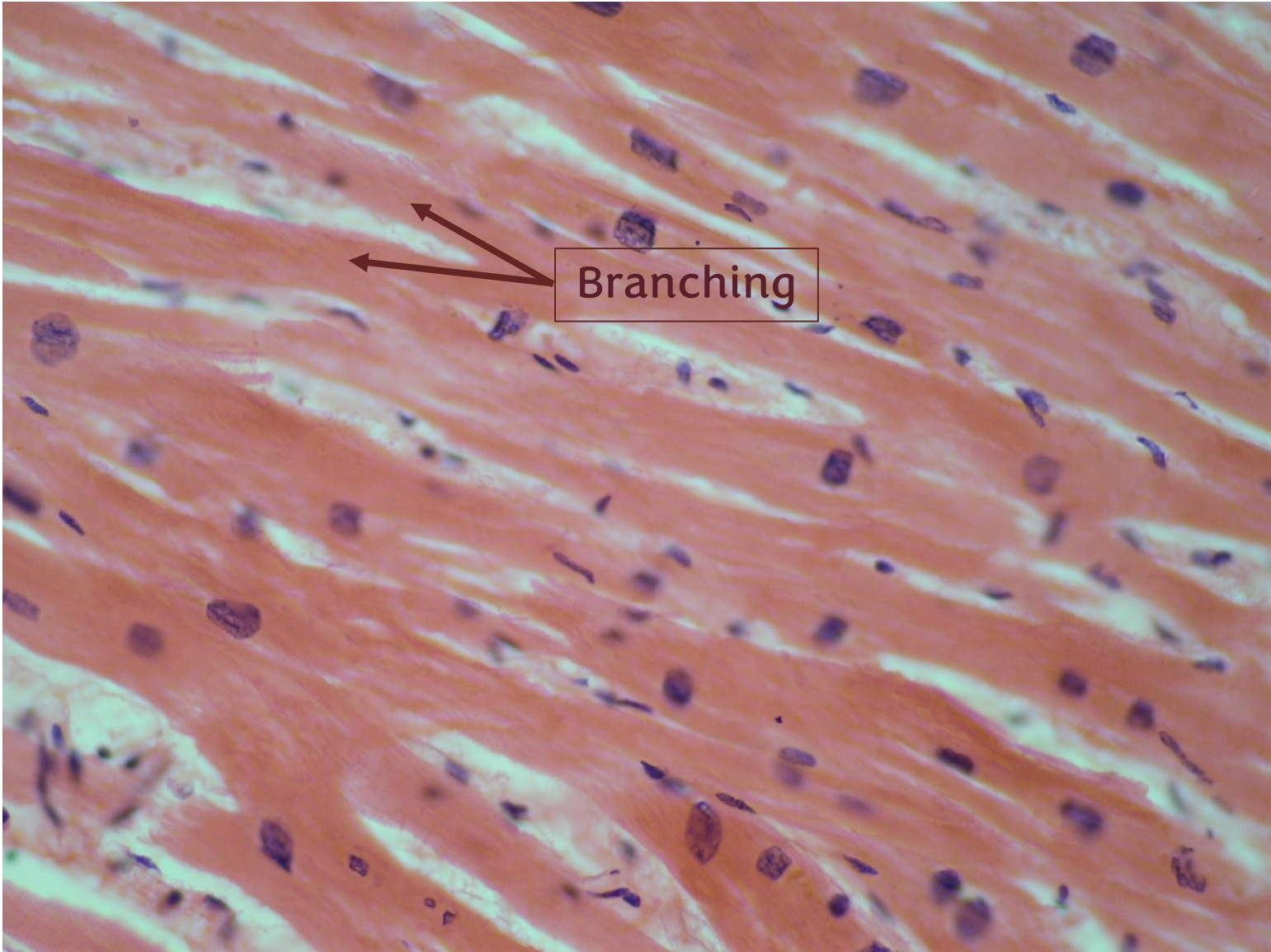
www.777.com

longitudinal Section cardiac ms.

H&E staining

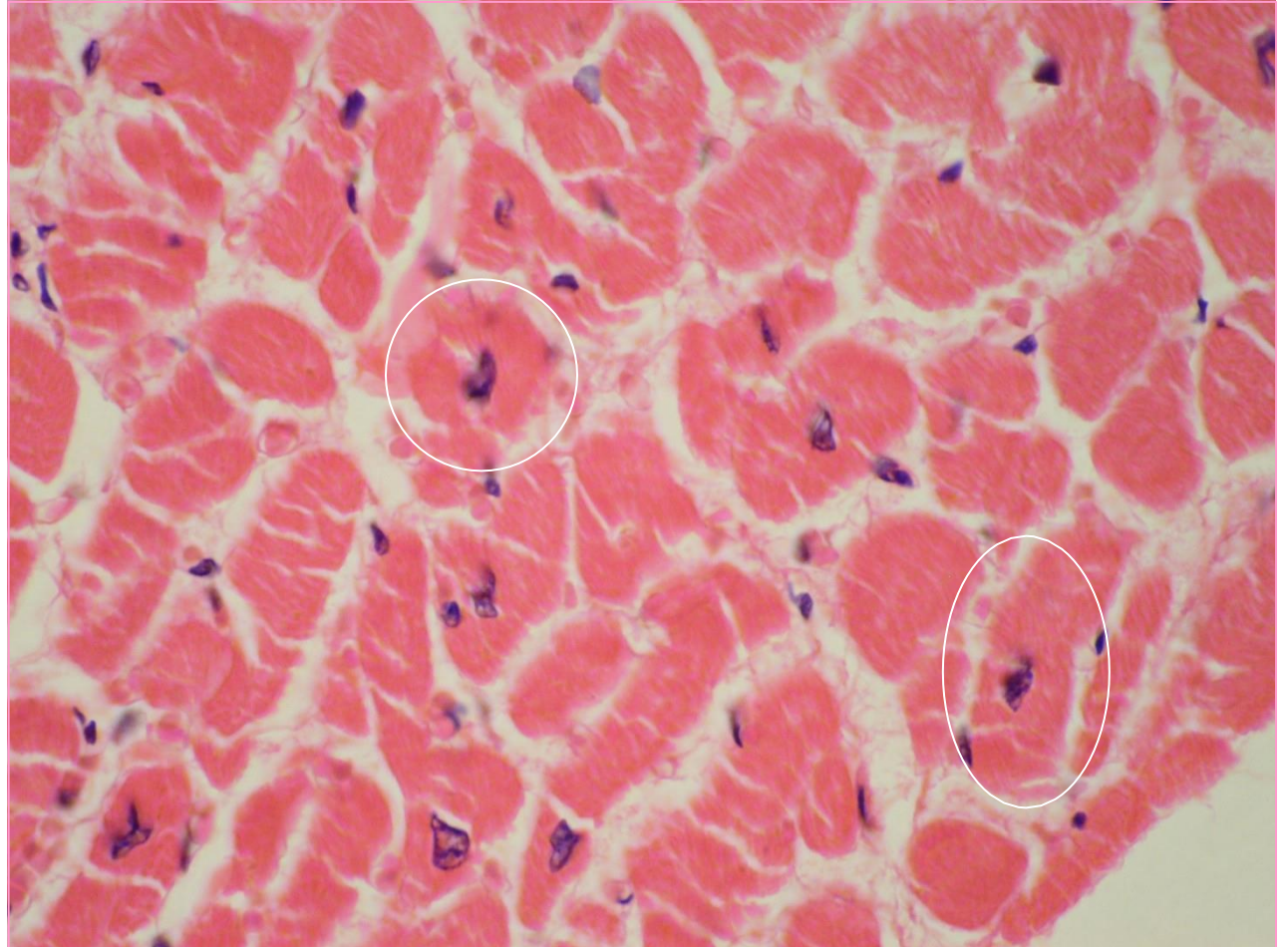
Now here we see branching, so these cells don't lie parallel to each other. They branch, communicate, and are attached to other cell fibers.

Nuclei are More centrally located

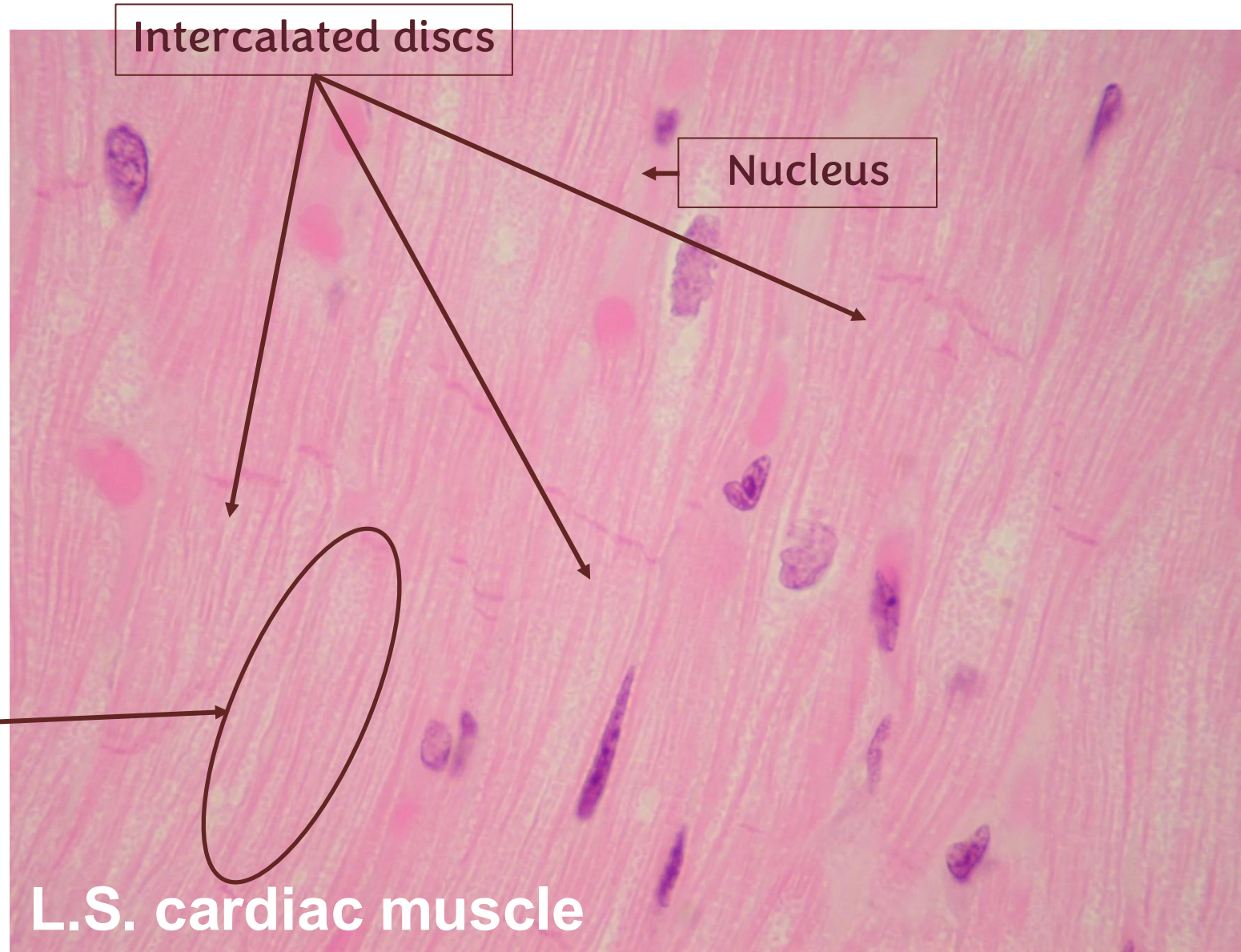


Cross section -cardiac muscle

You might mistake them for skeletal muscle, but again the nuclei are centrally located, so this is quite easy to remember. And the other thing, if you look at the cross section, you don't see uniform structures, whereas in skeletal muscle they are more like round fibers, more or less close in size and shape. Whereas in cardiac muscle, because of the branching, we see smaller and larger regions depending on where the cut went through the cardiac muscle.



Quick reminder that the entercalated discs : they are rich with junction complexes and gap junctions to allow the passage of action potential between the cardiac cells which leads to uniform contraction throughout the entire length with a delay between the contraction of the atria and the contraction of the ventricles (AV node)



Myofilaments

Intercalated discs

Nucleus

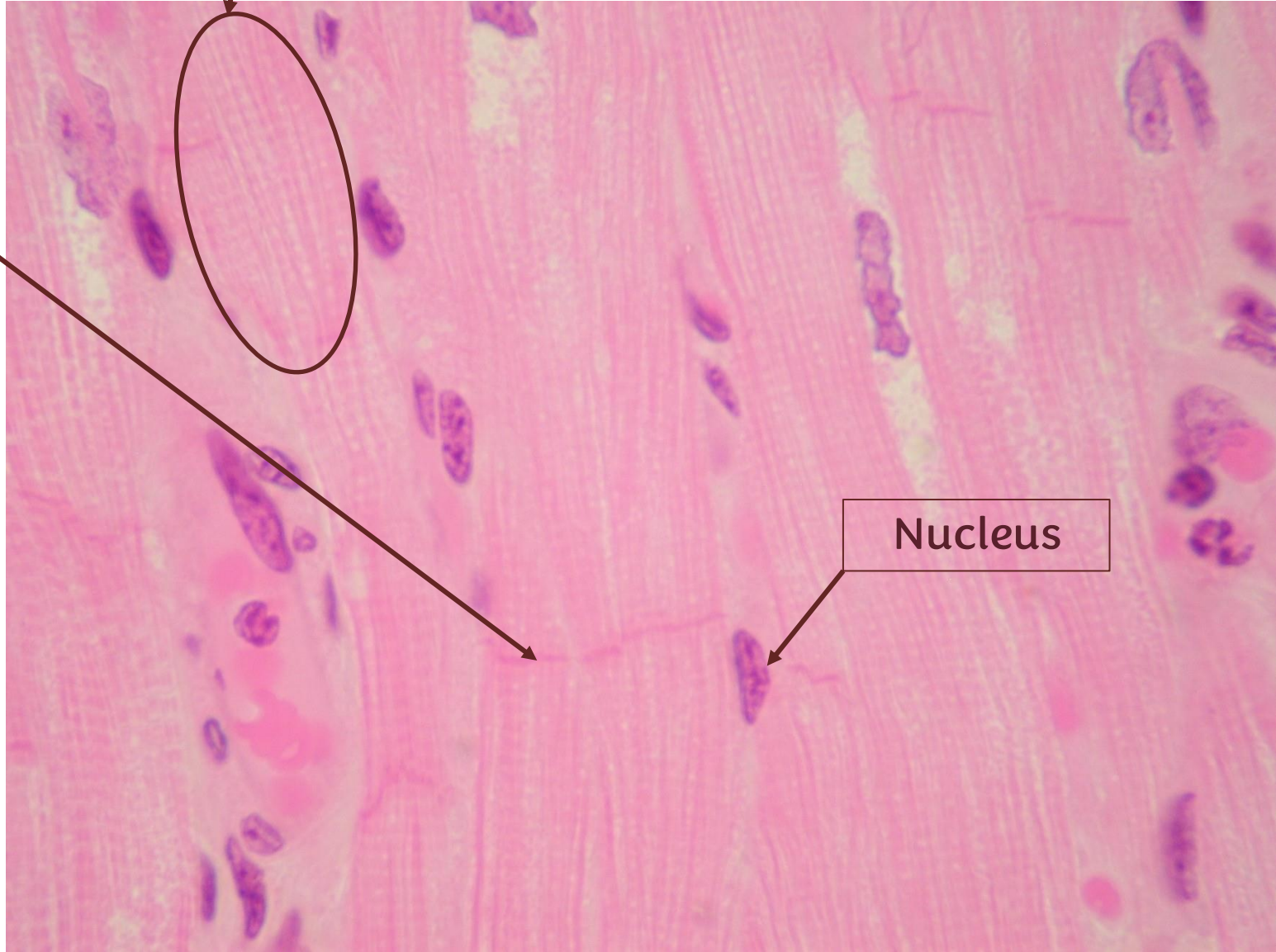
L.S. cardiac muscle

Myofilaments

If you pay attention to the myofilaments, the striation is actually quite evident.

Intercalated discs

Nucleus



Quiz

https://docs.google.com/forms/d/e/1FAIpQLSfVPrYtuWPqo6Ame2nvyafHSxP_Ahr-Gh5Bq3VJwa4MdSf77w/viewform?usp=publish-editor



For any feedback, scan the code or click on it.



Corrections from previous versions:

Versions	Slide # and Place of Error	Before Correction	After Correction
V0 → V1			
V1 → V2			

Additional Resources:

رسالة من الفريق العلمي:

طالب الطب يتعرض لكثير من الضغوطات، وجسمه يستجيب لتلك المتغيرات في الخفاء، تجلس بالساعات جلسات طويلة، تشعر بالألم في العظام والعضلات والإرهاق طوال الوقت، الأمر الذي قد يؤدي الى تفاقمات مستقبلاً

Reference Used:

1. Dr.Ghada's lecture

هل جربت يوماً أن تبحث عن مقاطع فيديو ووسائل لتهدئة هذه الآلام؟ قد تجدها في البداية مضيعة للوقت، لكنها استثمار في سبيل الحفاظ على صحتك وقد تكون بديلاً عن تصفح الهاتف اللا هادف، ويمكن القيام بتمارين التمدد قبل النوم لتقويم العمود الفقري، ومع الوقت ستجد انها اصبحت من روتينك اليومي لقد وصلت الى نهاية هذا المساق، كل عام وانت بخير

هل تعلم أن الرياضة قبل الدراسة تساعد في رفع مستوى التركيز والانتباه إذا كنت تشعر بالنعاس أو التشتت. أما إذا كنت تريد استرجاع ما حفظته وتثبيتته بشكل أفضل، فمارسها بعد الدراسة بوقت كافٍ.

استودعتكم الله الذي لا تضيع ودائعه