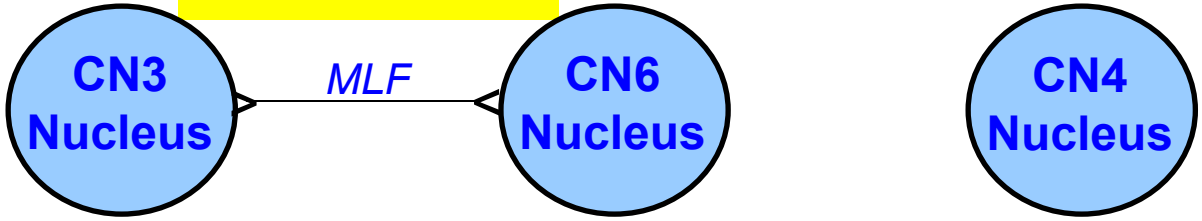
Motility Disorders: *Internuclear Ophthalmoplegia+*

Supranuclear

Internuclear

Nuclear



Infranuclear

- Fascicular
- Subarachnoid
- Cavernous sinus
- Orbital
- Neuromuscular junction
- Extraocular muscle

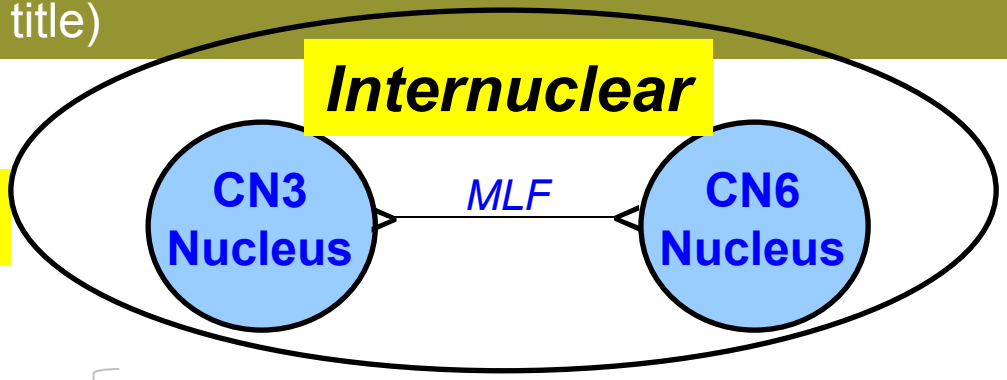
This slide captures one way to think about the motility disorders. If it is unfamiliar, I strongly suggest you review the slide-set entitled ***'Motility disorders: Overview'*** before proceeding.

Motility Disorders: *Internuclear Ophthalmoplegia+*

Supranuclear

In this slide-set we will address *internuclear ophthalmoplegia* (INO), along with several related conditions (that's what the '+' refers to in the title)

Internuclear



Nuclear

CN4 Nucleus

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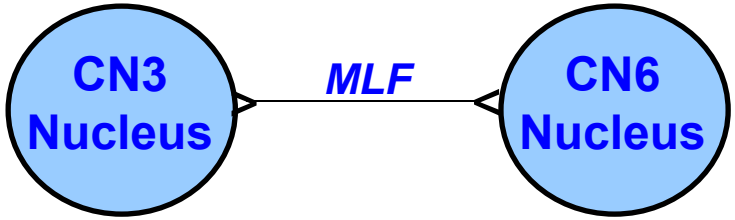

What does MLF *stand for in this context?*

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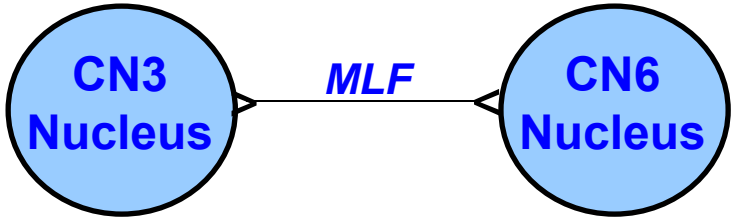

What does MLF *stand for in this context?*
Medial longitudinal fasciculus

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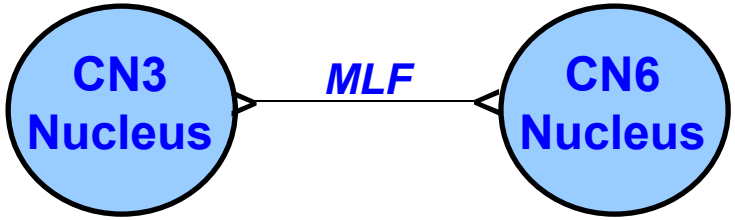

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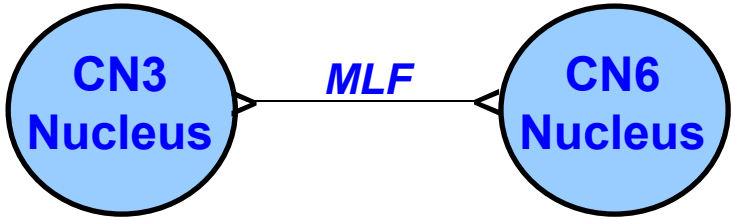

What does MLF *stand for in this context?*
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Again in this context, what does the word fasciculus *mean?*
It means ‘a small fascicle’

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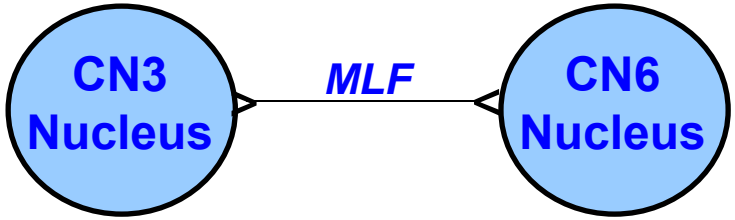

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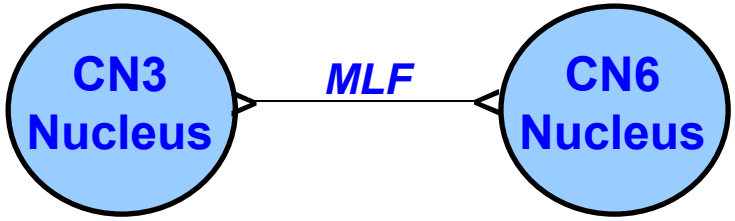

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Medial longitudinal fasciculus

Again in this context, what does the word fasciculus *mean?*
It means ‘a small fascicle’

OK then, in context, what does fascicle *refer to?*
It refers to a bundle of nerve fibers running together within the substance of the brainstem. In other words, it’s a cranial nerve that’s left its nucleus, but has yet to ‘break out’ into the subarachnoid space.

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- *Fascicular*
- *Subarachnoid*
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- Neu
- Extraocular mu

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Medial longitudinal fasciculus

Again in this context, what does the word fasciculus *mean?*
It means 'a small fascicle'

But you knew this already. Recall that the first segment of the *Infranuclear* portion of the cranial nerve pathway is the *Fascicular*, followed by the *Subarachnoid*

In other words, **it's a cranial nerve that's left its nucleus, but has yet to 'break out' into the subarachnoid space.**

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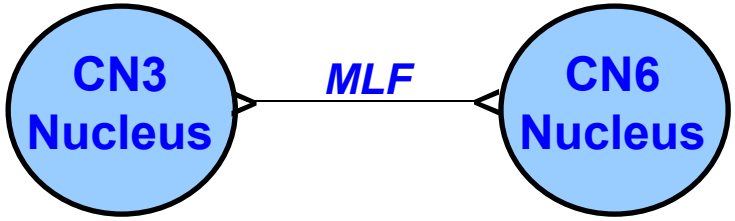

From where to where do the fascicles of the MLF run?

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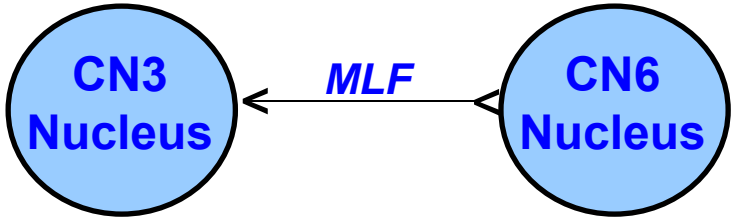

From where to where do the fascicles of the MLF run?

From the CN6 nucleus to the ipsi- v contralateral CN3 nucleus

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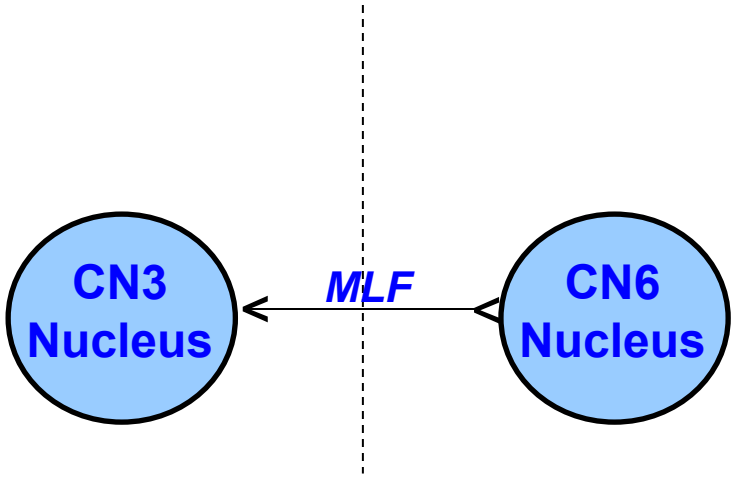

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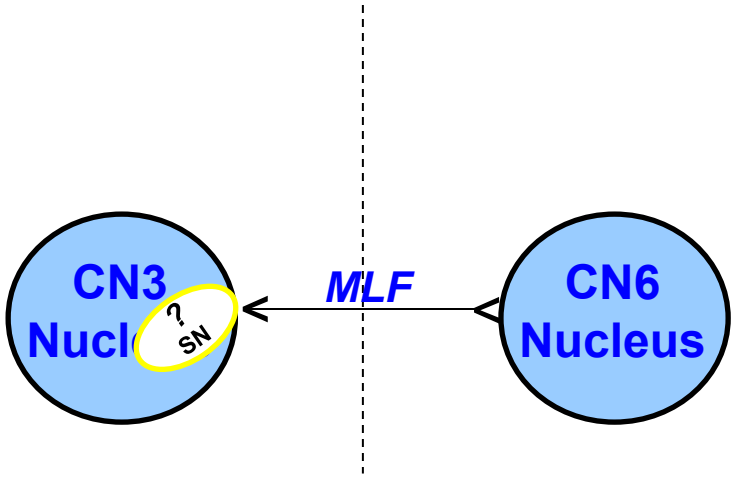

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From the CN6 nucleus to the contralateral CN3 nucleus—specifically, to its EOM subnucleus

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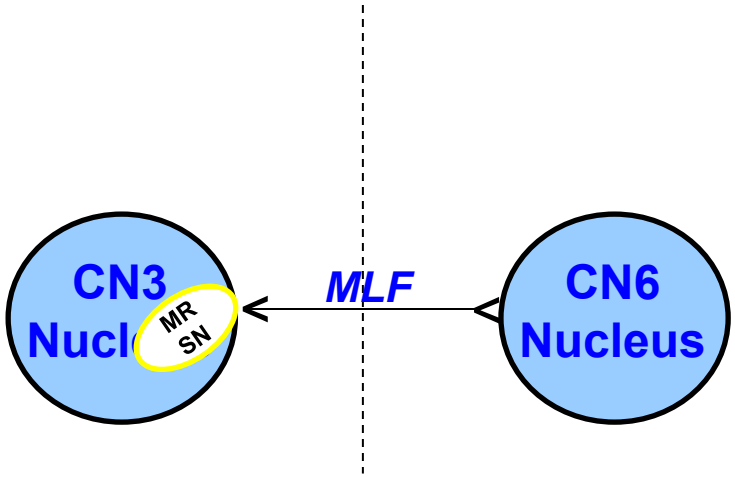

From where to where do the fascicles of the MLF run?
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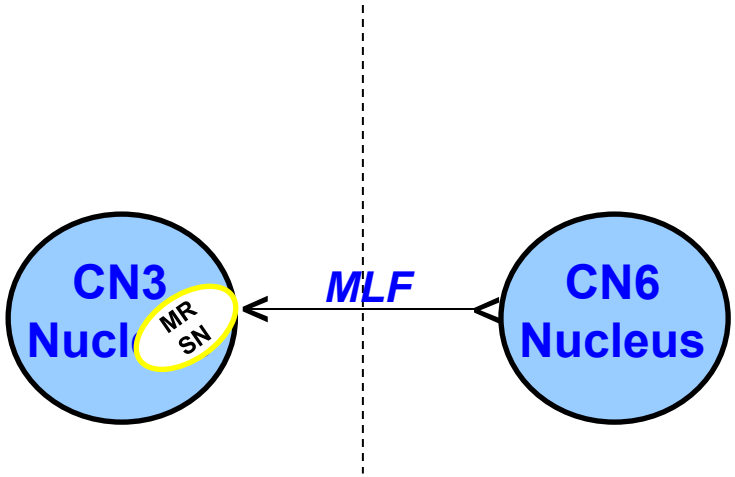

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What purpose does the MLF serve?

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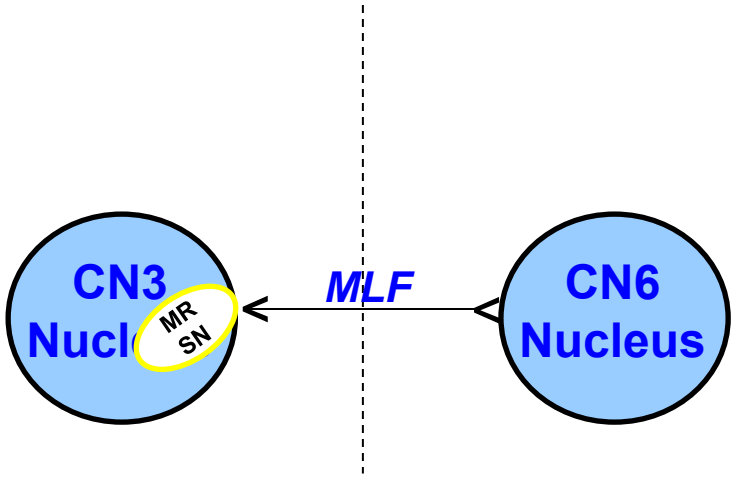

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To allow coordinated lateral gaze of both eyes

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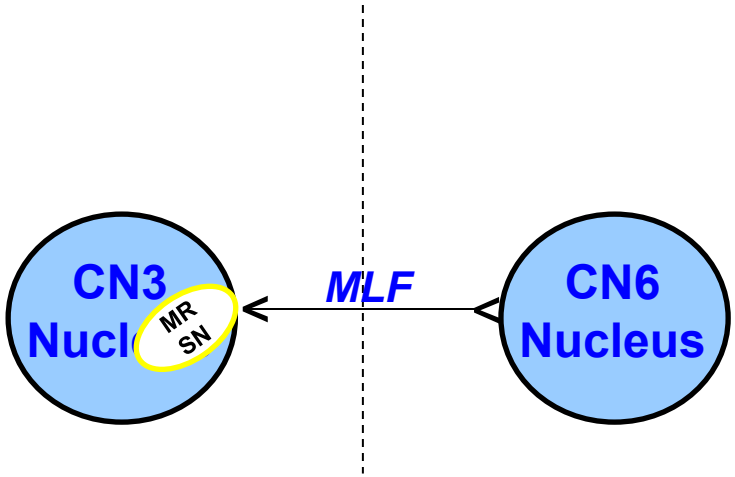

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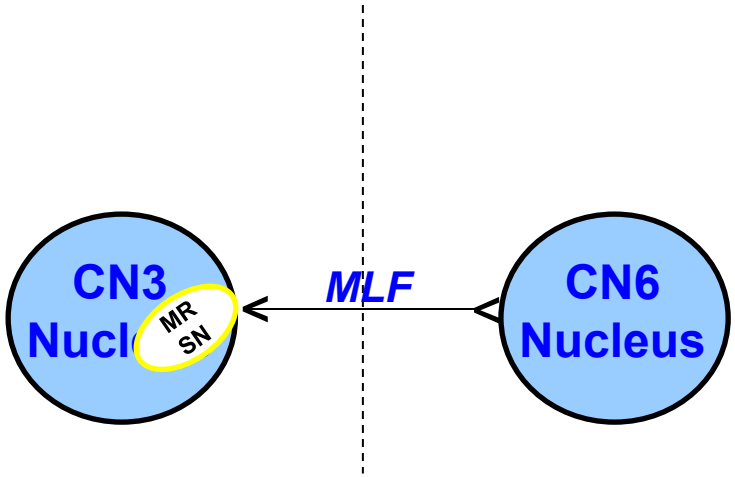

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How does the MLF facilitate lateral gaze coordination?
By causing the contralateral MR to fire simultaneously with the ipsilateral lateral rectus (LR), thus ensuring both eyes turn into lateral gaze together

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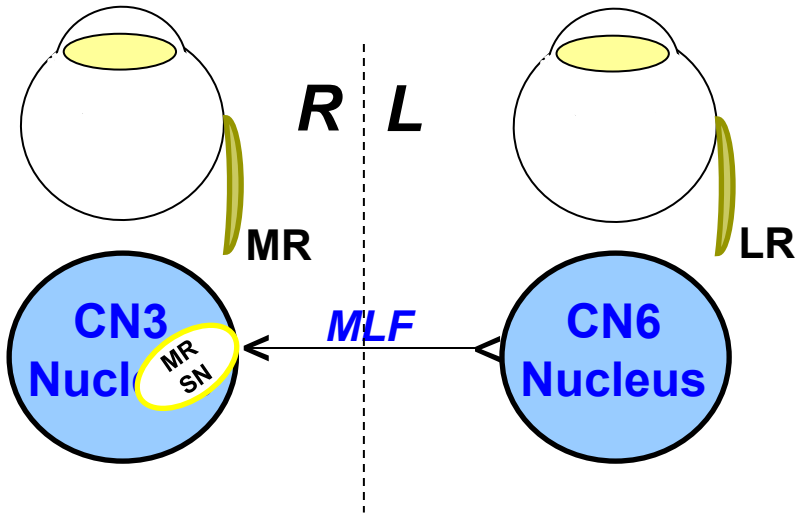

From where to where do the fascicles of the MLF run?

So if the depicted CN6 nucleus is on a pt's left side, the depicted MLF runs to her right MR subnucleus.

By causing the contralateral MR to fire simultaneously with the ipsilateral lateral rectus (LR), thus **ensuring both eyes turn into lateral gaze together**

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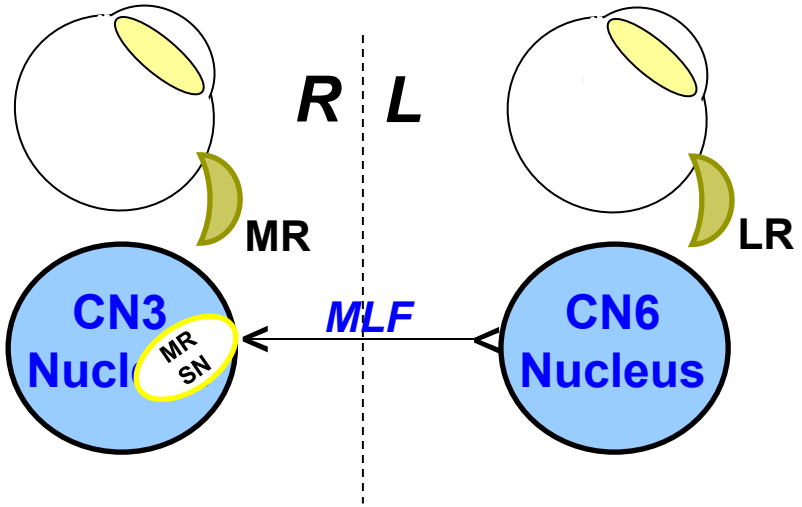

From where to where do the fascicles of the MLF run?

So if the depicted CN6 nucleus is on a pt's left side, the depicted MLF runs to her right MR subnucleus. When the pt endeavors to look to her left, the left CN6 nucleus causes the left LR to contract while also sending impulses (via the MLF) to her right MR subnucleus, which in turn causes the right MR to contract simultaneously—and both eyes shift into left gaze in coordinated fashion.

By causing the contralateral MR to fire simultaneously with the ipsilateral lateral rectus (LR), thus **ensuring both eyes turn into lateral gaze together**

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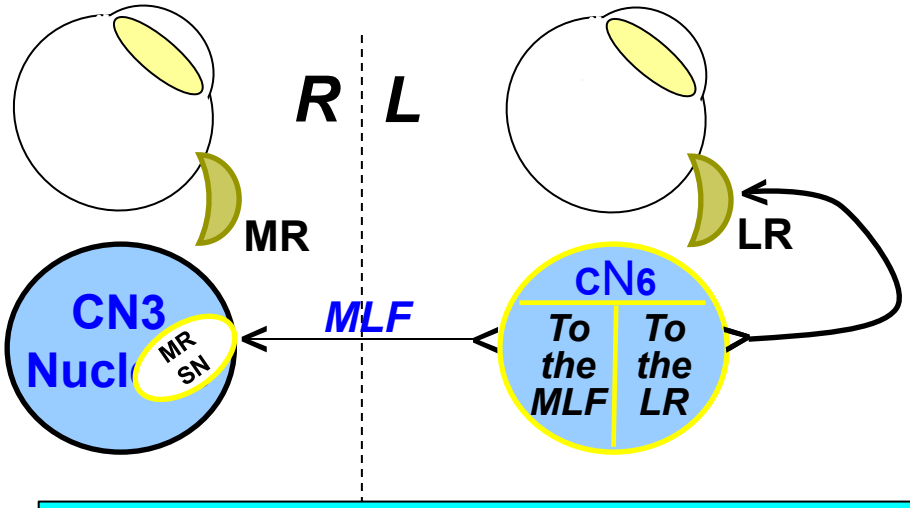

Note that the CN6 nucleus consists of two subpopulations of neurons: those that innervate the ipsilateral LR, and those whose axons will form the MLF and innervate the contralateral MR subnucleus

From where to wh

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runs to her right MF
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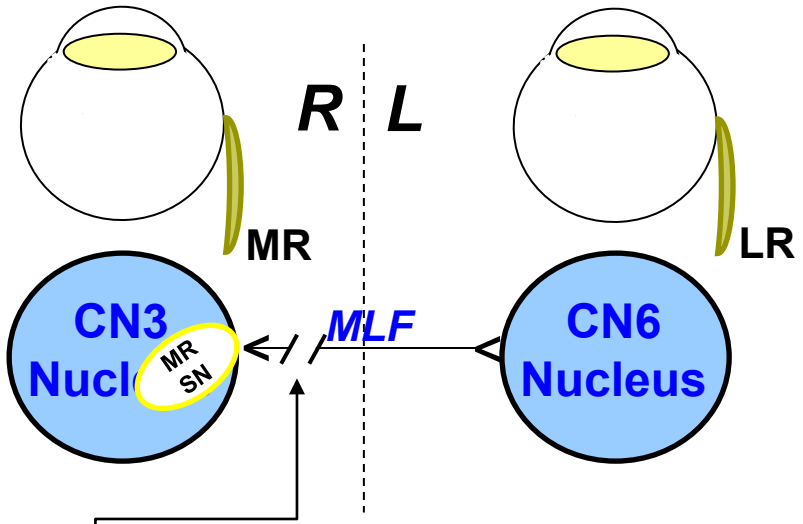

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What effect does a lesion of the MLF have on lateral gaze?

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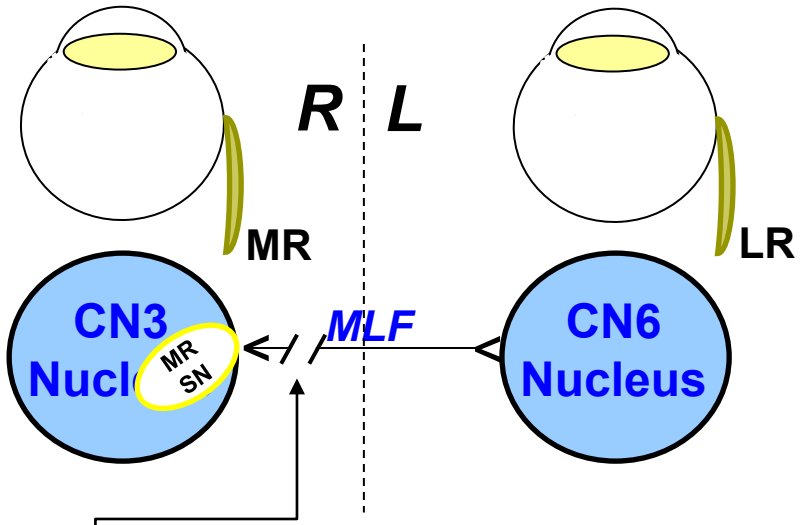

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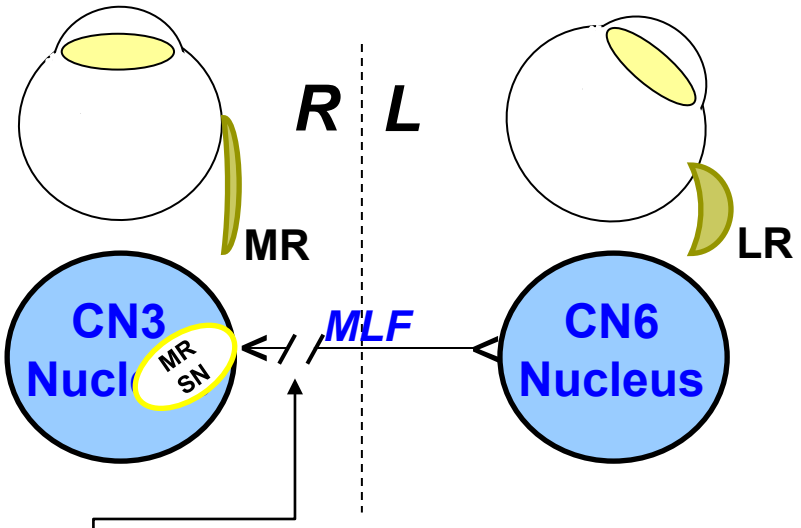

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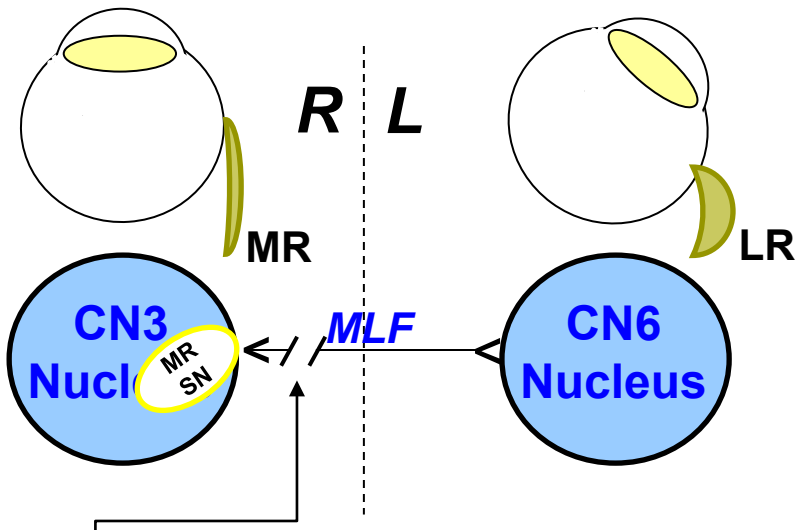

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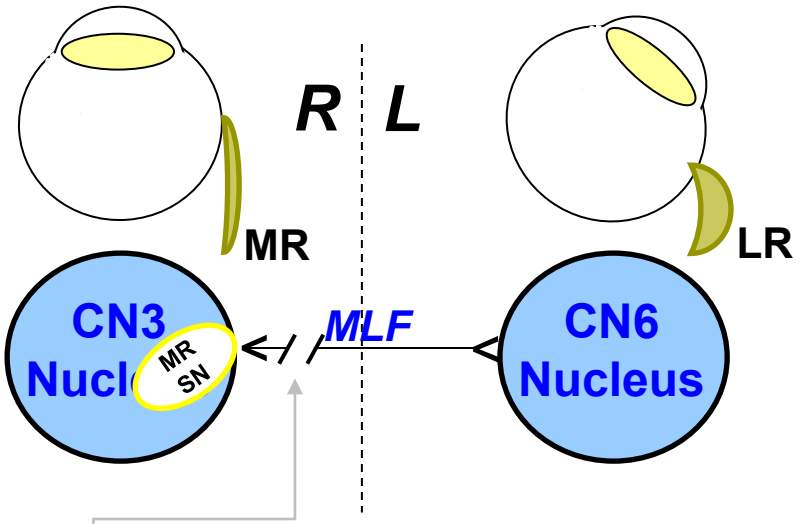

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How does the MLF facilitate lateral gaze coordination?
By cau
ipsilate
lateral gaze together

This is an internuclear ophthalmoplegia (INO)

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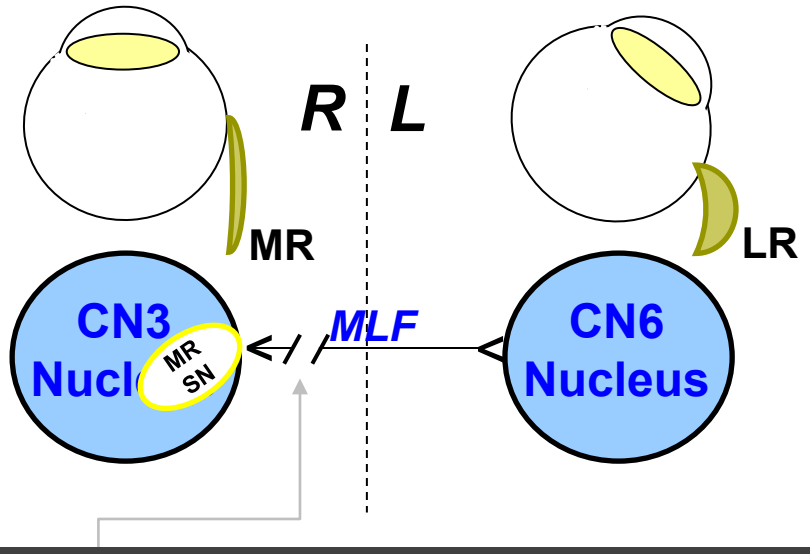

Would this be considered a right *INO, or a* left *INO? What is the rule for naming INOs?*

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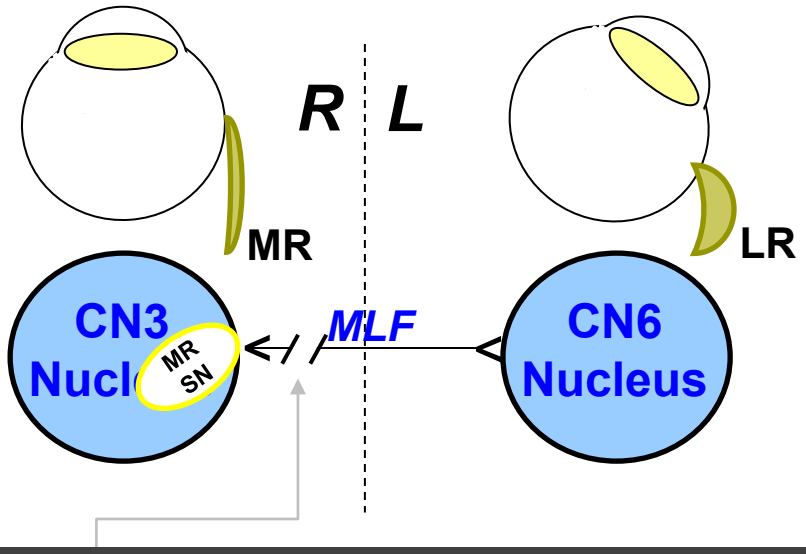

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By convention, INOs are named based on the side with impaired ADduction.

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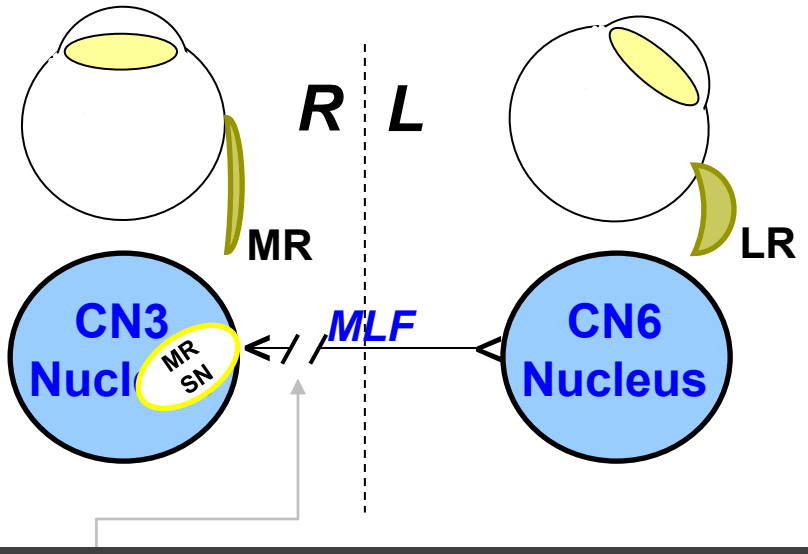

Would this be considered a right *INO, or a* left *INO? What is the rule for naming INOs?*
By convention, INOs are named based on the side with impaired ADduction. Therefore, the scenario as presented would represent a **right INO**.

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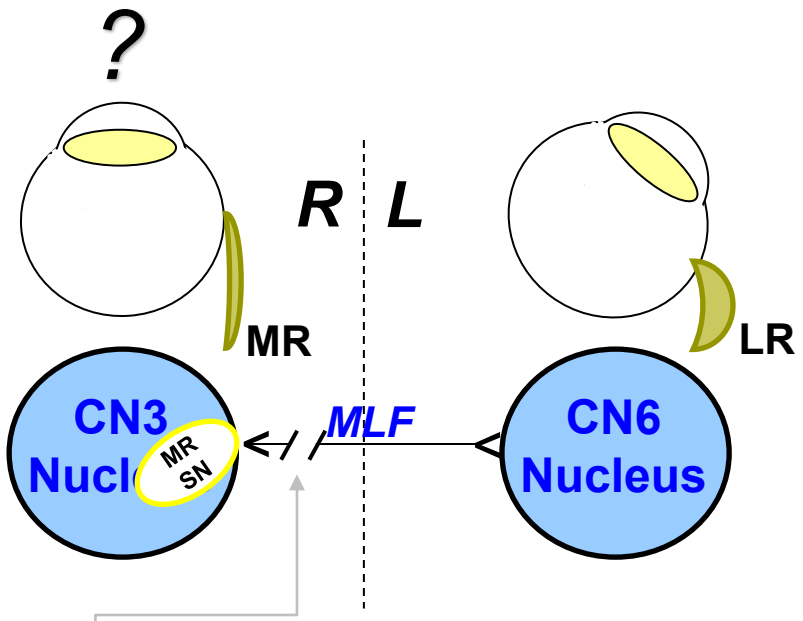

What form does this 'impairment' take? That is, on attempted lateral gaze in an INO pt, what does the adducting eye do?

impaired ADduction of the contralateral eye.

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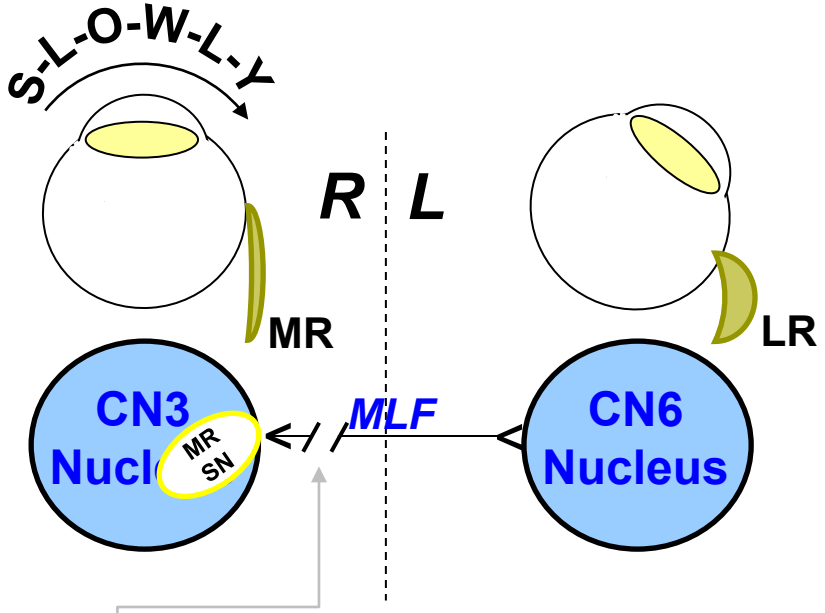

What form does this 'impairment' take? That is, on attempted lateral gaze in an INO pt, what does the adducting eye do?
It adducts, but at a much slower velocity than that of the abduction movement of the fellow eye. (Take note: The *Neuro* book refers to this slowed-saccade phenomenon as the "cardinal sign" of an INO.)

impaired ADduction of the contralateral eye.

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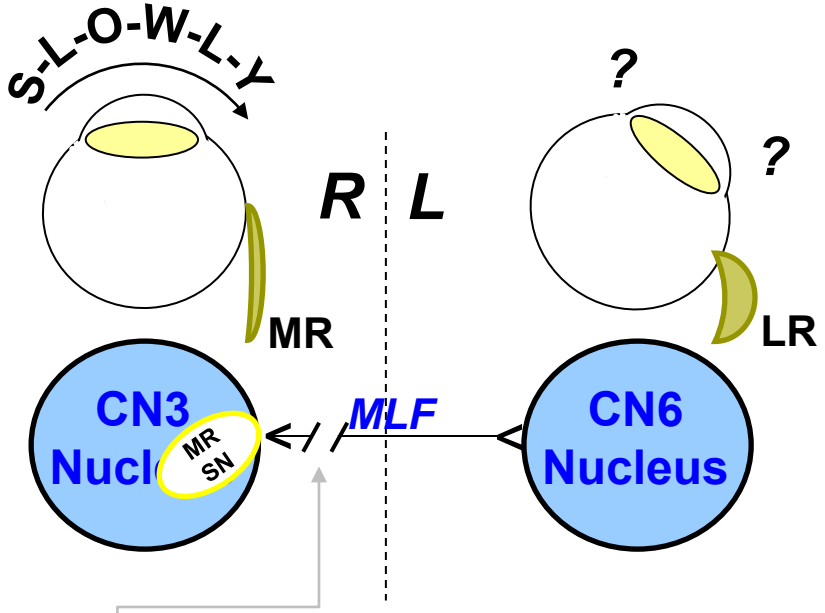

From where to where do the fascicles of the MLF run?
From the C

While it abducts normally, the LR in INO often manifests an uncommon finding--what is it?

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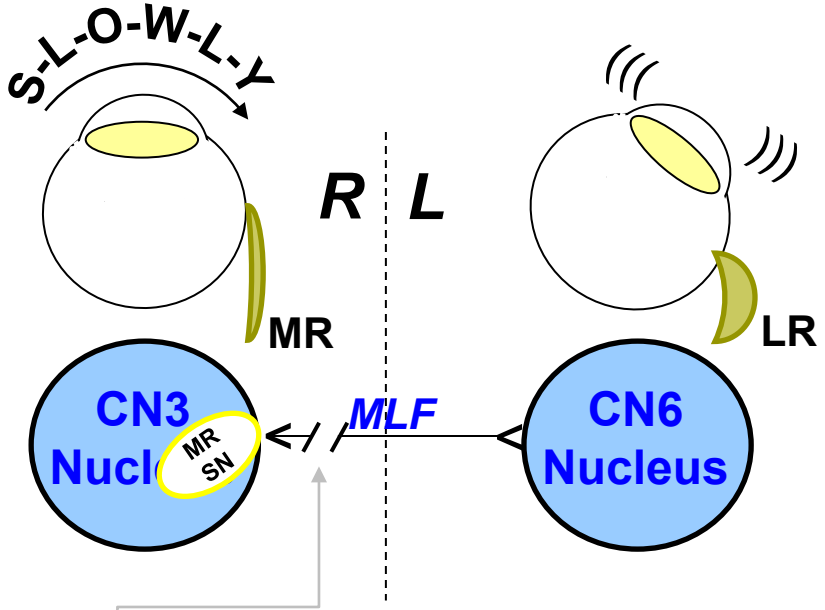

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While it abducts normally, the LR in INO often manifests an uncommon finding--what is it?
The abducting eye often exhibits **end-point nystagmus**

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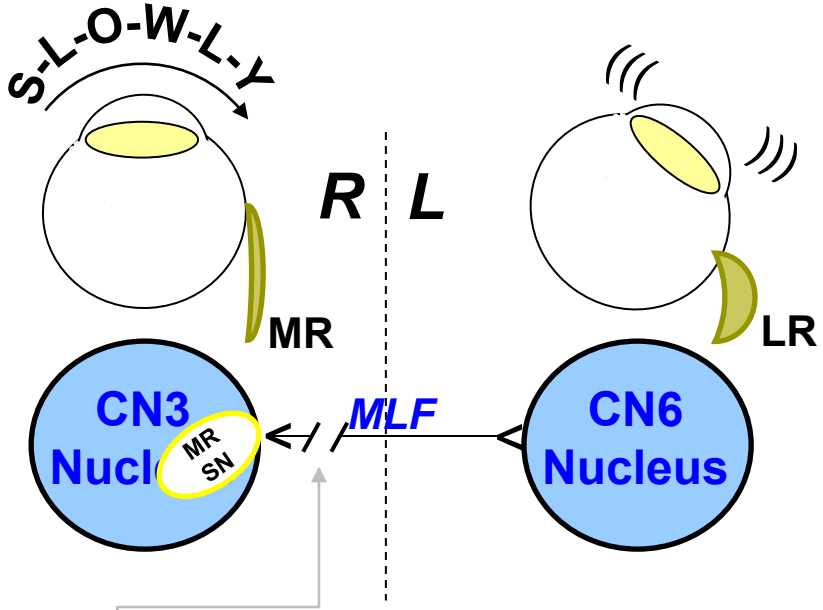

What about convergence movements?

What effe
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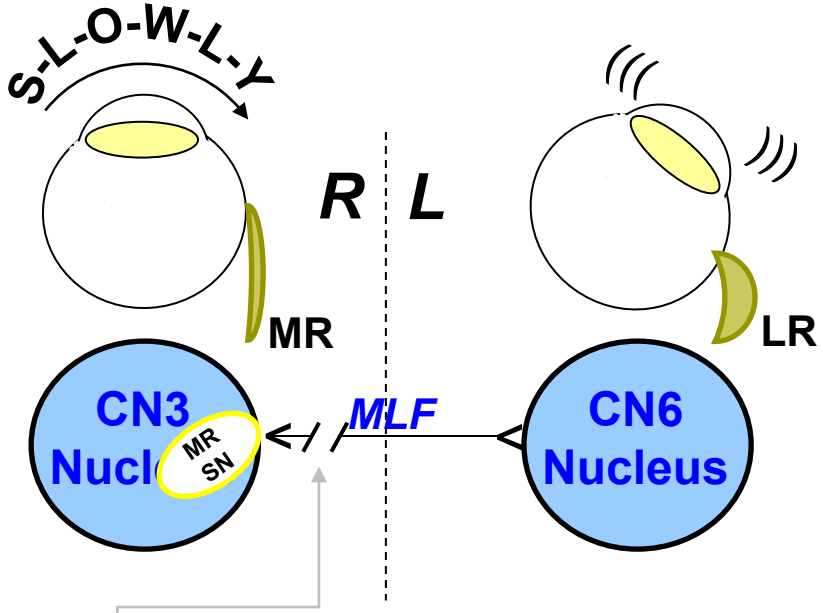

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In theory, convergence should be unaffected by an INO (in practice, it may be impaired)

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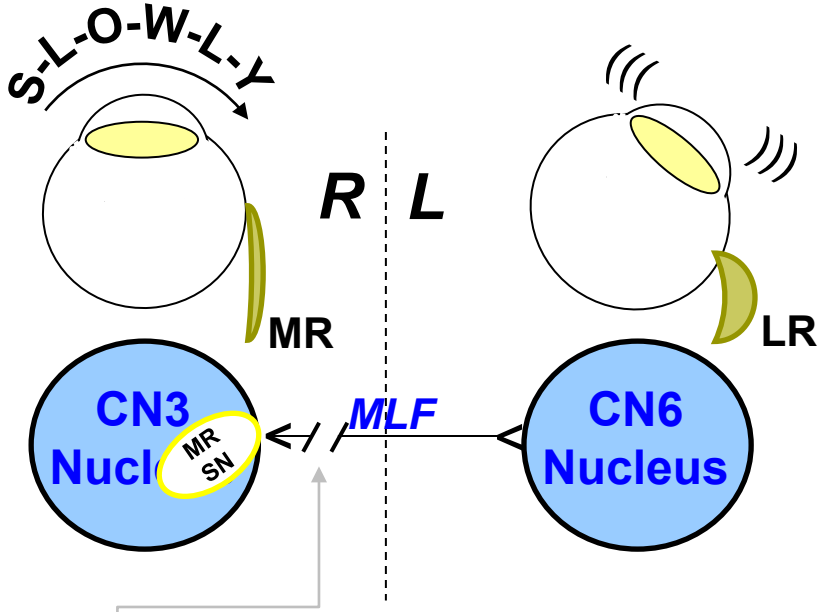

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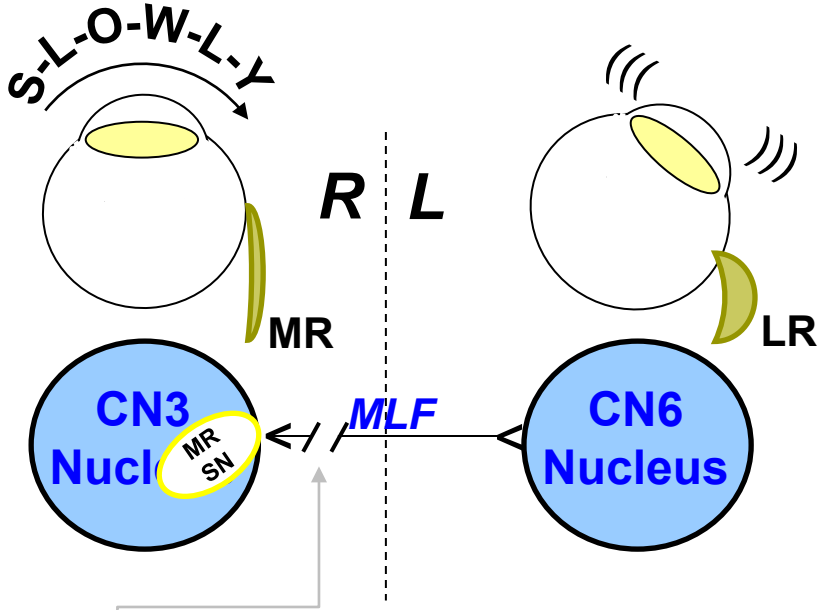

What about convergence movements?
In theory, convergence should be unaffected by an INO (in practice, it may be impaired)

Why would one expect convergence to be unaffected by an INO?
Because neural inputs controlling convergence movements do not reach the MR subnuclei via the MLF

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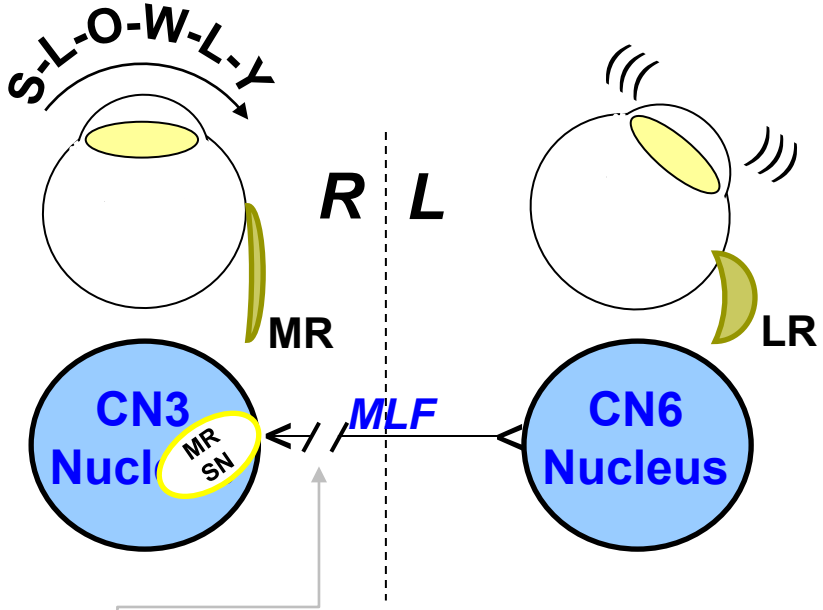

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By cau
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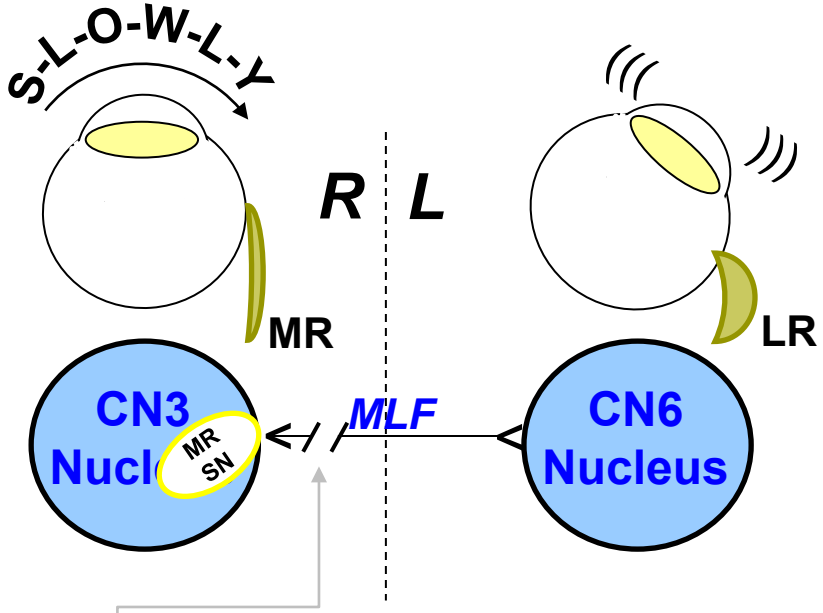

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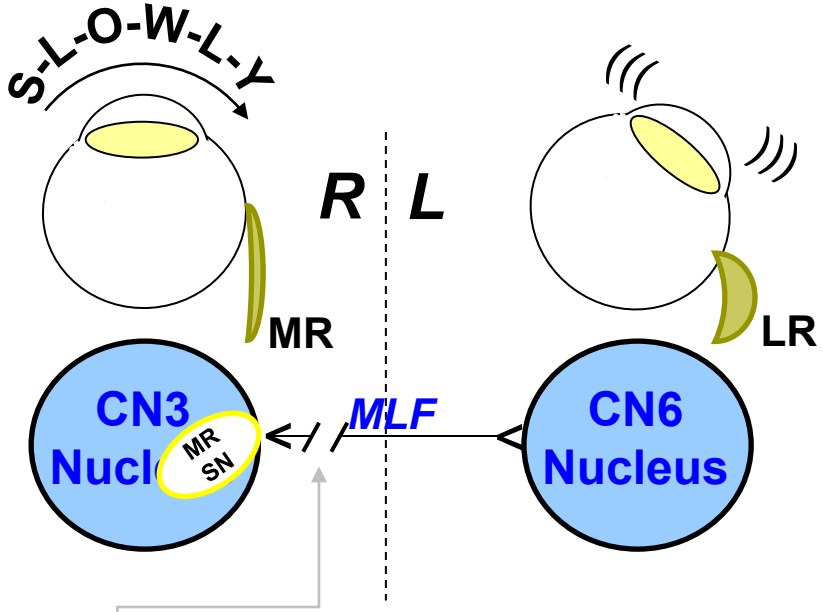

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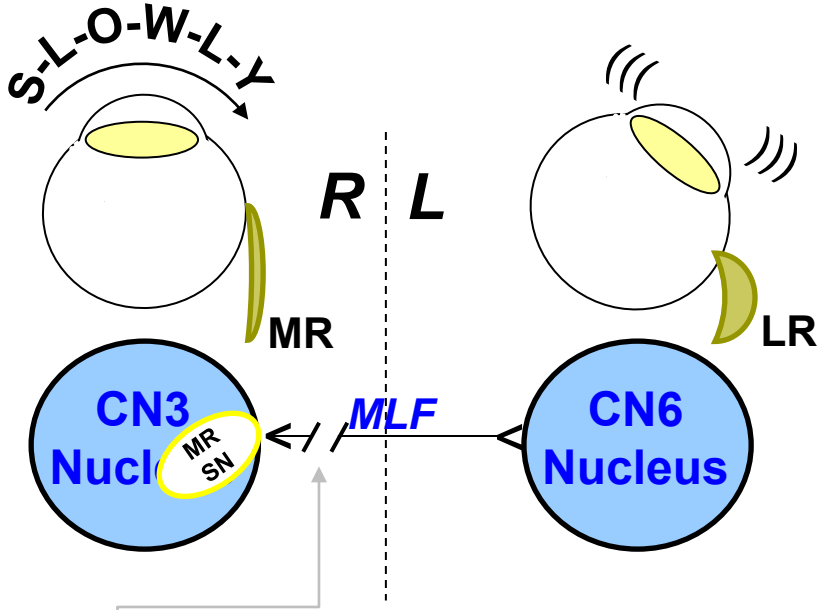

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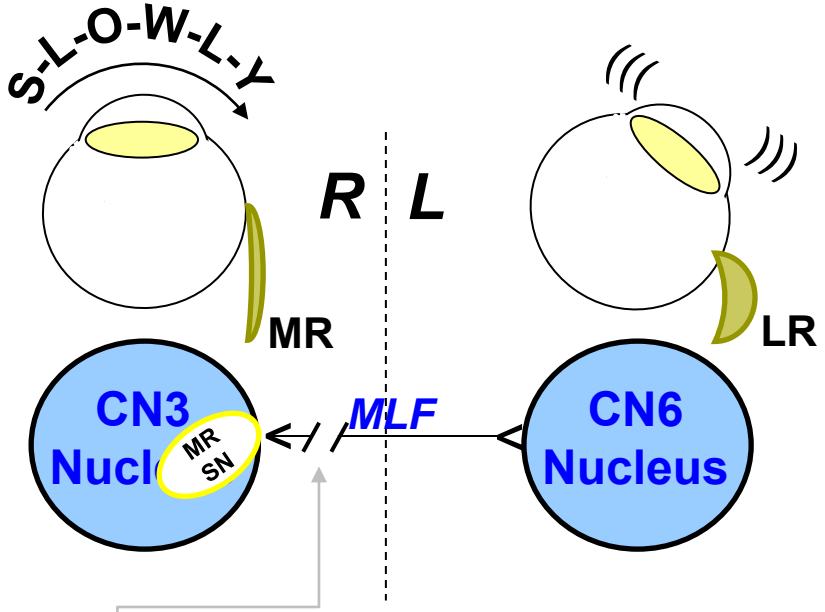

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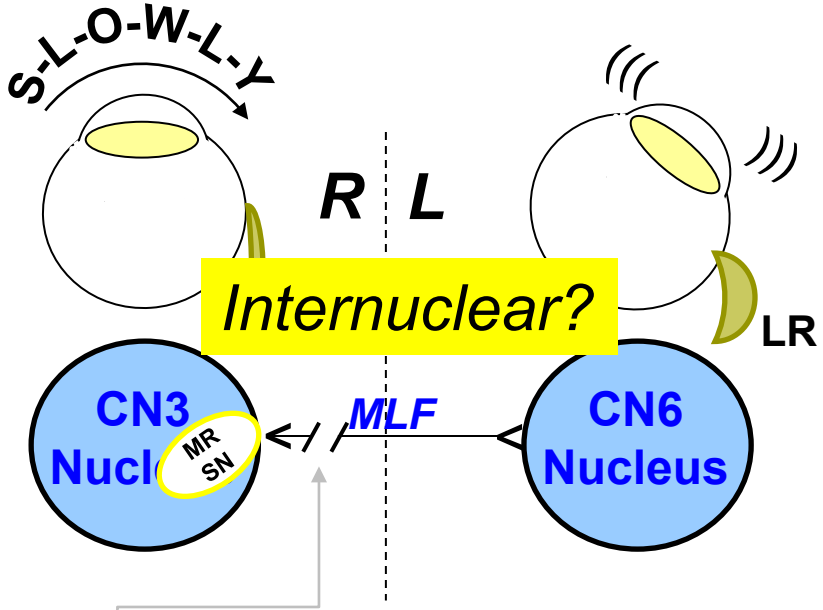

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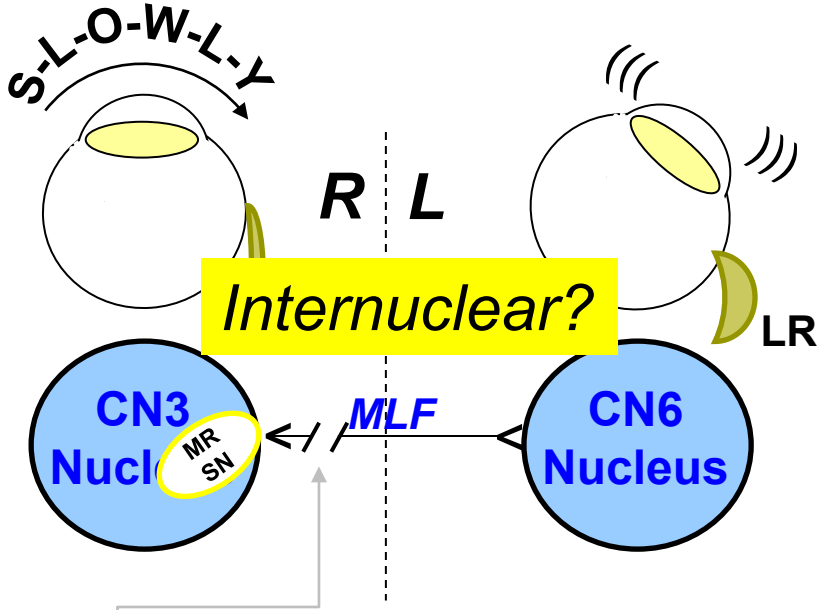

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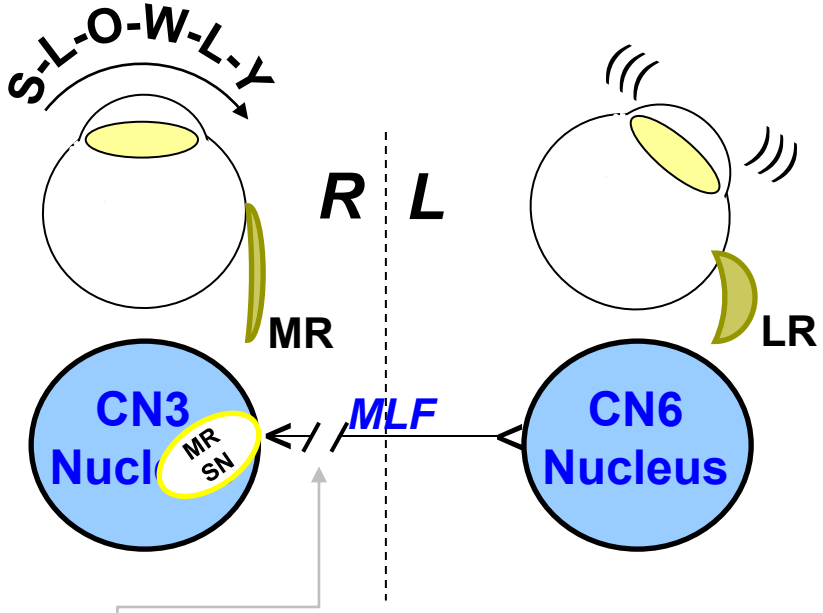

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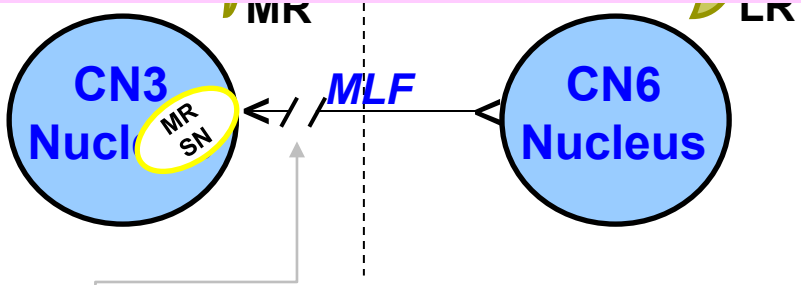

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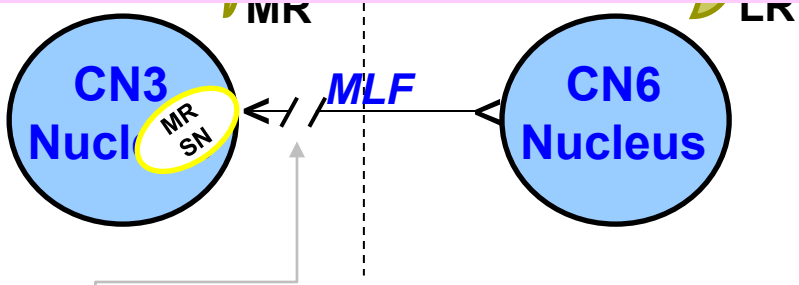

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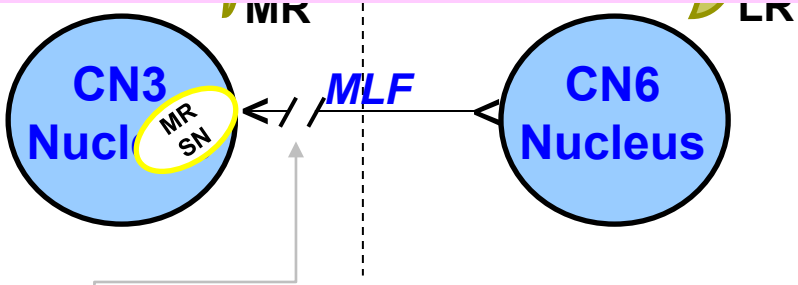

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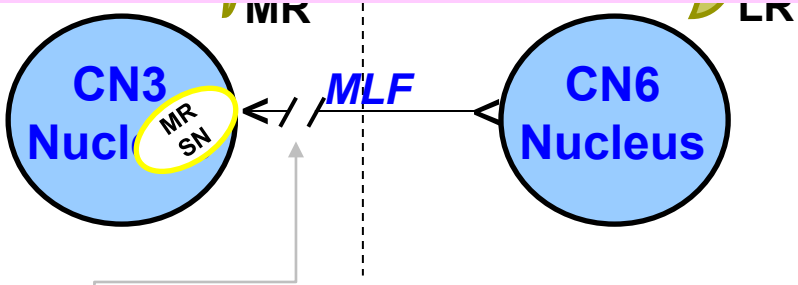

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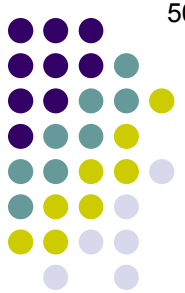

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--Convergence insufficiency
--Convergence spasm

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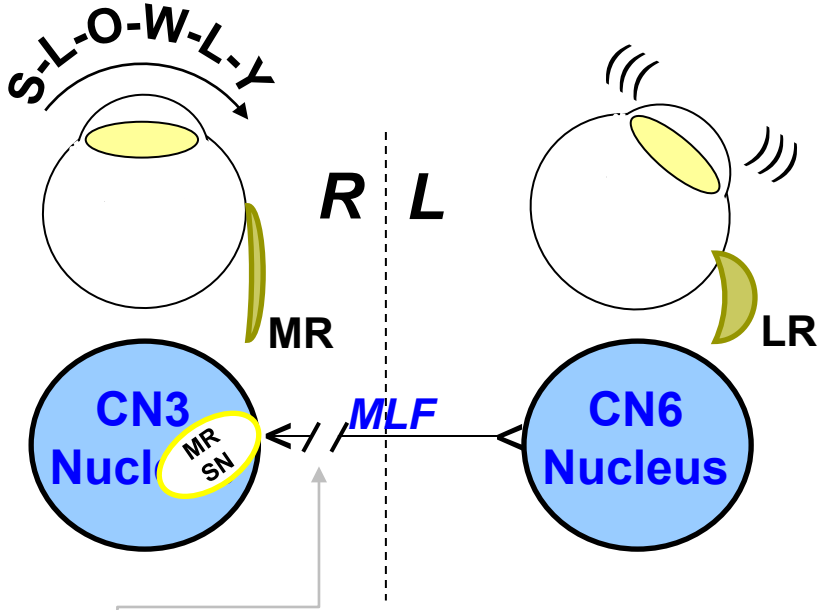

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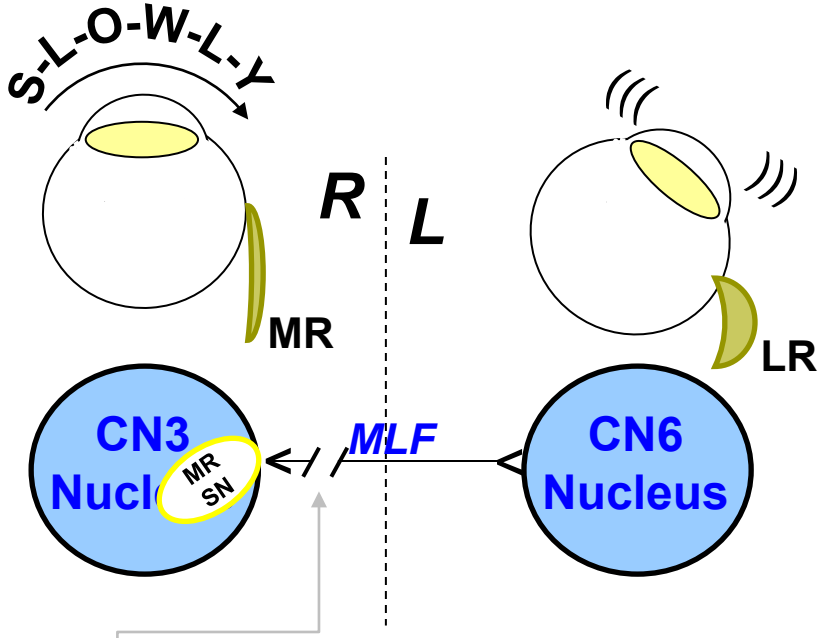

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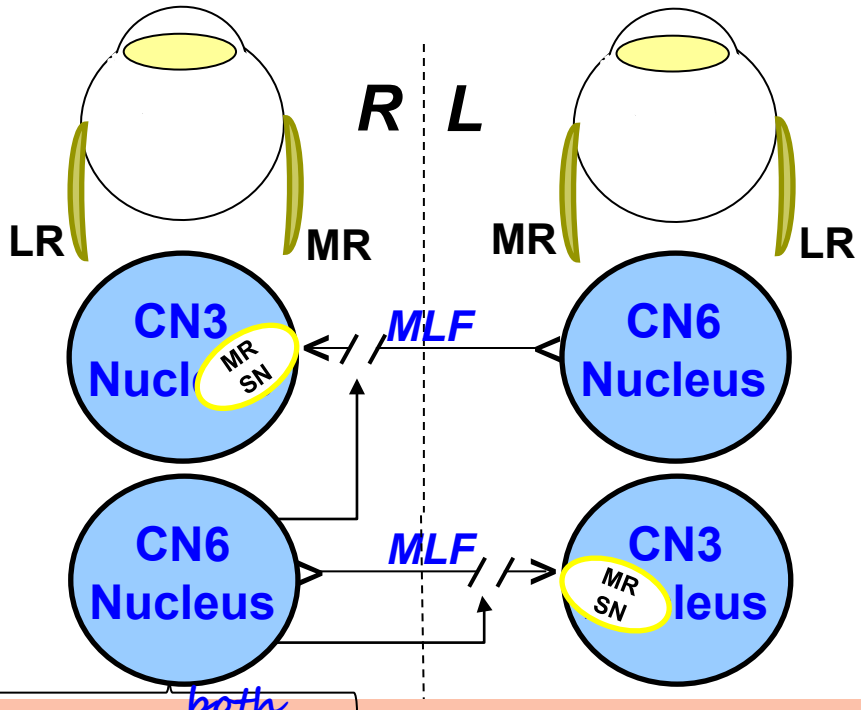

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Is **bilateral** *INO* (BINO) *a thing?*

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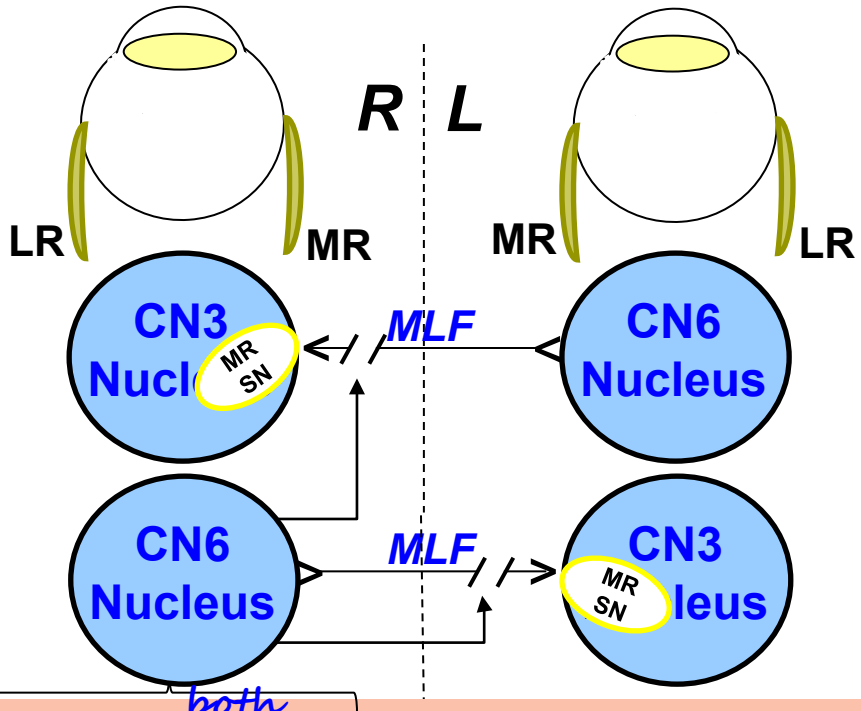

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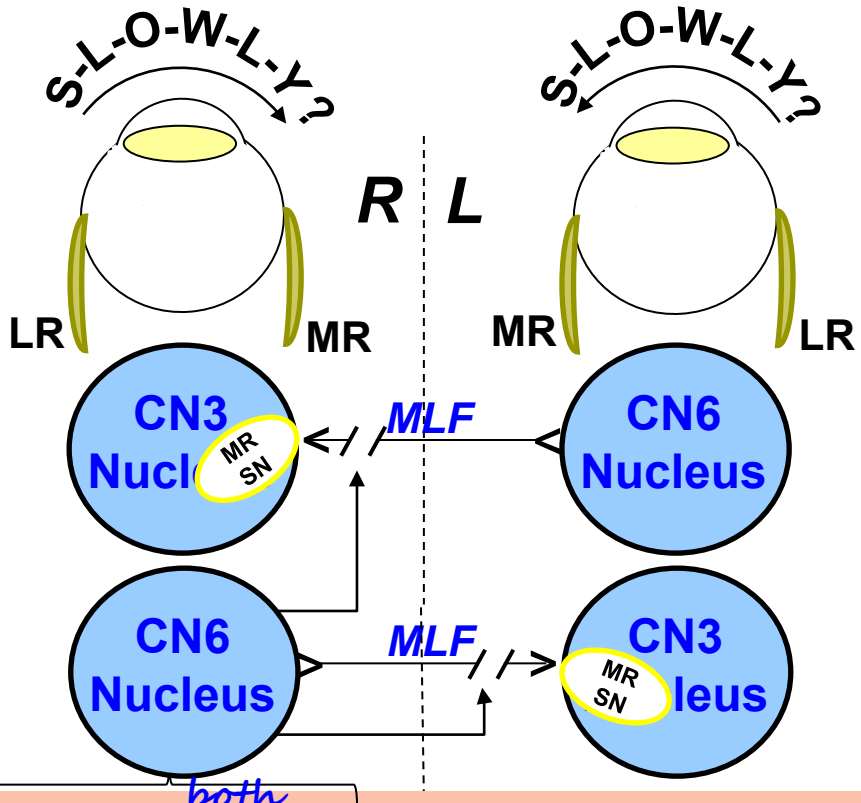

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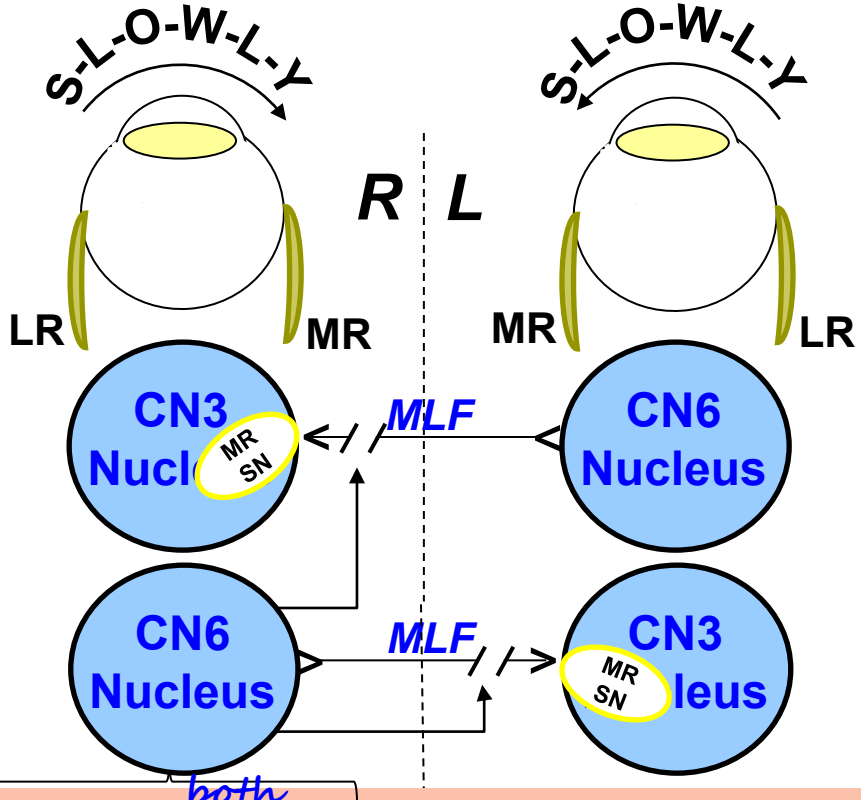

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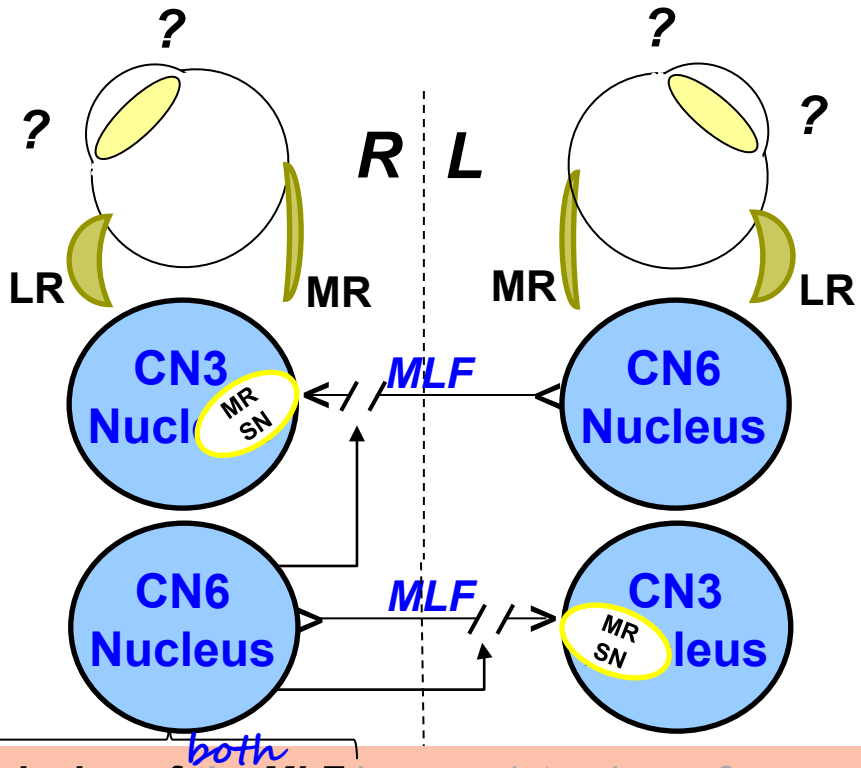

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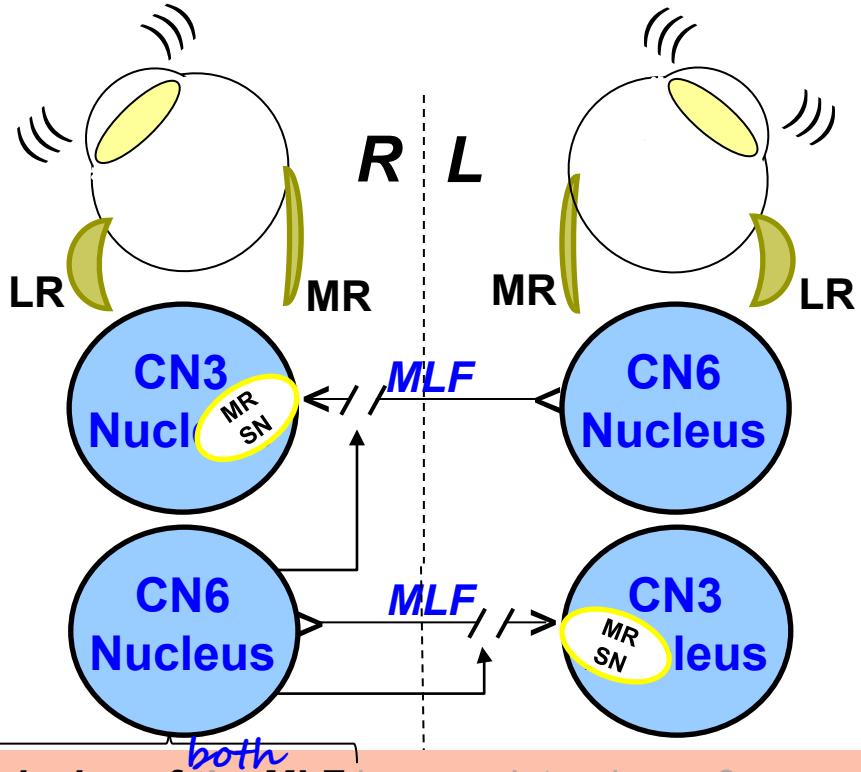

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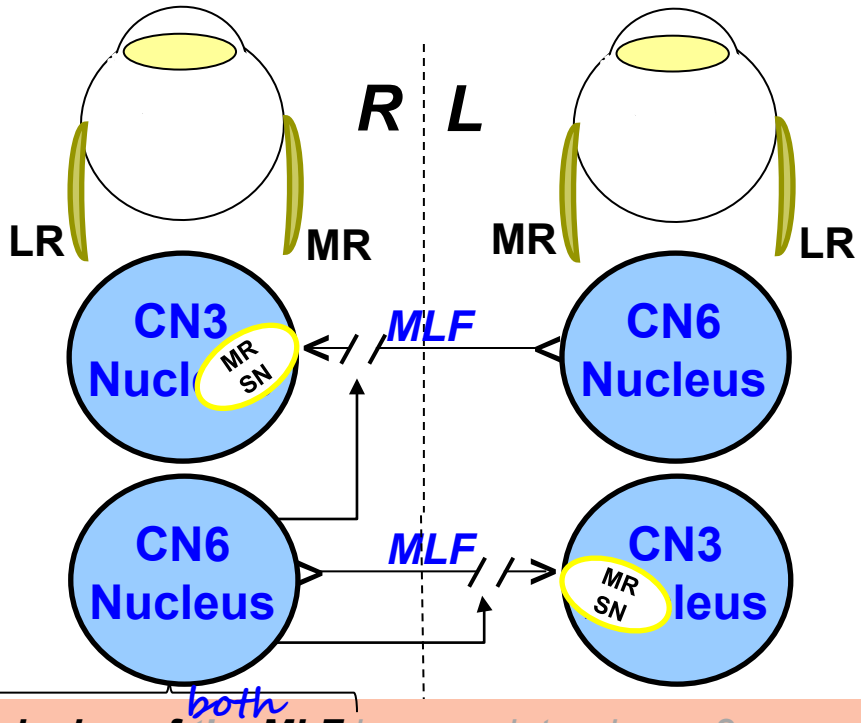

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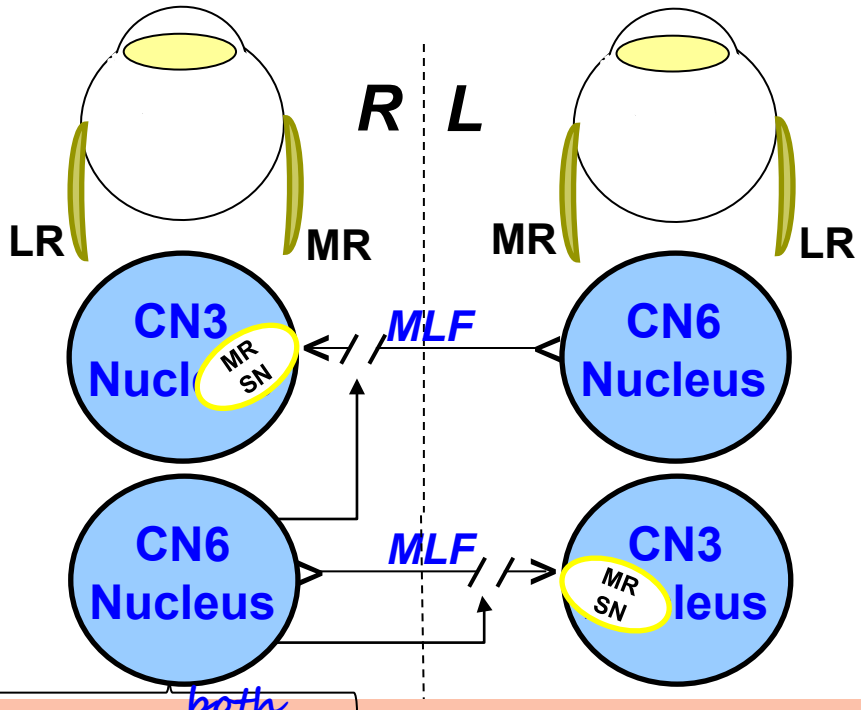

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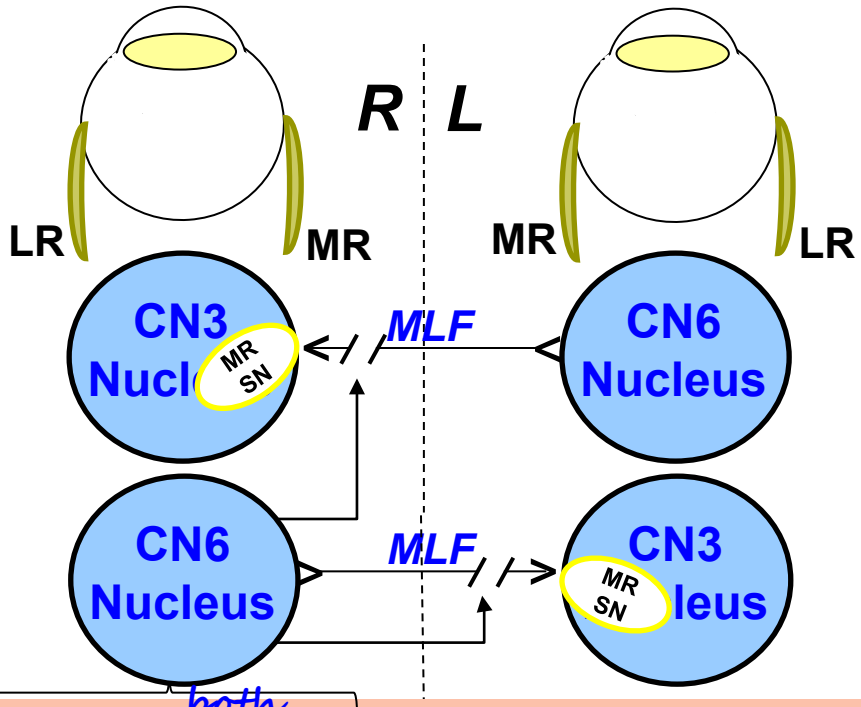

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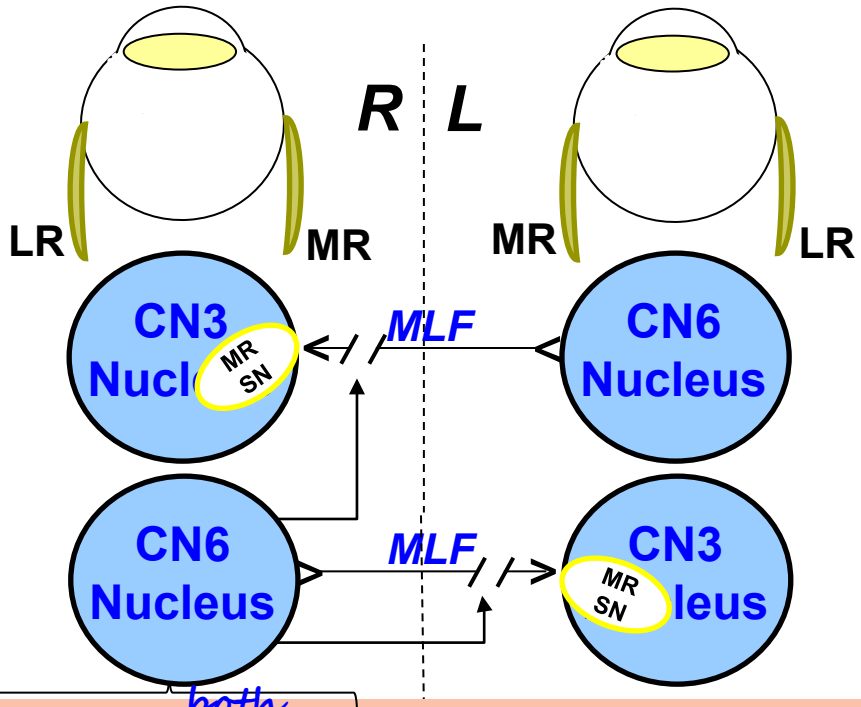
One finding concerns a vertical-gaze issue. What is it? **Vertical nystagmus**

Broadly speaking, what is the etiology of the vertical nystagmus?

a bilate…

*This is ~~an~~ in…

Motility Disorders: *Internuclear Ophthalmoplegia+*



What effect does ***a lesion of the MLFs*** *have on lateral gaze?*

If the … lateral MR …

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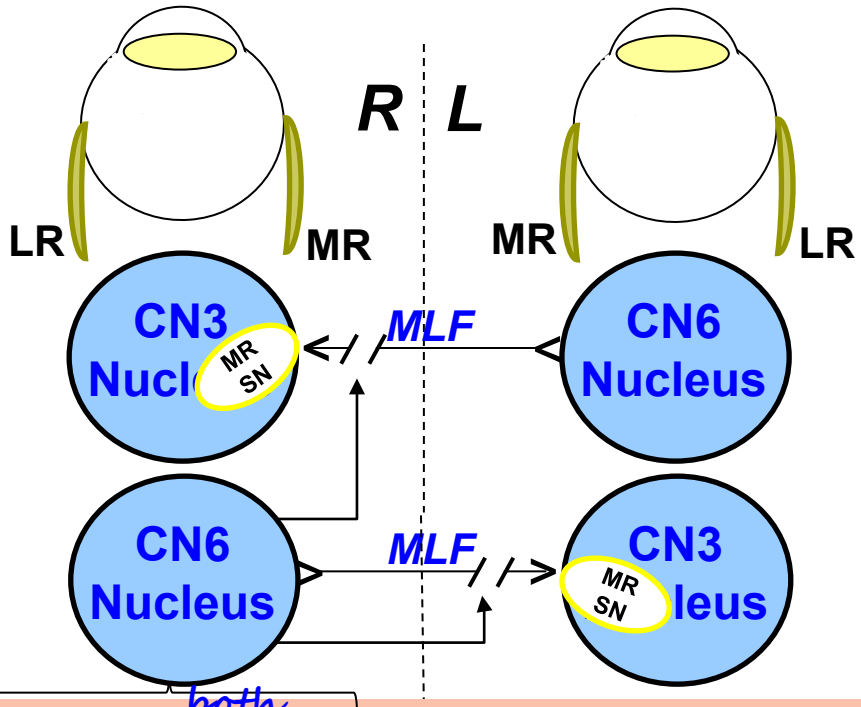
BINO can present with two other findings of interest:
One finding concerns a vertical-gaze issue. What is it? **Vertical nystagmus**

Broadly speaking, what is the etiology of the vertical nystagmus?
Like the skew deviation that can accompany INO, the nystagmus is 2ndry to disruption of input from the [redacted] system

a bilate…

This is an in…

Motility Disorders: *Internuclear Ophthalmoplegia+*



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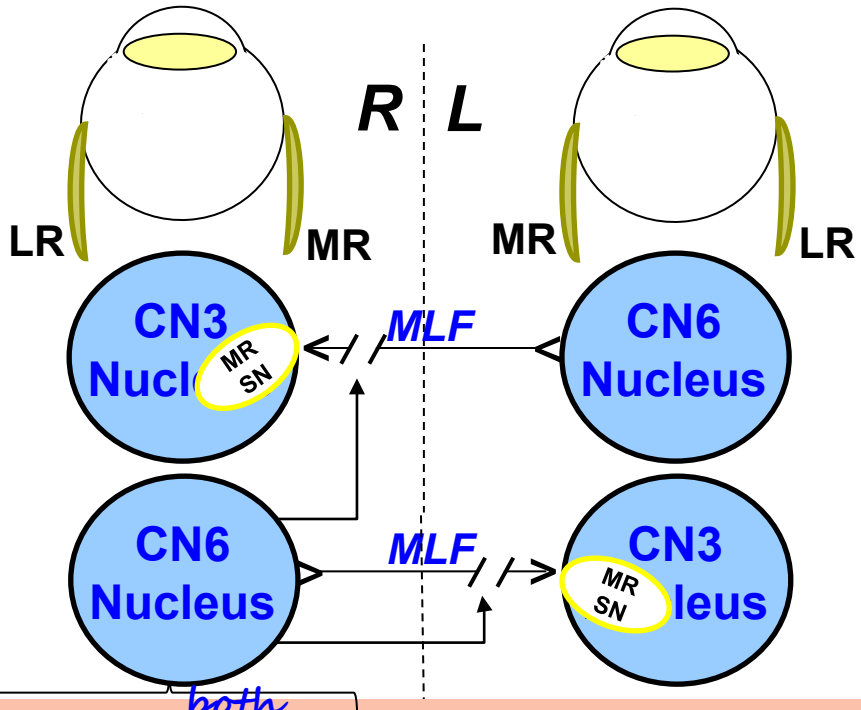
Broadly speaking, what is the etiology of the vertical nystagmus?
Like the skew deviation that can accompany INO, the nystagmus is 2ndry to disruption of input from the vestibular system

a bilate…

This is an in…

Motility Disorders: *Internuclear Ophthalmoplegia+*



What effect does ***a lesion of the MLFs*** *have on lateral gaze?*

If the

MR

Thus

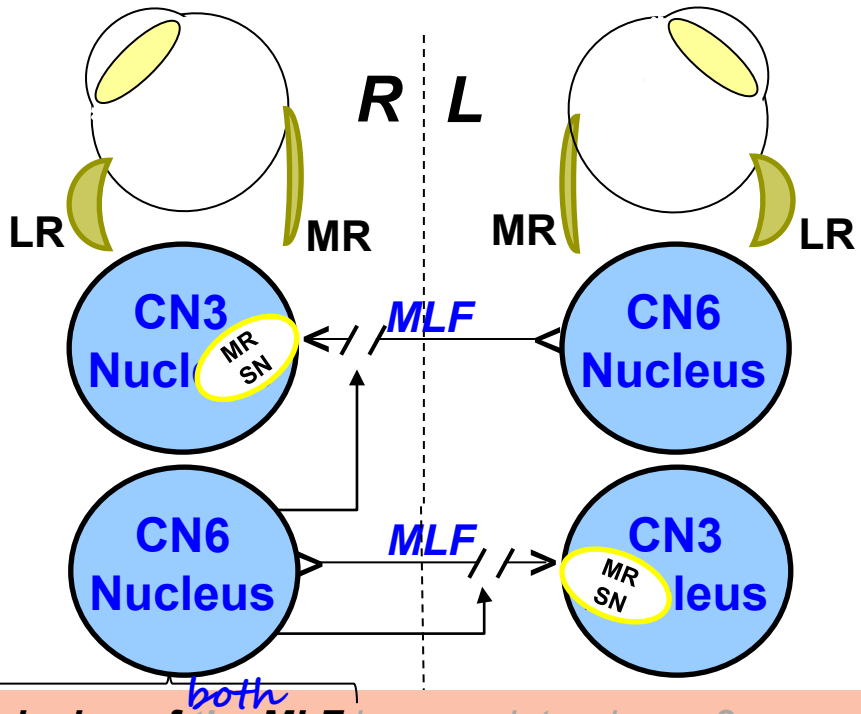
impaired ADduction of the contralateral eye.

BINO can present with two other findings of interest:
One finding concerns a vertical-gaze issue. What is it? **Vertical nystagmus**
The other is a strabismic issue. What is it?

a bilateral BINO

This is ~~an~~ internuclear ophthalmoplegia (~~INO~~)

Motility Disorders: *Internuclear Ophthalmoplegia+*



What effect does ***a lesion of ~~the~~ MLFs*** *have on lateral gaze?*

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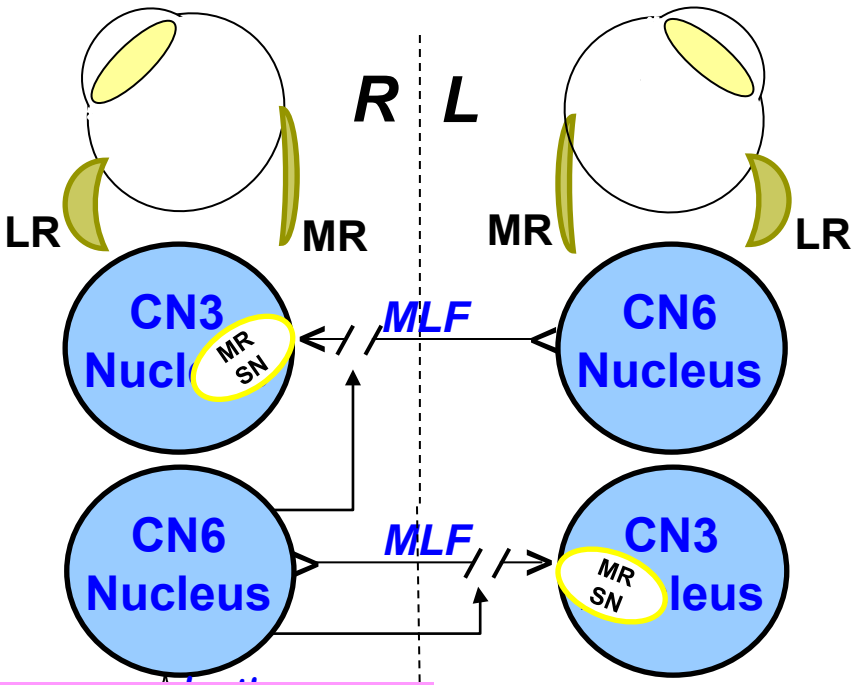
BINO can present with two other findings of interest:
One finding concerns a vertical-gaze issue. What is it? **Vertical nystagmus**
The other is a strabismic issue. What is it? **Large-angle exotropia**

This is ~~an~~ a bilateral internuclear ophthalmoplegia (~~INO~~ BINO)

Motility Disorders: *Internuclear Ophthalmoplegia+*



What term is used to describe the appearance of individuals with exotropia in BINO?

on lateral gaze?

of interest:

What is it? **Vertical nystagmus**

Large-angle exotropia

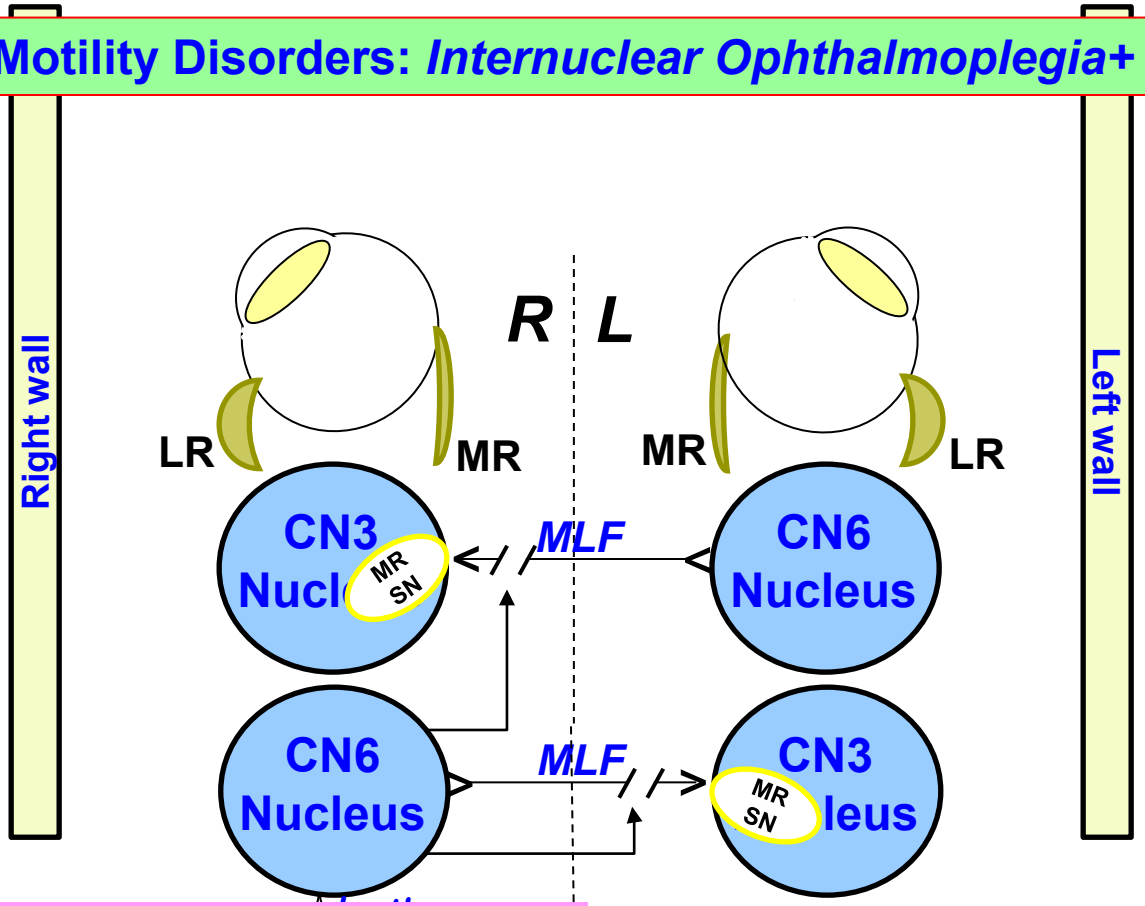
, but

impaired ADduction of the contralateral eye.

a bilateral BINO

This is ~~an~~ internuclear ophthalmoplegia (~~INO~~)

Motility Disorders: *Internuclear Ophthalmoplegia+*



What term is used to describe the appearance of individuals with exotropia in BINO?
The term is 'wall eyed.'

on lateral gaze?

of interest:

What is it? **Vertical nystagmus**

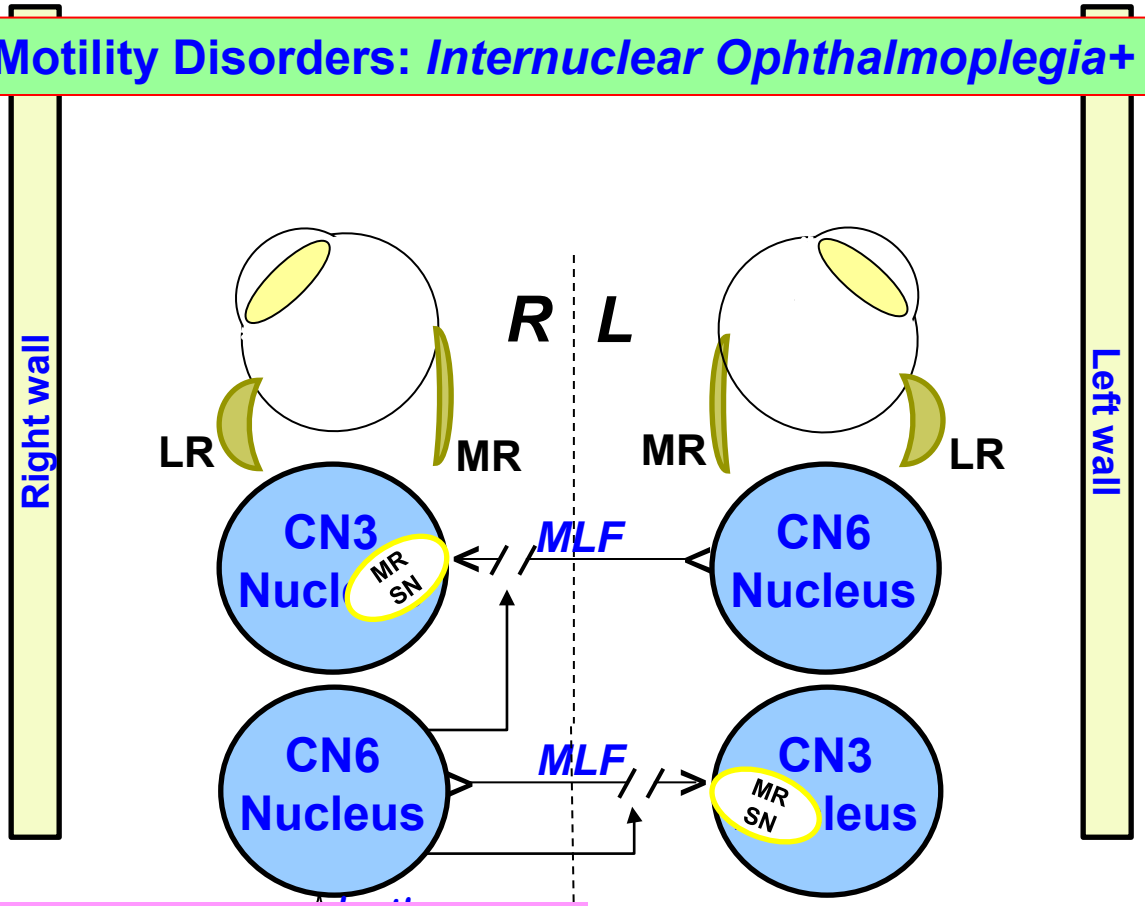
Large-angle exotropia

impaired ADduction of the contralateral eye.

a bilateral *BINO*

This is ~~an~~ internuclear ophthalmoplegia (~~INO~~)

Motility Disorders: *Internuclear Ophthalmoplegia+*



What term is used to describe the appearance of individuals with exotropia in BINO?
The term is 'wall eyed.' Thus, these individuals are said to have a 'wall-eyed bilateral INO' (WEBINO).

on lateral gaze?

of interest:

What is it? **Vertical nystagmus**

Large-angle exotropia

, but

impaired ADduction of the contralateral eye.

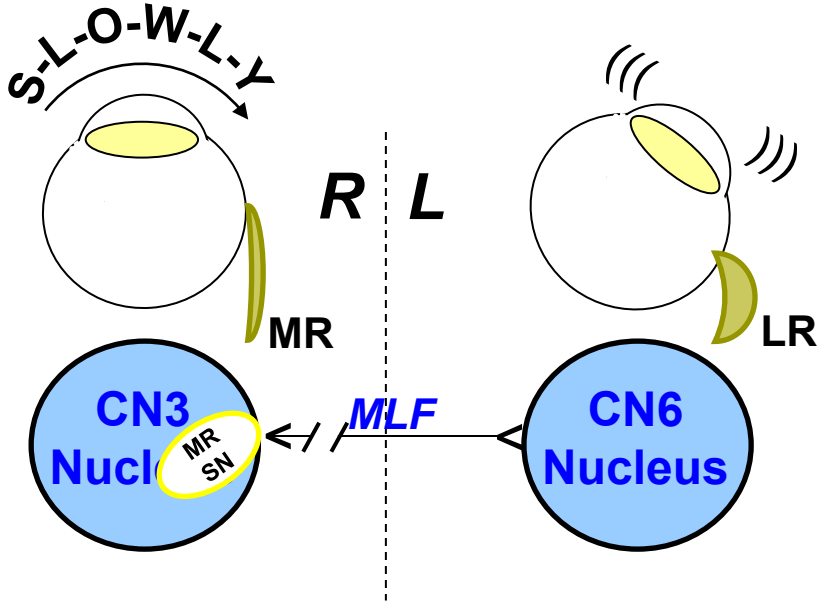
wall-eyed

a bilateral

WEBINO

This is ~~an~~ internuclear ophthalmoplegia (~~INO~~)

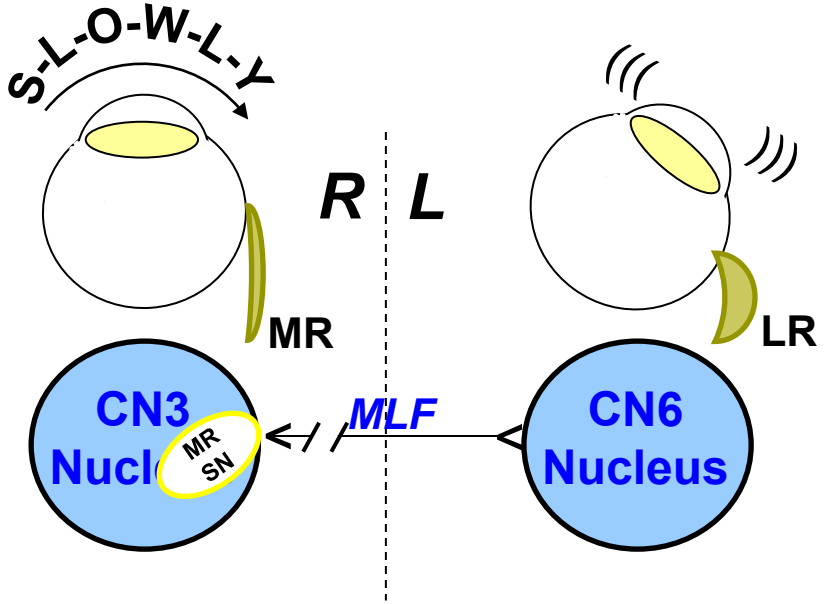
Motility Disorders: *Internuclear Ophthalmoplegia+*



What is the etiology underlying INO?

This is an internuclear ophthalmoplegia (INO)

Motility Disorders: *Internuclear Ophthalmoplegia+*



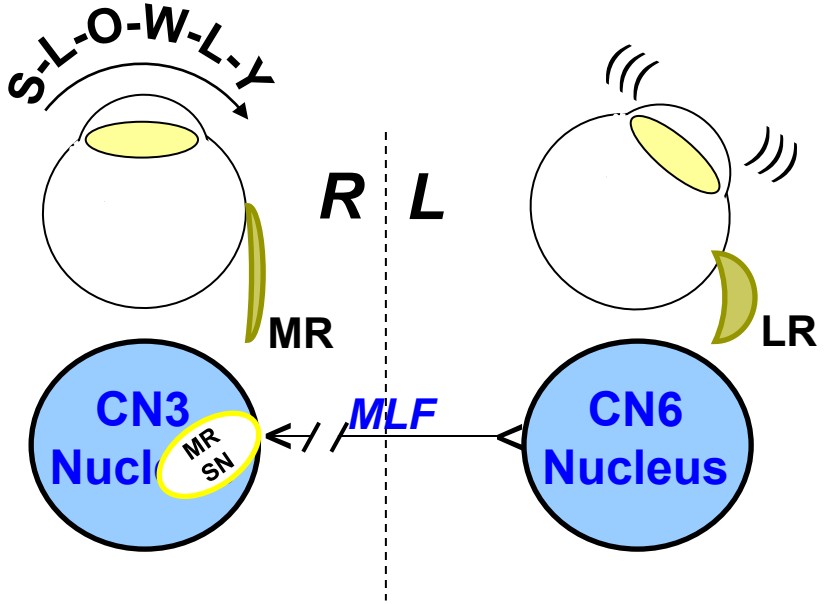
What is the etiology underlying INO?

That is usually a function of pt

age?
gender?
ethnicity?

This is an internuclear ophthalmoplegia (INO)

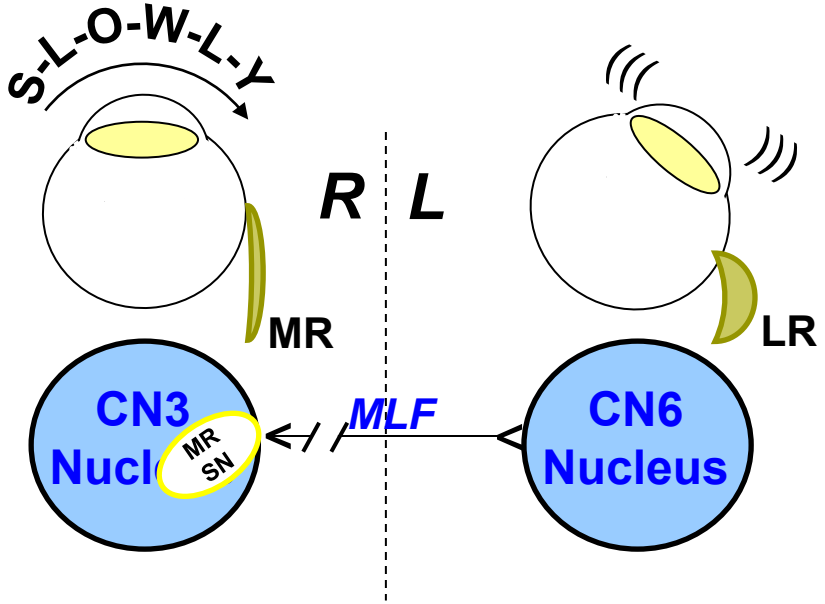
Motility Disorders: *Internuclear Ophthalmoplegia+*



What is the etiology underlying INO?
That is usually a function of pt age:

This is an internuclear ophthalmoplegia (INO)

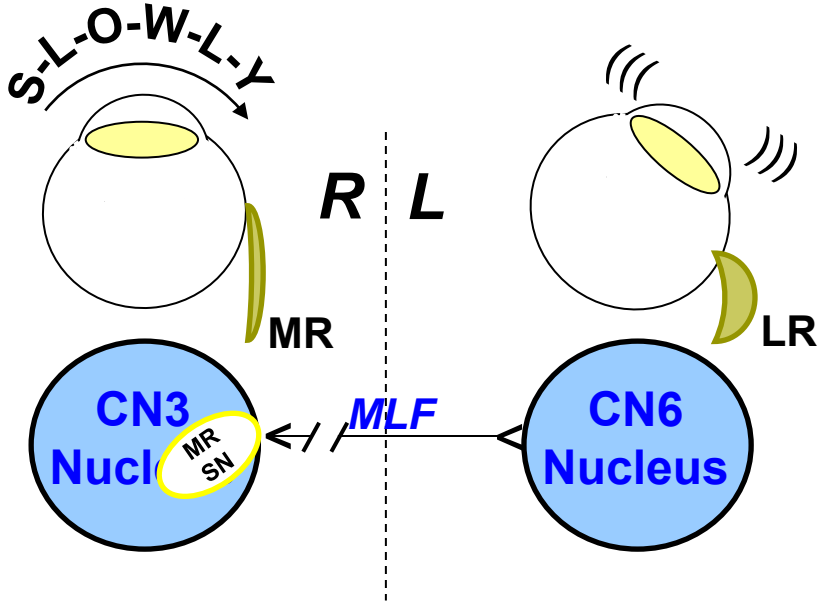
Motility Disorders: *Internuclear Ophthalmoplegia+*



What is the etiology underlying INO?
That is usually a function of pt age:
--In a teen/young adult, it is likely…

This is an internuclear ophthalmoplegia (INO)

Motility Disorders: *Internuclear Ophthalmoplegia+*



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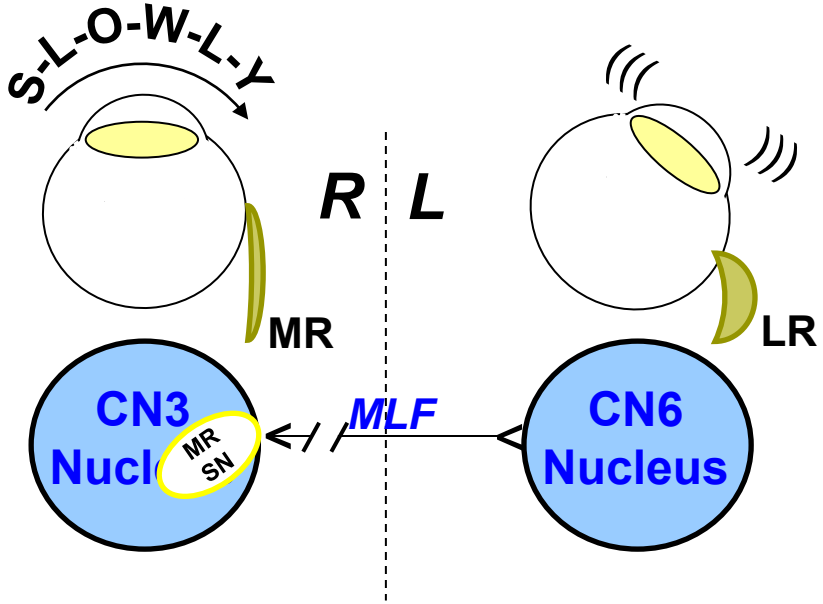
--In a teen/young adult, it is likely…demyelinating dz

This is an internuclear ophthalmoplegia (INO)

Motility Disorders: *Internuclear Ophthalmoplegia+*



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That is usually a function of pt age:
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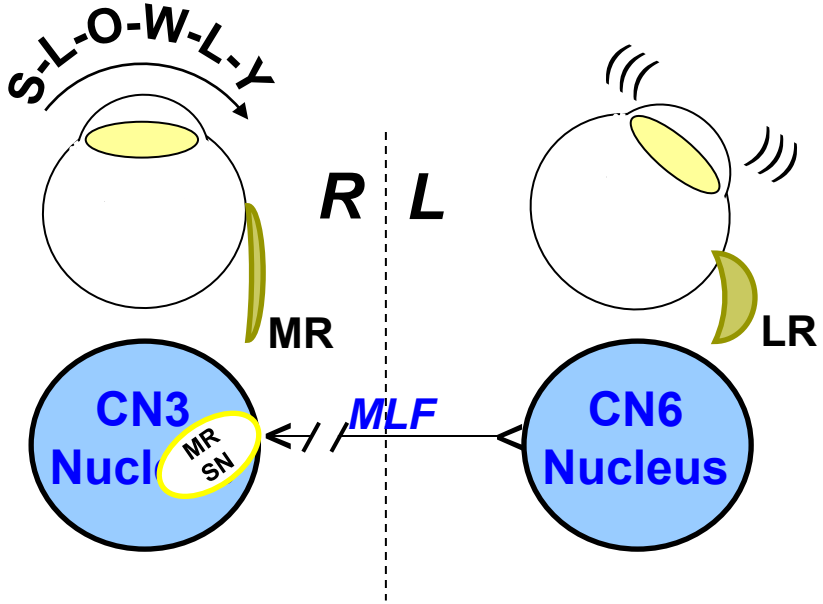
--In an older adult, it is likely 2ndry to a…

This is an internuclear ophthalmoplegia (INO)

Motility Disorders: *Internuclear Ophthalmoplegia+*



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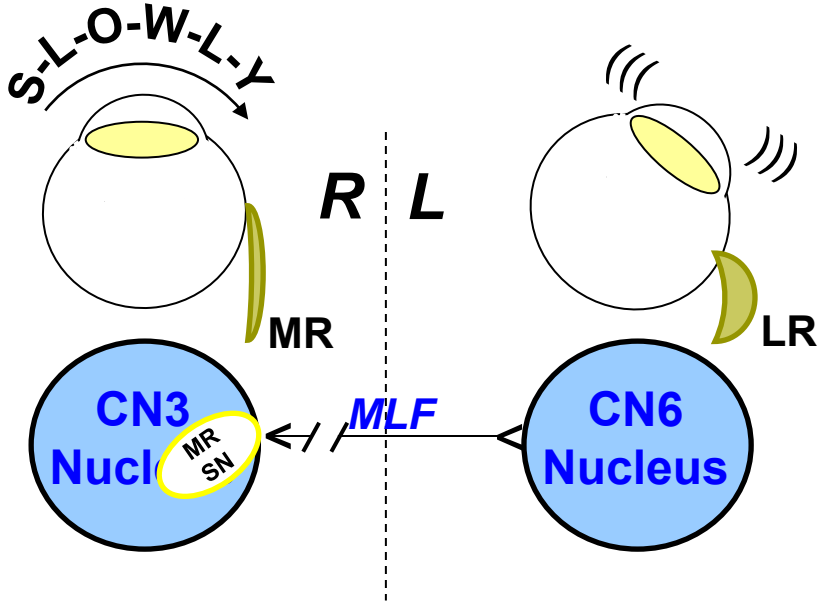
--In a teen/young adult, it is likely…demyelinating dz
--In an older adult, it is likely 2ndry to a…CVA

This is an internuclear ophthalmoplegia (INO)

Motility Disorders: *Internuclear Ophthalmoplegia+*



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What condition/etiology must always be considered?

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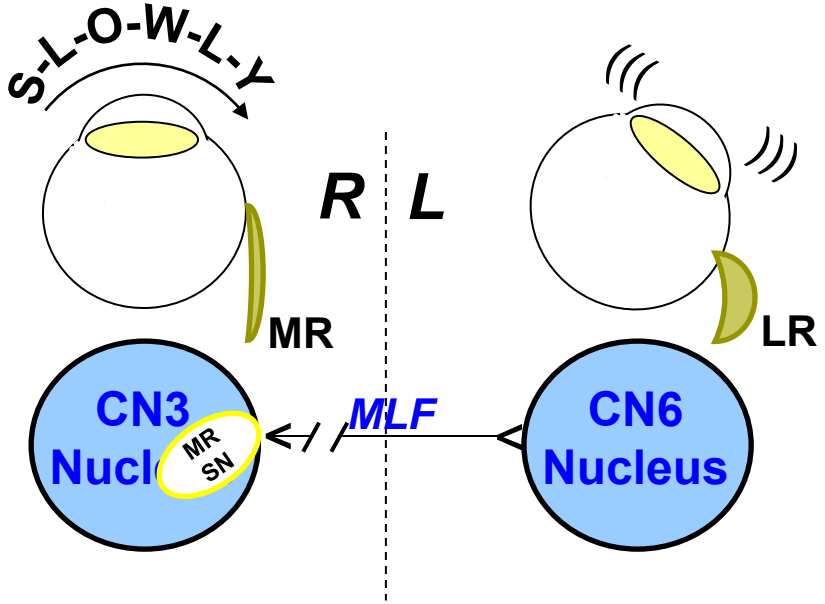
Motility Disorders: *Internuclear Ophthalmoplegia+*



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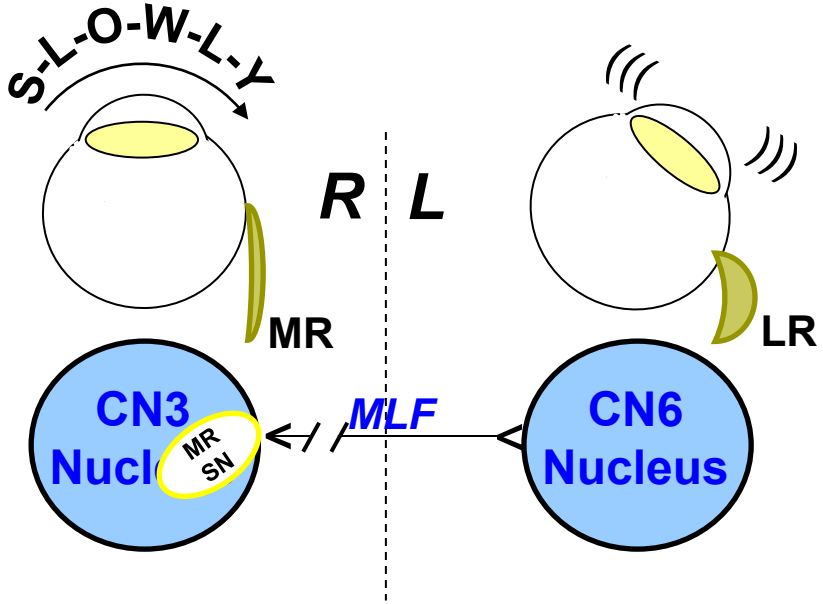
What condition/etiology must always be considered?
A pseudo-INO 2ndry to abb.

This is an internuclear ophthalmoplegia (INO)

Motility Disorders: *Internuclear Ophthalmoplegia+*



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What condition/etiology must always be considered?
A pseudo-INO 2ndry to MG

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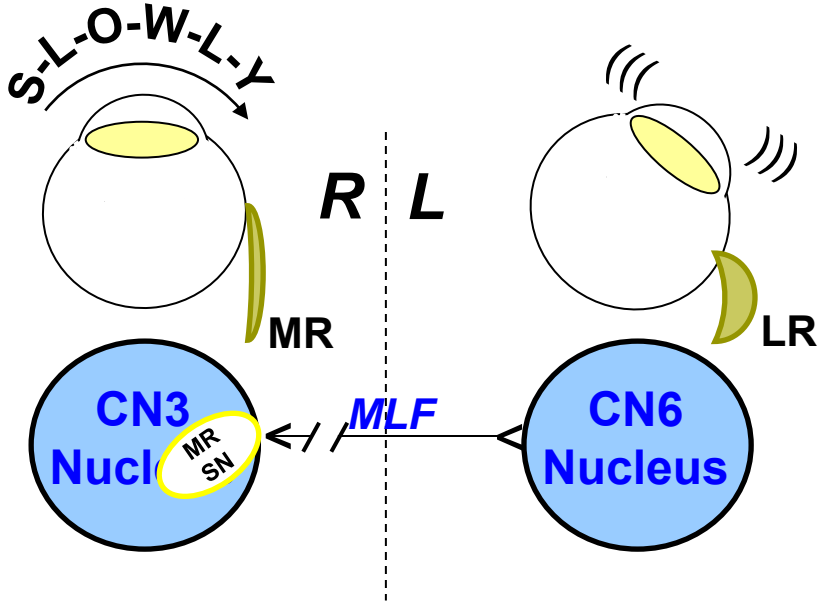
Motility Disorders: *Internuclear Ophthalmoplegia+*



What is the etiology underlying INO?

What aspects of the presentation of an 'INO' that would indicate that it's pseudo-INO 2ndry to MG?

linating dz
CVA

What condition/etiology must always be considered?

A pseudo-INO 2ndry to MG

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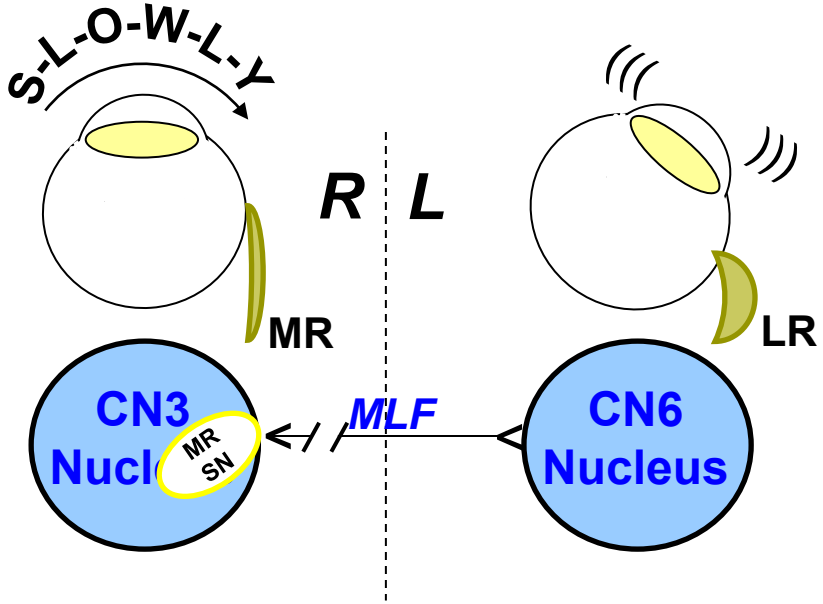
Motility Disorders: *Internuclear Ophthalmoplegia+*



What is the etiology underlying INO?

What aspects of the presentation of an 'INO' that would indicate that it's pseudo-INO 2ndry to MG?
--The absence of [redacted] in the ABducting eye

linating dz
CVA

What condition/etiology must always be considered?

A pseudo-INO 2ndry to MG

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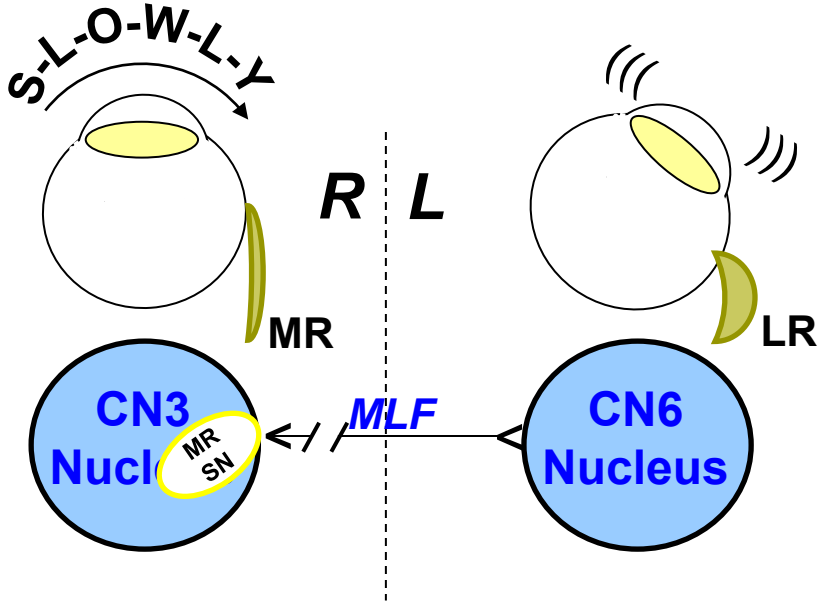
Motility Disorders: *Internuclear Ophthalmoplegia+*



What is the etiology underlying INO?

What aspects of the presentation of an 'INO' that would indicate that it's pseudo-INO 2ndry to MG?
--The absence of end-point nystagmus in the ABducting eye

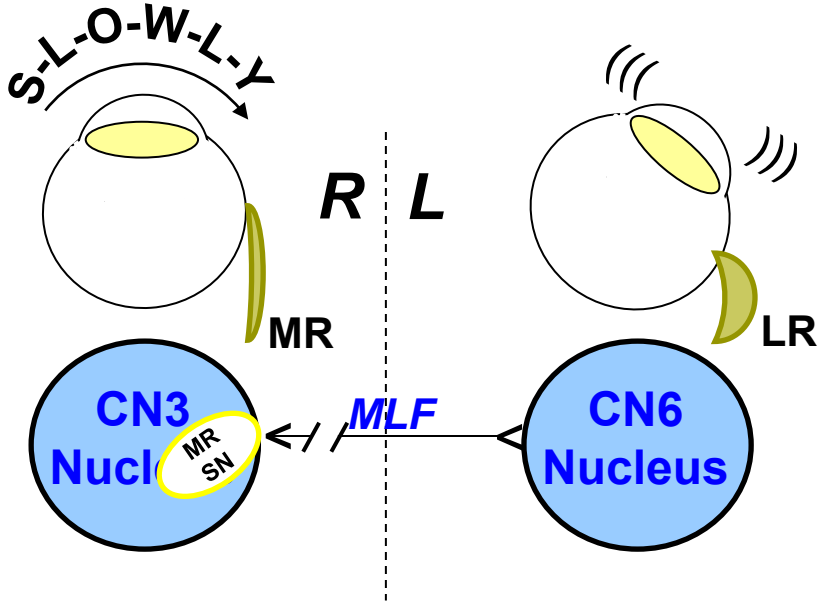
linating dz
CVA

What condition/etiology must always be considered?

A pseudo-INO 2ndry to MG

This is an internuclear ophthalmoplegia (INO)

Motility Disorders: *Internuclear Ophthalmoplegia+*



What is the etiology underlying INO?

What aspects of the presentation of an 'INO' that would indicate that it's pseudo-INO 2ndry to MG?
--The absence of end-point nystagmus in the ABducting eye
--The presence of MG-related

linating dz
CVA

What condition/etiology must always be considered?

A pseudo-INO 2ndry to MG

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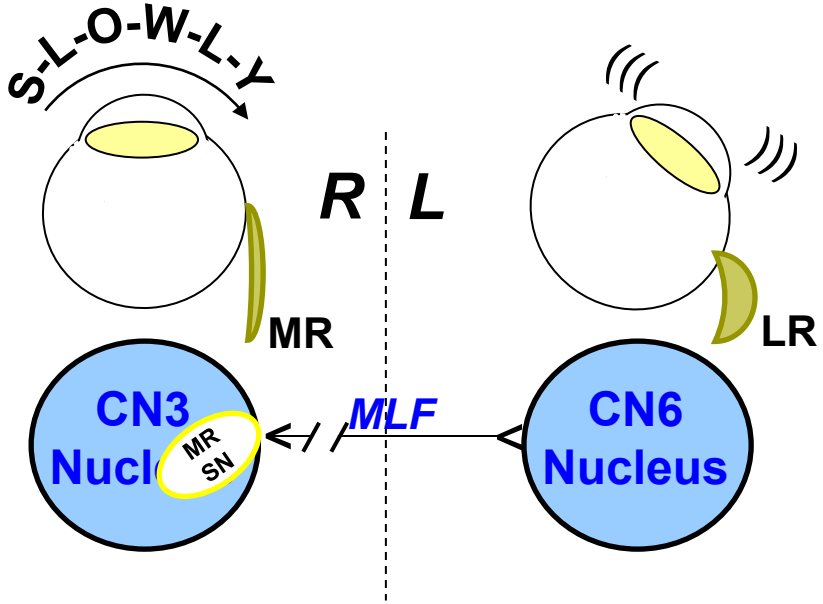
Motility Disorders: *Internuclear Ophthalmoplegia+*



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What aspects of the presentation of an 'INO' that would indicate that it's pseudo-INO 2ndry to MG?
--The absence of end-point nystagmus in the ABducting eye
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linating dz
CVA

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A pseudo-INO 2ndry to MG

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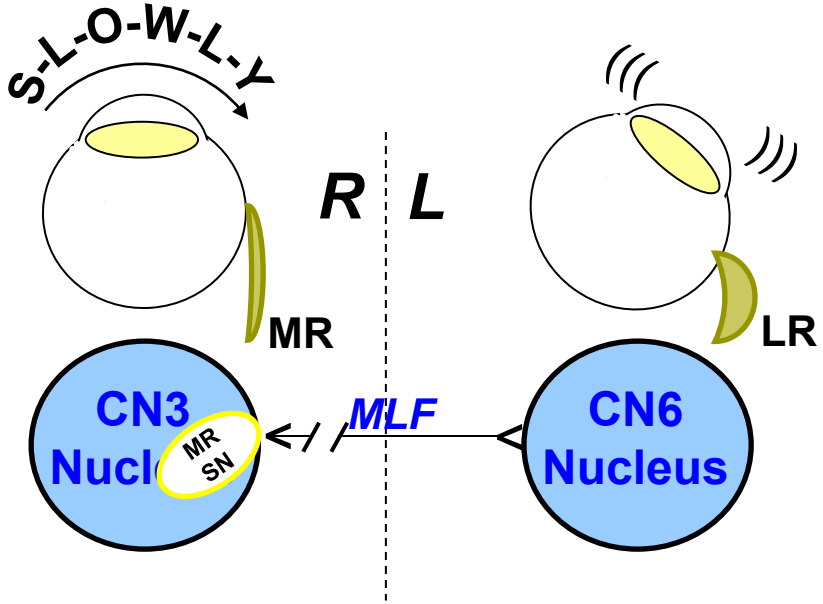
Motility Disorders: *Internuclear Ophthalmoplegia+*



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--The presence of **MG-related lid signs**

What are the lid signs implicating MG?

--

--

What condition/etiology must always be considered?

A pseudo-INO 2ndry to MG

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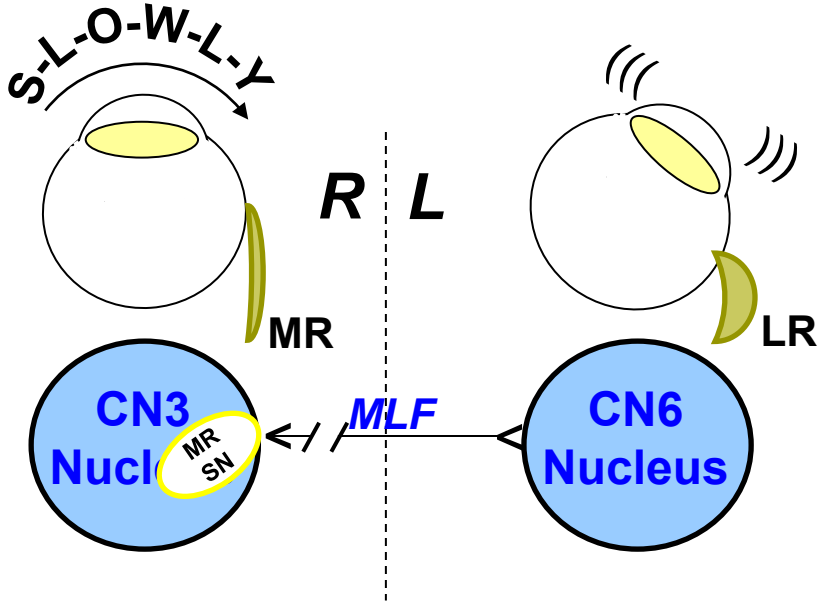
Motility Disorders: *Internuclear Ophthalmoplegia+*



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eponym lid twitch

--Fatiguability of ptosis

What condition/etiology must always be considered?

A pseudo-INO 2ndry to MG

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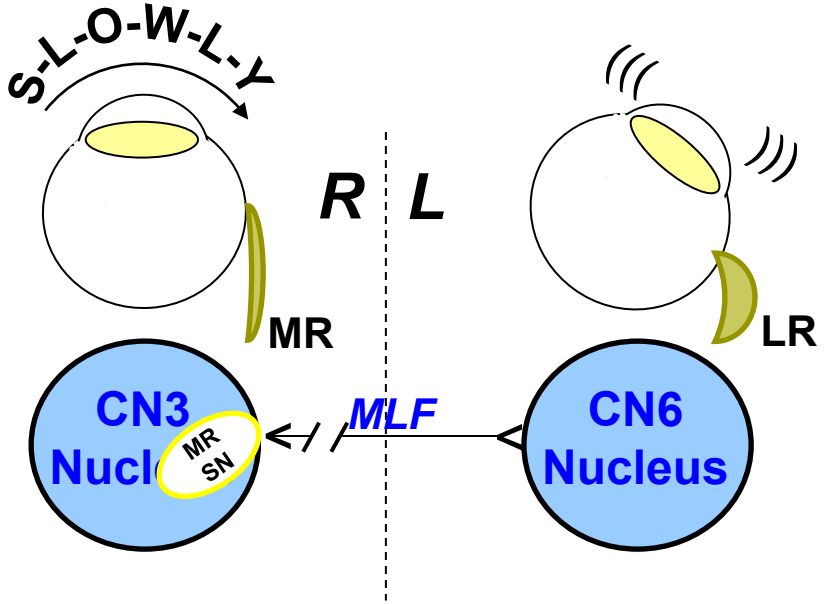
Motility Disorders: *Internuclear Ophthalmoplegia+*



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--The absence of end point nystagmus in the
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What are the lid signs implicating MG?
--Cogan lid twitch
--Fatiguability of ptosis

What condition/etiology must always be considered?
A pseudo-INO 2ndry to MG

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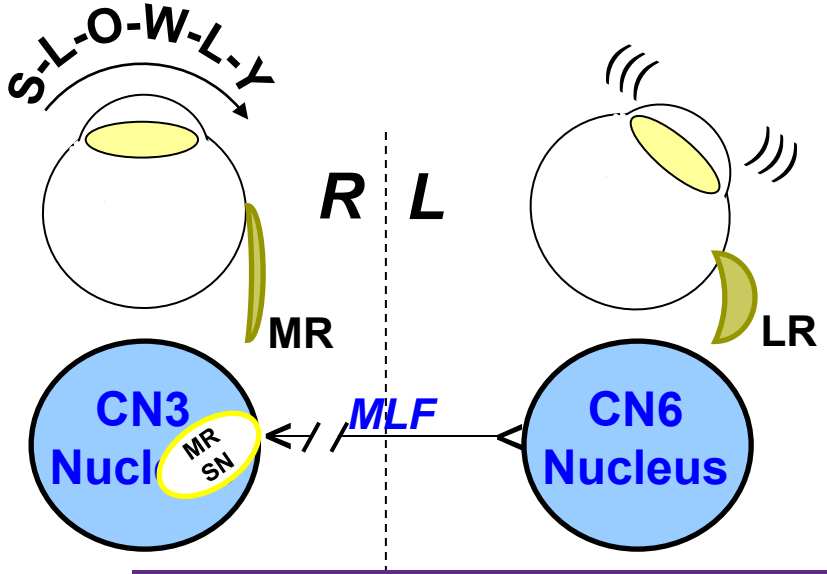
Motility Disorders: *Internuclear Ophthalmoplegia+*



What is Cogan lid twitch*?*

What is the e

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A pseudo-INO 2ndry to MG

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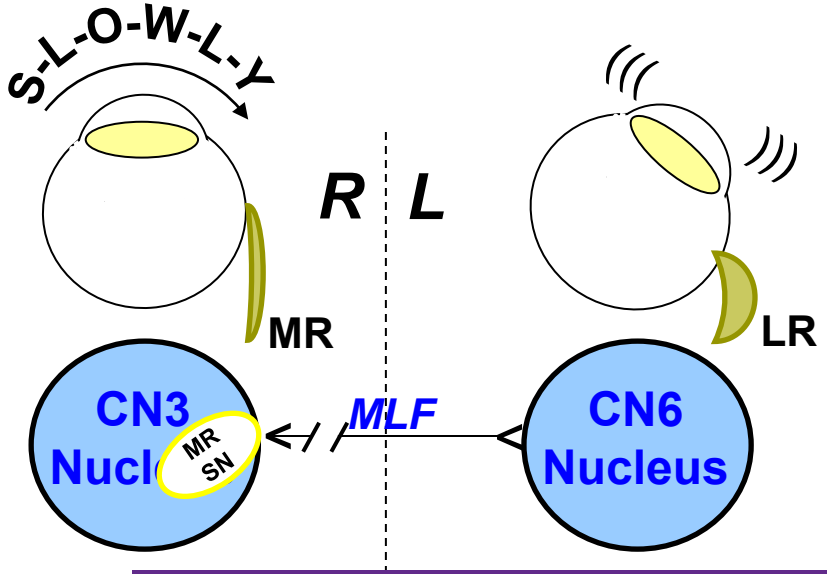
Motility Disorders: *Internuclear Ophthalmoplegia+*



What is Cogan lid twitch*?*
A phenomenon in which, when the eye shifts from down- to upgaze, the upper lid overshoots its normal upgaze resting position before settling into that position

What is the e

What aspects of the presentatio
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What condition/etiology must always be considered?
A pseudo-INO 2ndry to MG

This is an internuclear ophthalmoplegia (INO)

Motility Disorders: ***Internuclear Ophthalmoplegia*+**

Supranuclear

In this slide-set we will address *internuclear ophthalmoplegia* (INO), along with **several related conditions** (that's what the **'+'** refers to in the title)

We will now turn to the '*several related conditions*' alluded to at the beginning of the slide-set

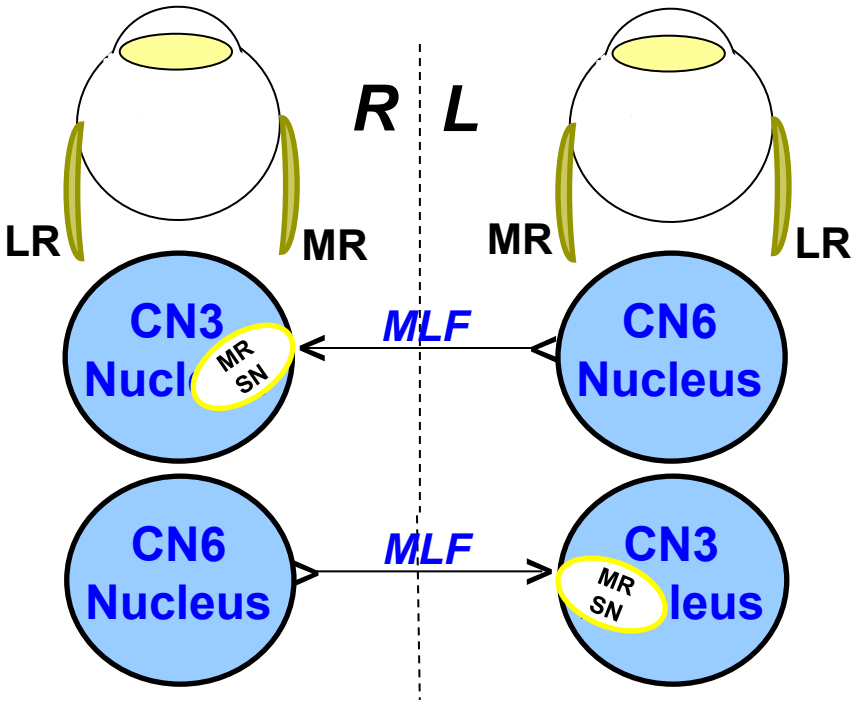
Nu

CN4 Nucleus

Infranuclear

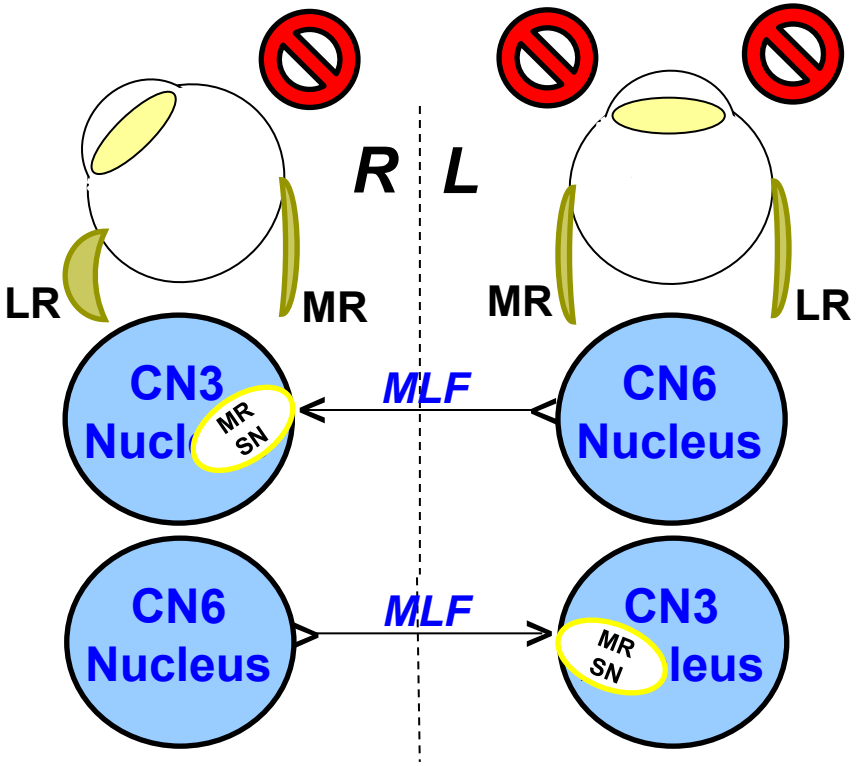
- Fascicular
- Subarachnoid
- Cavernous sinus
- Orbital
- Neuromuscular junction
- Extraocular muscle

Motility Disorders: *Internuclear Ophthalmoplegia*+



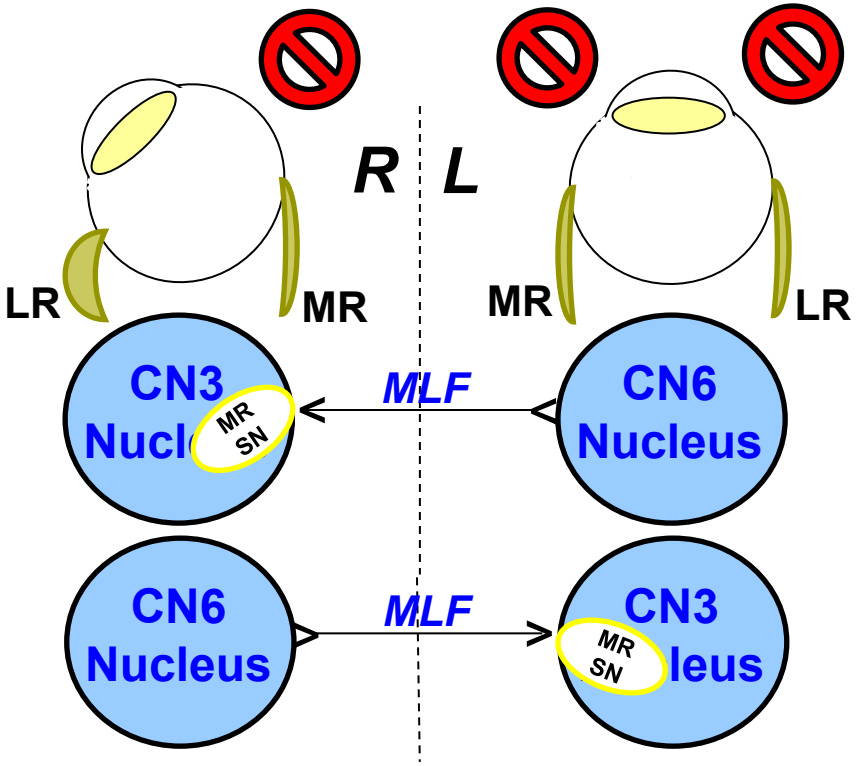
In the present context, what is the one-and-a-half syndrome*?*

Motility Disorders: *Internuclear Ophthalmoplegia*+



In the present context, what is the one-and-a-half syndrome*?*
A clinical condition in which one eye is incapable of horizontal movement (the 'one') and the other is capable only of ABduction (the 'half')

Motility Disorders: *Internuclear Ophthalmoplegia*+



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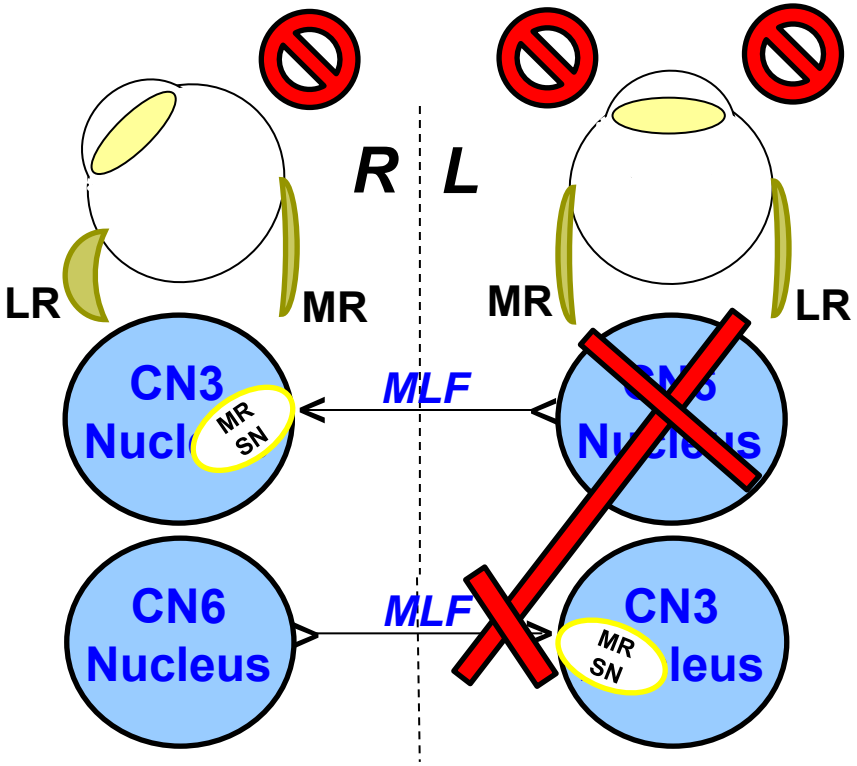
What is the cause?

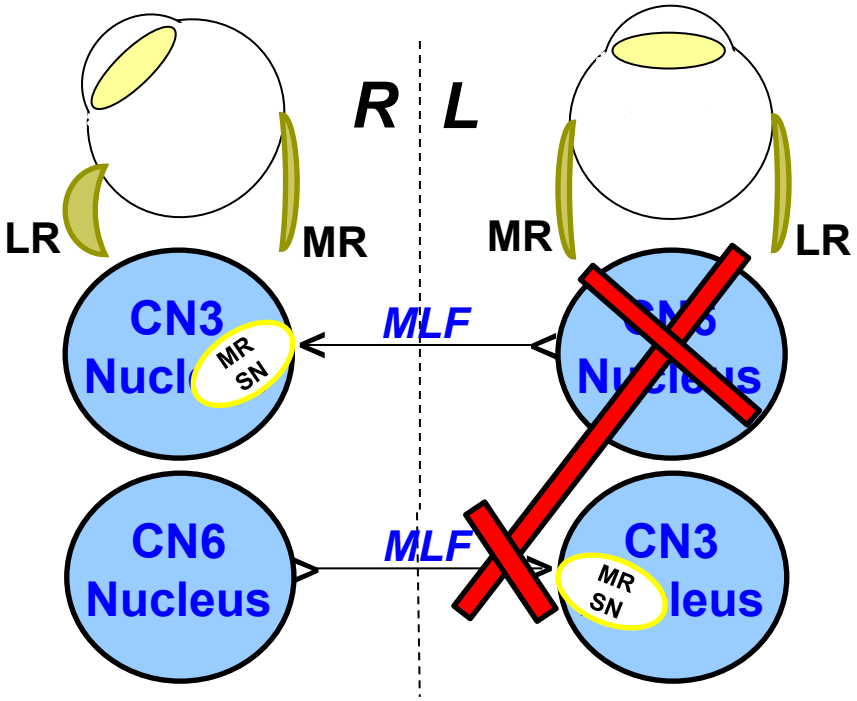
Motility Disorders: *Internuclear Ophthalmoplegia*+



In the present context, what is the one-and-a-half syndrome*?*
A clinical condition in which one eye is incapable of horizontal movement (the 'one') and the other is capable only of ABduction (the 'half')

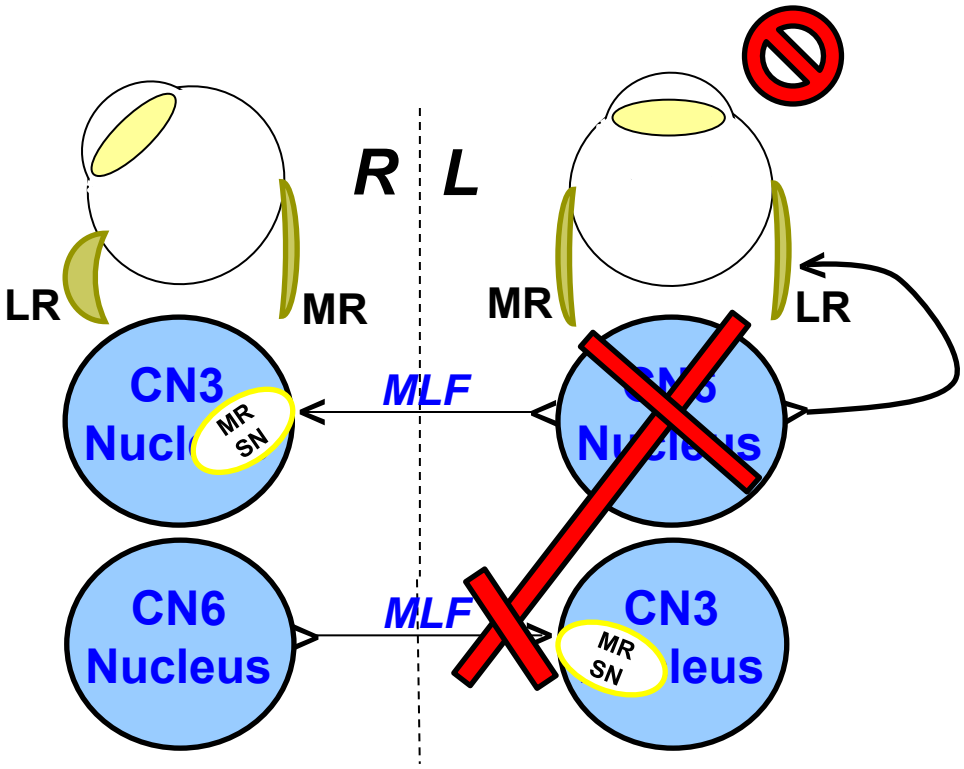
What is the cause?
A lesion that bags the MLF on one side along with the ipsilateral CN6 nucleus (or ipsilateral PPRF)

Motility Disorders: *Internuclear Ophthalmoplegia*+



How would a lesion bagging both the CN6 and MLF on one side of the brainstem lead to one eye without horizontal movements, and the other with ABduction only?

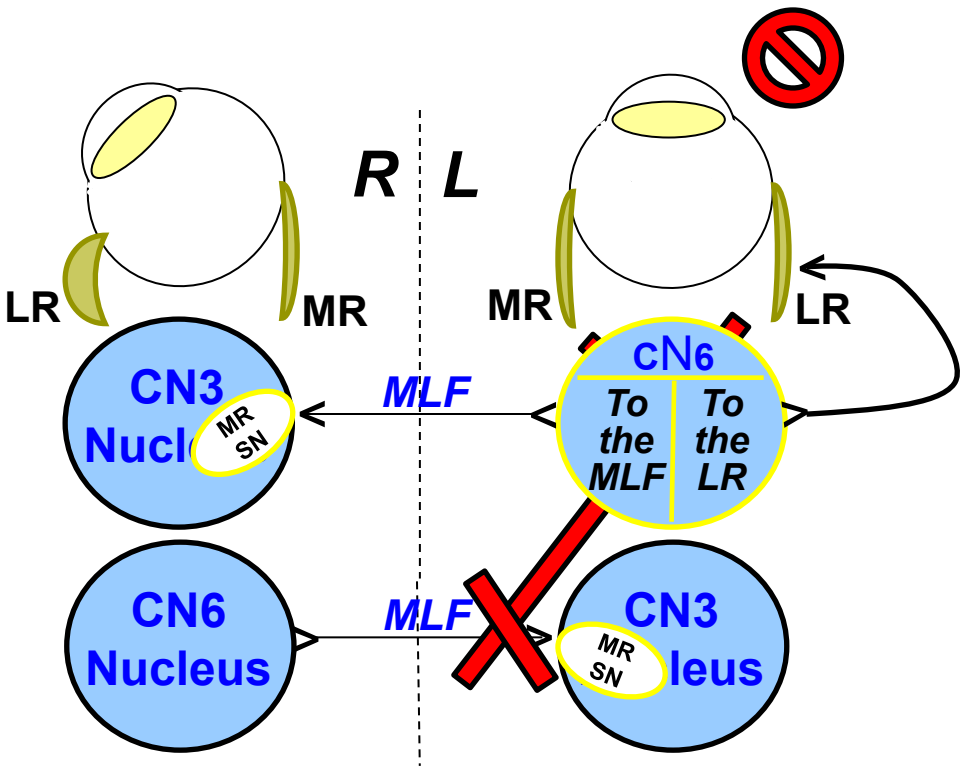
Motility Disorders: *Internuclear Ophthalmoplegia*+



How would a lesion bagging both the CN6 and MLF on one side of the brainstem lead to one eye without horizontal movements, and the other with ABduction only?

Obviously, knocking out the CN6 nucleus will bag the ipsilateral LR.

Motility Disorders: *Internuclear Ophthalmoplegia*+



How would a lesion bagging both the CN6 and MLF on one side of the brainstem lead to one eye without horizontal movements, and the other with ABduction only?

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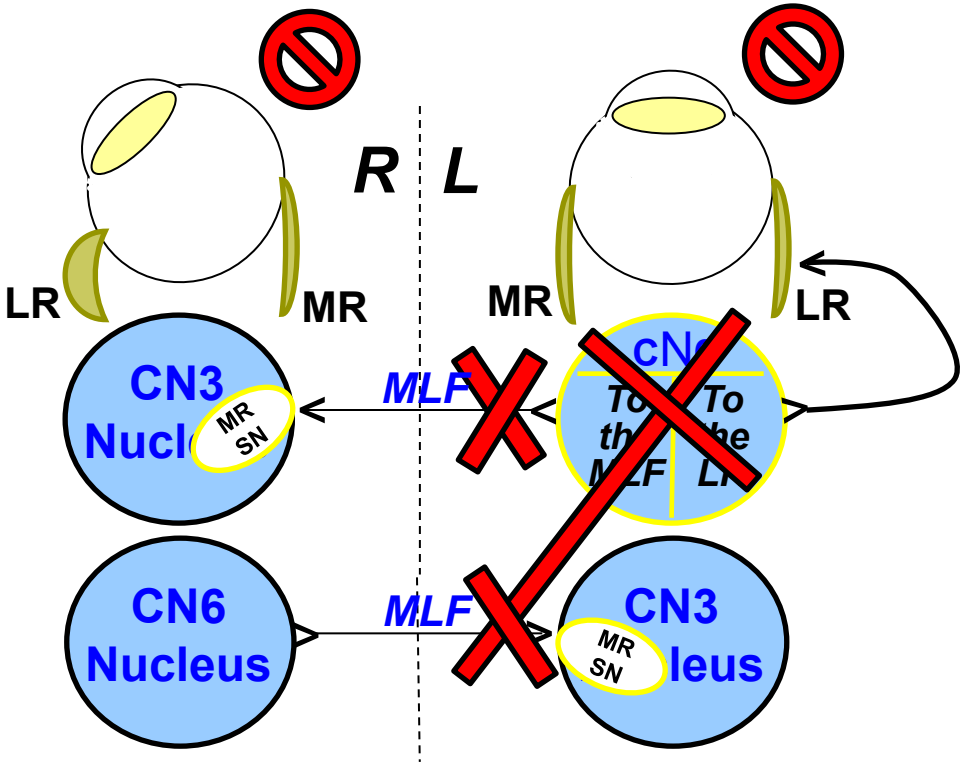

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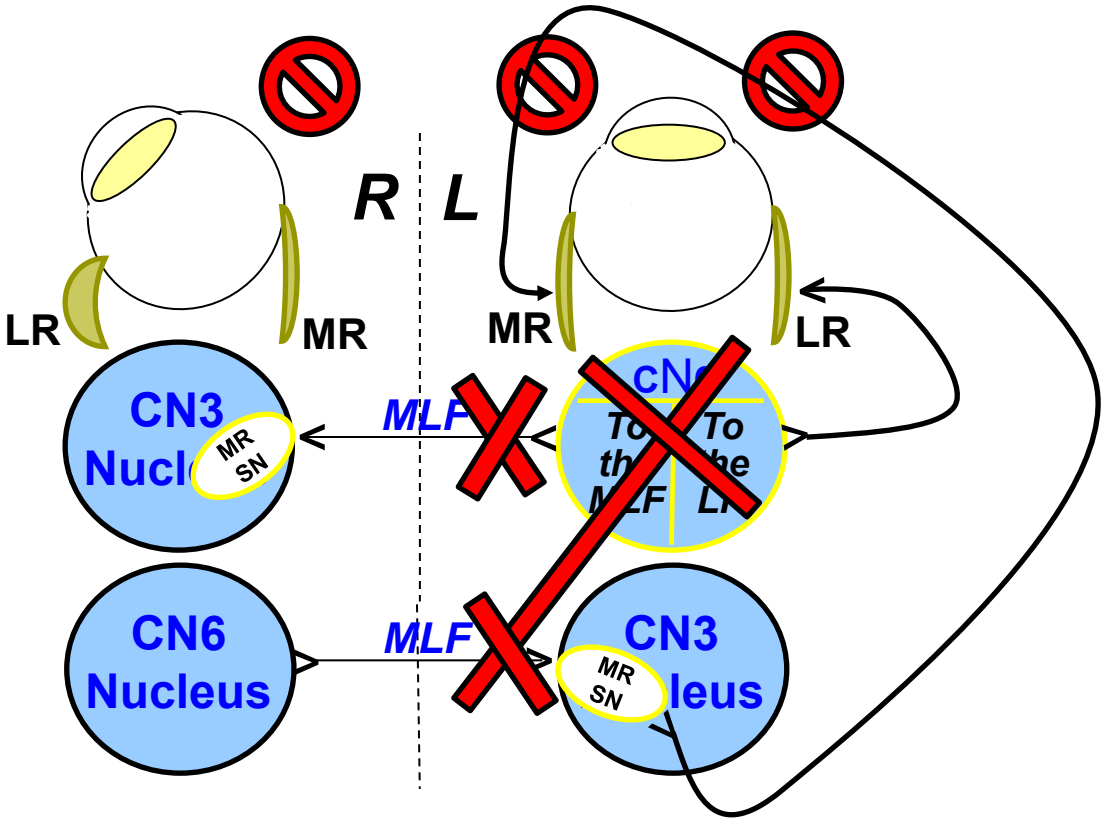

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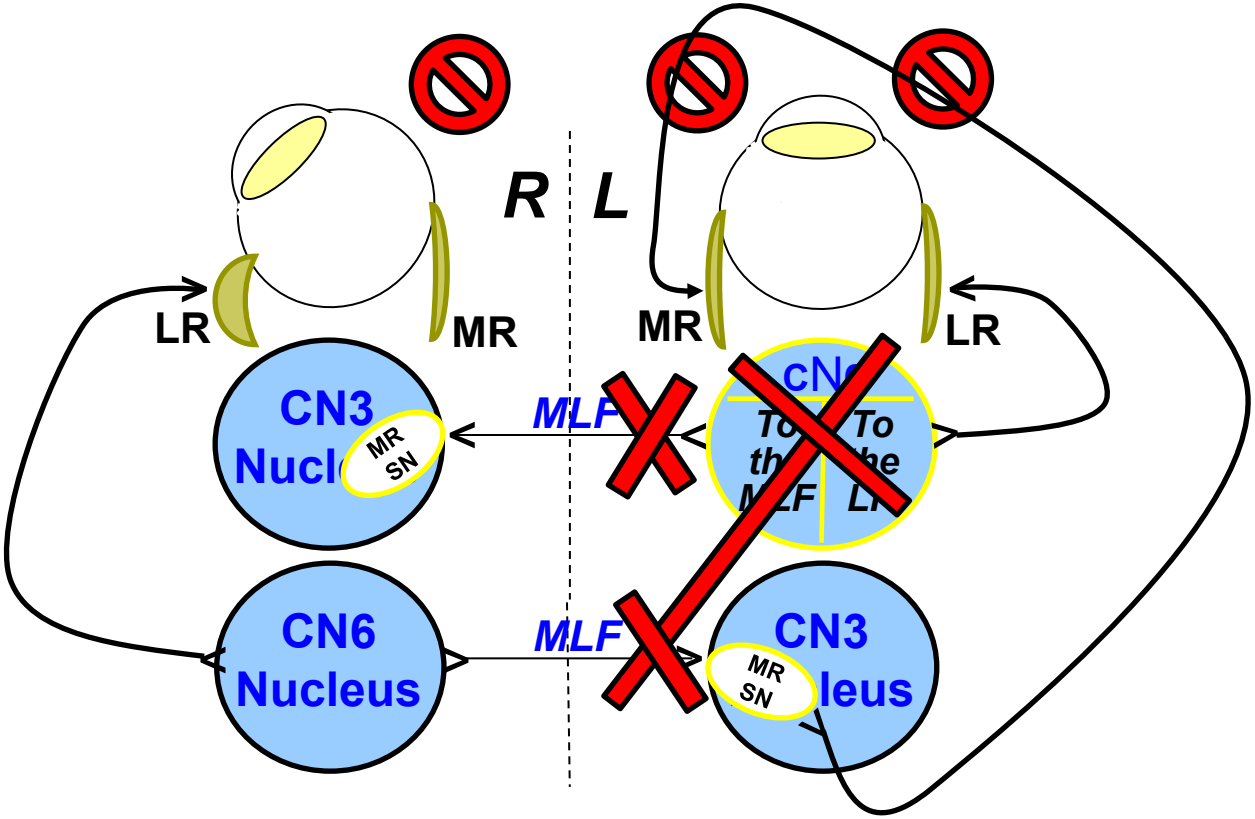

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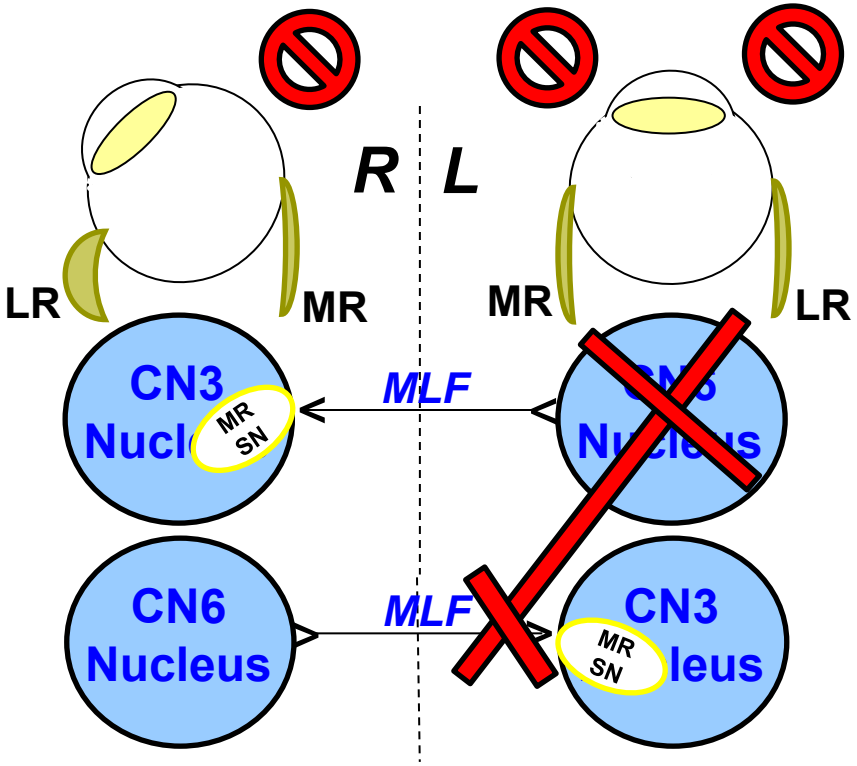
Motility Disorders: *Internuclear Ophthalmoplegia*+



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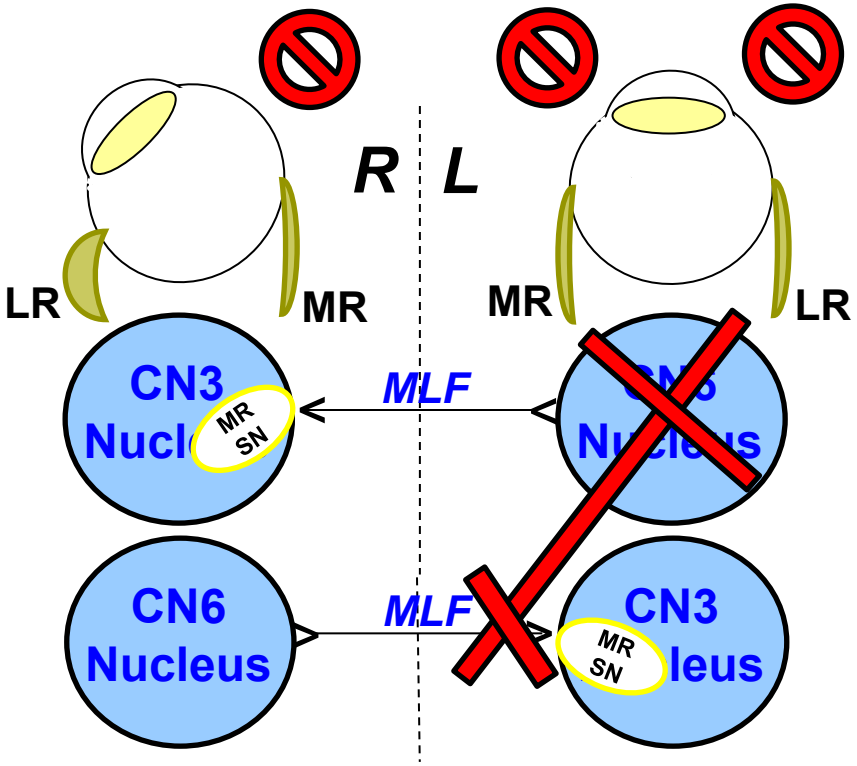
Motility Disorders: *Internuclear Ophthalmoplegia*+



In the present context, what is the **eight**-and-a-half syndrome*?*
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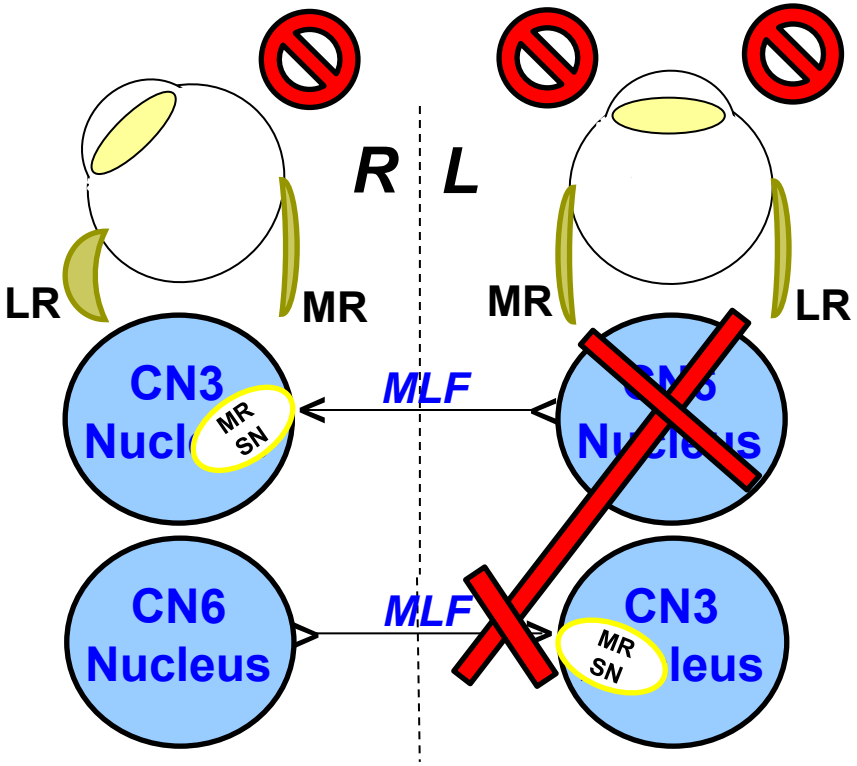
Motility Disorders: *Internuclear Ophthalmoplegia+*



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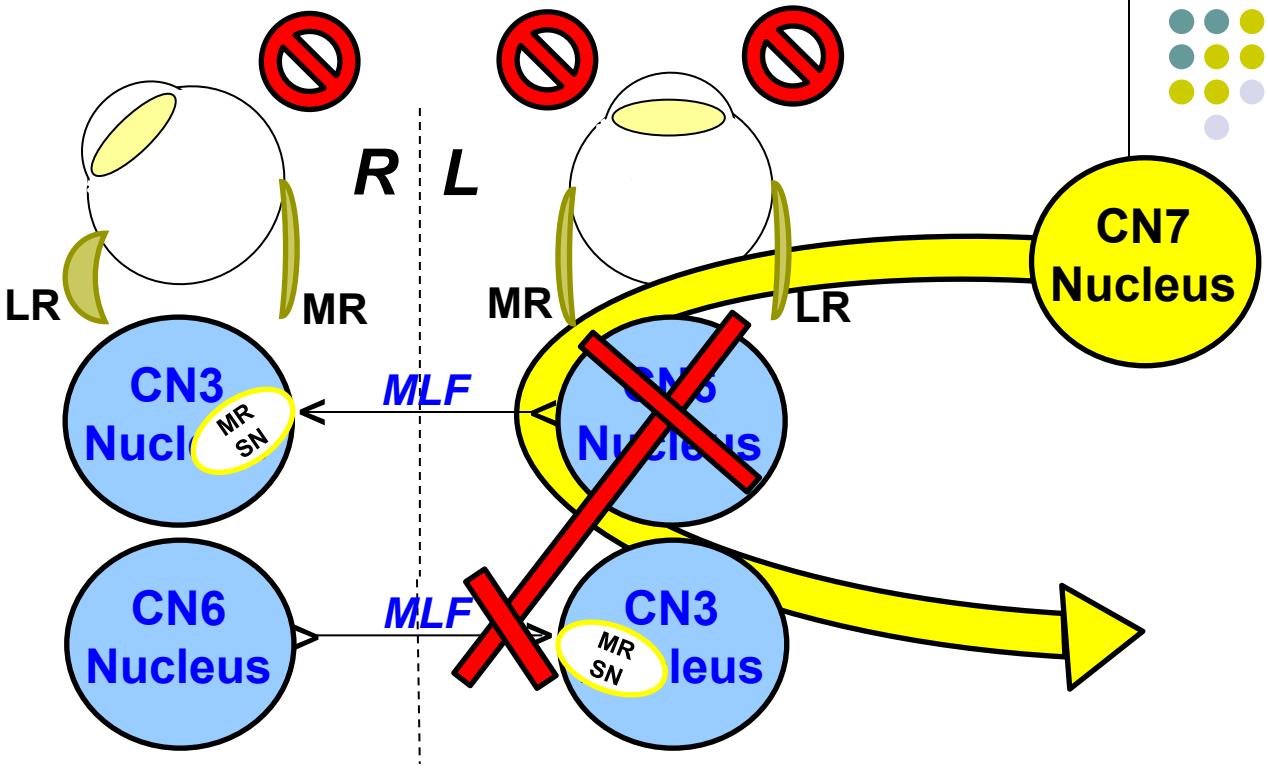

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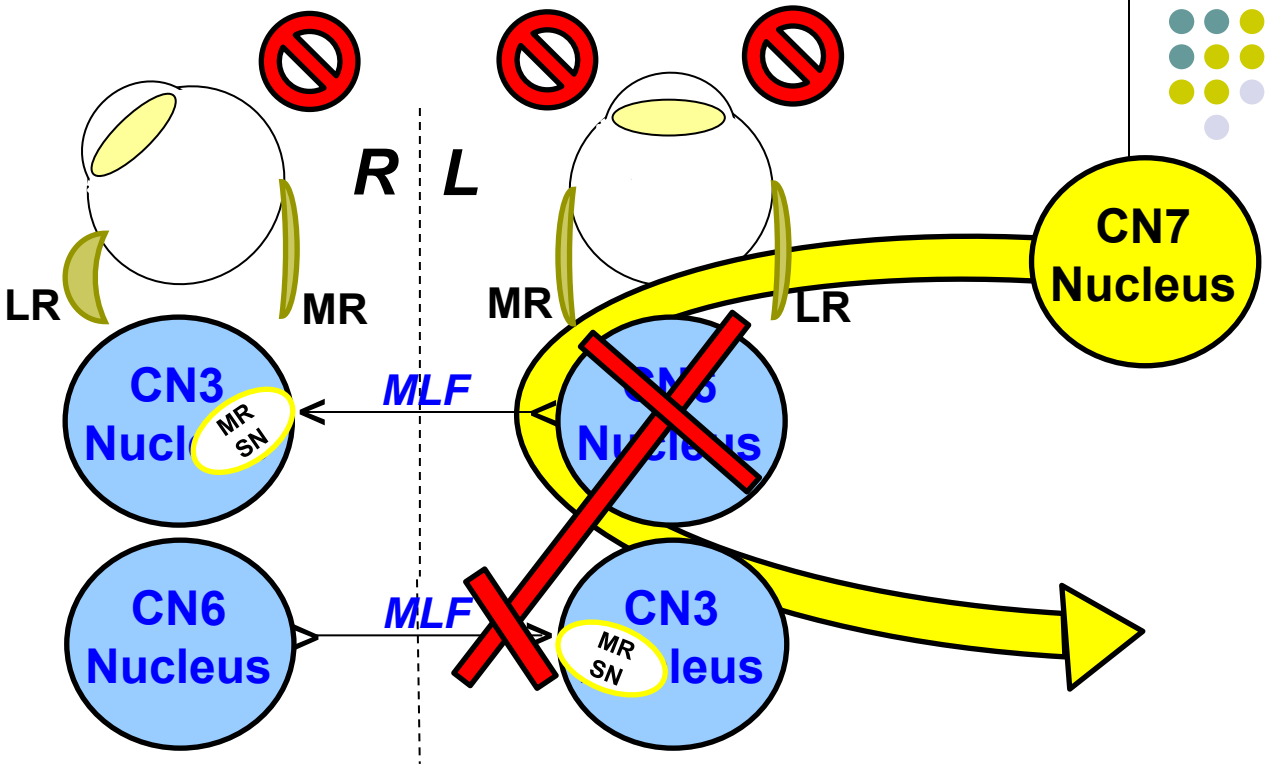

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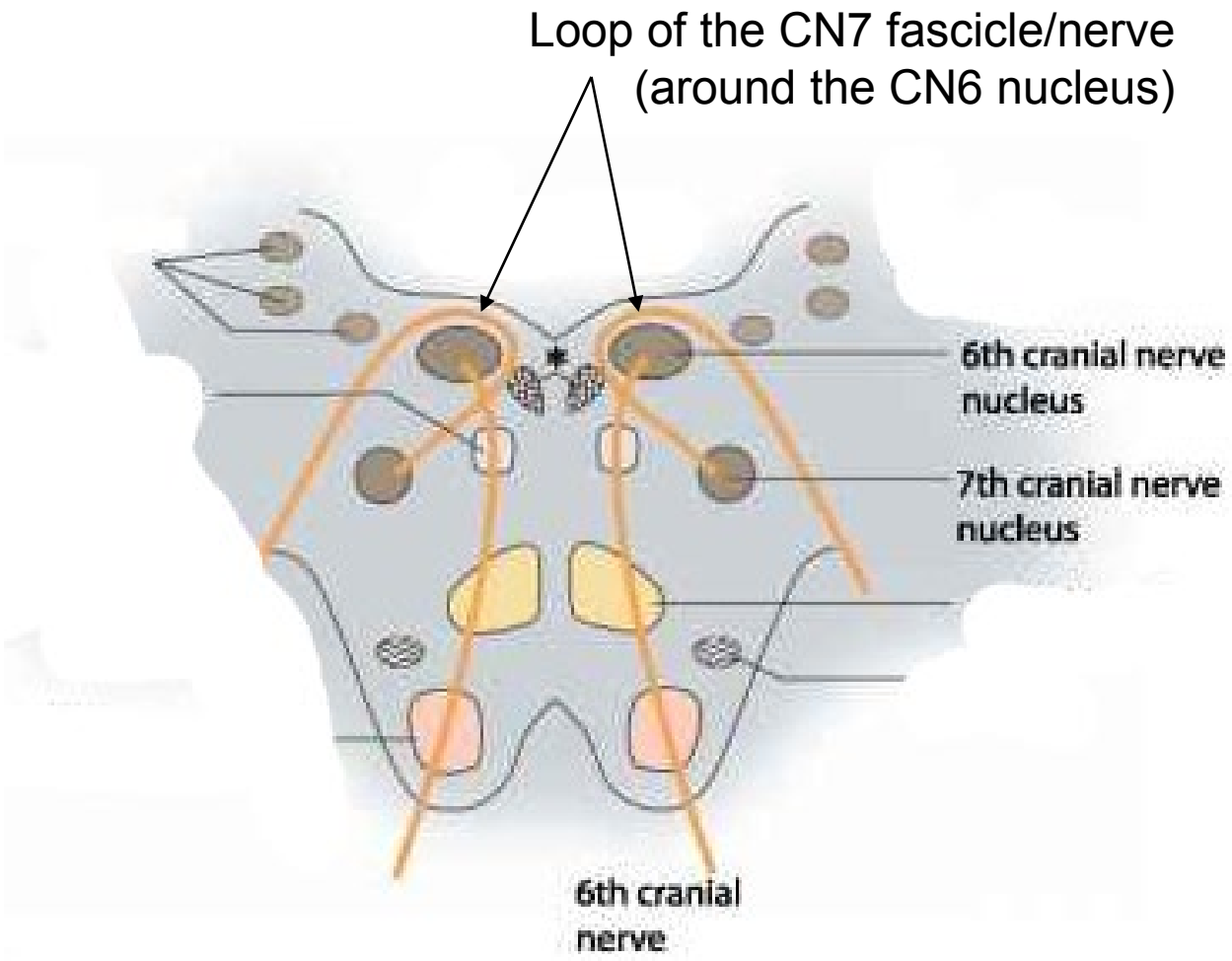
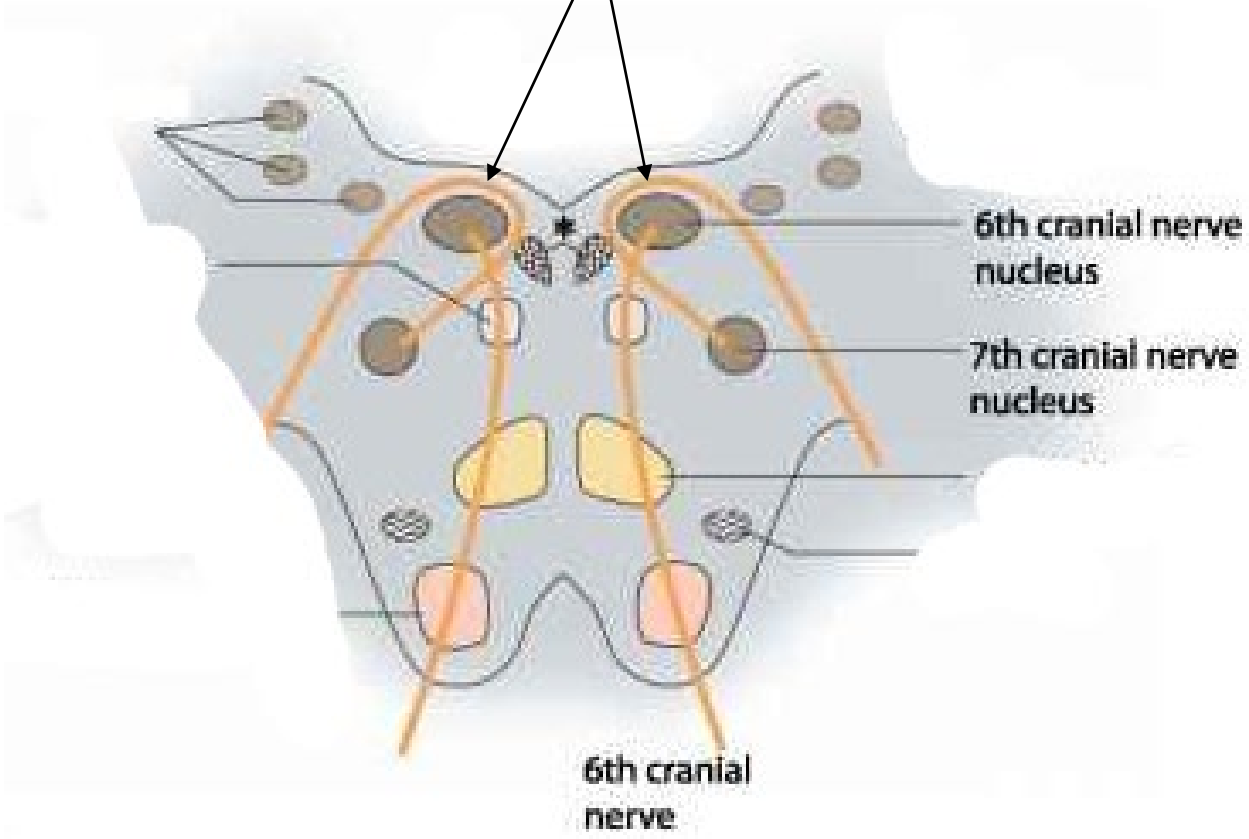


Motility Disorders: *Internuclear Ophthalmoplegia*+

Neuroanatomists don't refer to this as the facial nerve's "loop"—what do they call it?

? ~~Loop~~ of the CN7 fascicle/nerve (around the CN6 nucleus)



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The **genu** of CN7

Genu

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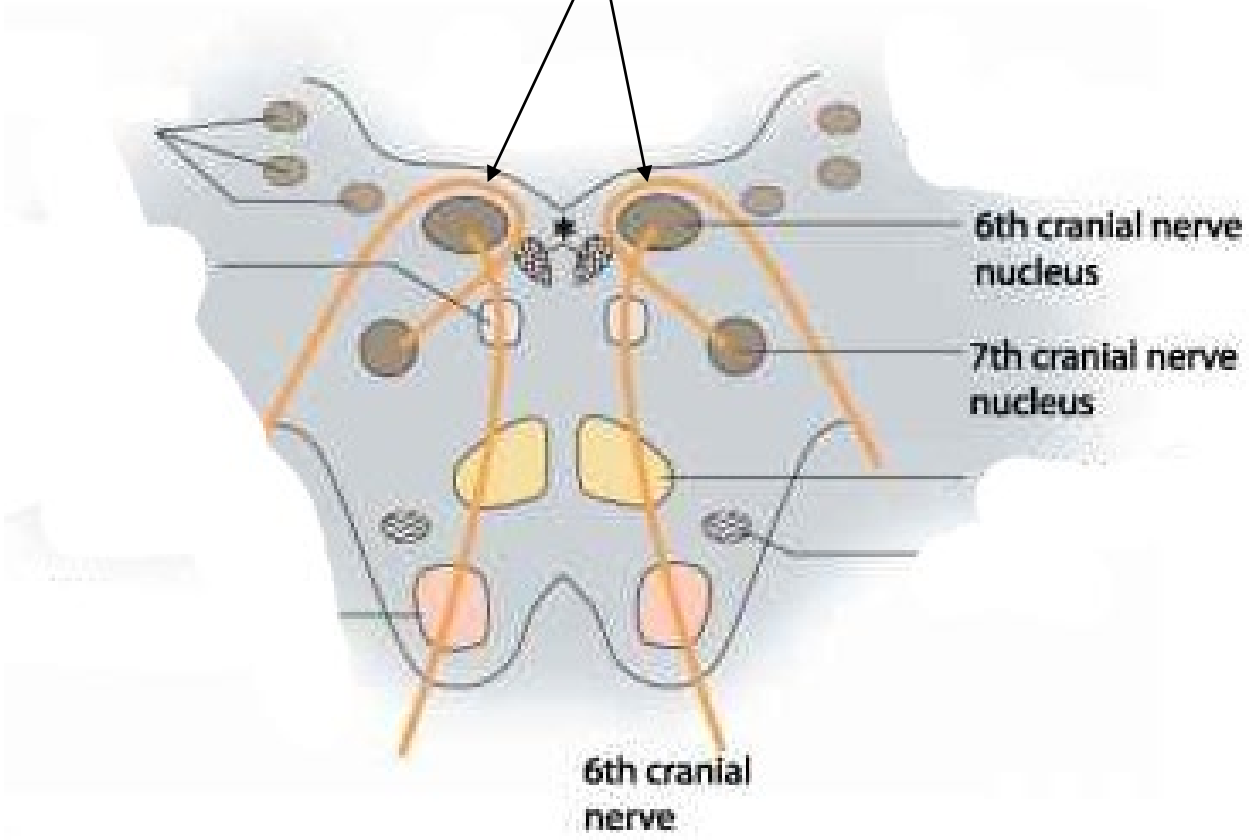

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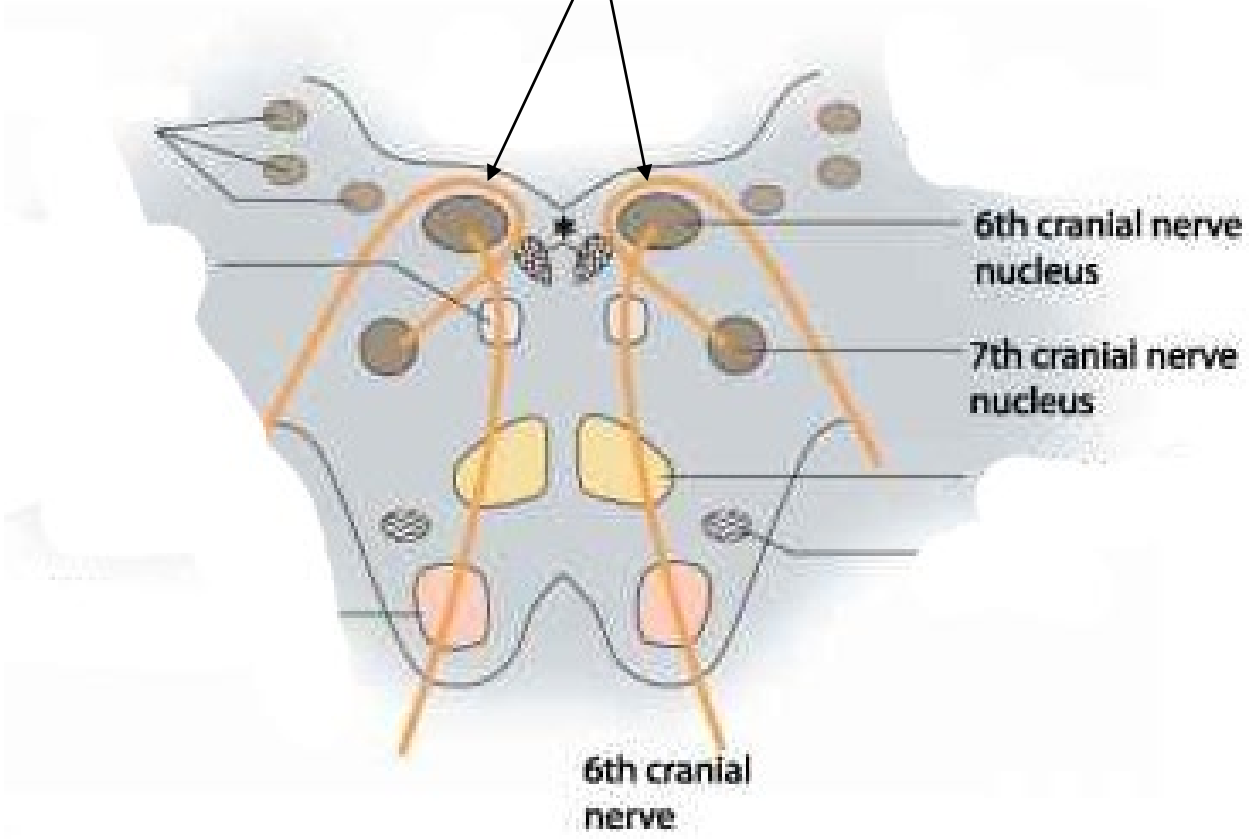

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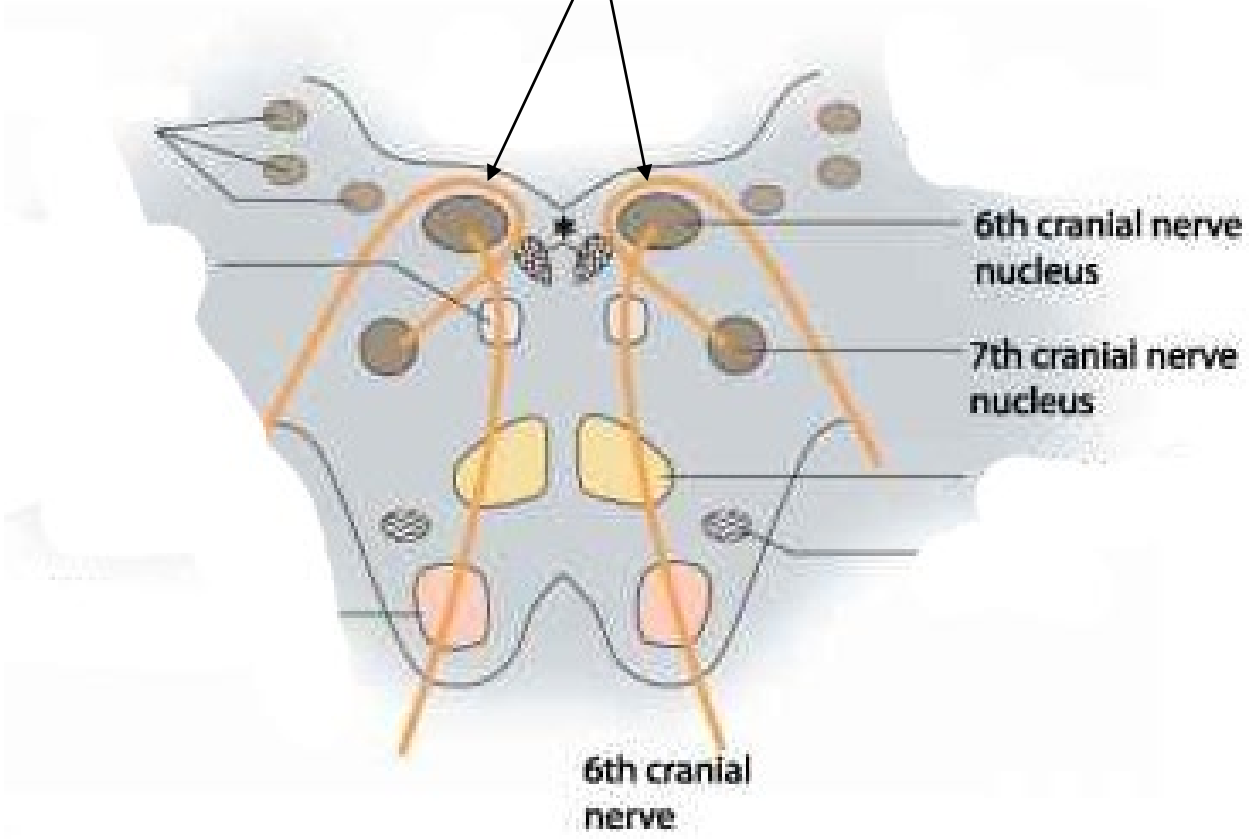

The genu of CN7 creates a visible bump on the brainstem's surface. By what name is this bump known?

oplegia+

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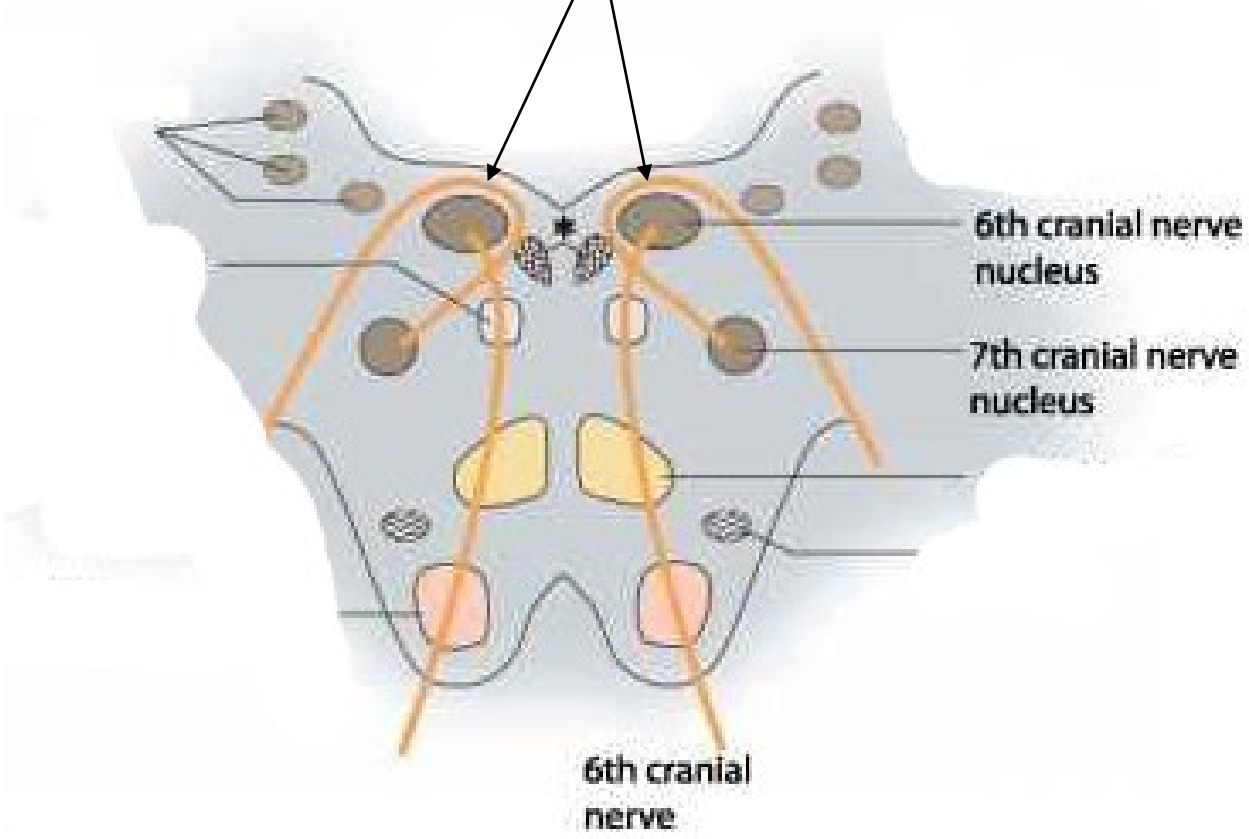

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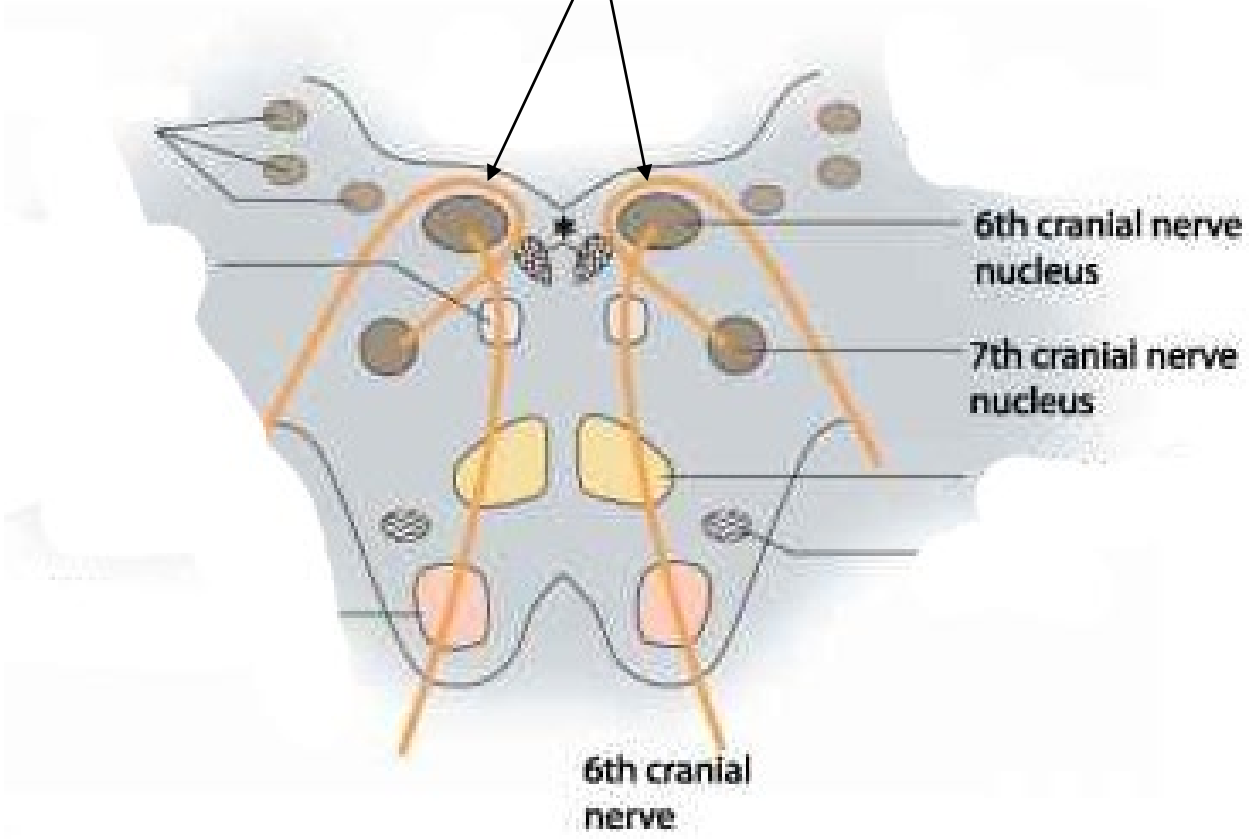
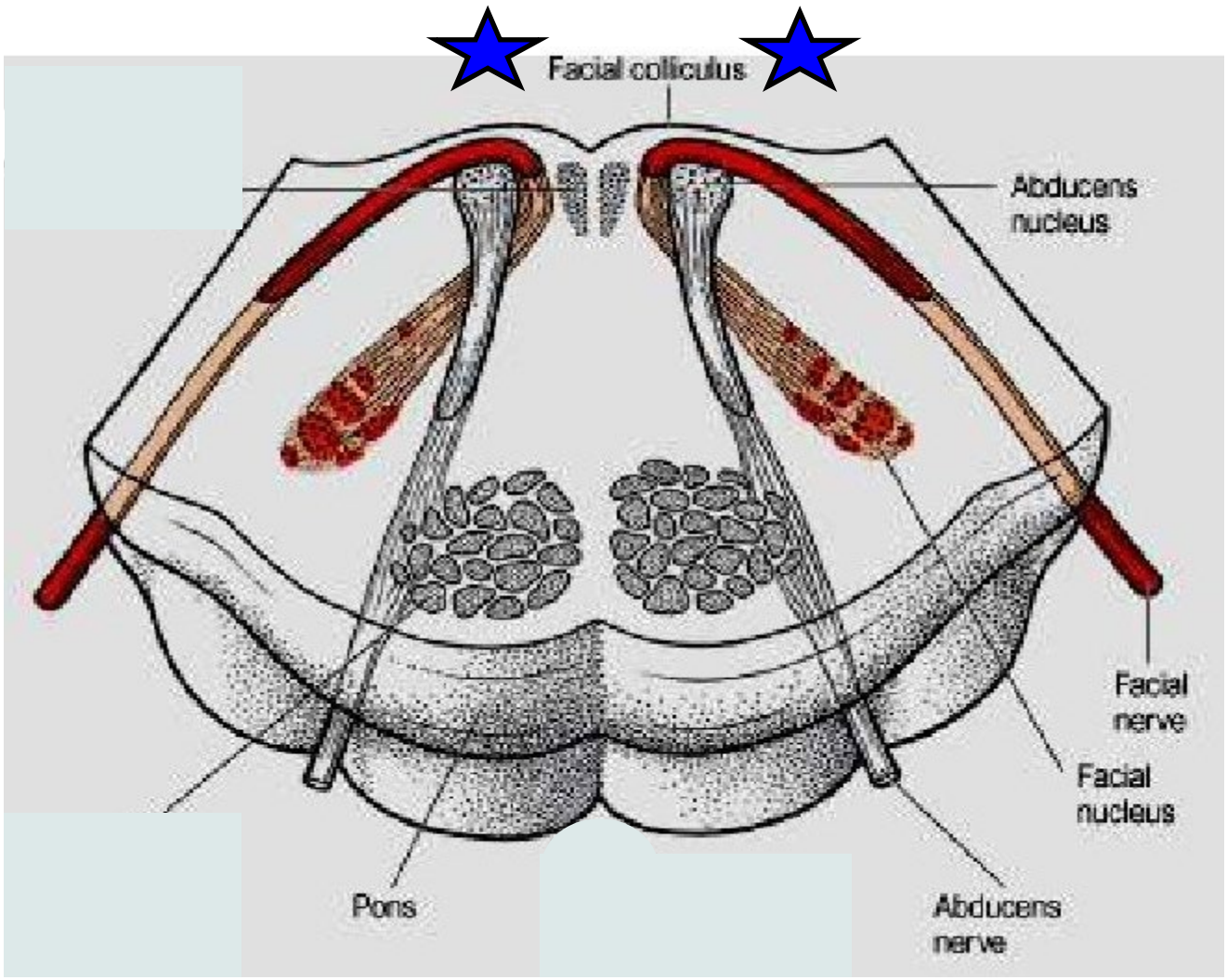
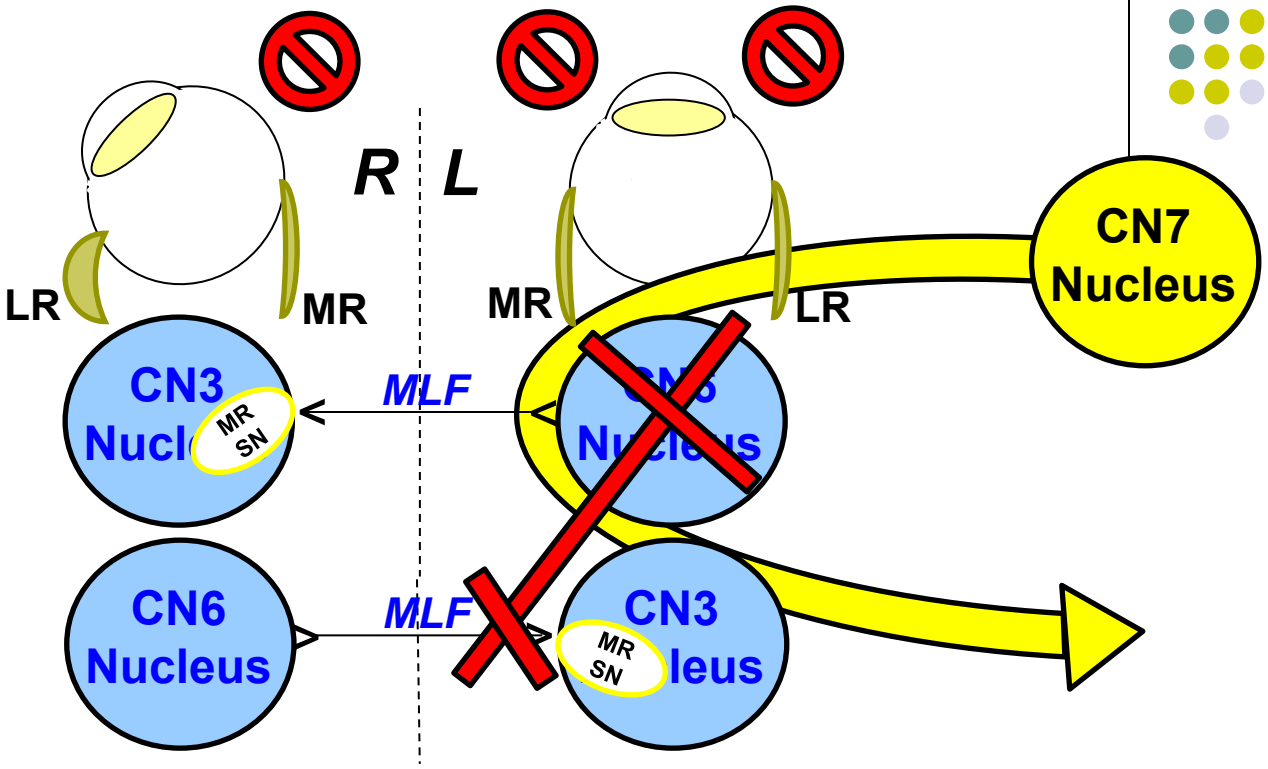


Motility Disorders: *Internuclear Ophthalmoplegia*+



Facial colliculus

Motility Disorders: *Internuclear Ophthalmoplegia+*



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A clinical condition consisting of a one-and-a-half syndrome *plus*
an ipsilateral CN7 palsy (7 + 1.5 = 8.5 ... get it?)

What is the most common cause of the one-and-a-half and eight-and-a-half syndromes?

What is the anatomic relationship that makes this possible?
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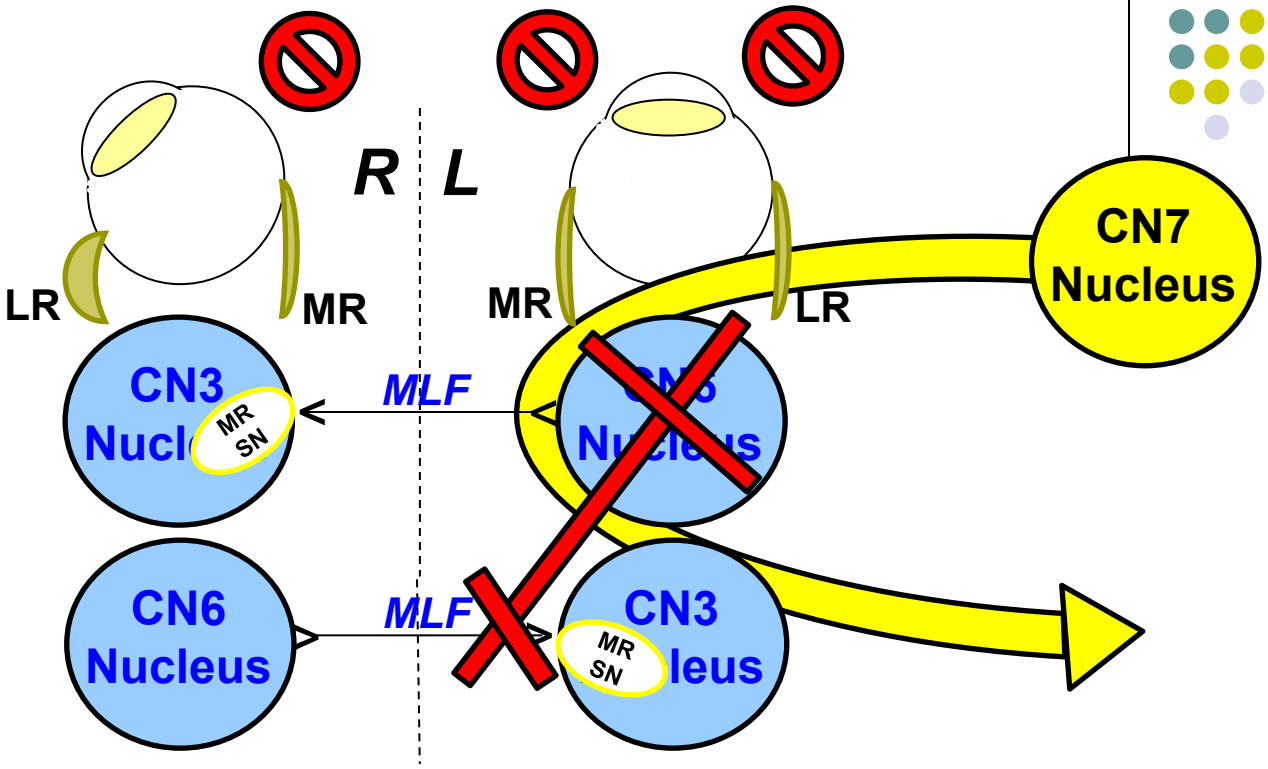
Motility Disorders: *Internuclear Ophthalmoplegia+*



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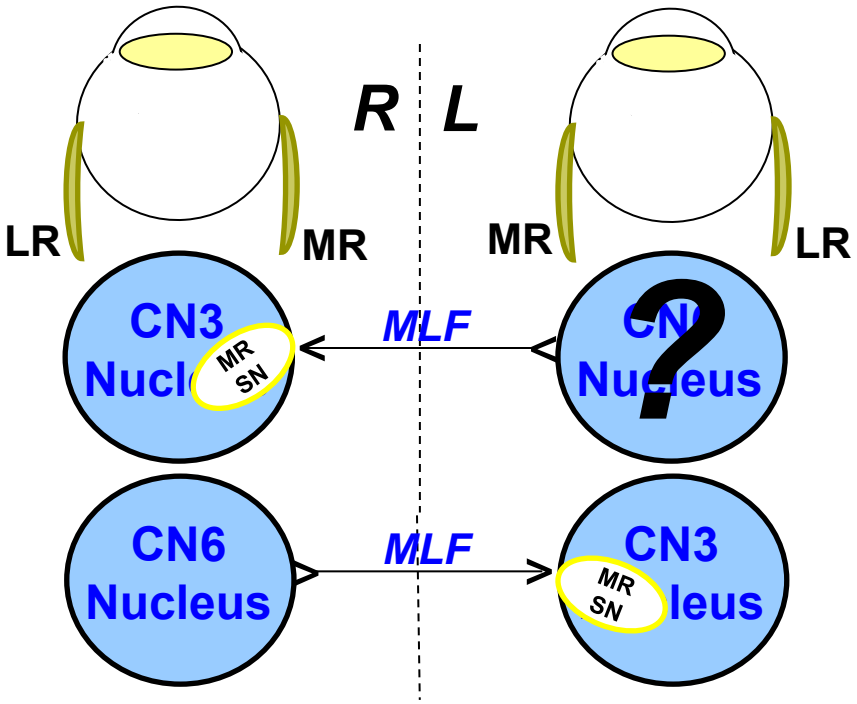
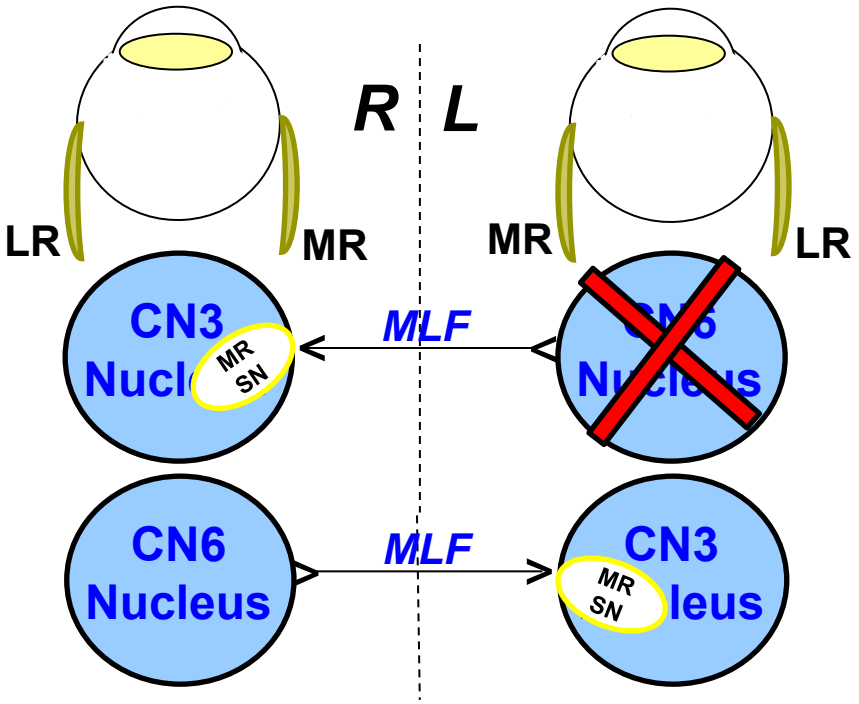


Is a selective lesion of the CN6 nucleus a thing?

Motility Disorders: *Internuclear Ophthalmoplegia*+



Is a selective lesion of the CN6 nucleus a thing?

Yes (albeit a rare one)

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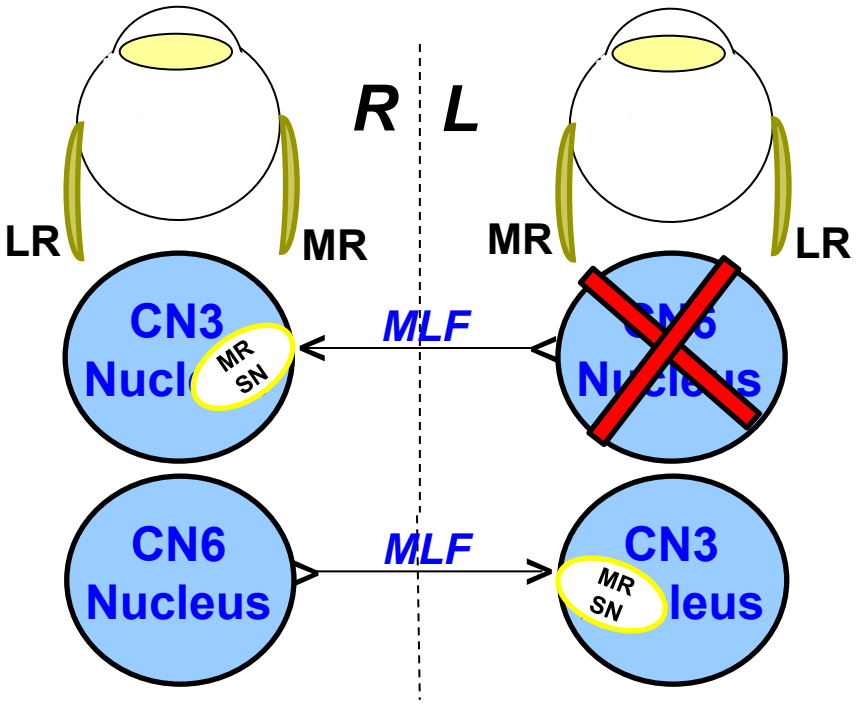

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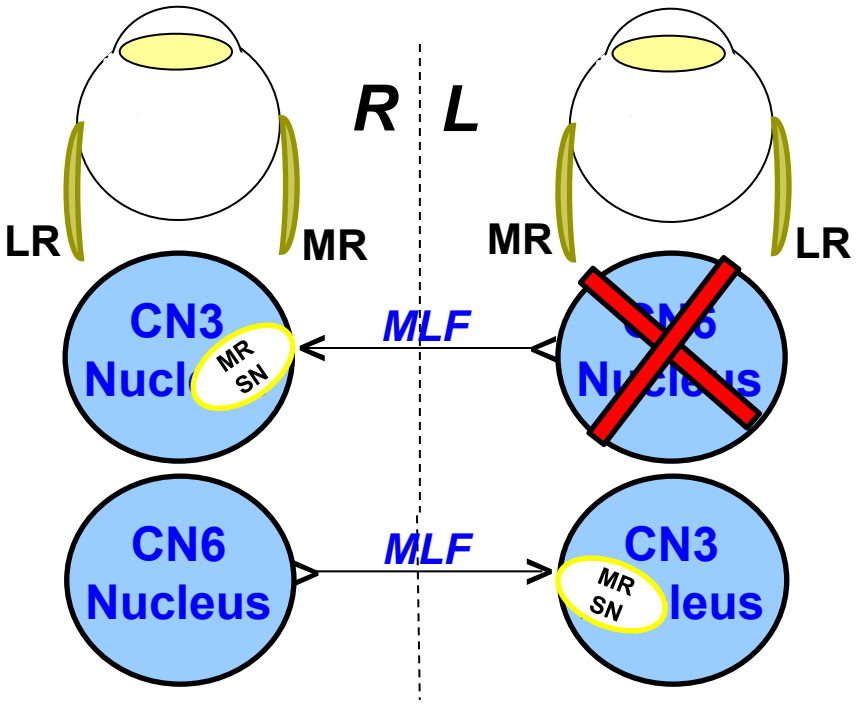
How does it present?

Motility Disorders: *Internuclear Ophthalmoplegia+*



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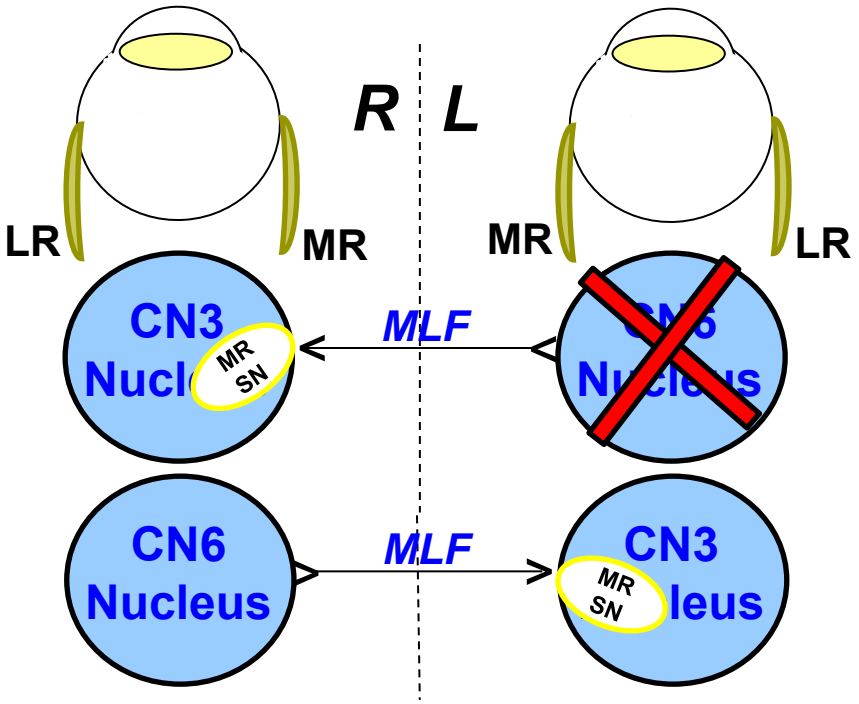
How does it present?
As a lateral gaze vs rectus palsy

Motility Disorders: *Internuclear Ophthalmoplegia+*



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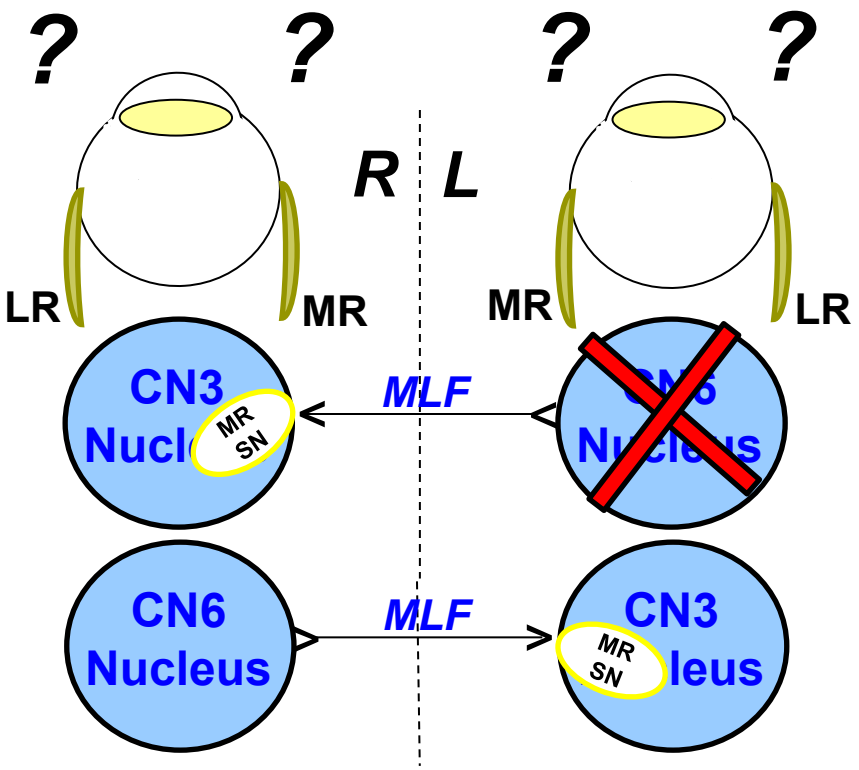

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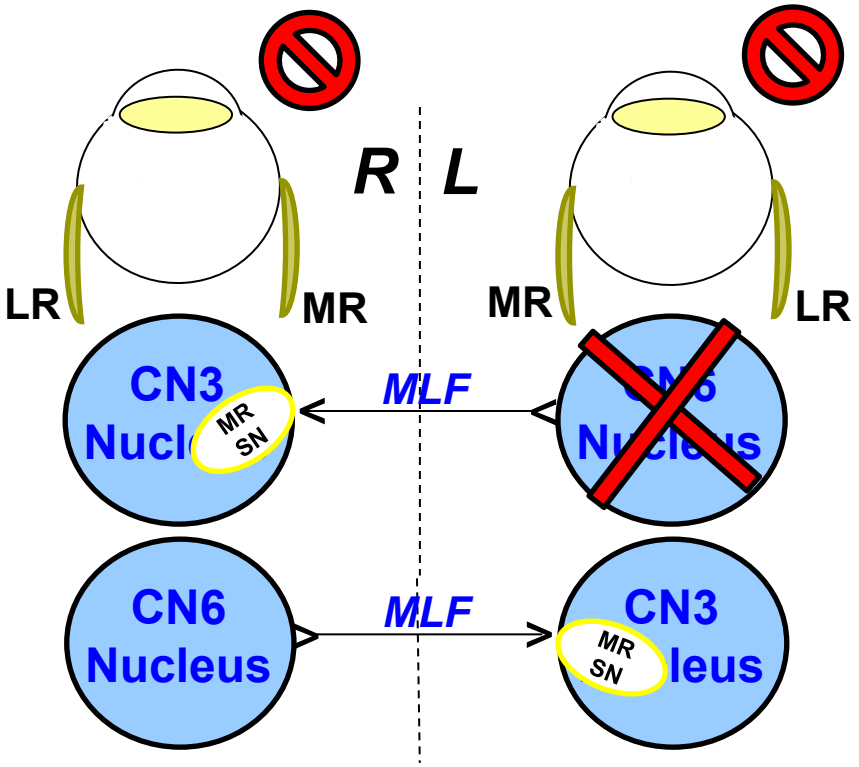
How does it present?
As a lateral gaze palsy ipsilateral vs contralateral to the lesion

Motility Disorders: *Internuclear Ophthalmoplegia+*



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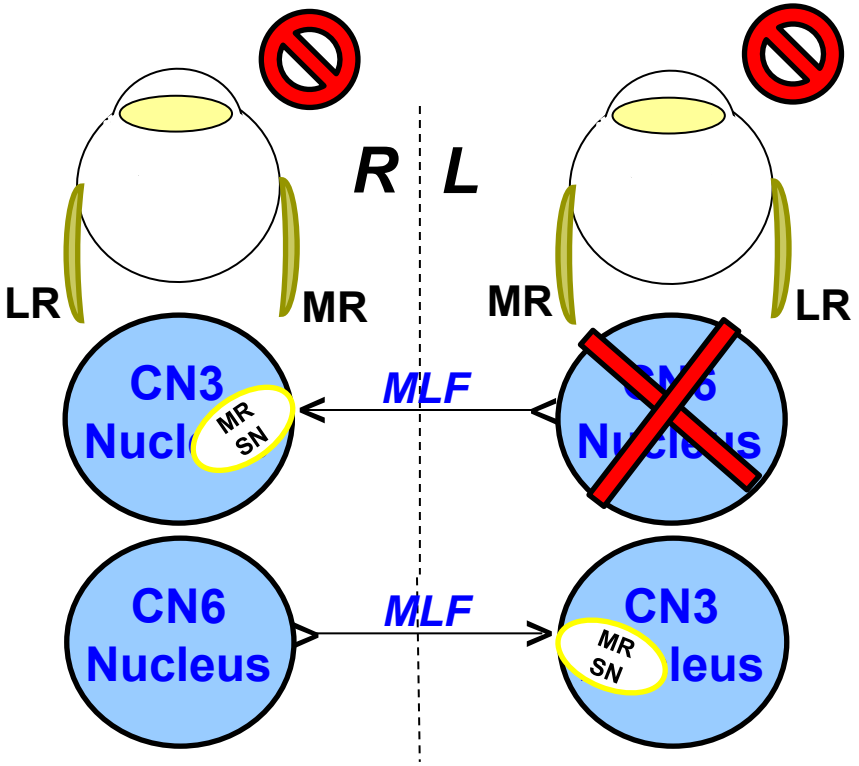
How does it present?
As a lateral gaze palsy ipsilateral to the lesion

Motility Disorders: *Internuclear Ophthalmoplegia+*



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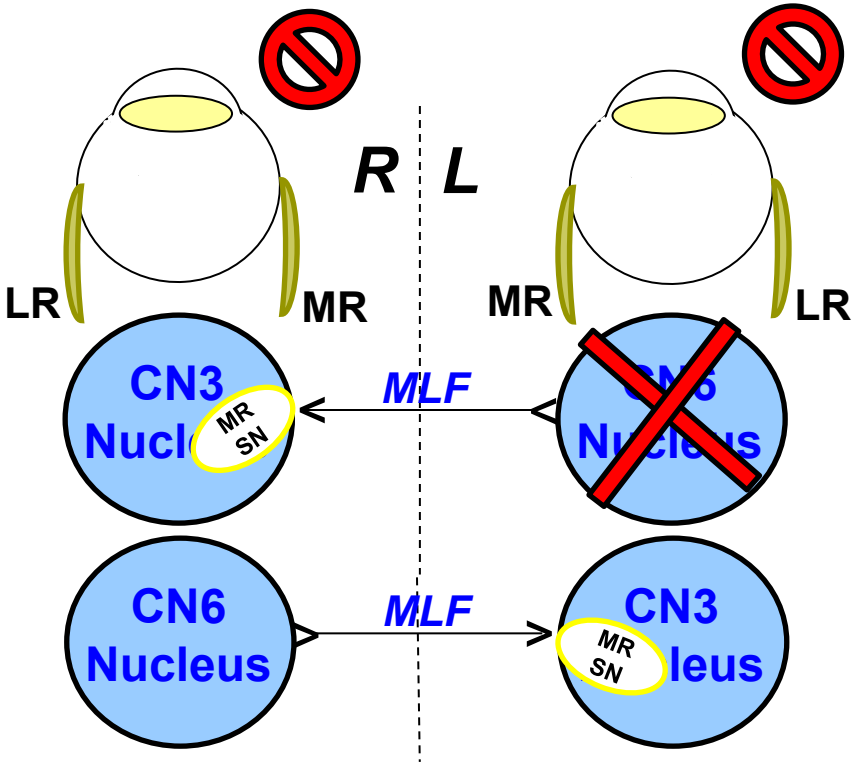
Why does it present as a lateral gaze palsy?.

Motility Disorders: *Internuclear Ophthalmoplegia+*



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Why does it present as a lateral gaze palsy?
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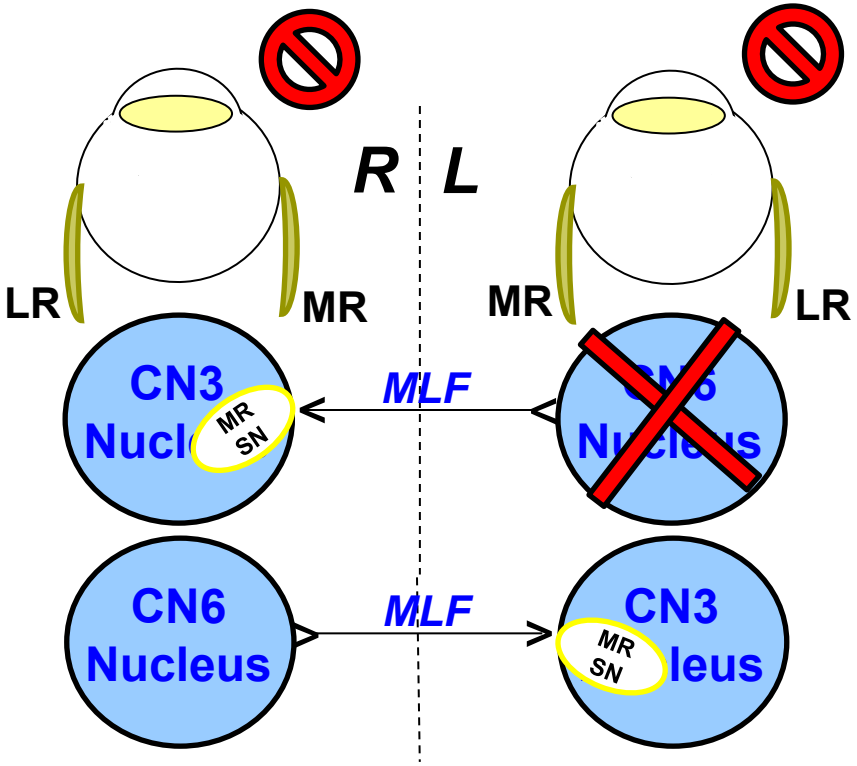

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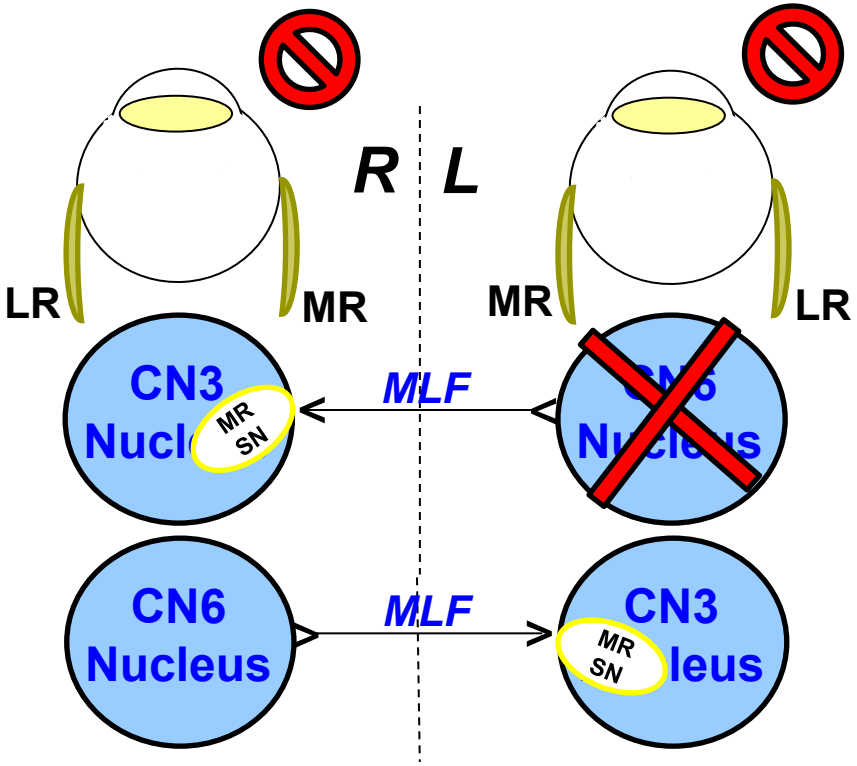
Motility Disorders: *Internuclear Ophthalmoplegia+*



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Do pts with a nuclear sixth c/o diplopia?

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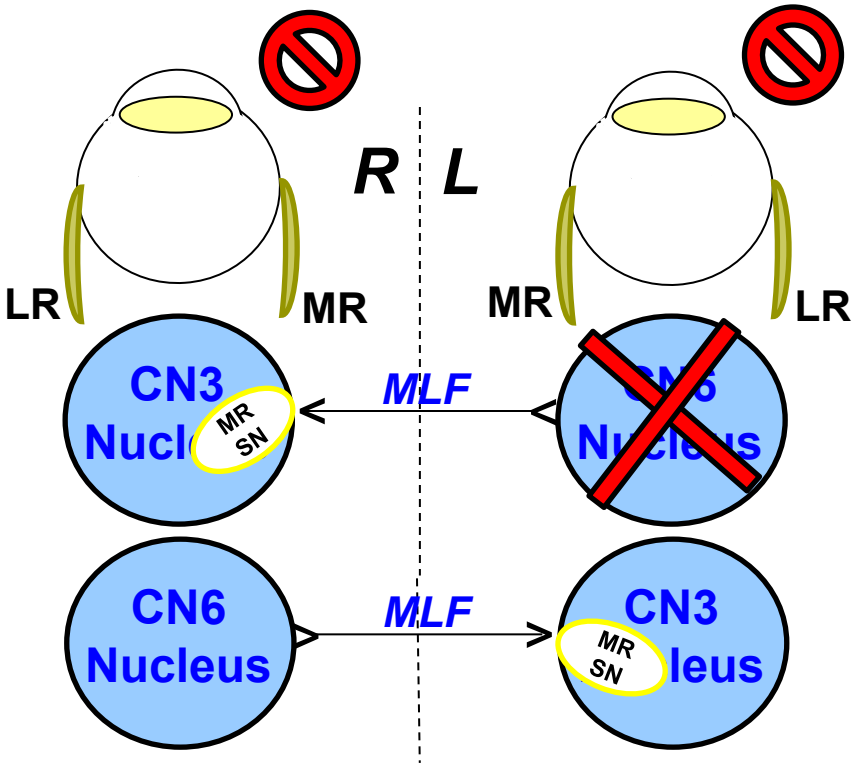

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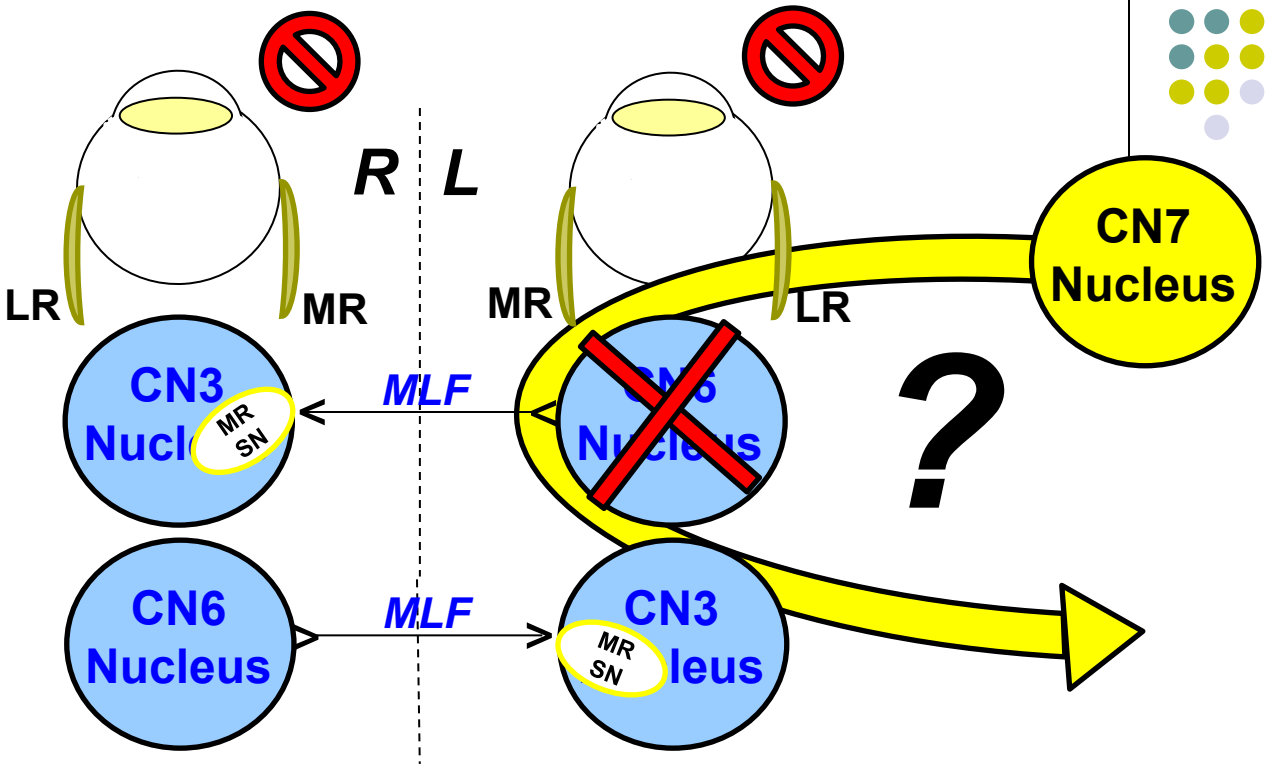
Do pts with a nuclear sixth c/o diplopia?
Because the effect on gaze is symmetric, diplopia is usually not present

Motility Disorders: *Internuclear Ophthalmoplegia+*



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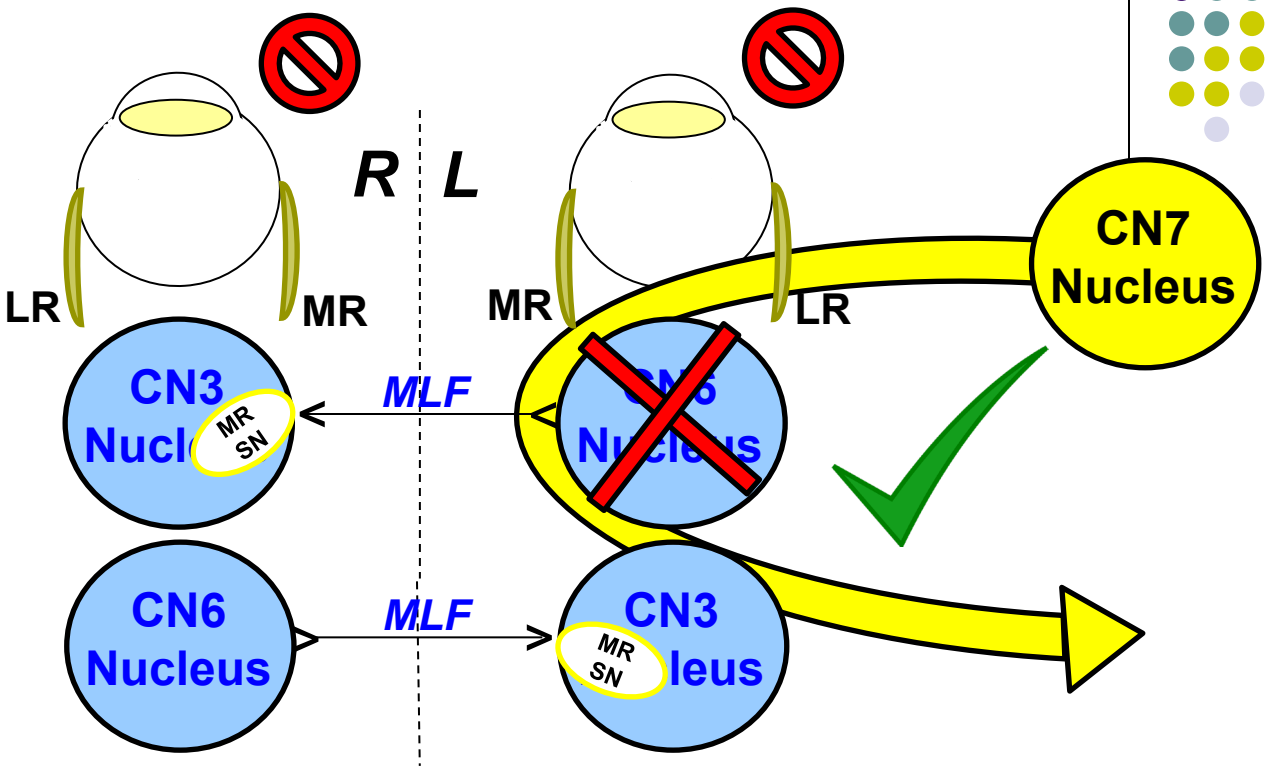
Is a CN6 + CN7 lesion a thing?

Motility Disorders: *Internuclear Ophthalmoplegia+*



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How does it present?
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Is a CN6 + CN7 lesion a thing?
Also yes (and also rare)