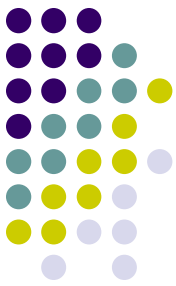
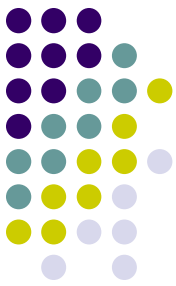


- Define **Sherrington's law**

- **Sherrington's law:** increased vs decreased innervation to a muscle is accompanied by increased vs decreased innervation to its antagonist



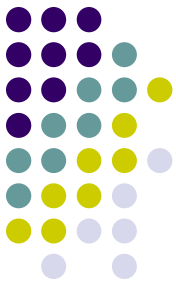
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- Define **Sherrington's law**

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What is the full name of Sherrington's law?
Sherrington's law of...

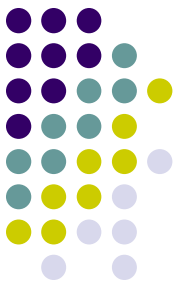


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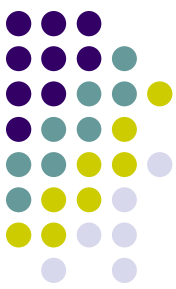
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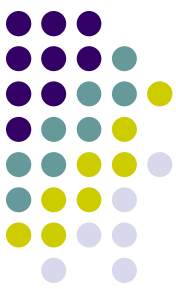
*Sherrington's law of...**reciprocal innervation***



- Define **Sherrington's law** and **Hering's law**
- **Sherrington's law:** Increased innervation to a muscle is accompanied by decreased innervation to its antagonist
- **Hering's law:** Innervation to two words is equal

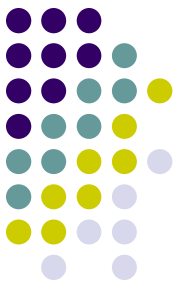


- Define **Sherrington's law** and **Hering's law**
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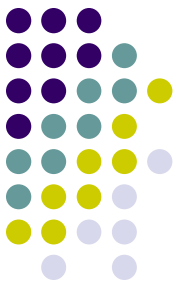
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Hering's law of...**motor correspondence**



- Define **Sherrington's law** and **Hering's law**
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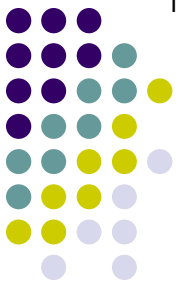
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To what does the term yoke muscles refer?

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- Define Sherrington's law and Hering's law

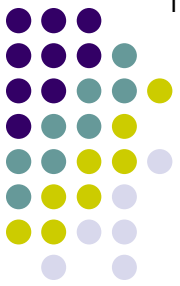
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Speaking of positions of gaze...How many positions are used in evaluating ocular motility and alignment?

to yoke muscles is equal

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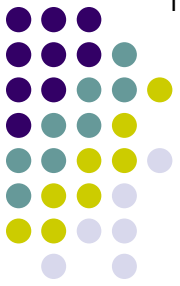
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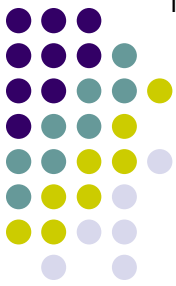
The nine positions are divided into three groups—what are they?

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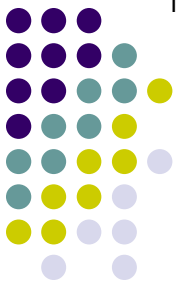
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- Cardinal positions
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● Define Sherrington's law and Hering's law

● Sherrington's law: Increased innervation to a

Speaking
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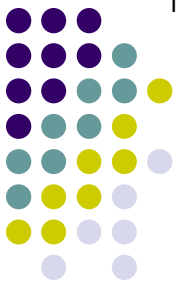
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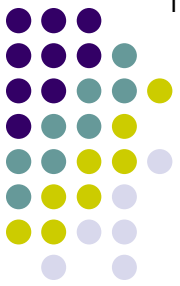
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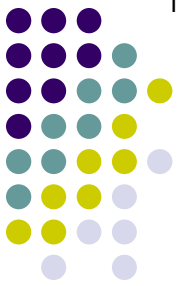
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● Sherrington's law: Increased innervation to a

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Nine

The nine
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--Primary position (1)

--Cardinal positions

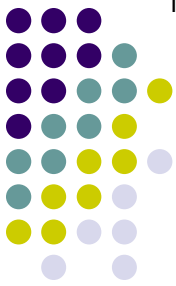
--Up and down

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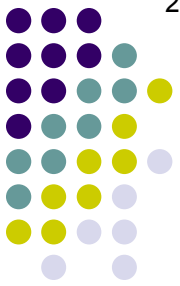
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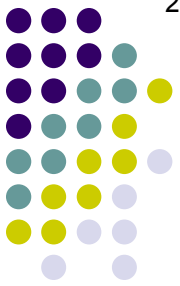
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What is a cardinal positions of gaze?

One that corresponds to the field of action for a given EOM

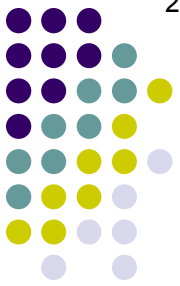
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The nine
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- Primary position (1)
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- Up and down (2)

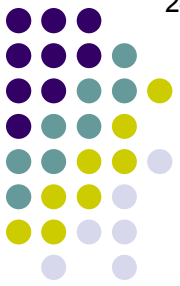
One

Ok. then what is a field of action?

To what

It refers to the two muscles—one for each eye—that are responsible for putting the eyes into a given **position of gaze**

is equal



● Define Sherrington's law and Hering's law

● Sherrington's law: Increased innervation to a

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The nine
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One

Ok. then what is a field of action?

It is a gaze direction in which the influence of a given EOM is mostly readily apparent. In essence, it's the position in which a given EOM 'cannot hide'—ie, the gaze direction in which a given muscle will be 'exposed' if it is not functioning properly.

To what
It refers to the two muscles—one for each eye—that are responsible for putting the eyes into a given **position of gaze**

is equal



Q

Sherrington's Law vs Hering's Law

- Definition

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OK,
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Well, we just said that 9 gaze positions are used in evaluating the EOMs.

There's one primary gaze (duh)...plus 'up' and 'down' make three. This implies (correctly) **What are the six cardinal positions of gaze?**

The nine
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- Primary position (1)
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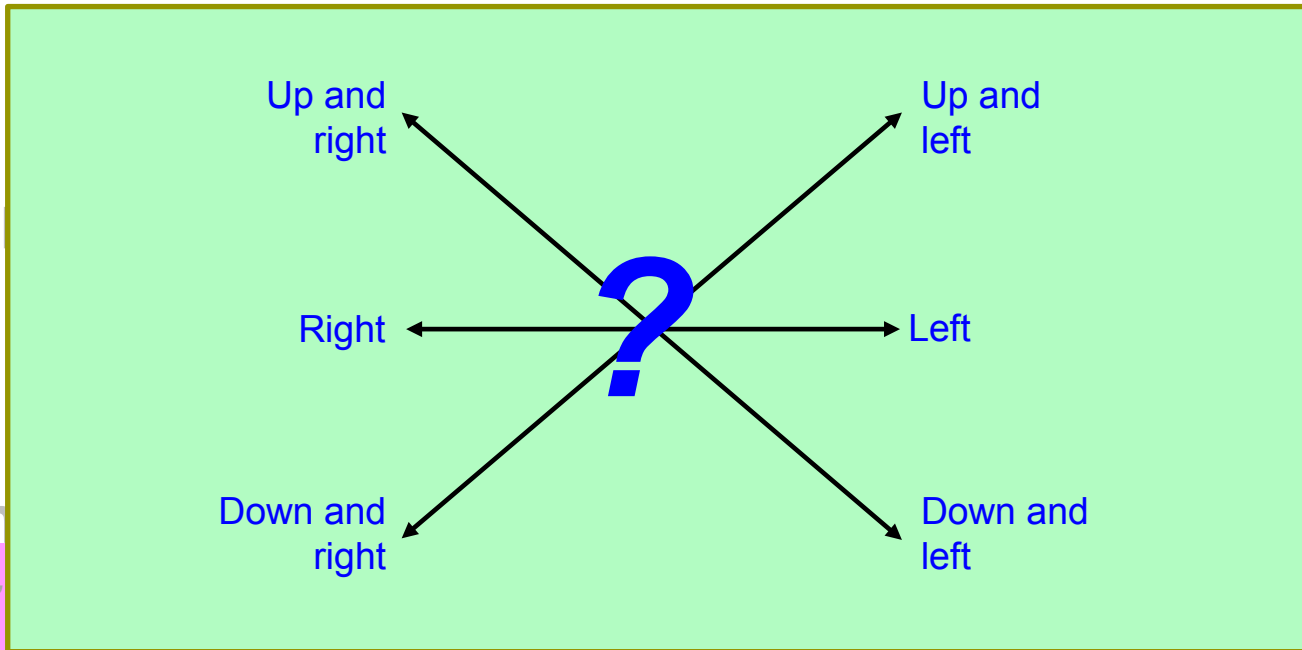
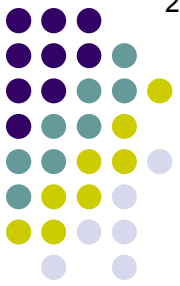
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It refers to the two muscles—one for each eye—that are responsible for putting the eyes into a given **position of gaze**

A

Sherrington's Law vs Hering's Law



● Definition

● Sherrington's Law

Speaking of the nine positions of gaze, we use the primary position (1) and the six cardinal positions (6).

The nine positions of gaze are: the primary position (1), the six cardinal positions (6), and the up and down positions (2).

- Primary position (1)
- Cardinal positions (6)**
- Up and down (2)

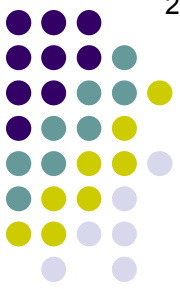
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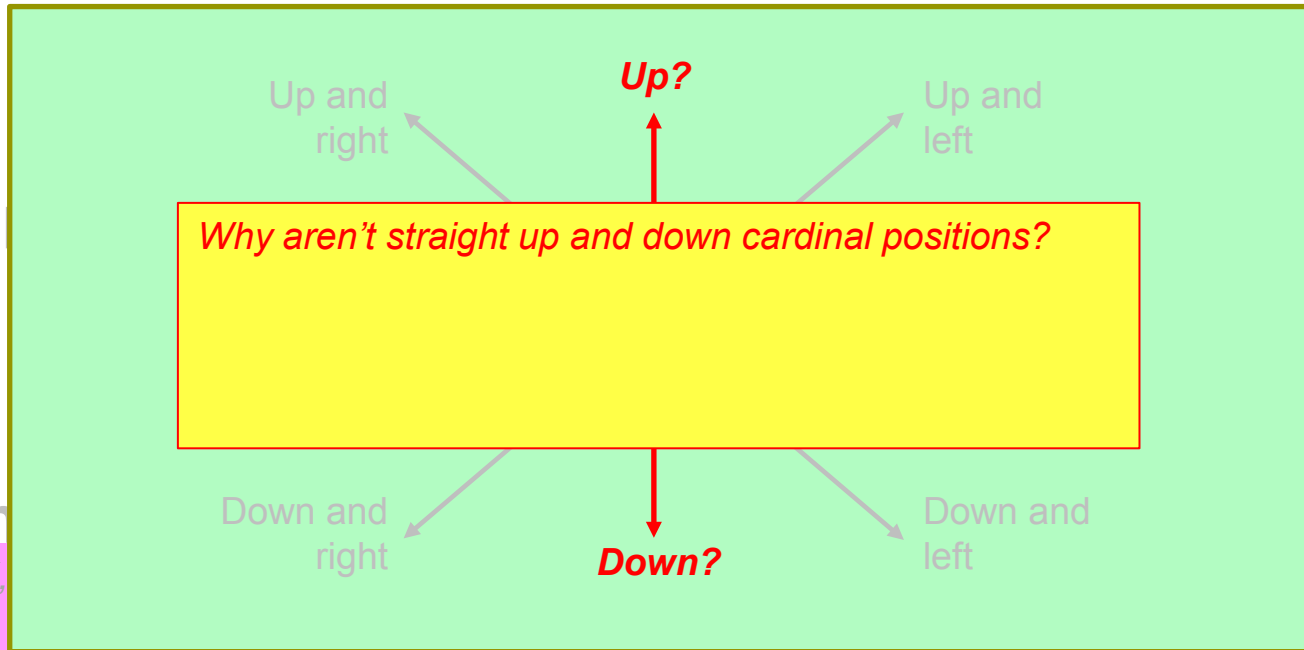
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Sherrington's Law vs Hering's Law

• Definition



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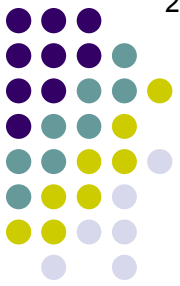
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Sherrington's Law vs Hering's Law



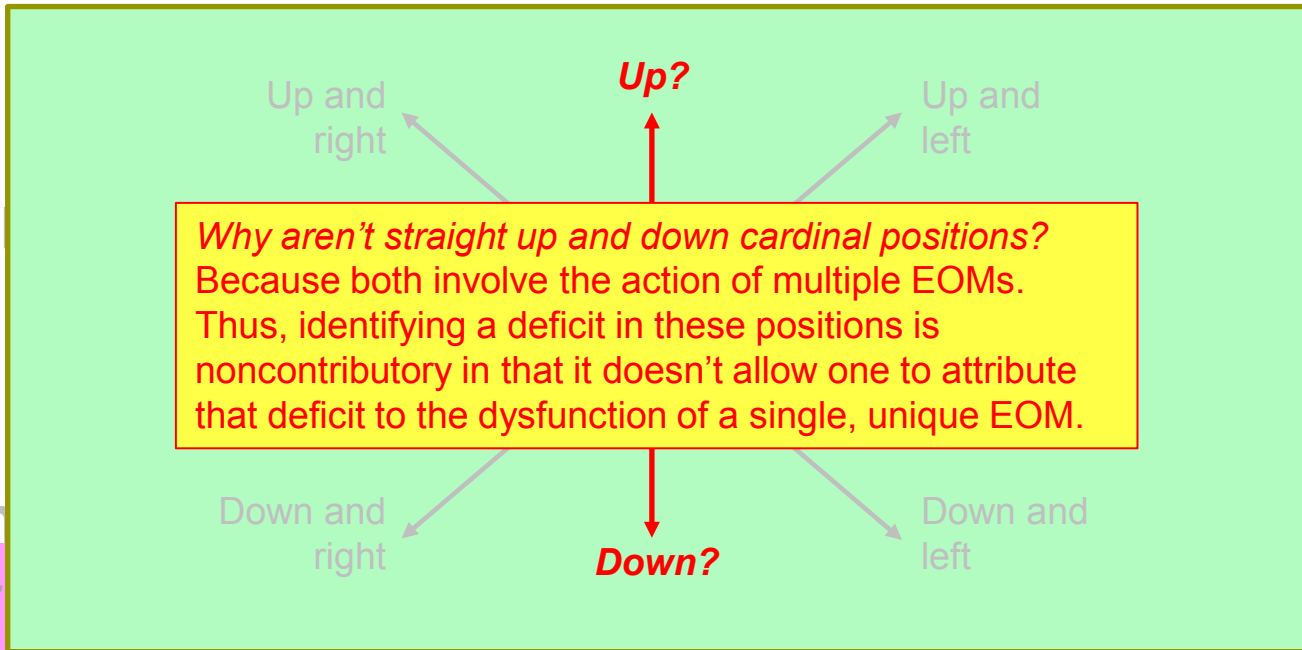
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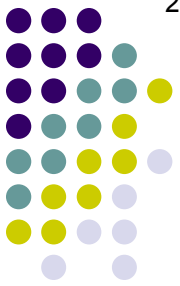
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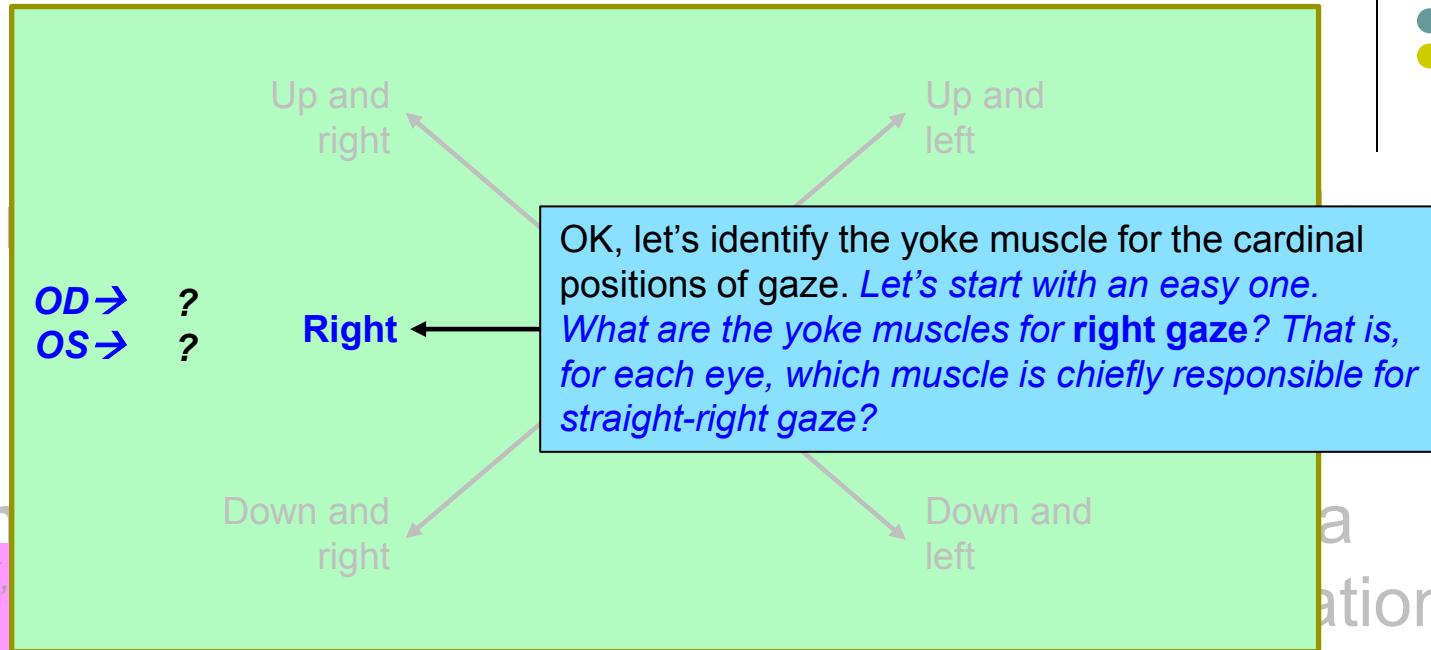
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Q

Sherrington's Law vs Hering's Law



Speaking
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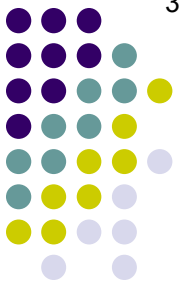
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Sherrington's Law vs Hering's Law



● Definition

OD → LR
OS → MR

Right

OK, let's identify the yoke muscle for the cardinal positions of gaze. *Let's start with an easy one. What are the yoke muscles for right gaze? That is, for each eye, which muscle is chiefly responsible for straight-right gaze?*

Up and right

Up and left

Down and right

Down and left

Speaking
are used
Nine

OK,
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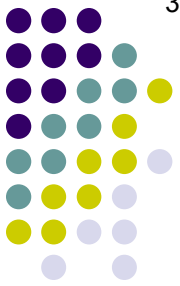
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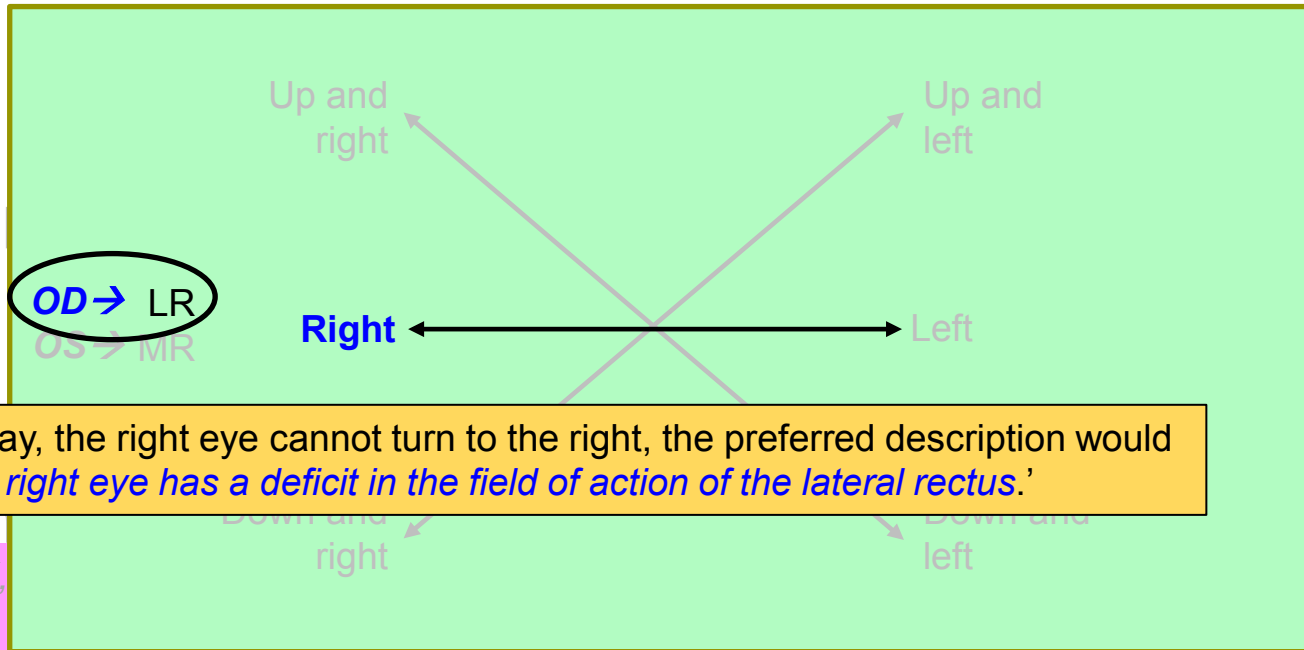
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Sherrington's Law vs Hering's Law



● Definition



So if, say, the right eye cannot turn to the right, the preferred description would be *'the right eye has a deficit in the field of action of the lateral rectus.'*

Speaking of the
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The nine
what are they?

- Primary position (1)
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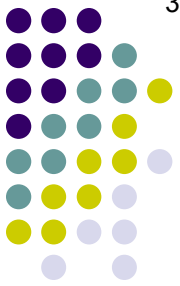
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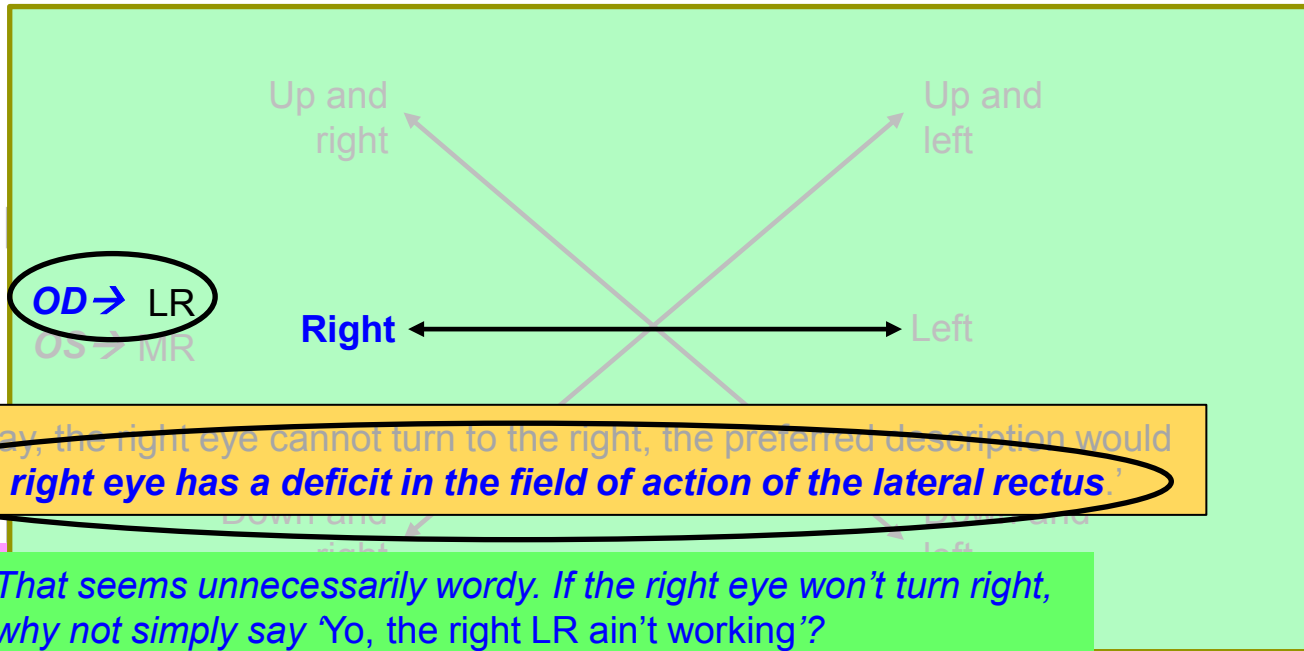
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Sherrington's Law vs Hering's Law



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- Primary position (1)
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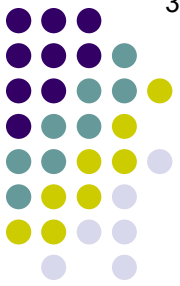
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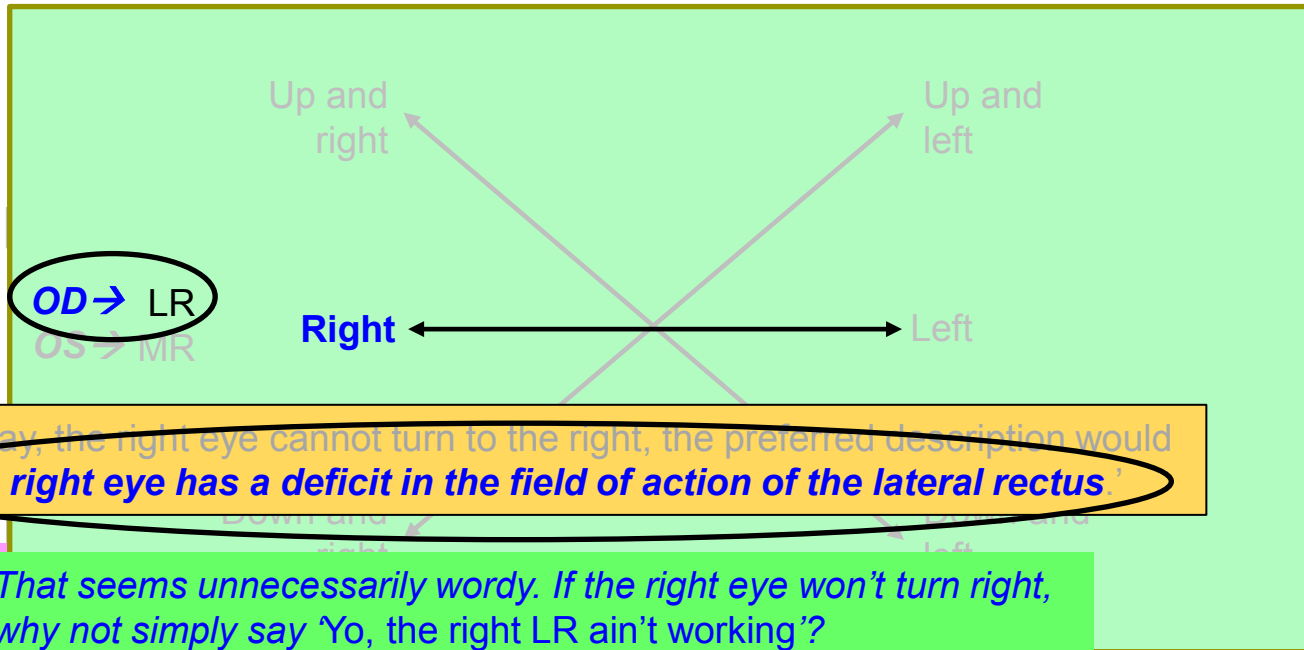
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Sherrington's Law vs Hering's Law



● Defi



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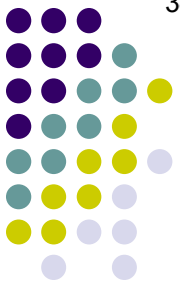
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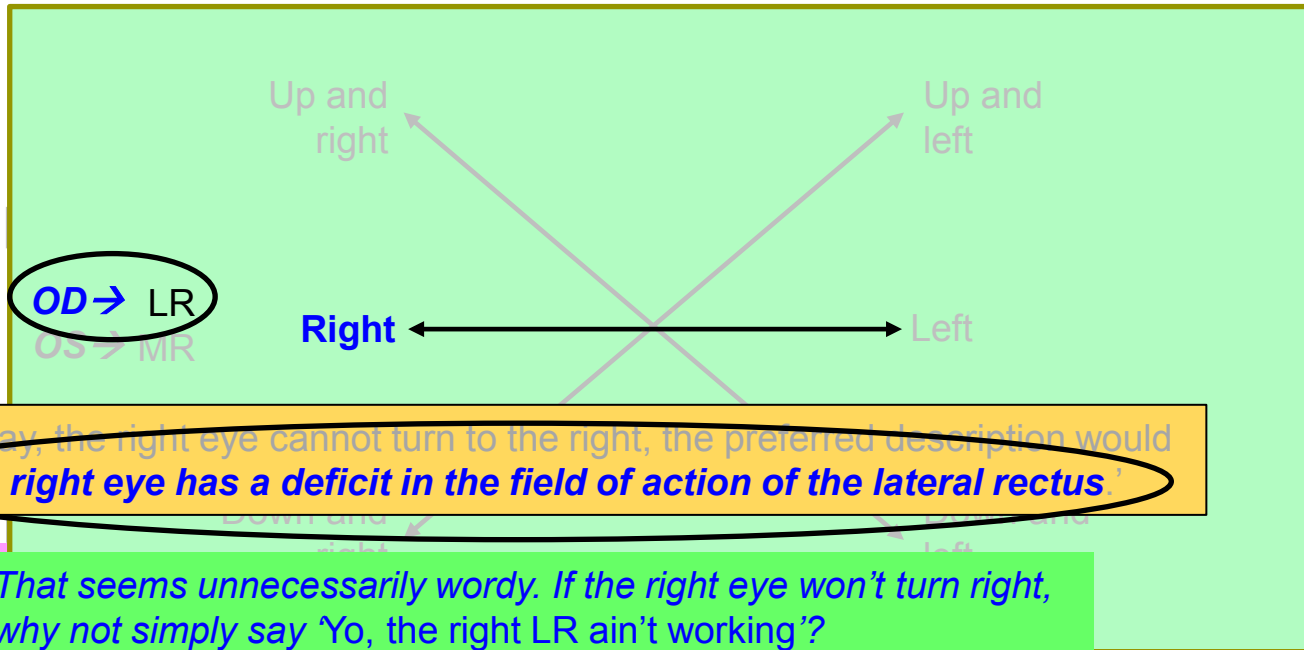
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- Up and down (2)

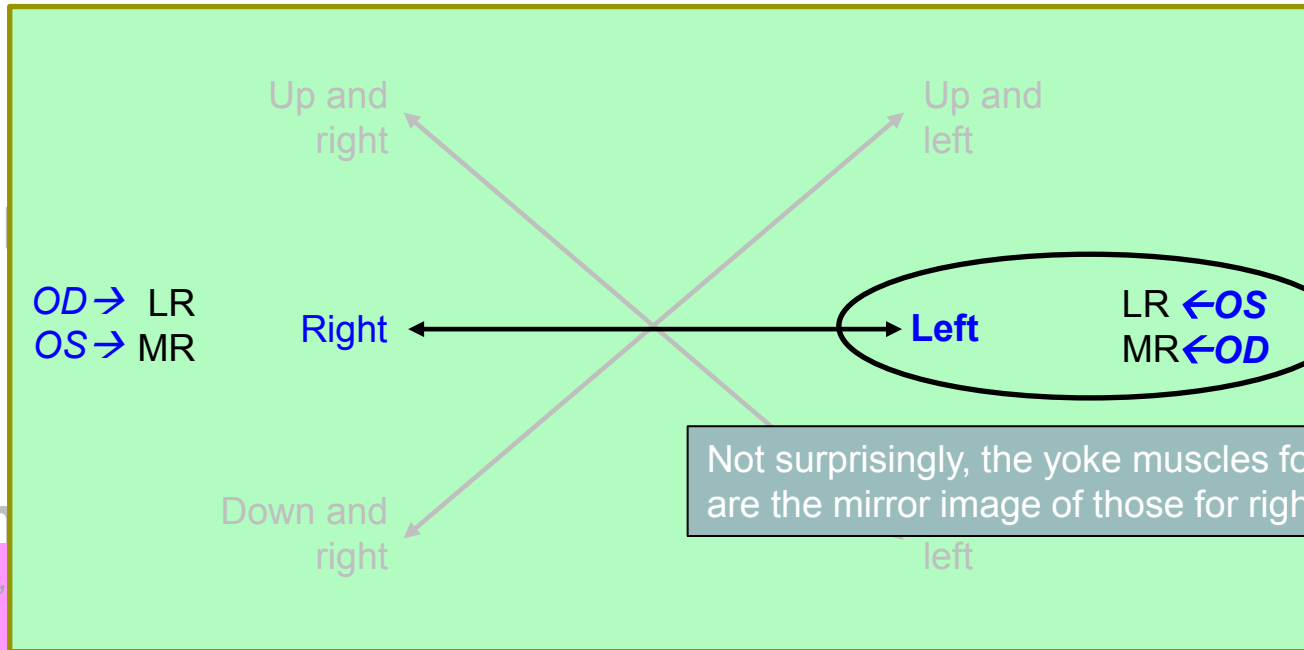
That seems unnecessarily wordy. If the right eye won't turn right, why not simply say 'Yo, the right LR ain't working'? Because an inability of the right eye to ABduct is not necessarily indicative of LR dysfunction. For example, LR function might be fully intact, but a medial restrictive process—say, entrapment of the MR in a healed medial-wall fracture—could be present.

n to yoke muscles is equal

To what does the term yoke muscles refer?

It refers to the two muscles—one for each eye—that are responsible for putting the eyes into a given position of gaze

Sherrington's Law vs Hering's Law

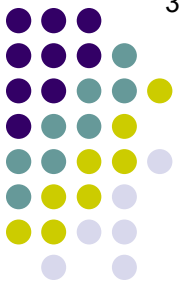


Not surprisingly, the yoke muscles for **left** gaze are the mirror image of those for right gaze

yoke muscles

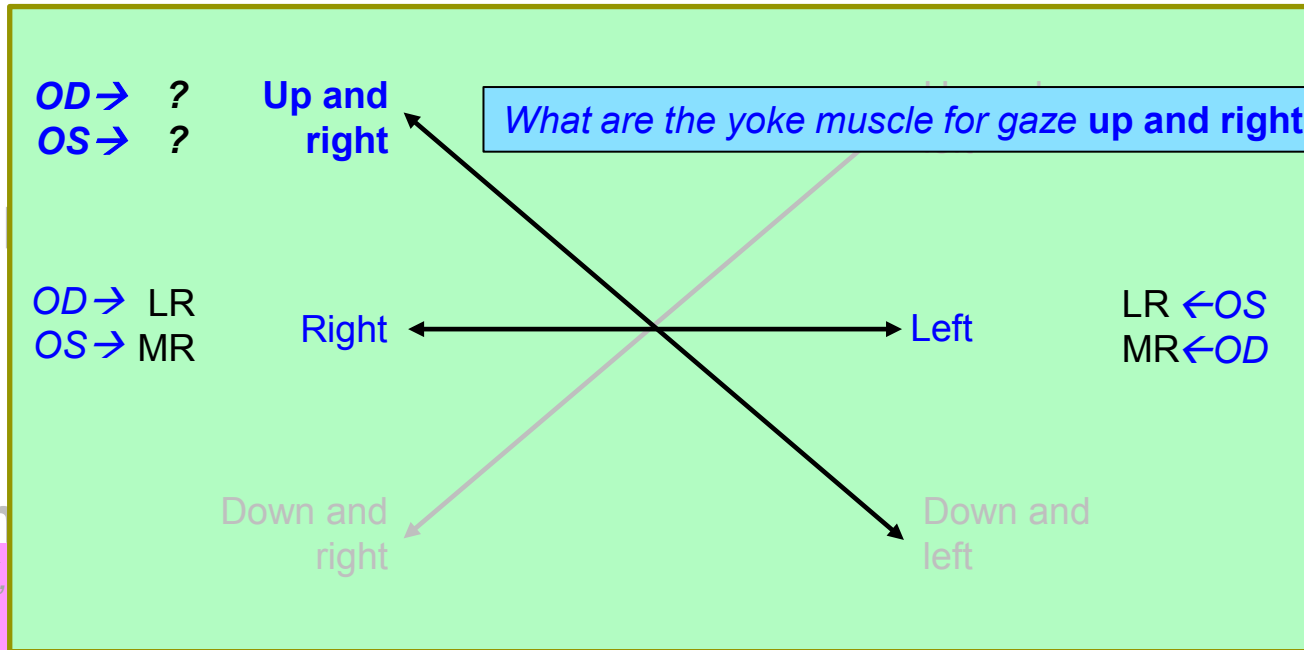
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Q

Sherrington's Law vs Hering's Law



● Definition

● Sherrington's Law

Speaking are used the Nine

The nine what are they?

- Primary position (1)
- Cardinal positions (6)
- Up and down (2)

Well, we just said that 9 gaze positions are used in evaluating the EOMs.

There's one primary gaze (duh)...plus 'up' and 'down' make three. This implies (correctly) **What are the six cardinal positions of gaze?**

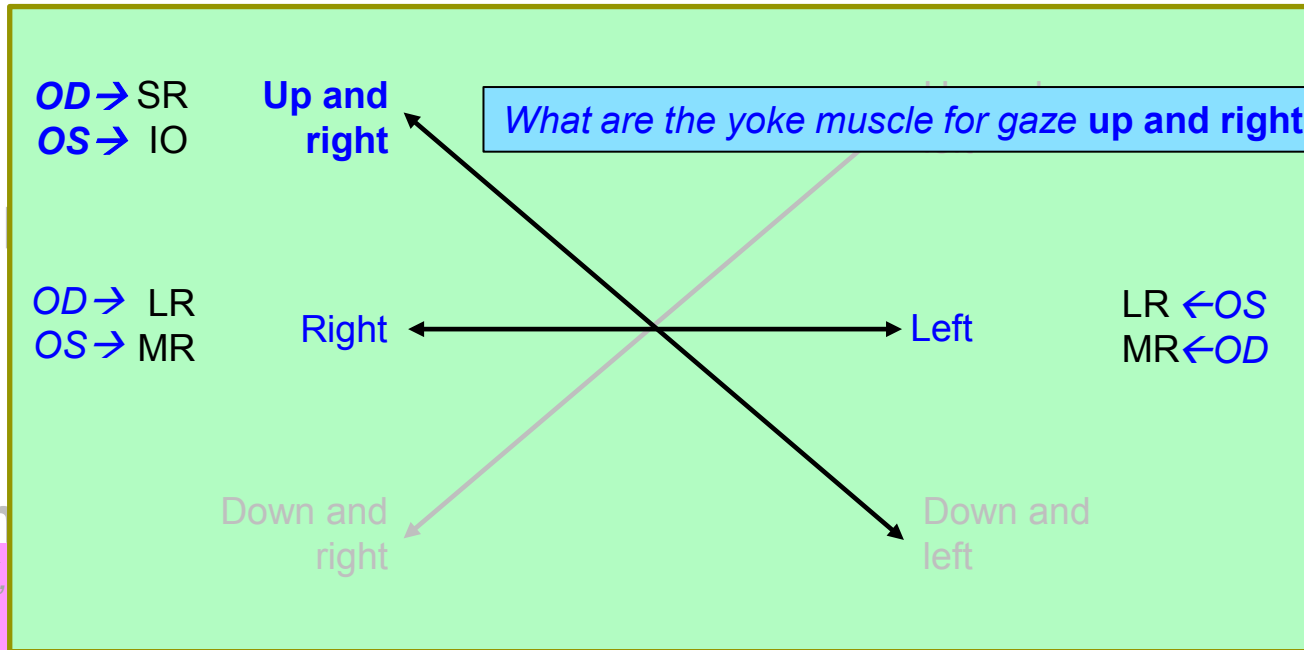
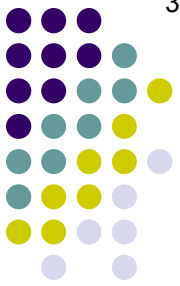
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A

Sherrington's Law vs Hering's Law



- Definition

- Sherrington's Law

Speaking of the nine muscles used in the eyes.

The nine muscles used in the eyes are:

- Primary position (1)
- Cardinal positions (6)
- Up and down (2)

Well, we just said that 9 gaze positions are used in evaluating the EOMs.

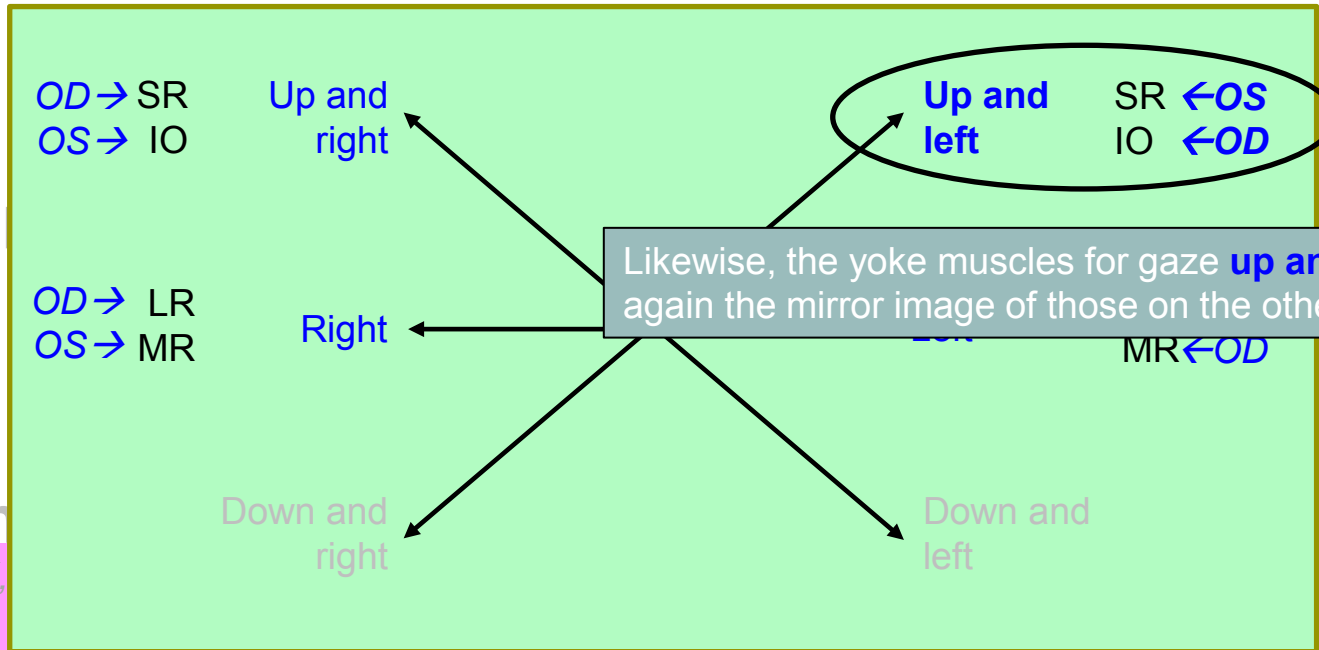
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Sherrington's Law vs Hering's Law



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The nin
what are they?

- Primary position (1)
- Cardinal positions (6)**
- Up and down (2)

OK,
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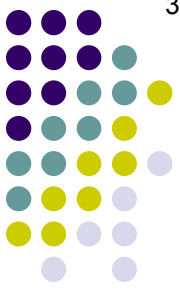
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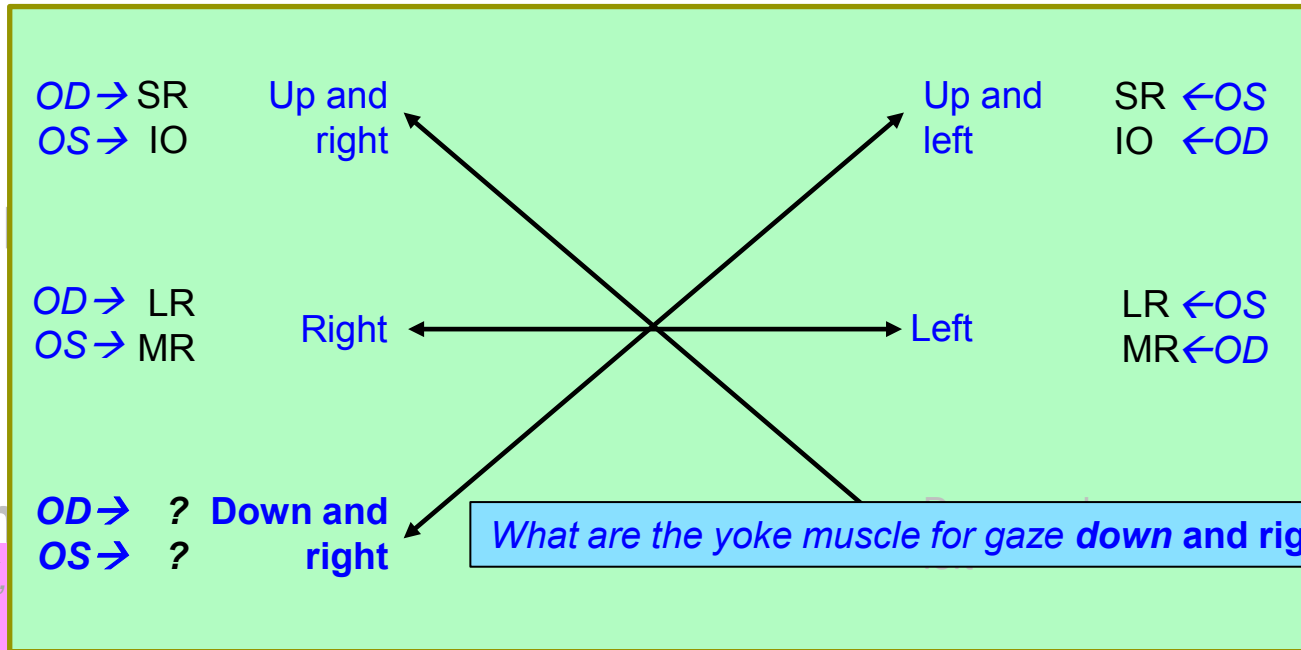
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Sherrington's Law vs Hering's Law



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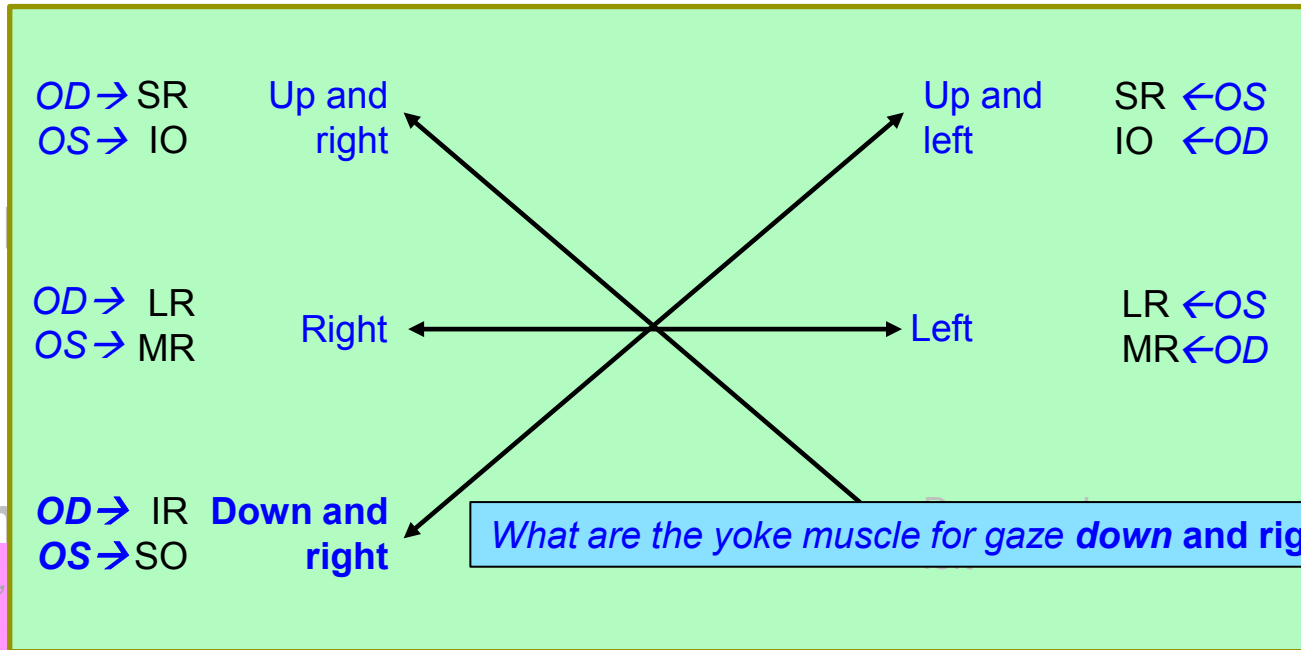
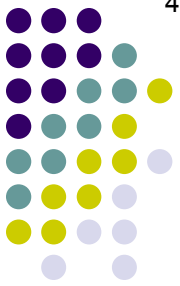
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Sherrington's Law vs Hering's Law



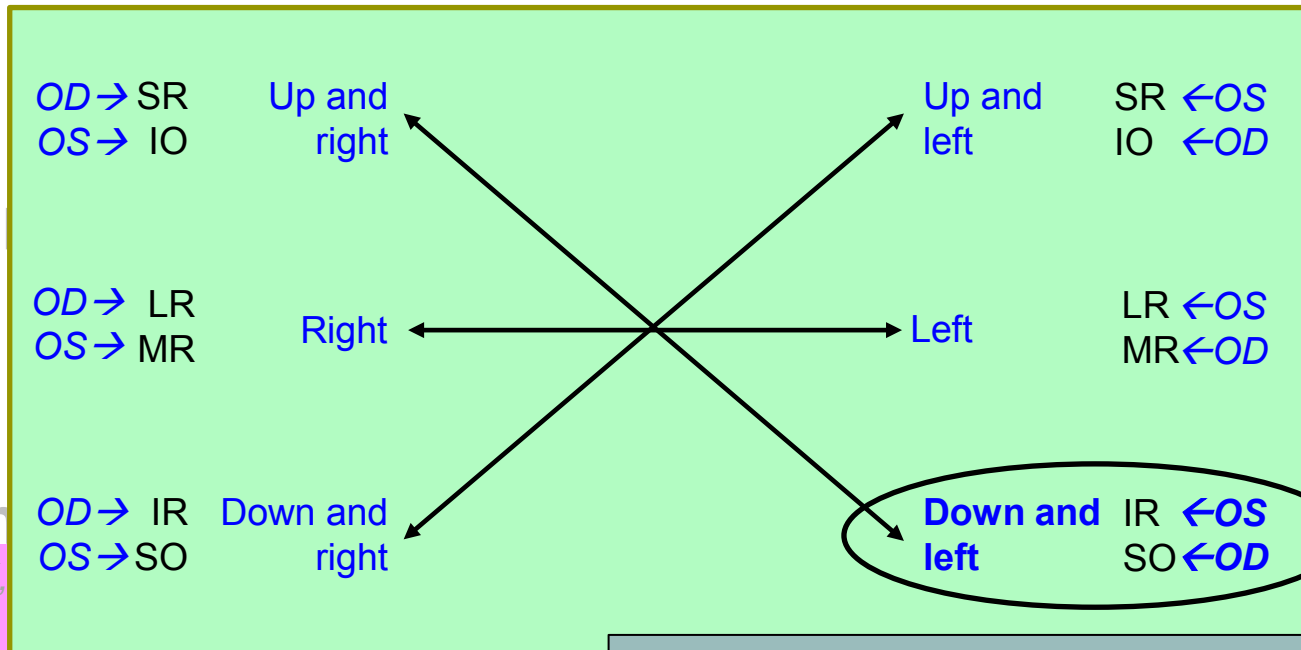
What are the yoke muscle for gaze **down and right**?

yoke muscles

To what does the term yoke muscles refer?

It refers to the two muscles—one for each eye—that are responsible for putting the eyes into a given position of gaze

Sherrington's Law vs Hering's Law



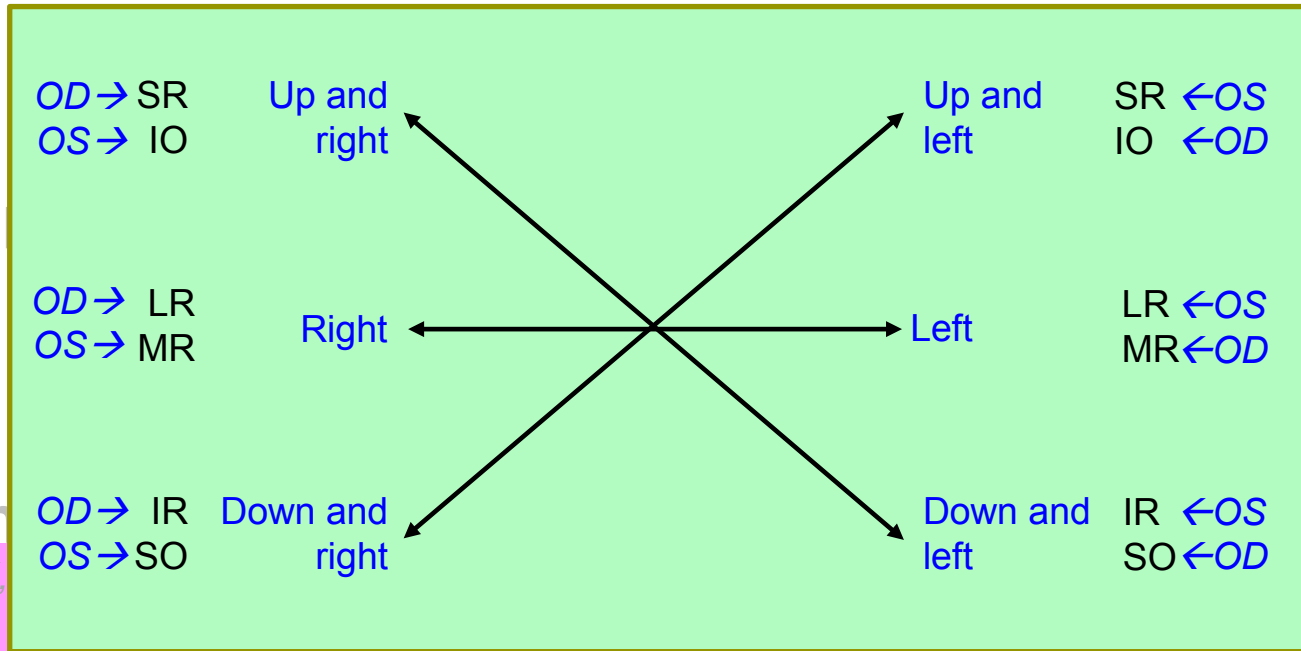
As expected, the yoke muscles for gaze **down and left** are the mirror image of those on the other side

yoke muscles

To what does the term yoke muscles refer?

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Sherrington's Law vs Hering's Law



● Defi

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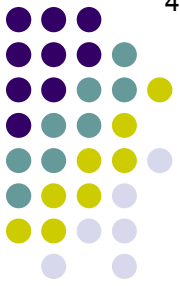
The cardinal positions of gaze, and the yoke muscles for each
(summary slide—proceed when ready)

- Primary position (1)
- Cardinal positions (6)**
- Up and down (2)

n to **yoke muscles** is equal

To what does the term yoke muscles refer?

It refers to the two muscles—one for each eye—that are responsible for putting the eyes into a given position of gaze

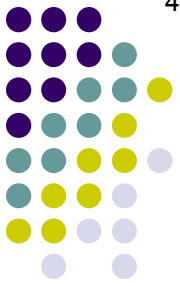


- Define **Sherrington's law** and **Hering's law**

- Sherrington's law:** Increased innervation to a muscle is accompanied by decreased innervation to its antagonist

Speaking of Hering's law...What determines the total amount of innervational input the eyes receive?

- Hering's law:**



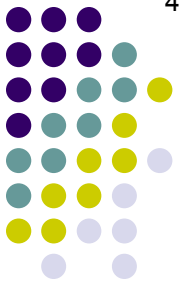
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It is determined by the amount of innervation needed for the fixating eye to get into and maintain position



- Define Sherrington's law and Hering's law

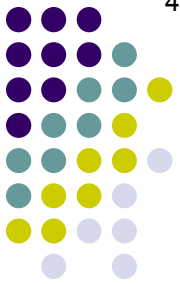
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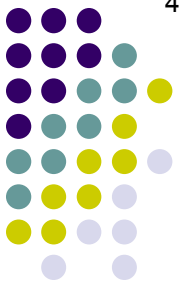
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When the oculomotor control system is intact, it doesn't. But when one eye has a paretic muscle, which eye is fixating has an enormous effect on the amount of innervational input.



Sherrington's Law vs Hering's Law

Consider a pt with a paretic right lateral rectus (RLR).

No question for the next several slides—read, then proceed

Sherrington's law and Hering's law

Increased innervation to a muscle is accompanied by decreased innervation to its antagonist

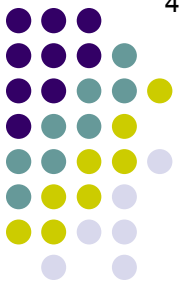
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Sherrington's Law vs Hering's Law

Consider a pt with a paretic right lateral rectus (RLR). As expected, his muscle balance is ET. What happens when he looks at an object to his right? If he fixates with his intact left eye, a normal, moderate amount of innervational input to the left medial rectus (LMR) is all that is required to get this eye into right gaze. And by Hering's law, an equivalent moderate amount of innervation will be sent to the RLR.

law and Hering's law

Increased innervation to a muscle is accompanied by decreased innervation to its antagonist

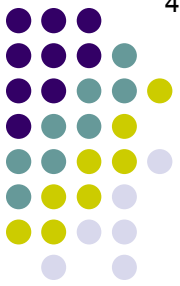
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law and Hering's law

Increased innervation to a muscle is accompanied by decreased innervation to its antagonist

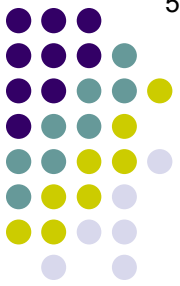
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Next consider what happens if the pt fixates the same object of regard to his right, but this time with the paretic right eye. To get the paretic RLR to contract enough to cause the eye to ABduct, our pt must crank in a massive amount of innervational input.

muscle is accompanied by decreased innervation to its antagonist

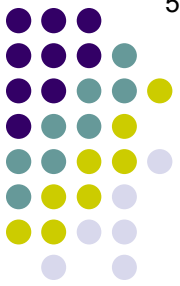
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muscle is accompanied by decreased innervation to its antagonist

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Speaking of Hering's law... What determines the total amount of innervational input the eyes receive?

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Sherrington's Law vs Hering's Law



Consider a pt with a paretic right lateral rectus (RLR). As expected, his muscle balance is ET. What happens when he looks at an object to his right? If he fixates with his intact left eye, a normal, moderate amount of innervational input to the left medial rectus (LMR) is all that is required to get this eye into right gaze. And by Hering's law, an equivalent moderate amount of innervation will be sent to the RLR. Even though it is paretic, the moderate innervational input it receives will not produce much abduction, and the measured ET will increase only modestly.

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The amount of strabismus present while the pt fixates with the nonparetic eye is called the **moderate ET** deviation.

Hering's law:

innervational input the eyes receive?

It is determined by the amount of innervation needed for the fixating eye to get into and maintain position

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Sherrington's Law vs Hering's Law



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The amount of strabismus present while the pt fixates with the nonparetic eye is called the *primary deviation*.

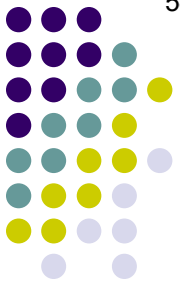
Hering's law:

Innervational input the eyes receive?

It is determined by the amount of innervation needed for the fixating eye to get into and maintain position

OK, but both eyes are pointing at the same thing. Why would it matter which is fixating?

When the oculomotor control system is intact, it doesn't. But when one eye has a paretic muscle, which eye is fixating has an enormous effect on the amount of innervational input.

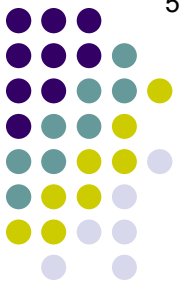


OD fixating (= **primary** deviation)

Pt with left LR palsy

Q

Sherrington's Law vs Hering's Law



Consider a pt with a paretic right lateral rectus (RLR). As expected, his muscle balance is ET. What happens when f he looks at an object to his right? If he fixates with his intact left eye, a normal, moderate amount of innervational input to the left medial rectus (LMR) is all that is required to get this eye into right gaze. And by Hering's law, an equivalent moderate amount of innervation will be sent to the RLR. Given that it is paretic, the moderate innervational input it receives will not produce much abduction, and the measured ET will increase only modestly.

Next consider what happens if the pt fixates the same object of regard to his right, but this time with the paretic right eye. To get the paretic RLR to contract enough to abduct the eye, our pt must crank in a massive amount of innervational input. By Hering's law we know the same (massive) amount of innervation will be sent to the (intact) LMR, causing this eye to way over-adduct, thereby producing a large increase in the measured ET.

The amount present while the pt fixates with the paretic eye is called the deviation.

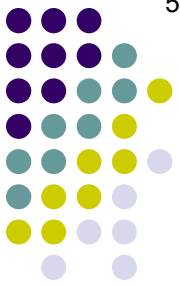
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When the oculomotor control system is intact, it doesn't. But when one eye has a paretic muscle, which eye is fixating has an enormous effect on the amount of innervational input.



Consider a pt with a paretic right lateral rectus (RLR). As expected, his muscle balance is ET. What happens when he looks at an object to his right? If he fixates with his intact left eye, a normal, moderate amount of innervational input to the left medial rectus (LMR) is all that is required to get this eye into right gaze. And by Hering's law, an equivalent moderate amount of innervation will be sent to the RLR. Given that it is paretic, the moderate innervational input it receives will not produce much abduction, and the measured ET will increase only modestly.

Next consider what happens if the pt fixates the same object of regard to his right, but this time with the paretic right eye. To get the paretic RLR to contract enough to abduct the eye, our pt must crank in a massive amount of innervational input. By Hering's law we know the same (massive) amount of innervation will be sent to the (intact) LMR, causing this eye to way over-adduct, thereby producing a large increase in the measured ET.

The amount present while the pt fixates with the paretic eye is called the *secondary deviation*.

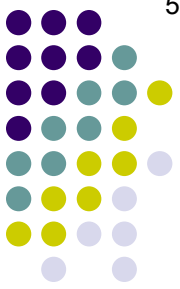
Hering's law:

Innervational input the eyes receive?

It is determined by the amount of innervation needed for the fixating eye to get into and maintain position

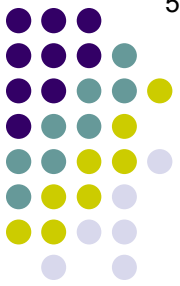
OK, but both eyes are pointing at the same thing. Why would it matter which is fixating?

When the oculomotor control system is intact, it doesn't. But when one eye has a paretic muscle, which eye is fixating has an enormous effect on the amount of innervational input.



OS fixating (= **secondary** deviation)

Pt with left LR palsy



Sherrington's Law vs Hering's Law

Consider a pt with a paretic right lateral rectus (RLR). As expected, his muscle balance is ET. What happens when he looks at an object to his right? If he fixates with his intact left eye, a normal, moderate amount of innervational input to the left medial rectus (LMR) is all that is required to get this eye into right gaze. And by Hering's law, an equivalent moderate amount of innervation will be sent to the RLR. Given that it is paretic, the moderate innervational input it receives will not produce much abduction, and the measured ET will increase only modestly.

Next consider what happens if the pt fixates the same object of regard to his right, but this time with the paretic right eye. To get the paretic RLR to contract enough to abduct the eye, our pt must crank in a massive amount of innervational input. By Hering's law, we know the same (massive) amount of innervation will be sent to the (intact) LMR, causing this eye to way over-adduct, thereby producing a **large increase in the measured ET**.

The amount of strabismus present while the pt fixates with the nonparetic eye is called the *primary deviation*. The amount present while the pt fixates with the paretic eye is called the *secondary deviation*. **Hering's law is the reason these measurements are not identical, and why the secondary deviation is always larger.**

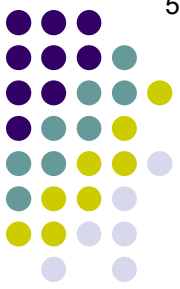
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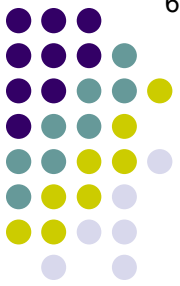
When the oculomotor control system is intact, it doesn't. But when one eye has a paretic muscle, **which eye is fixating has an enormous effect on the amount of innervational input.**



OD fixating (= **primary** deviation)

OS fixating (= **secondary** deviation)

Pt with left LR palsy (side-by-side for comparison purposes)

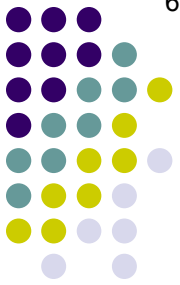


- Define **Sherrington's law** and **Hering's law**, and for each state the classic example of a strabismus-type in which it is violated:
 - **Sherrington's law:** Increased innervation to a muscle is accompanied by decreased innervation to its antagonist
 - Violated in... strabismic condition (2 words)
 - **Hering's law:** Innervation to yoke muscles is equal

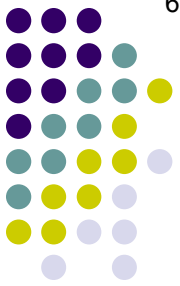
OK, now back to a question about Sherrington's law



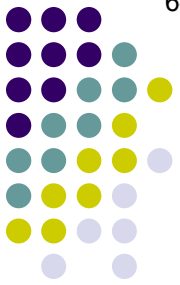
- Define **Sherrington's law** and **Hering's law**, and for each state the classic example of a strabismus-type in which it is violated:
 - **Sherrington's law:** Increased innervation to a muscle is accompanied by decreased innervation to its antagonist
 - Violated in... Duane syndrome
 - **Hering's law:** Innervation to yoke muscles is equal



- Define **Sherrington's law** and **Hering's law**, and for strabismic amblyopia.
 - She *Briefly, what is Duane syndrome?* a
mus to its antagonist
● Violated in. **Duane syndrome**
● **Hering's law**: Innervation to yoke muscles is equal



- Define Sherrington's law and Hering's law, and for strabismic amblyopia.
 - Briefly, what is Duane syndrome?*
A motility disorder with the following key findings:
 - At least some limitation of direction movement
 - Attempted movement causes the globe to one word, and may cause it to this or that movement
- She...
mus...
to its antagonist
- Violated in. **Duane syndrome**
- Hering's law: Innervation to yoke muscles is equal



- Define **Sherrington's law** and **Hering's law**, and for strabismic amblyopia.
 - Briefly, what is Duane syndrome?*
A motility disorder with the following key findings:
 - At least some limitation of horizontal movement
 - Attempted adduction causes the globe to retract , and may cause it to up- or downshoot
- **Sherrington's law**: Innervation to yoke muscles is equal to its antagonist
 - Violated in **Duane syndrome**
- **Hering's law**: Innervation to yoke muscles is equal



Horizontal movement limitation

Duane syndrome



Horizontal movement limitation



Globe retraction

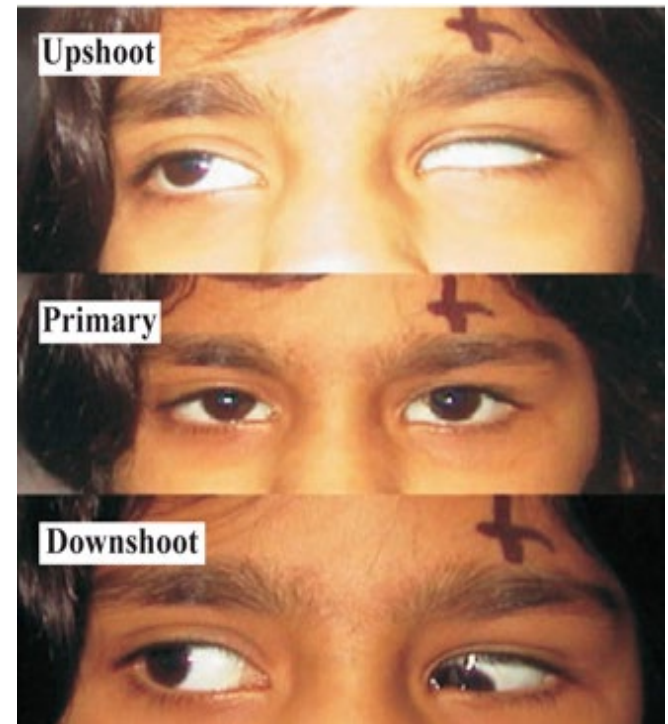
Duane syndrome



Horizontal movement limitation

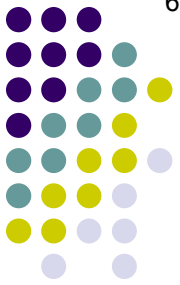


Globe retraction

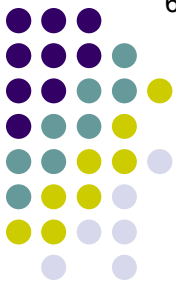


Upshoot/downshoot

Duane syndrome



- Define **Sherrington's law** and **Hering's law**, and for strabismic amblyopia.
 - Briefly, what is Duane syndrome?*
A motility disorder with the following key findings:
 - At least some limitation of horizontal movement
 - Attempted adduction causes the globe to retract , and may cause it to up- or downshoot
 - What is the cause?*
- **Sherrington's law**: Innervation to yoke muscles is equal to its antagonist
 - Violated in **Duane syndrome**
- **Hering's law**: Innervation to yoke muscles is equal



- Define **Sherrington's law** and **Hering's law**, and for strabismic amblyopia

Briefly, what is Duane syndrome?

A motility disorder with the following key findings:

--At least some limitation of horizontal movement

-- Attempted adduction causes the globe to retract , and may cause it to up- or downshoot

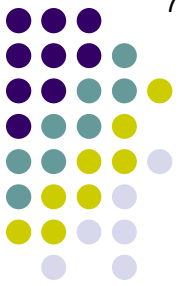
- **Sherrington's law**: Innervation to yoke muscles is equal to its antagonist

What is the cause?

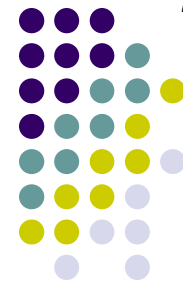
The nucleus for cranial nerve # is missing, and the lateral rectus is innervated by cranial nerve #

- Violated in **Duane syndrome**

- **Hering's law**: Innervation to yoke muscles is equal



- Define Sherrington's law and Hering's law, and for strabismic amblyopia
- She *Briefly, what is Duane syndrome?*
A motility disorder with the following key findings:
 - At least some limitation of horizontal movement
 - Attempted adduction causes the globe to retract , and may cause it to up- or downshoot*What is the cause?*
The nucleus for cranial nerve VI is missing, and the lateral rectus is innervated by cranial nerve III
- Violated in. **Duane syndrome**
- Hering's law: Innervation to yoke muscles is equal



- Define Sherrington's law and Hering's law,

Briefly, what is Duane syndrome?

A motility disorder with the following key findings:

- At least some limitation of horizontal movement
- Attempted adduction causes the globe to retract , and may cause it to up- or downshoot

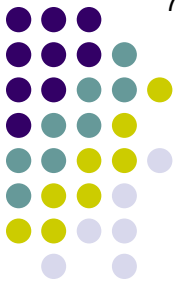
- She

What is the cause?

The nucleus for cranial nerve VI is missing, and the lateral rectus is innervated by cranial nerve III

- Violated in. **Duane syndrome**

How does this dysinnervation result in the key findings listed above?



- Define Sherrington's law and Hering's law,

and for
strabismus

Briefly, what is Duane syndrome?

A motility disorder with the following key findings:

--At least some limitation of horizontal movement

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to its antagonist

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The nucleus for cranial nerve VI is missing, and the lateral rectus is innervated by cranial nerve III

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Duane syndrome

How does this dysinnervation result in the key findings listed above?

When someone with an intact oculomotor system adducts an eye, Sherrington's law dictates that innervation is increased to the medial rectus and decreased to the lateral rectus.



- Define Sherrington's law and Hering's law,

and for strabismic amblyopia

Briefly, what is Duane syndrome?
A motility disorder with the following key findings:
--At least some **limitation of horizontal movement**
-- Attempted adduction causes the globe to retract , and may cause it to up- or downshoot

- She must be able to adduct the eye to its antagonist

What is the cause?
The nucleus for cranial nerve VI is missing, and the lateral rectus is innervated by cranial nerve III

- Violated in **Duane syndrome**

How does this dysinnervation result in the key findings listed above?

When someone with an intact oculomotor system adducts an eye, Sherrington's law dictates that innervation is increased to the medial rectus and decreased to the lateral rectus. However, in a Duane's pt CN3 innervates the LR, so when she attempts to adduct **her** eye, innervation is increased to both the medial rectus **and** the aberrantly-innervated lateral rectus, **so the eye doesn't adduct.**



- Define Sherrington's law and Hering's law,

Briefly, what is Duane syndrome?

A motility disorder with the following key findings:

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-- Attempted adduction causes the globe to **retract**, and may cause it to up- or downshoot

- She

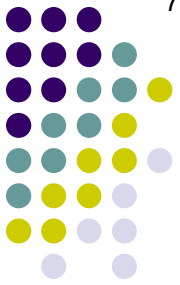
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● Define Sherrington's law and Hering's law,

and for
strabismic

Briefly, what is Duane syndrome?

A motility disorder with the following key findings:

--At least some **limitation of horizontal movement**

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mus
to its antagonist

What is the cause?

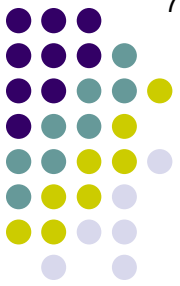
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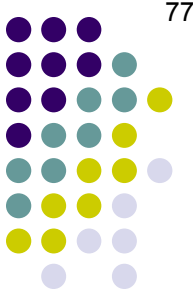
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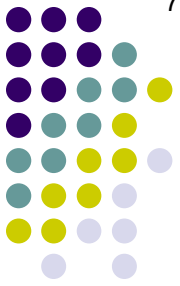
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- Define **Sherrington's law** and **Hering's law**, and for each state the classic example of a strabismus-type in which it is violated:
 - **Sherrington's law:** Increased innervation to a muscle is accompanied by decreased innervation to its antagonist
 - Violated in... Duane syndrome
 - **Hering's law:** Innervation to yoke muscles is equal
 - Violated in... strabismic condition (3 words)



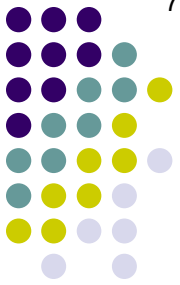
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 - Violated in... dissociated vertical deviation (DVD)



- Define Sherrington's law and Hering's law,

Who is the typical DVD pt?

- Sherrington's law: Innervation to yoke muscles is equal
- Hering's law: Innervation to yoke muscles is equal
 - Violated in... **dissociated vertical deviation (DVD)**

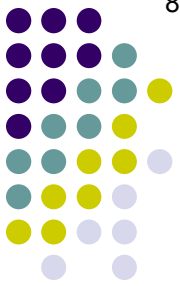


- Define Sherrington's law and Hering's law,

Who is the typical DVD pt?

A child with infantile/congenital ET or XT

- Sherrington's law: Innervation to yoke muscles is equal
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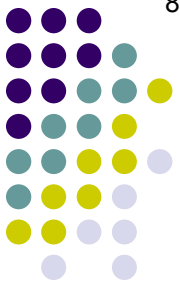
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- Define Sherrington's law and Hering's law,

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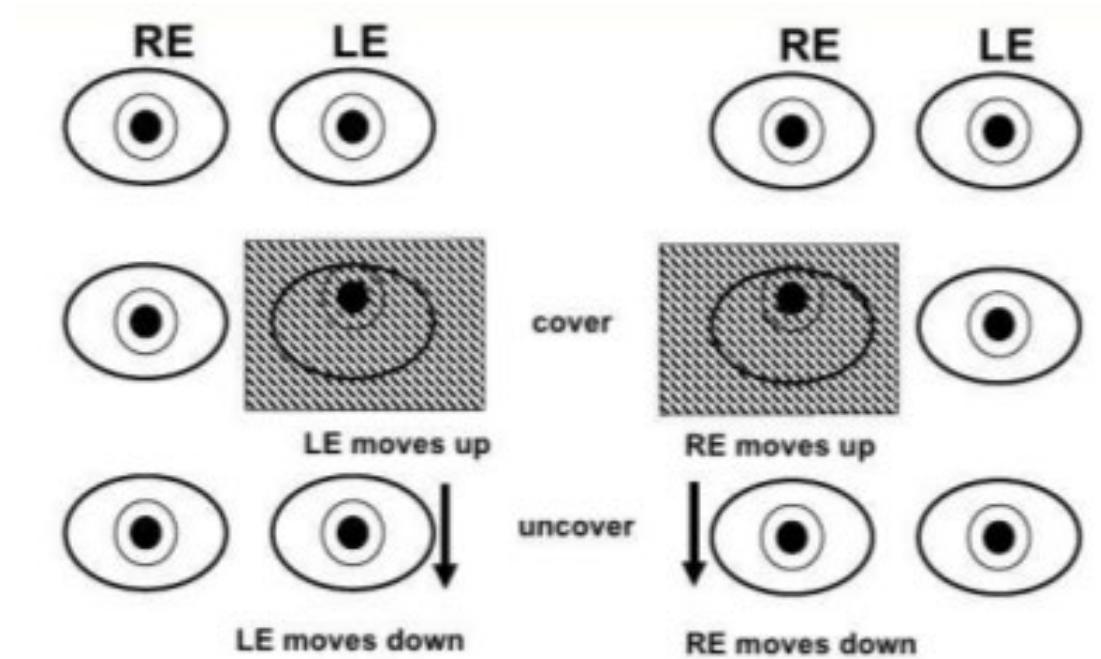
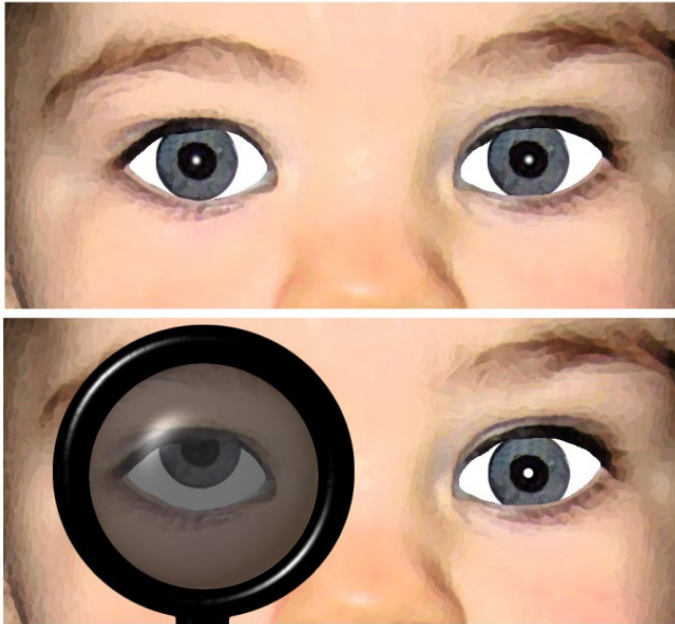
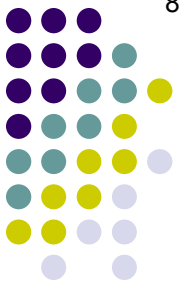
A child with infantile/congenital ET or XT

What is the classic clinical finding?

An eye will slowly elevate and extort, either spontaneously (*manifest DVD*) or when occluded (*latent DVD*). A crucial finding occurs when the drifting eye reorients downward, and it is this-- the fellow eye does not move downward simultaneously (as would normally be the case).

- Hering's law: Innervation to yoke muscles is equal

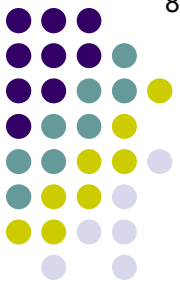
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DVD

Q

Sherrington's Law vs Hering's Law



- Define Sherrington's law and Hering's law,

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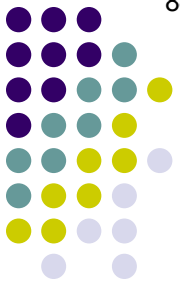
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An eye will slowly elevate and extort, either spontaneously (*manifest DVD*) or when occluded (*latent DVD*). A crucial finding occurs when the drifting eye reorients downward, and it is this--the fellow eye does not move downward simultaneously (as would normally be the case).

How does Hering's law relate to DVD?

- Hering's law: Innervation to yoke muscles is equal

- Violated in... **dissociated vertical deviation (DVD)**



- Define Sherrington's law and Hering's law,

Who is the typical DVD pt?

A child with infantile/congenital ET or XT

What is the classic clinical finding?

An eye will slowly elevate and extort, either spontaneously (*manifest DVD*) or when occluded (*latent DVD*). A crucial finding occurs when the drifting eye reorients downward, and it is this-- the fellow eye does not move downward simultaneously (as would normally be the case).

How does Hering's law relate to DVD?

As noted, in DVD the downward reorientation movement by the drifting eye is not accompanied by a downward movement of the fellow eye. As the muscles that depress the eyes are yoke muscles, this means that DVD represents a violation of Hering's law.

- Hering's law: Innervation to yoke muscles is equal

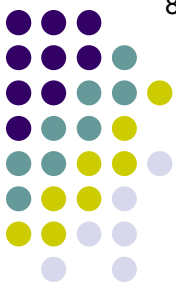
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Sherrington's Law vs Hering's Law

Speaking of EOM innervation...

What is the ratio of nerve fibers to muscle fibers in the EOMs?

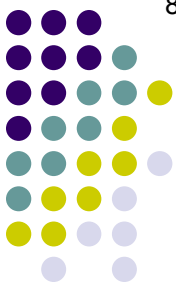


Sherrington's Law vs Hering's Law

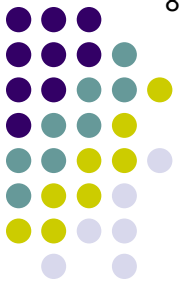
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1:3–1:5, ie, 1 nerve fiber for every 3-5 muscle fibers



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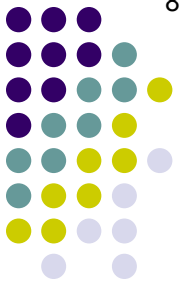


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When compared with that of skeletal muscle, is this ratio high, or low?



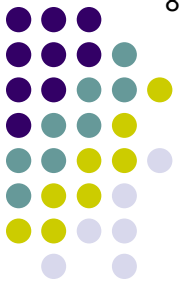
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Very high (in skeletal muscle, typical ratios are in the 1:x to 1:x range)



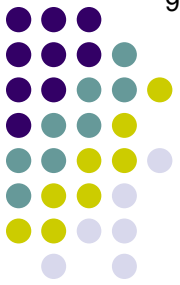
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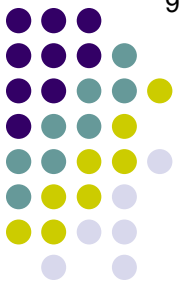
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Speaking of EOM innervation...

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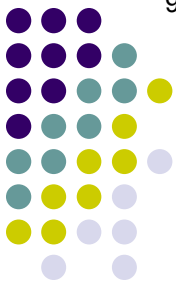
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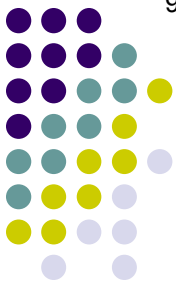
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The EOMs are composed of two types of muscle fibers—what are they?

Types		
?		
?		



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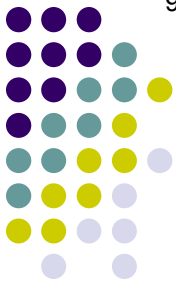
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The EOMs are composed of two types of muscle fibers—what are they?

Types		
Slow/tonic		
Fast/twitchy		



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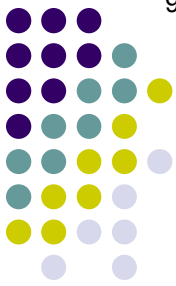
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*The EOMs are composed of two types of muscle fibers—what are they? **In what manner is each type innervated?***

(Hint forthcoming)

Types	Innervation	
Slow/tonic	?	
Fast/twitchy	?	



Speaking of EOM innervation...

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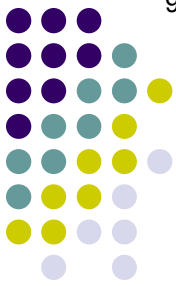
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*The EOMs are composed of two types of muscle fibers—what are they? **In what manner is each type innervated?***

(Thar she blows!)

Types	Innervation	
Slow/tonic	<i>En</i> <small>Latin-sounding word</small>	
Fast/twitchy	<i>En</i> <small>Latin-sounding word</small>	



Speaking of EOM innervation...

What is the ratio of nerve fibers to muscle fibers in the EOMs?

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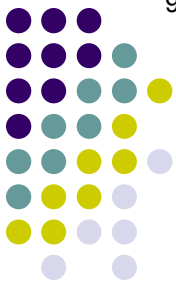
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*The EOMs are composed of two types of muscle fibers—what are they? **In what manner is each type innervated?***

Types	Innervation	
Slow/tonic	<i>En grappe</i>	
Fast/twitchy	<i>En plaque</i>	



Speaking of EOM innervation...

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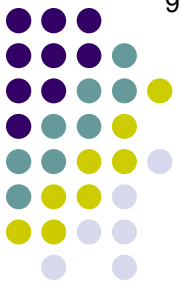
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Types	Innervation	
Slow/tonic	<i>En grappe</i>	
Fast/twitchy	<i>En plaque</i>	

What does en grappe mean?

Sherrington's Law vs Hering's Law



Speaking of EOM innervation...

What is the ratio of nerve fibers to muscle fibers in the EOMs?

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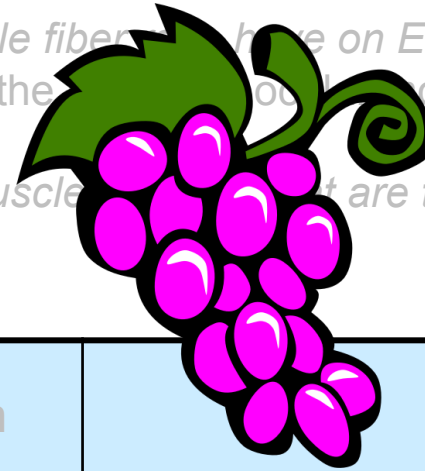
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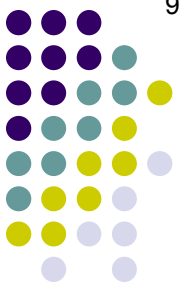
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The EOMs are composed of two types of muscle fibers. What are they? In what manner is each type innervated?



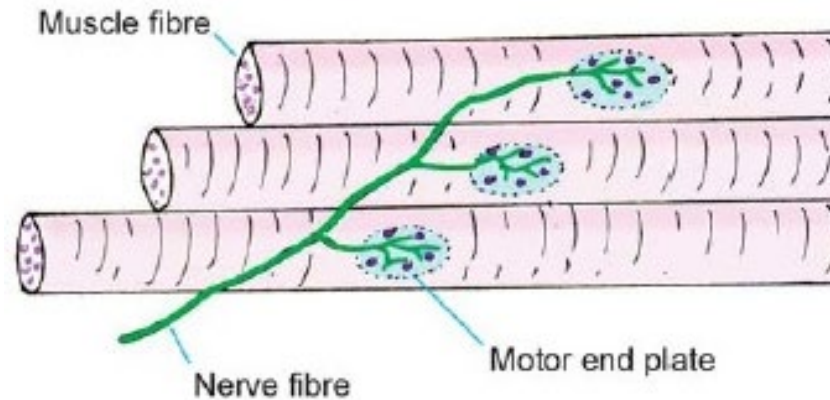
Types	Innervation	
Slow/tonic	<i>En grappe</i>	
Fast/twitchy	<i>En plaque</i>	

*What does en grappe mean?
It means 'grape-like'*

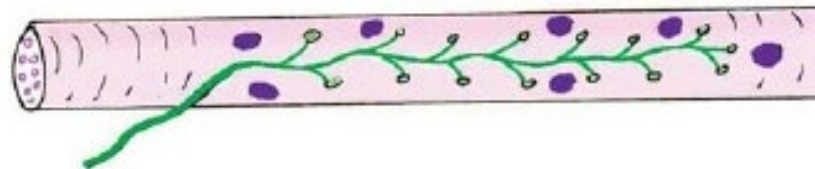


Sherrington's Law vs Hering's Law

A. En plaque endings



B. En grappe endings



EOM innervation: *En grappe* vs *en plaque*



Speaking of EOM innervation...

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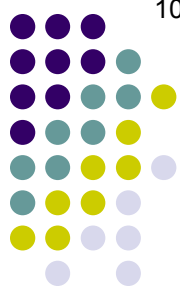
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Types	Innervation	Movement type
Slow/tonic	<i>En grappe</i>	?
Fast/twitchy	<i>En plaque</i>	?

Next question



Speaking of EOM innervation...

What is the ratio of nerve fibers to muscle fibers in the EOMs?

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Types	Innervation	Movement type
Slow/tonic	<i>En grappe</i>	Smooth pursuit
Fast/twitchy	<i>En plaque</i>	Saccades

Next question