Motility Disorders: Overview

CN…

CN…

CN…

Which cranial nerves innervate the extraocular muscles (EOMs)?

Motility Disorders: Overview

CN3 **CN6** **CN4**

Which cranial nerves innervate the extraocular muscles (EOMs)?

Motility Disorders: Overview

CN3
?

CN6
?

CN4
?

What is the name for the collections of neurons that give rise to each of these cranial nerves? (This is not a trick question--the answer is as obvious as it seems.)

Motility Disorders: Overview

CN3 Nucleus

CN6 Nucleus

CN4 Nucleus

What is the name for the collections of neurons that give rise to each of these cranial nerves? (This is not a trick question--the answer is as obvious as it seems.)

Motility Disorders: Overview

Nuclear

CN3 Nucleus

CN6 Nucleus

CN4 Nucleus

(As we shall soon see, this ‘nuclear level’ serves as a useful point around which to organize the EOM-control pathway.)

Motility Disorders: Overview

Um, Dr Flynn, 4 comes before 6. Why are these nuclei listed out of order?

CN3 Nucleus

CN6 Nucleus

CN4 Nucleus

Motility Disorders: Overview

Um, Dr Flynn, 4 comes before 6. Why are these nuclei listed out of order?
This will be explained shortly

CN3 Nucleus

CN6 Nucleus

CN4 Nucleus

Motility Disorders: Overview

?

?

Nuclear

CN3 Nucleus

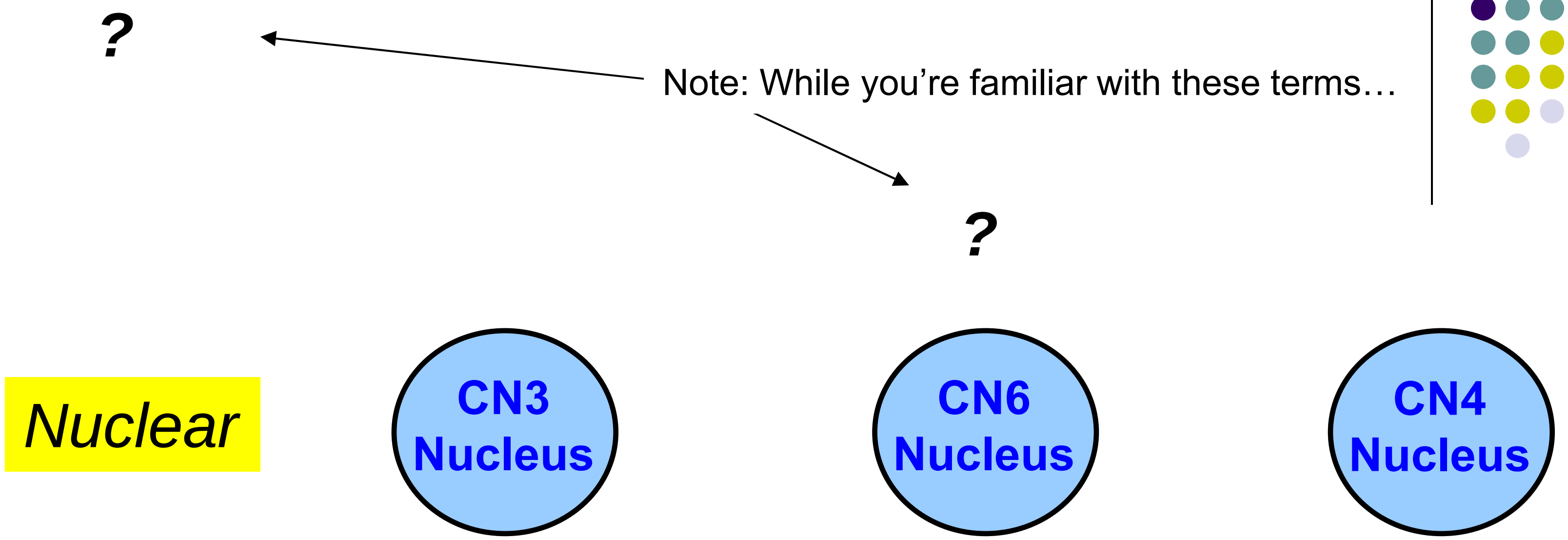
CN6 Nucleus

CN4 Nucleus

?

With respect to pathology of the EOM control pathways, there are four major ‘locations.’ One of these (the nuclear) has been identified already. What are the other three? (Hint: Their names reflect the relationship each has to the nuclear level.)

Motility Disorders: Overview



?

Note: While you’re familiar with these terms…

?

Nuclear

CN3 Nucleus

CN6 Nucleus

CN4 Nucleus

?

With respect to pathology of the EOM control pathways, there are four major ‘locations.’ One of these (the nuclear) has been identified already. What are the other three? (Hint: Their names reflect the relationship each has to the nuclear level.)

Motility Disorders: Overview

?

Note: While you're familiar with these terms…

?

Nuclear

CN3 Nucleus

CN6 Nucleus

CN4 Nucleus

With respect to pathology of the EOM control pathways, there are four major 'locations.' One of these (the nuclear) has been identified already. What are the other three? (Hint: Their names reflect the relationship each has to the nuclear level.)

?

…you may not be with this one, although you'll agree it makes sense in context.
(Further, and importantly, it is used in the BCSC *Neuro* book.)

Motility Disorders: Overview

Supranuclear

Note: While you're familiar with these terms…

Internuclear

Nuclear

CN3 Nucleus

CN6 Nucleus

CN4 Nucleus

With respect to pathology of the EOM control pathways, there are four major 'locations.' One of these (the nuclear) has been identified already. What are the other three? (Hint: Their names reflect the relationship each has to the nuclear level.)

Infranuclear

…you may not be with this one, although you'll agree it makes sense in context.
(Further, and importantly, it is used in the BCSC *Neuro* book.)

Motility Disorders: Overview

Supranuclear

The *supranuclear pathways* consists of inputs to the nuclei from centers in the cortex, cerebellum, vestibular system, etc.

Internuclear

Nuclear

CN3 Nucleus

CN6 Nucleus

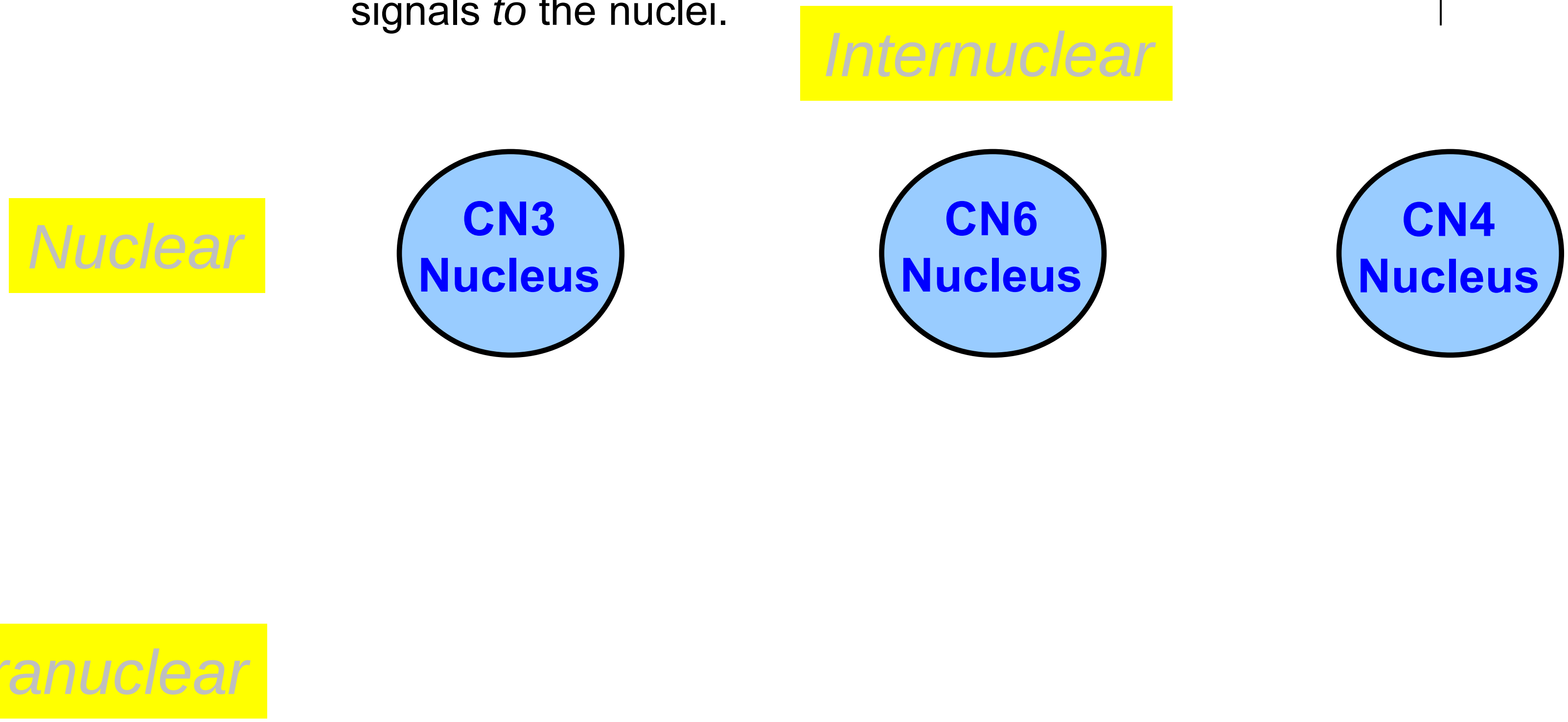
CN4 Nucleus

Infranuclear

Motility Disorders: Overview

Supranuclear

The *supranuclear pathways* consists of inputs to the nuclei from centers in the cortex, cerebellum, vestibular system, etc. These locations are 'supra' in that they carry signals *to* the nuclei.



Internuclear

Nuclear

CN3 Nucleus

CN6 Nucleus

CN4 Nucleus

Infranuclear

Motility Disorders: Overview

Supranuclear

Internuclear

Nuclear

CN3 Nucleus

CN6 Nucleus

CN4 Nucleus

Are lesions of the CN3 nucleus commonly encountered in clinical practice?

Infranuclear

Motility Disorders: Overview

Supranuclear

Internuclear

Nuclear

CN3 Nucleus

CN6 Nucleus

CN4 Nucleus

Are lesions of the CN3 nucleus commonly encountered in clinical practice?

No, they are rare

Infranuclear

Motility Disorders: Overview

Supranuclear

Internuclear

Nuclear

CN3 Nucleus

CN6 Nucleus

CN4 Nucleus

Are lesions of the CN4 nucleus commonly encountered in clinical practice?

Infranuclear

Motility Disorders: Overview

Supranuclear

Internuclear

Nuclear

CN3 Nucleus

CN6 Nucleus

CN4 Nucleus

Are lesions of the CN4 nucleus commonly encountered in clinical practice?

No, these are even rarer

Infranuclear

Motility Disorders: Overview

Supranuclear

Internuclear

Nuclear

CN3 Nucleus

CN6 Nucleus

CN4 Nucleus

Are lesions of the CN6 nucleus commonly encountered in clinical practice?

Infranuclear

Motility Disorders: Overview

Supranuclear

Internuclear

Nuclear

CN3 Nucleus

CN6 Nucleus

CN4 Nucleus

Are lesions of the CN6 nucleus commonly encountered in clinical practice?

While not common, they are a well-known clinical entity

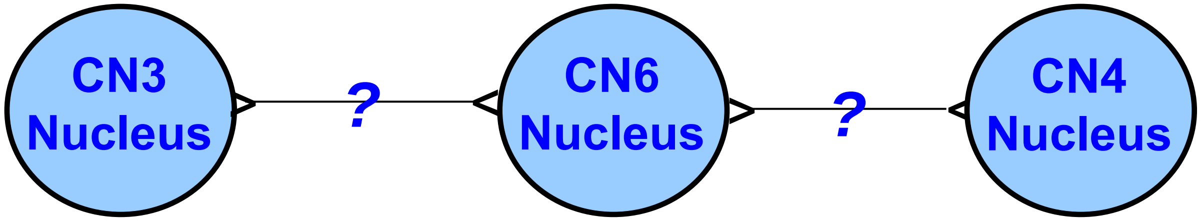
Infranuclear

Motility Disorders: Overview

Supranuclear

Internuclear

Nuclear



CN3 Nucleus

?

CN6 Nucleus

?

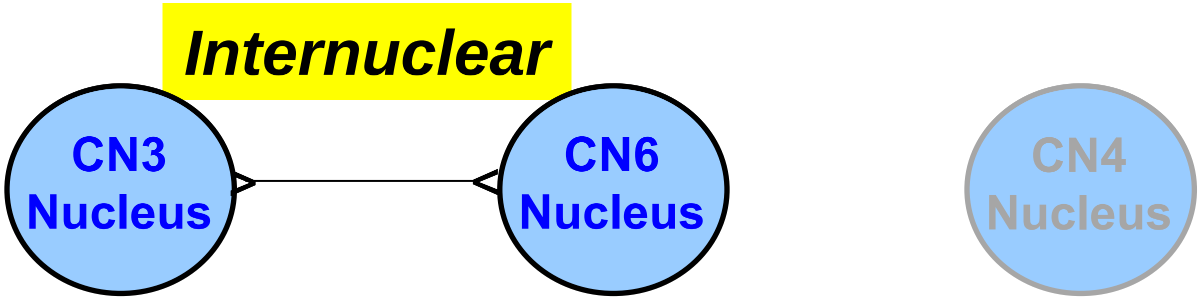
CN4 Nucleus

Which two nuclei share an internuclear connection that is of well-established clinical importance?

Infranuclear

Motility Disorders: Overview

Supranuclear



Nuclear

Which two nuclei share an internuclear connection that is of well-established clinical importance?

3 and 6 (Apropos a previous question: **This** is why the nuclei are not in numeric order!)

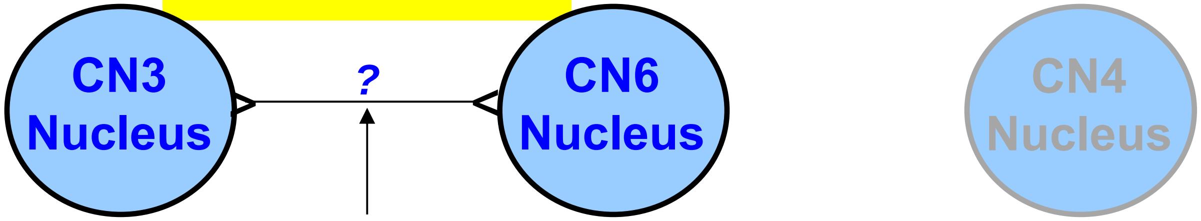
Infranuclear

Motility Disorders: Overview

Supranuclear

Internuclear

Nuclear

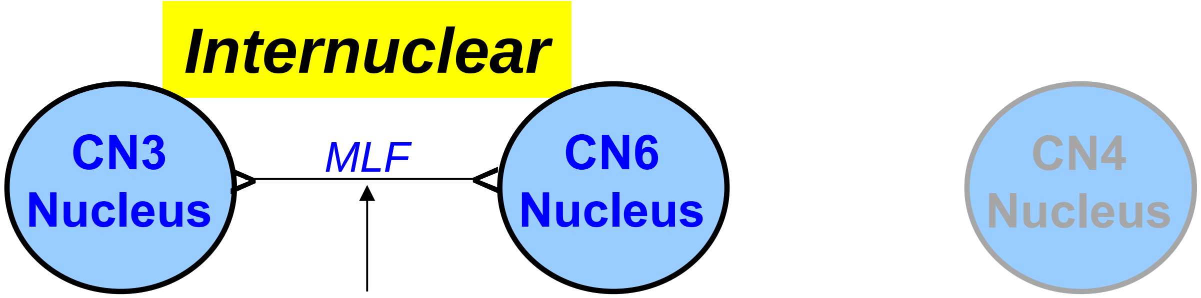


What is the name of the internuclear pathway connecting the CN3 and CN6 nuclei?

Infranuclear

Motility Disorders: Overview

Supranuclear



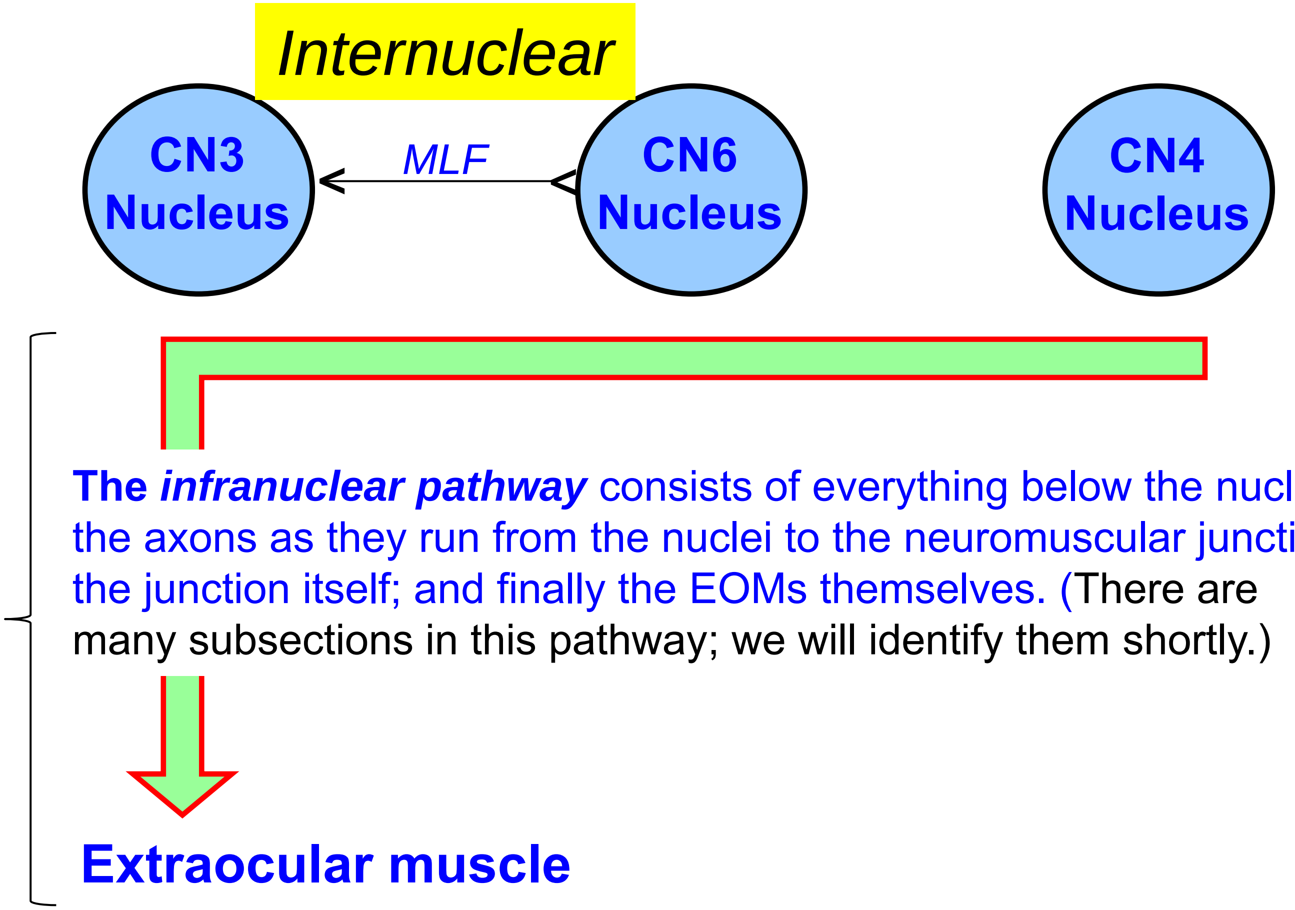
Nuclear

What is the name of the internuclear pathway connecting the CN3 and CN6 nuclei?
The **medial longitudinal fasciculus** (MLF)

Infranuclear

Motility Disorders: Overview

Supranuclear



Internuclear

Nuclear

CN3 Nucleus

MLF

CN6 Nucleus

CN4 Nucleus

Infranuclear

The *infranuclear pathway* consists of everything below the nuclei: the axons as they run from the nuclei to the neuromuscular junction; the junction itself; and finally the EOMs themselves. (There are many subsections in this pathway; we will identify them shortly.)

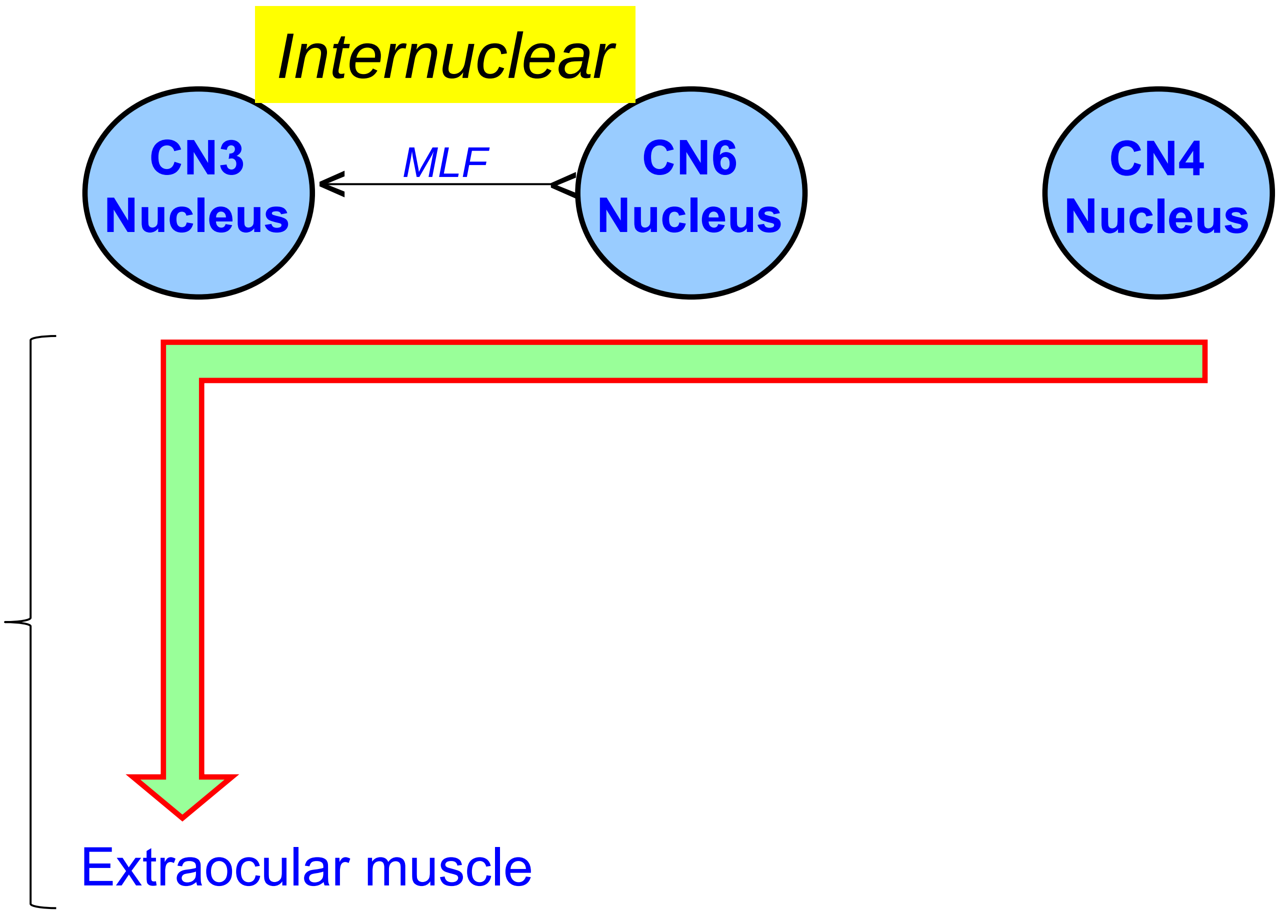
Extraocular muscle

This slide summarizes the basic organization of EOM control.

Supranuclear

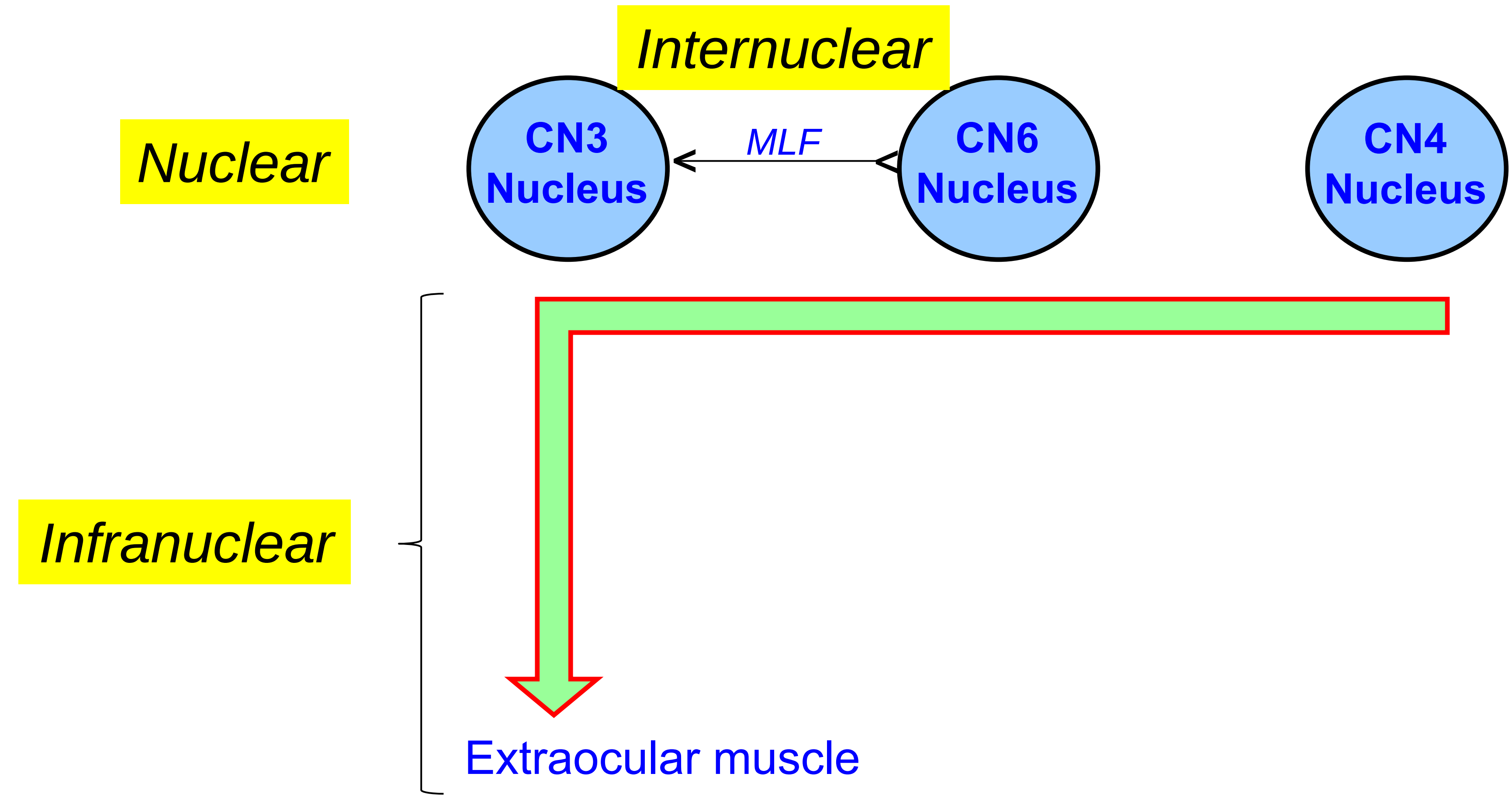
Nuclear

Infranuclear



This slide summarizes the basic organization of EOM control. When you encounter a pt with a motility issue, your first thought should be: *Is this issue* ***nuclear****,* ***supranuclear****,* ***internuclear****, or* ***infranuclear*** *in origin?*

Supranuclear



Internuclear

Nuclear

CN3 Nucleus

MLF

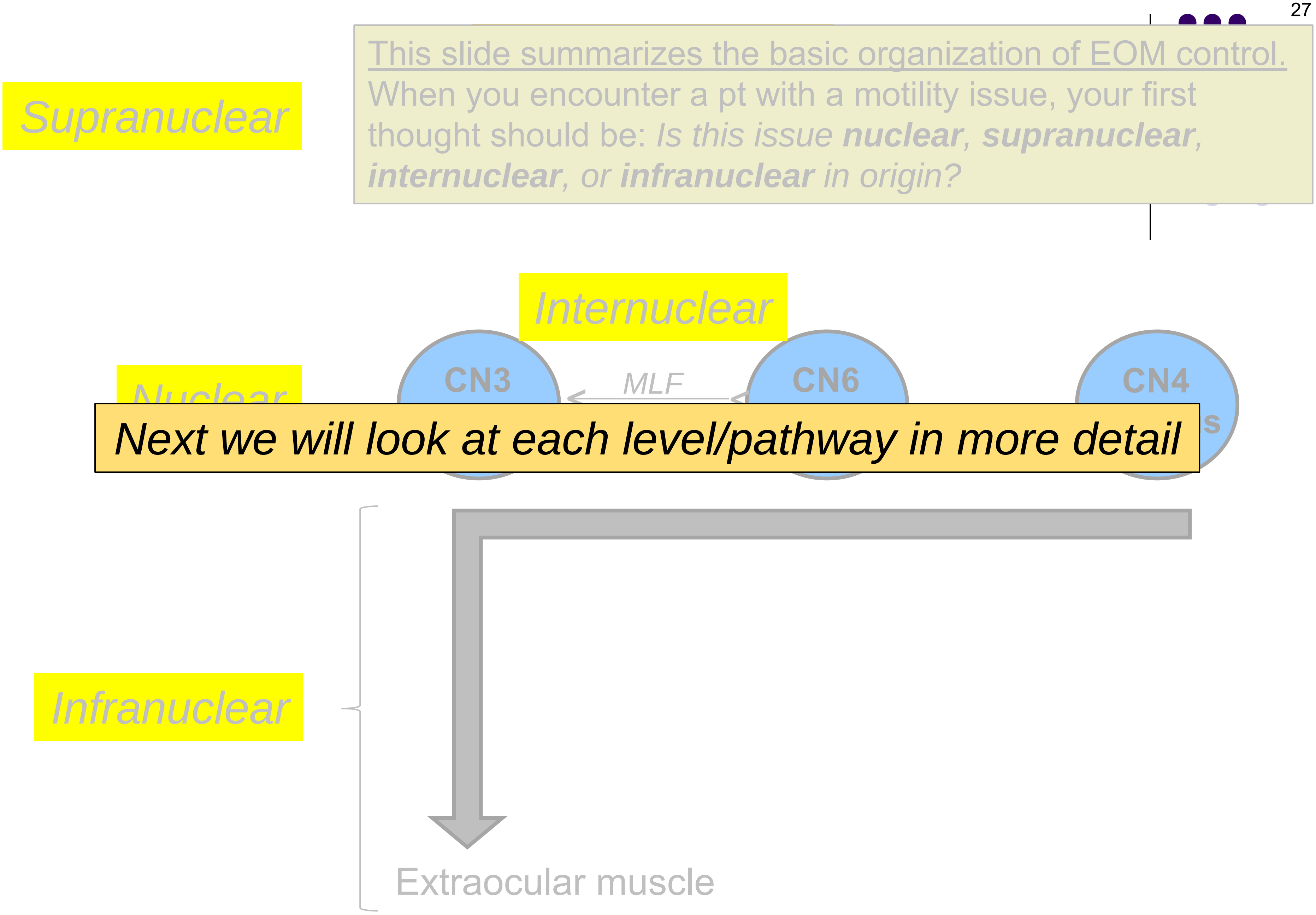
CN6 Nucleus

CN4 Nucleus

Infranuclear

Extraocular muscle

This slide summarizes the basic organization of EOM control. When you encounter a pt with a motility issue, your first thought should be: *Is this issue* ***nuclear****,* ***supranuclear****,* ***internuclear****, or* ***infranuclear*** *in origin?*

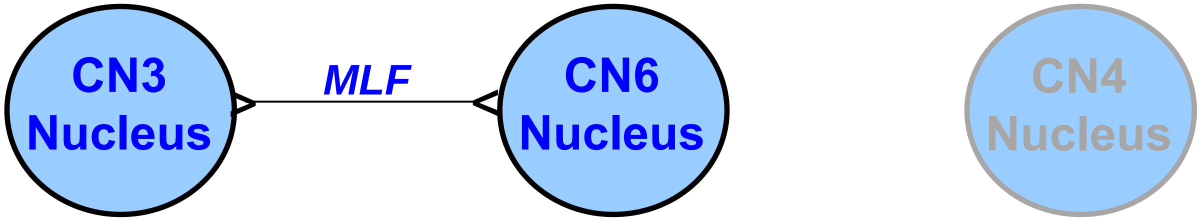


Next we will look at each level/pathway in more detail

Motility Disorders: Overview

Supranuclear

Nuclear



CN3 Nucleus

MLF

CN6 Nucleus

CN4 Nucleus

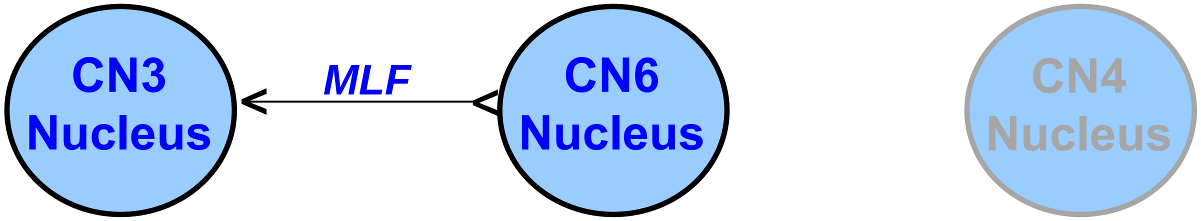
Infran

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

Motility Disorders: Overview

Supranuclear

Nuclear



Infran

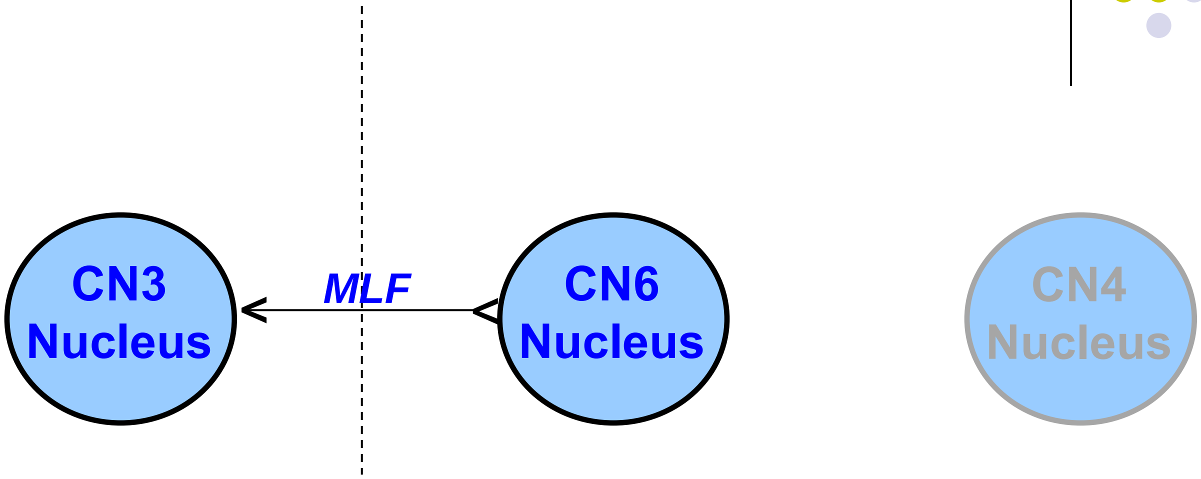
From where to where do the fascicles of the MLF run?

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

Motility Disorders: Overview

Supranuclear

Nuclear



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

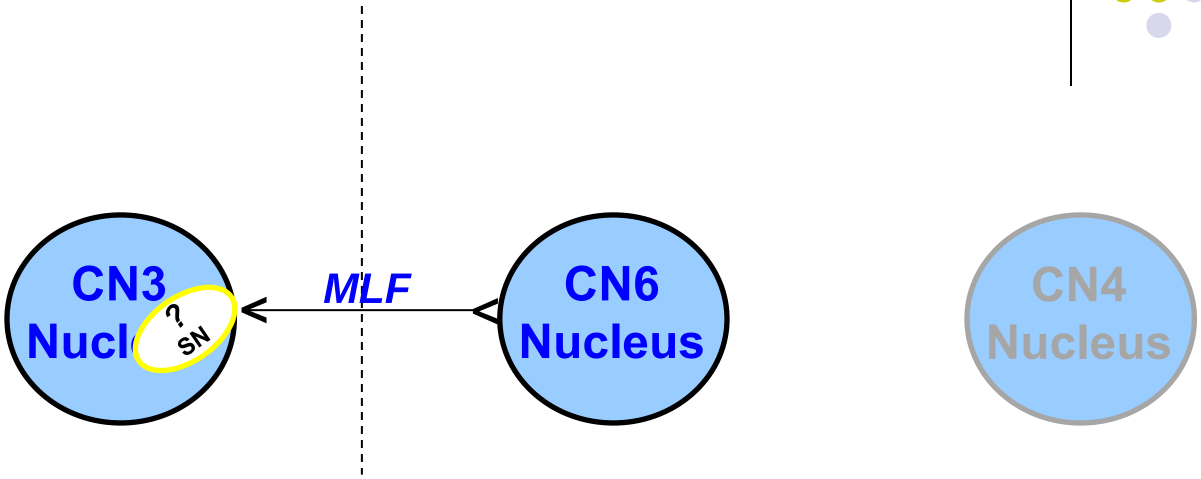
From the CN6 nucleus to the contralateral CN3 nucleus

Infran

Motility Disorders: Overview

Supranuclear

Nuclear



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

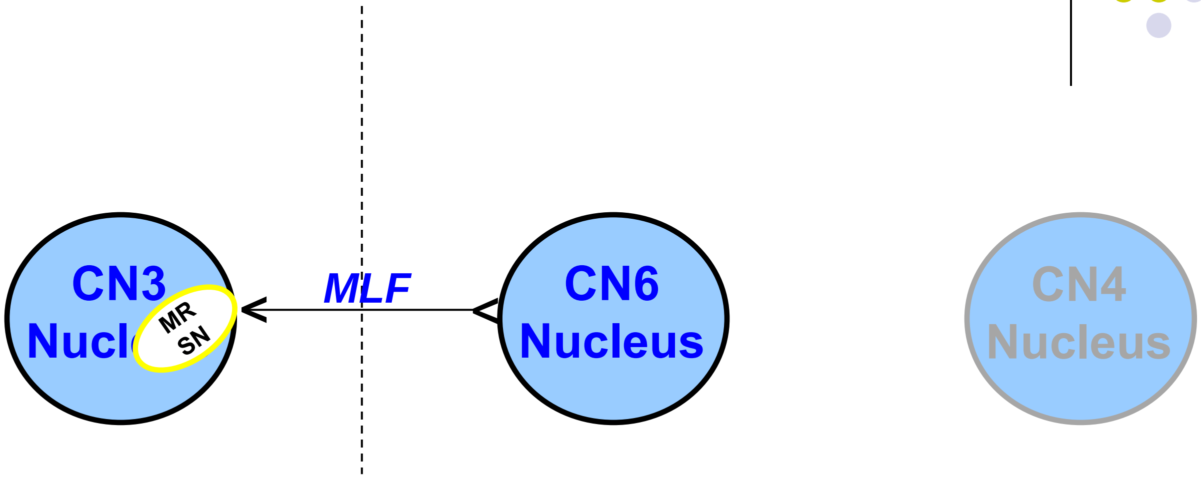
From the CN6 nucleus to the contralateral CN3 nucleus—specifically, to its EOM subnucleus

Infran

Motility Disorders: Overview

Supranuclear

Nuclear



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

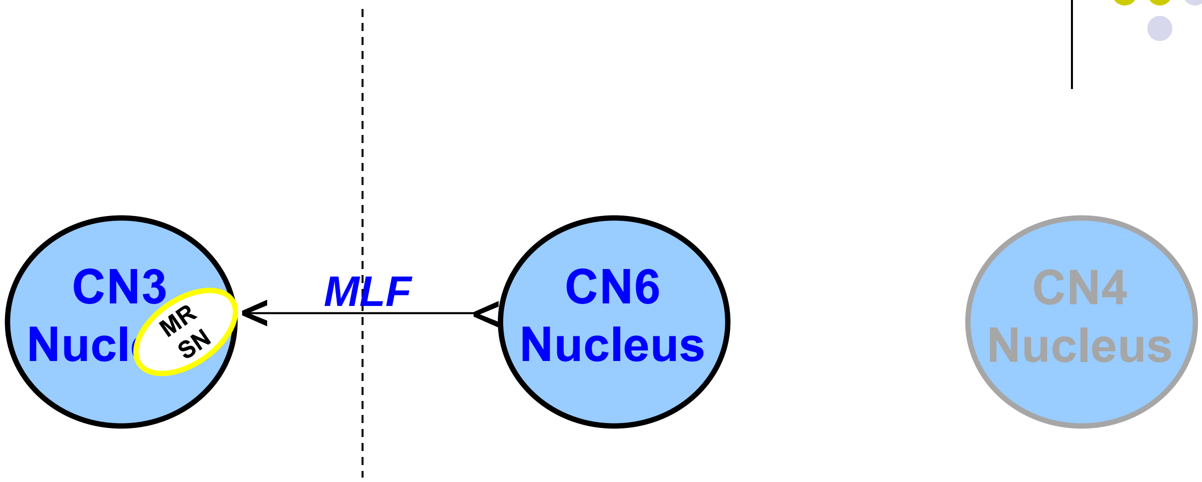
From the CN6 nucleus to the contralateral CN3 nucleus—specifically, to its medial rectus (MR) subnucleus

Infran

Motility Disorders: Overview

Supranuclear

Nuclear



Infran

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

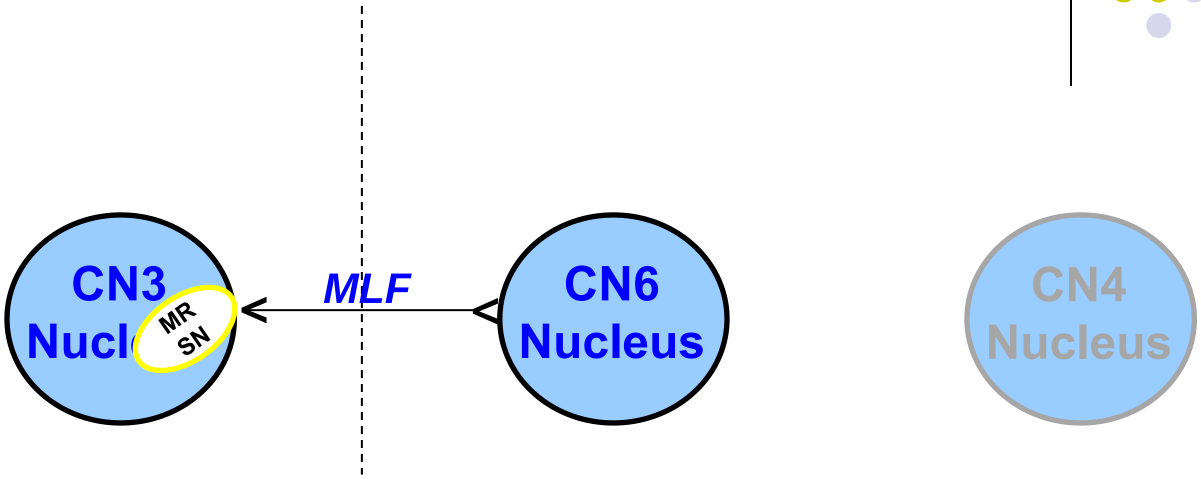
From the CN6 nucleus to the contralateral CN3 nucleus—specifically, to its medial rectus (MR) subnucleus

What purpose does the MLF serve?

Motility Disorders: Overview

Supranuclear

Nuclear



Infran

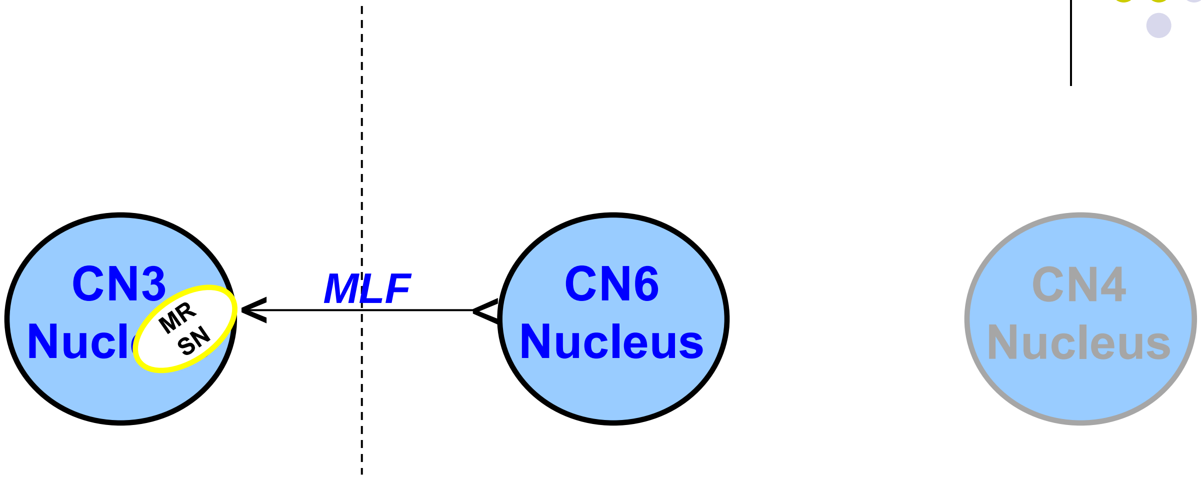
From where to where do the fascicles of the MLF run?
From the CN6 nucleus to the contralateral CN3 nucleus—specifically, to its medial rectus (MR) subnucleus

What purpose does the MLF serve?
To allow coordinated lateral gaze of both eyes

Motility Disorders: Overview

Supranuclear

Nuclear



Infran

From where to where do the fascicles of the MLF run?
From the CN6 nucleus to the contralateral CN3 nucleus—specifically, to its medial rectus (MR) subnucleus

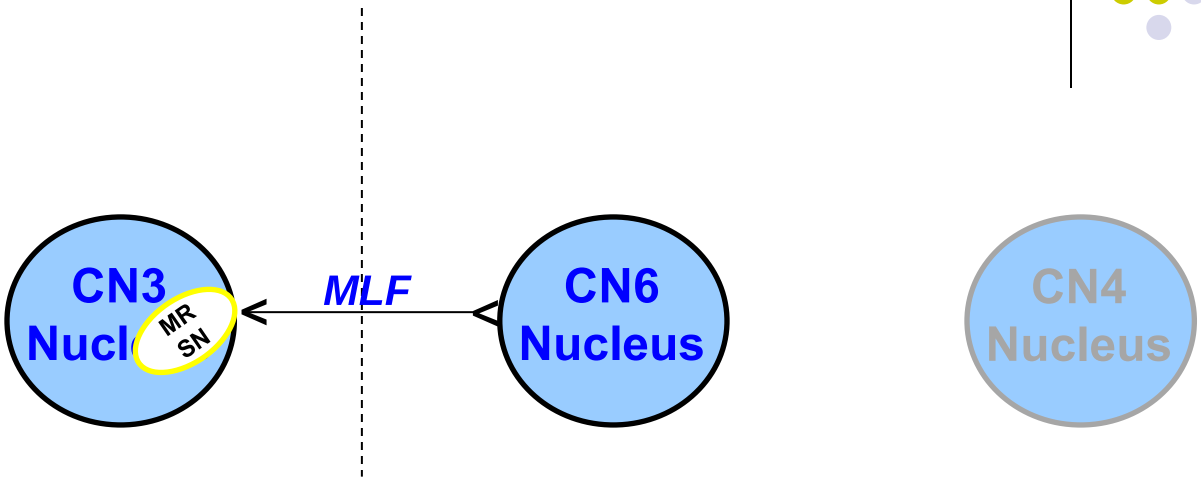
What purpose does the MLF serve?
To allow coordinated lateral gaze of both eyes

How does the MLF facilitate lateral gaze coordination?

Motility Disorders: Overview

Supranuclear

Nuclear



Infran

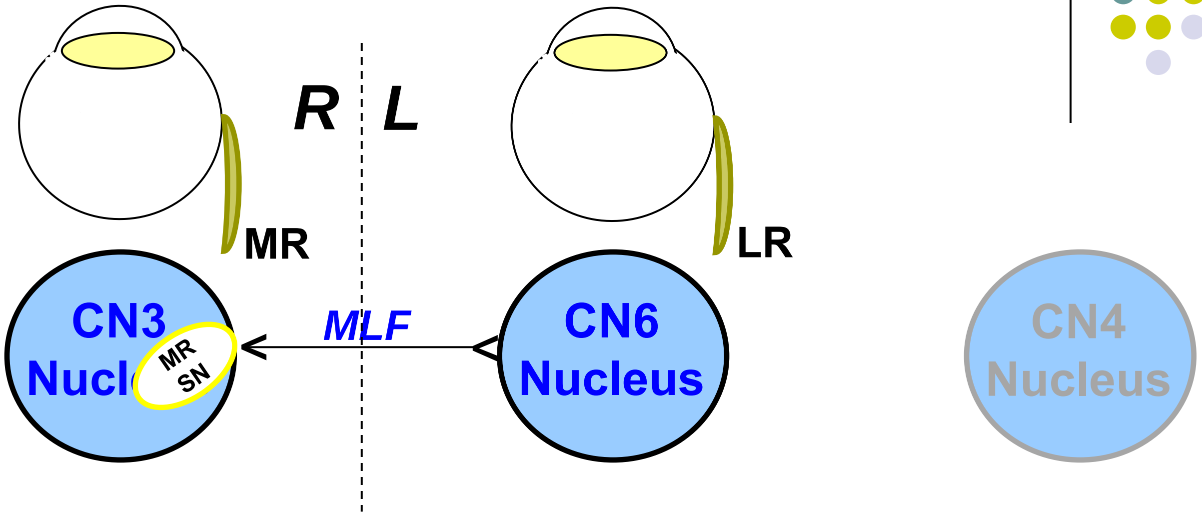
From where to where do the fascicles of the MLF run?
From the CN6 nucleus to the contralateral CN3 nucleus—specifically, to its medial rectus (MR) subnucleus

What purpose does the MLF serve?
To allow coordinated lateral gaze of both eyes

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

Motility Disorders: Overview

Supranuclear



Nuclear

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.

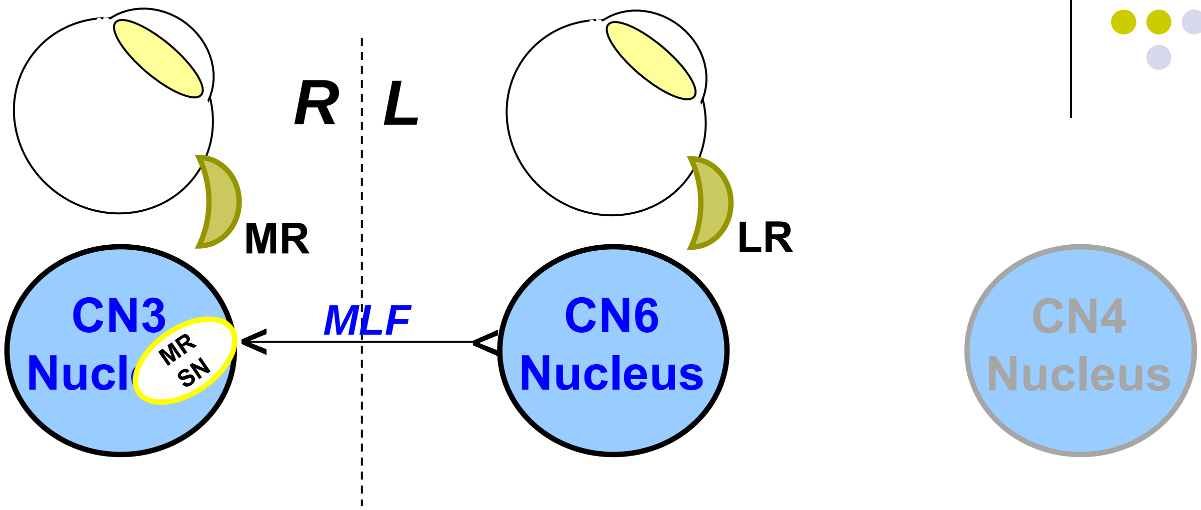
Infr

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

Motility Disorders: Overview

Supranuclear

Nuclear



Infr

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

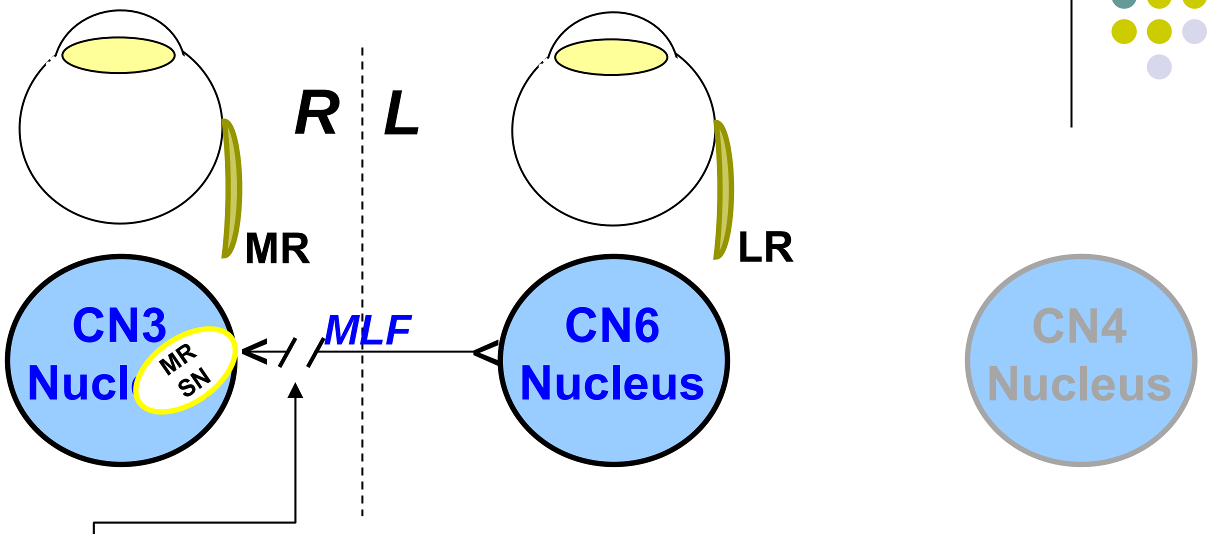
So if the depicted CN6 nucleus is on a pt’s left side, the depicted MLF runs to her right MR subnucleus. When the pt endeavors to look to her left, the left CN6 nucleus causes the left LR to contract while also sending impulses (via the MLF) to her right MR subnucleus, which in turn causes the right 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**

Motility Disorders: Overview

Supranuclear

Nuclear



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

From the CN6 nucleus to the contralateral CN3 nucleus—specifically, to its medial rectus (MR) subnucleus

Inf

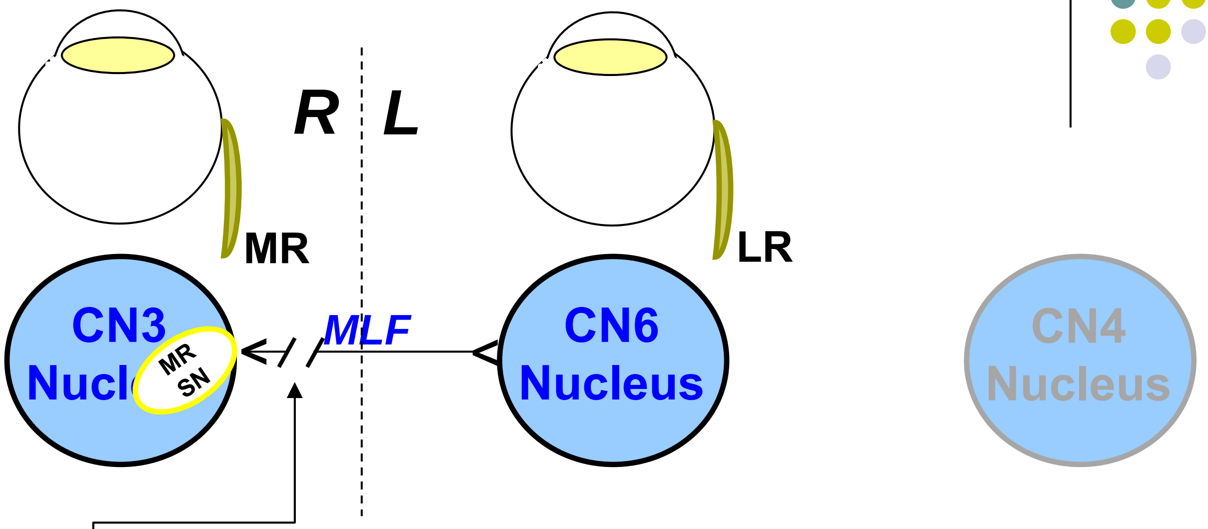
What effect does a lesion of the MLF have on lateral gaze?

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**

Motility Disorders: Overview

Supranuclear



Nuclear

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

From the CN6 nucleus to the contralateral CN3 nucleus—specifically, to its medial rectus (MR) subnucleus

Inf

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

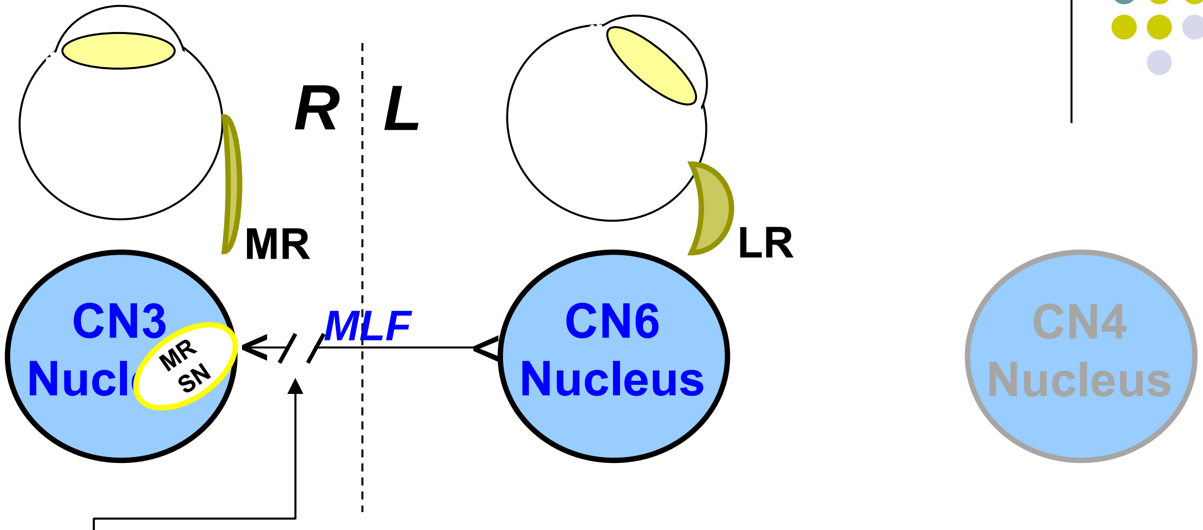
If the MLF is bagged, the impulse intended to result in the firing of the contralateral MR is affected…

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**

Motility Disorders: Overview

Supranuclear



Nuclear

Inf

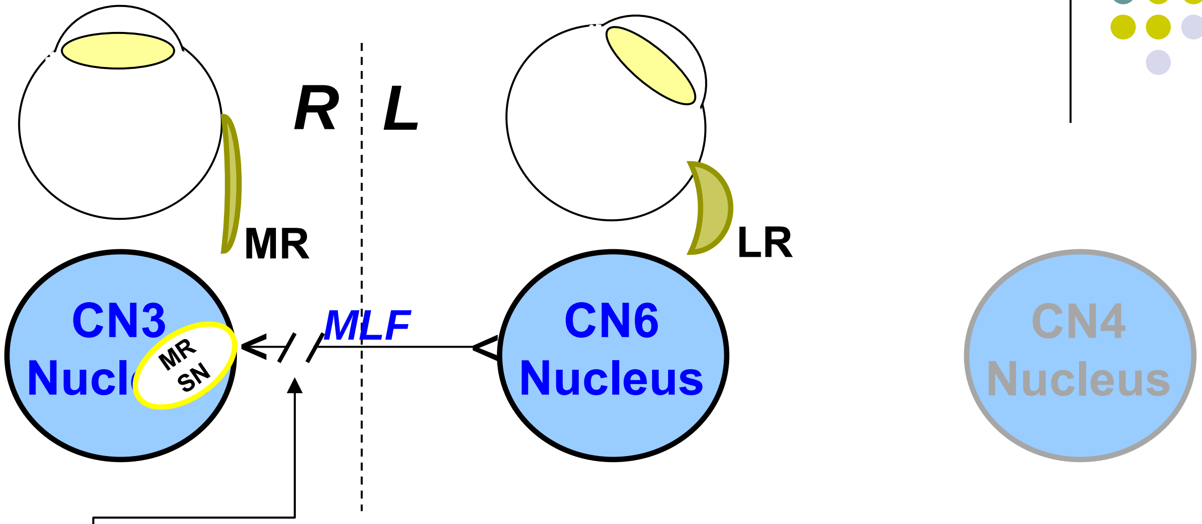
From where to where do the fascicles of the MLF run?
From the CN6 nucleus to the contralateral CN3 nucleus—specifically, to its medial rectus (MR) subnucleus

What effect does *a lesion of the MLF* *have on lateral gaze?*
If the MLF is bagged, the impulse intended to result in the firing of the contralateral MR is affected…but the impulse to the ipsilateral LR gets through unscathed.

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**

Motility Disorders: Overview

Supranuclear



Nuclear

Inf

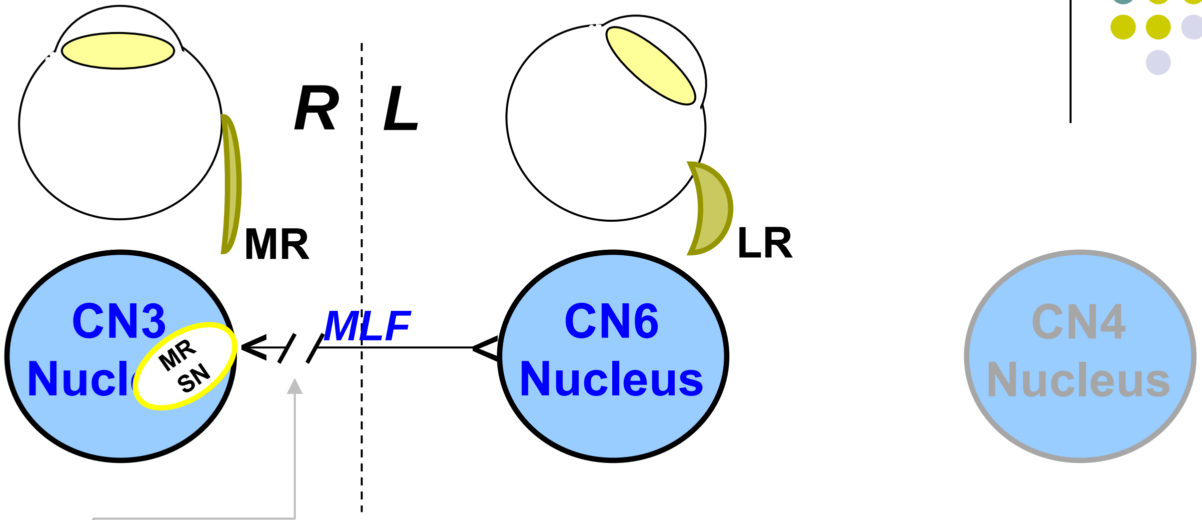
What effect does a lesion of the MLF have on lateral gaze?
If the MLF is bagged, the impulse intended to result in the firing of the contralateral MR is affected…but the impulse to the ipsilateral LR gets through unscathed. Thus, attempted lateral gaze results in normal ABduction of the ipsilateral eye, but impaired ADduction of the contralateral eye.

From where to where do the fascicles of the MLF run?
From the CN6 nucleus to the contralateral CN3 nucleus—specifically, to its medial rectus (MR) subnucleus.

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**

Motility Disorders: Overview

Supranuclear



Nuclear

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

From the CN6 nucleus to the contralateral CN3 nucleus—specifically, to its medial rectus (MR) subnucleus

Inf

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

If the MLF is bagged, the impulse intended to result in the firing of the contralateral MR is affected…but the impulse to the ipsilateral LR gets through unscathed. <u>Thus, attempted lateral gaze results in normal ABduction of the ipsilateral eye, but impaired ADduction of the contralateral eye</u>.

How does the MLF facilitate lateral gaze coordination?

By causing the contralateral MR to fire simultaneously with the

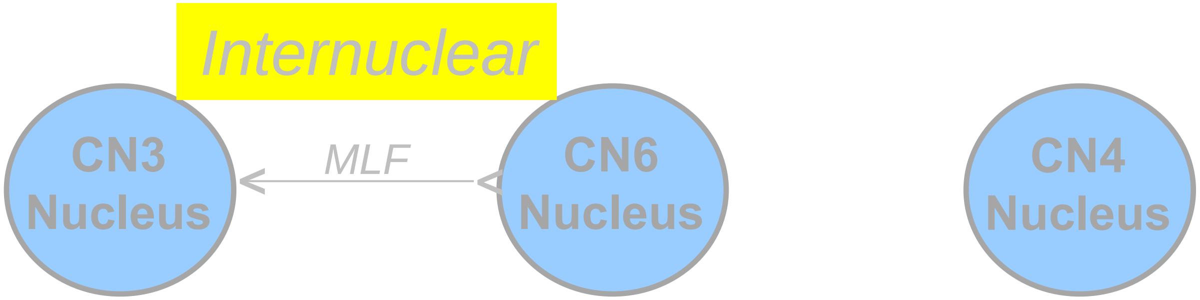
This is an internuclear ophthalmoplegia (INO; see slide-set N20)

lateral gaze together

Motility Disorders: Overview

Supranuclear

Nuclear



Internuclear

CN3 Nucleus

MLF

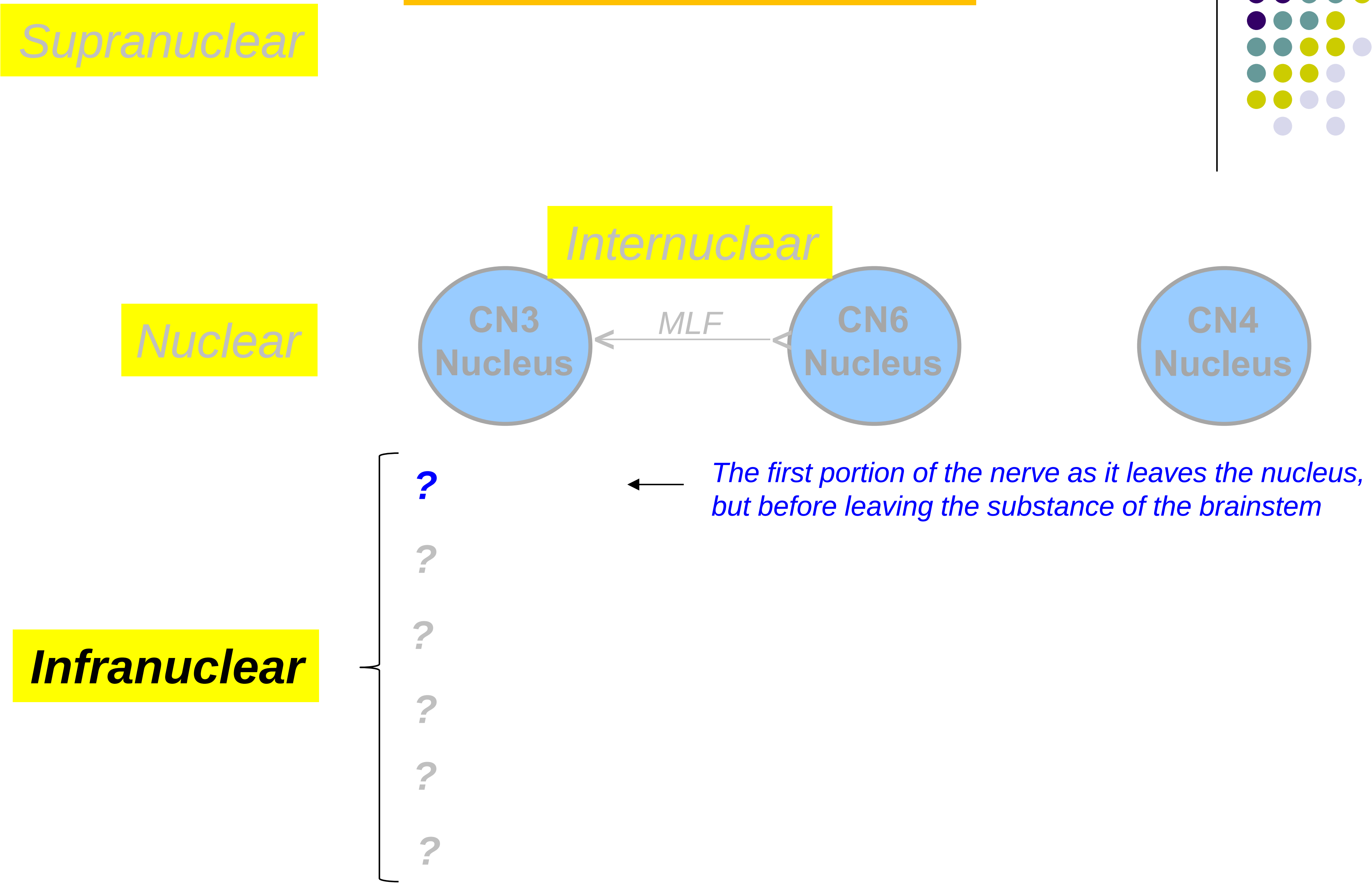
CN6 Nucleus

CN4 Nucleus

Infranuclear

Next we will turn our attention to the ***infranuclear pathway***, which proceeds in an ordered fashion from the nuclei to the extraocular muscles themselves

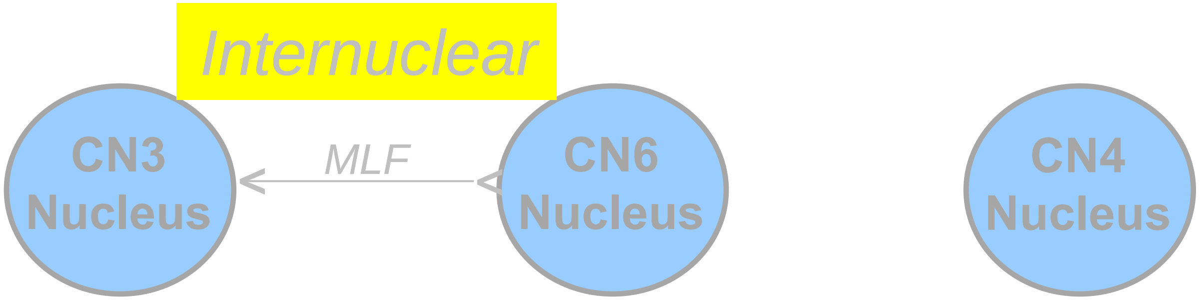
Motility Disorders: Overview



The first portion of the nerve as it leaves the nucleus, but before leaving the substance of the brainstem

Motility Disorders: Overview

Supranuclear



Nuclear

Infranuclear

Fascicular ← *The first portion of the nerve as it leaves the nucleus, but before leaving the substance of the brainstem*

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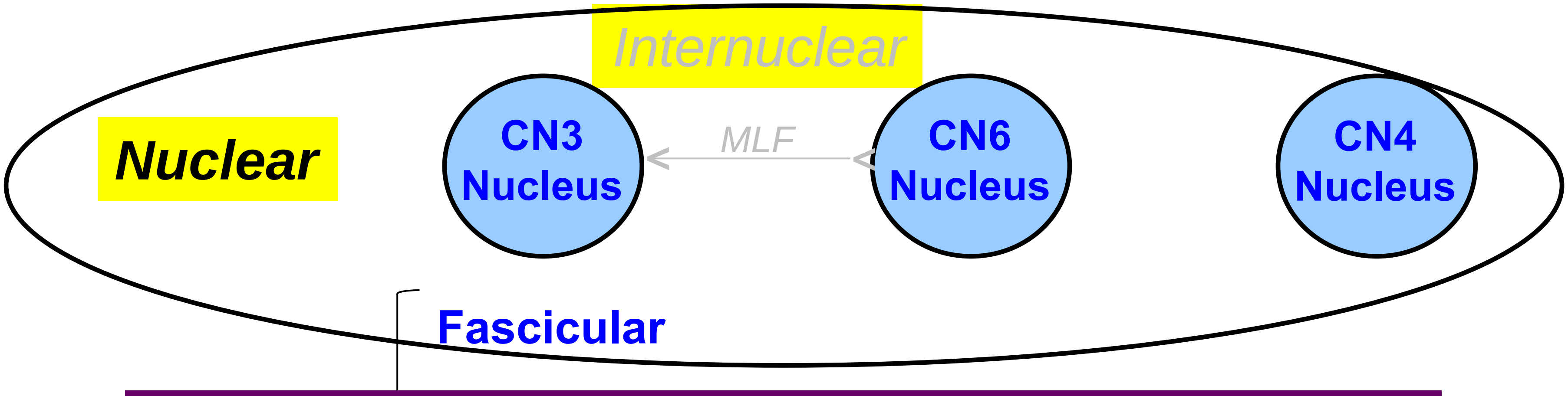
Motility Disorders: Overview

Supranuclear



Internuclear

Nuclear

CN3 Nucleus

MLF

CN6 Nucleus

CN4 Nucleus

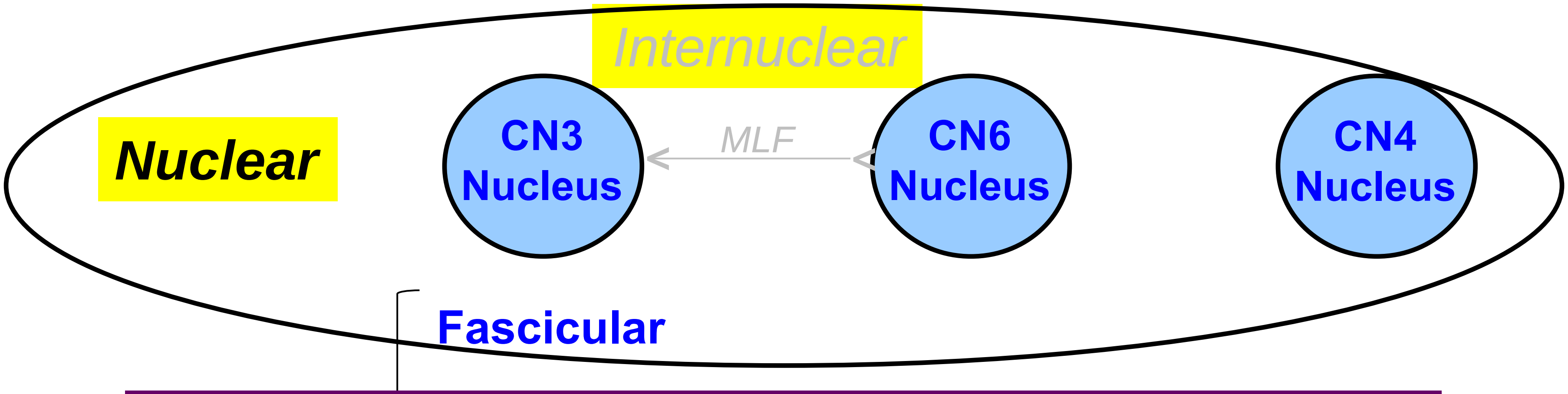
Fascicular

Infra

The cranial-nerve nuclei and their fascicles are located within the brainstem. Given this, it shouldn’t come as a surprise that, generally speaking, lesions of the nuclei and/or fascicles do not present with *isolated* EOM abnormalities; ie, the ophthalmoparesis is almost always accompanied by **nonocular** signs and symptoms of CNS damage.

Motility Disorders: Overview

Supranuclear



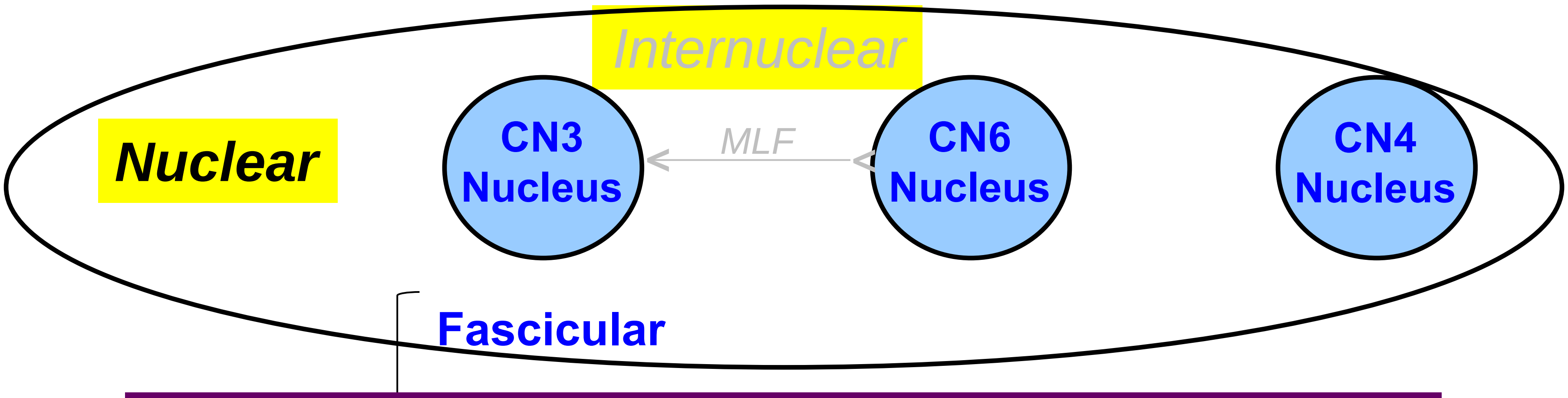
Infra

The cranial-nerve nuclei and their fascicles are located within the brainstem. Given this, it shouldn’t come as a surprise that, generally speaking, lesions of the nuclei and/or fascicles do not present with *isolated* EOM abnormalities; ie, the ophthalmoparesis is almost always accompanied by **nonocular** signs and symptoms of CNS damage.

What general term is used to describe conditions presenting with motility dysfunction 2ndry to fascicle damage + non-ocular CNS findings?

Motility Disorders: Overview

Supranuclear



Infra

The cranial-nerve nuclei and their fascicles are located within the brainstem. Given this, it shouldn’t come as a surprise that, generally speaking, lesions of the nuclei and/or fascicles do not present with *isolated* EOM abnormalities; ie, the ophthalmoparesis is almost always accompanied by **nonocular** signs and symptoms of CNS damage.

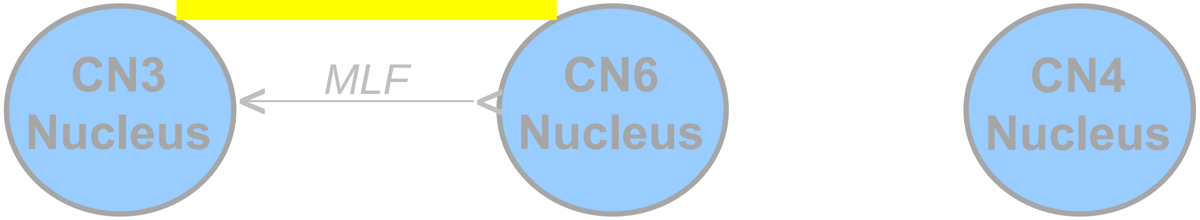
What general term is used to describe conditions presenting with motility dysfunction 2ndry to fascicle damage + non-ocular CNS findings?
Fascicular syndrome

Motility Disorders: Overview

Supranuclear

Internuclear

Nuclear



Fascicular

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?

Infranuclear

Speaking of fascicular syndromes…the Neuro book *describes four involving the CN3 fascicle, and two for the CN6. Name them.*

CN3 fascicular syndromes:

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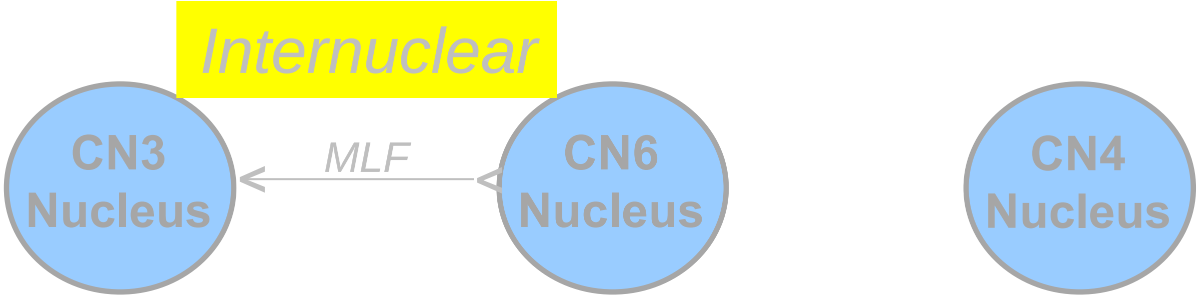
Motility Disorders: Overview

Supranuclear



Nuclear

Infranuclear

Fascicular

?

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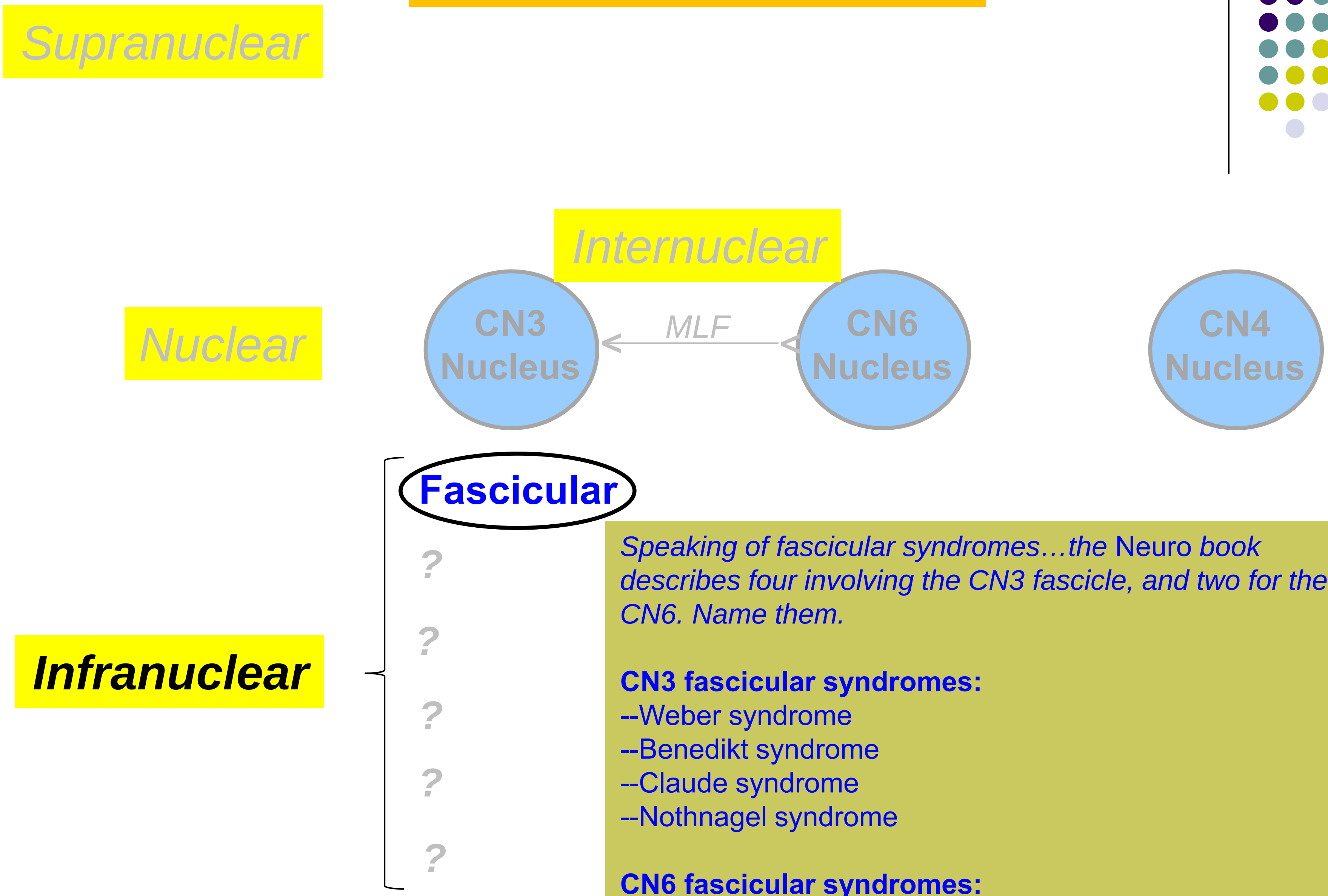
?

Speaking of fascicular syndromes…the Neuro book *describes four involving the CN3 fascicle, and two for the CN6. Name them.*

CN3 fascicular syndromes:
--Weber syndrome
--Benedikt syndrome
--Claude syndrome
--Nothnagel syndrome

Motility Disorders: Overview



Speaking of fascicular syndromes…the Neuro *book describes four involving the CN3 fascicle, and two for the CN6. Name them.*

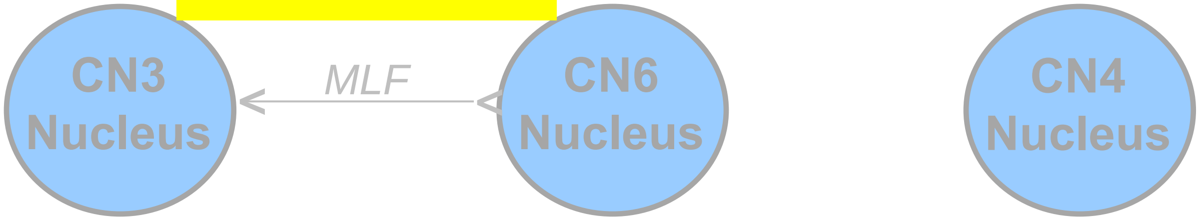
CN3 fascicular syndromes:
--Weber syndrome
--Benedikt syndrome
--Claude syndrome
--Nothnagel syndrome

CN6 fascicular syndromes:
--
--

Motility Disorders: Overview

Supranuclear

Internuclear



Nuclear

Infranuclear

Fascicular

?

?

?

?

?

Speaking of fascicular syndromes…the Neuro book *describes four involving the CN3 fascicle, and two for the CN6. Name them.*

CN3 fascicular syndromes:
--Weber syndrome
--Benedikt syndrome
--Claude syndrome
--Nothnagel syndrome

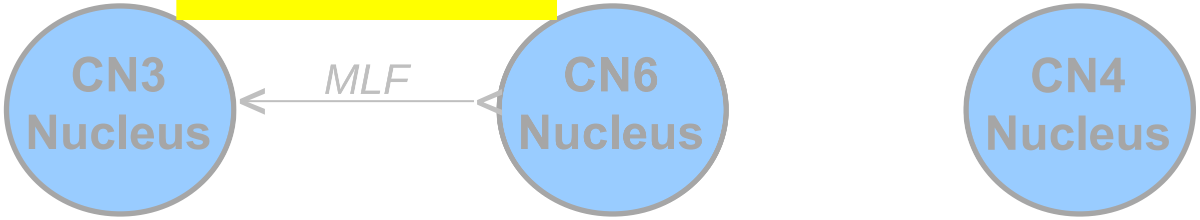
CN6 fascicular syndromes:
--Foville syndrome
--Millard-Gubler syndrome

Motility Disorders: Overview

Supranuclear

Internuclear

Nuclear



Infranuclear

Fascicular

?

?

?

?

?

Speaking of fascicular syndromes…the Neuro *book describes four involving the CN3 fascicle, and two for the CN6. Name them.*

CN3 fascicular syndromes:
--Weber syndrome
--Benedikt syndrome
--Claude syndrome
--Nothnagel syndrome

CN6 fascicular syndromes:
--Foville syndrome
--Millard-Gubler syndrome

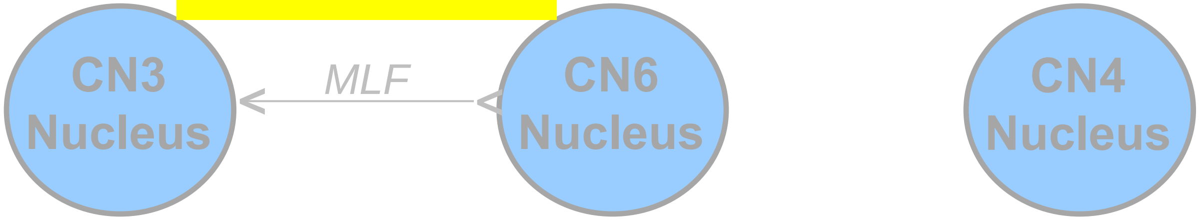
The fascicular syndromes are addressed in detail in their own slide-set (N14)

Motility Disorders: Overview

Supranuclear

Internuclear

Nuclear

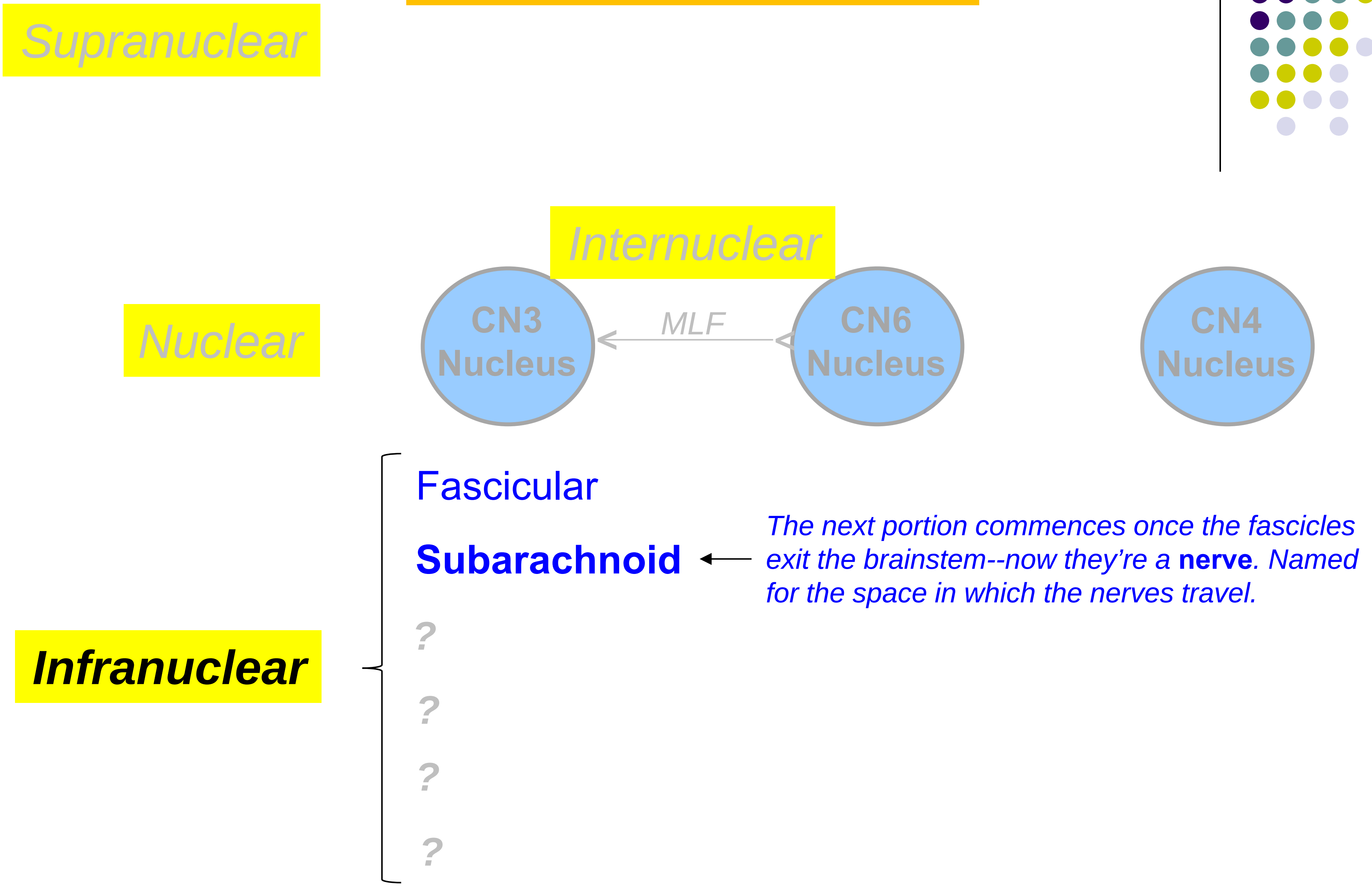


Infranuclear

- Fascicular
- ***?***
- *?*
- *?*
- *?*
- *?*

The next portion commences once the fascicles exit the brainstem--now they're a ***nerve****. Named for the space in which the nerves travel.*

Motility Disorders: Overview



Supranuclear

Internuclear

Nuclear

Infranuclear

Fascicular

Subarachnoid ←

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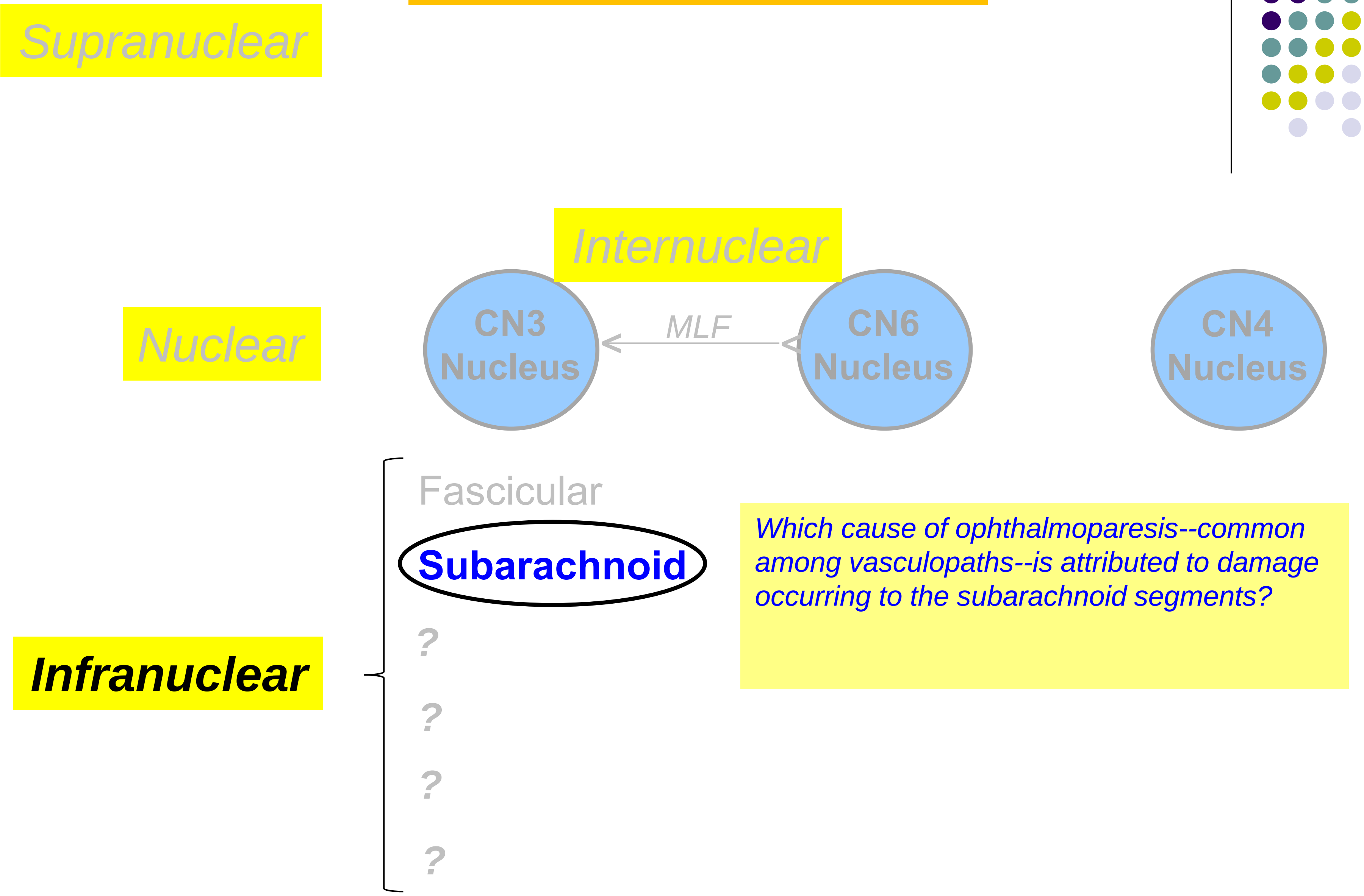
?

?

?

?

Motility Disorders: Overview



Supranuclear

Internuclear

Nuclear

CN3 Nucleus

MLF

CN6 Nucleus

CN4 Nucleus

Infranuclear

Fascicular

Subarachnoid

?

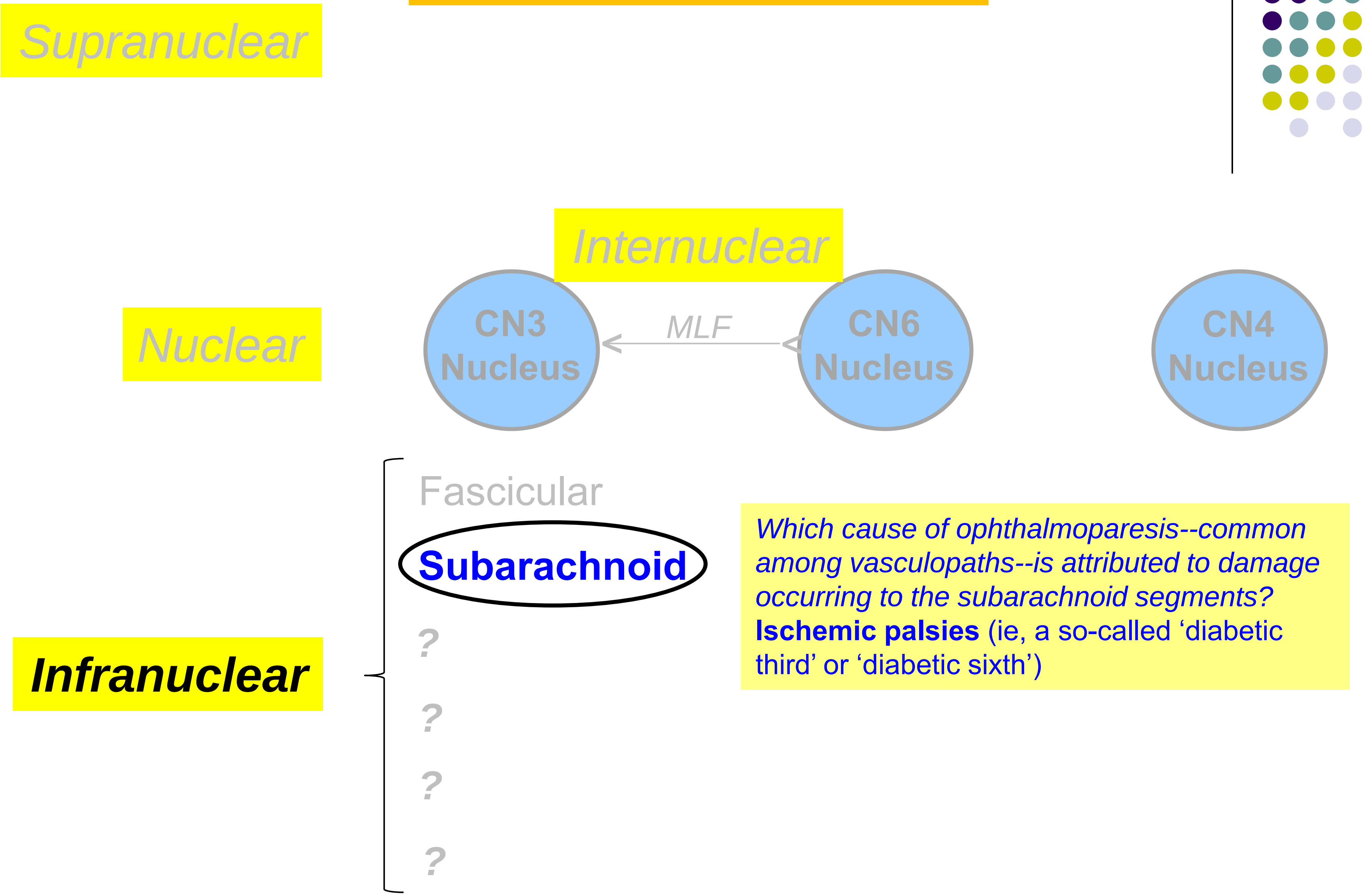
?

?

?

Which cause of ophthalmoparesis--common among vasculopaths--is attributed to damage occurring to the subarachnoid segments?

Motility Disorders: Overview



Supranuclear

Internuclear

Nuclear

CN3 Nucleus

MLF

CN6 Nucleus

CN4 Nucleus

Infranuclear

Fascicular

Subarachnoid

?

?

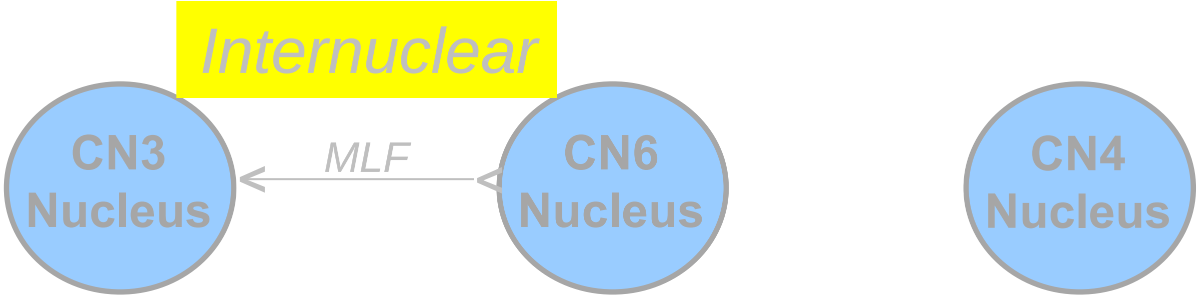
?

?

Which cause of ophthalmoparesis--common among vasculopaths--is attributed to damage occurring to the subarachnoid segments? **Ischemic palsies** (ie, a so-called 'diabetic third' or 'diabetic sixth')

Motility Disorders: Overview

Supranuclear



Nuclear

Infranuclear

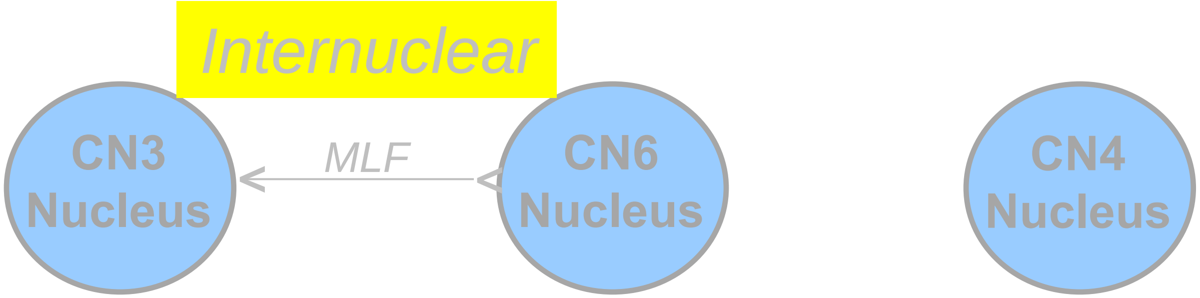
- Fascicular
- Subarachnoid
- **?**
- *?*
- *?*
- *?*

The nerves then leave the subarachnoid space by diving into a space of a very different sort. This portion is named for the space entered into.

Motility Disorders: Overview

Supranuclear

Nuclear



Infranuclear

- Fascicular
- Subarachnoid
- **Cavernous sinus**
- ?
- ?
- ?

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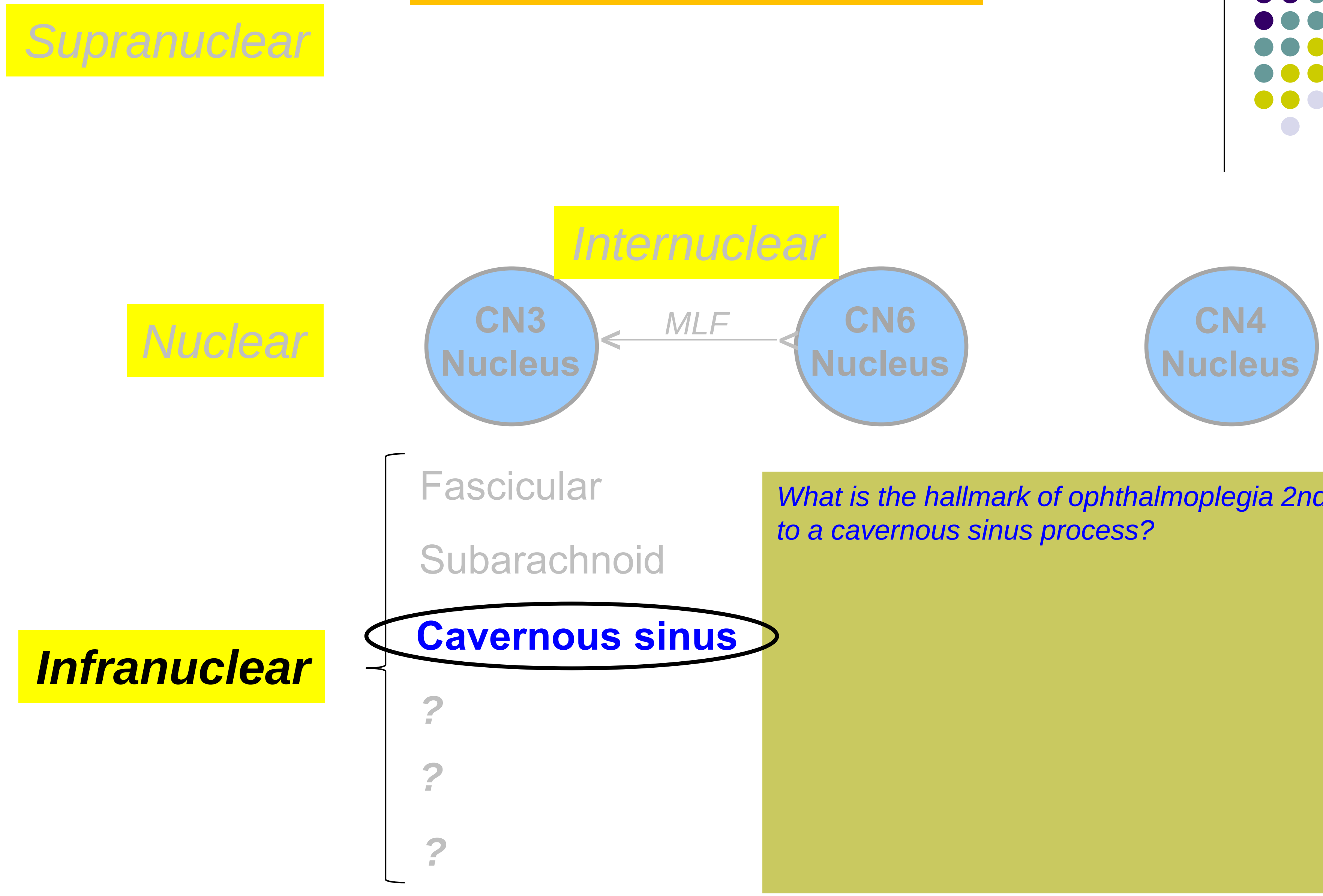
Motility Disorders: Overview



Supranuclear

Internuclear

Nuclear

CN3 Nucleus

MLF

CN6 Nucleus

CN4 Nucleus

Infranuclear

- Fascicular
- Subarachnoid
- **Cavernous sinus**
- *?*
- *?*
- *?*

What is the hallmark of ophthalmoplegia 2ndry to a cavernous sinus process?

Motility Disorders: Overview

Supranuclear

Internuclear

Nuclear

CN3 Nucleus ← *MLF* ← **CN6 Nucleus**

CN4 Nucleus

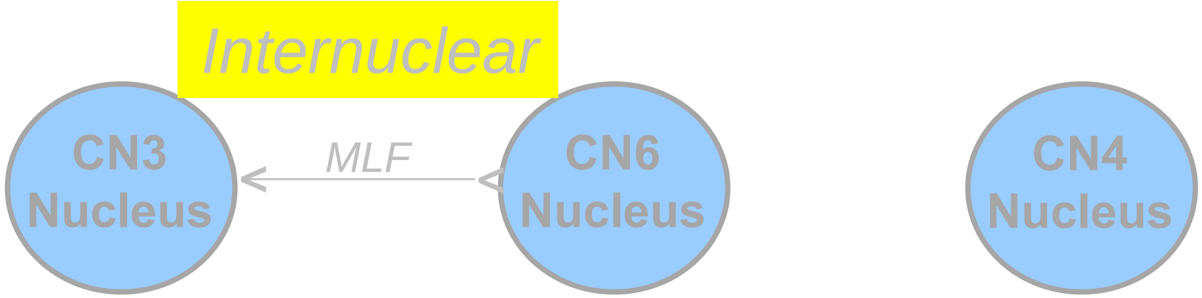
Infranuclear

- Fascicular
- Subarachnoid
- **Cavernous sinus**
- *?*
- *?*
- *?*

What is the hallmark of ophthalmoplegia 2ndry to a cavernous sinus process?
The involvement of two or more cranial nerves simultaneously

Motility Disorders: Overview

Supranuclear



Nuclear

Infranuclear

- Fascicular
- Subarachnoid
- **Cavernous sinus**
- ***?***
- ***?***
- ***?***

What is the hallmark of ophthalmoplegia 2ndry to a cavernous sinus process?
The involvement of two or more cranial nerves simultaneously

Which nerves may be involved?
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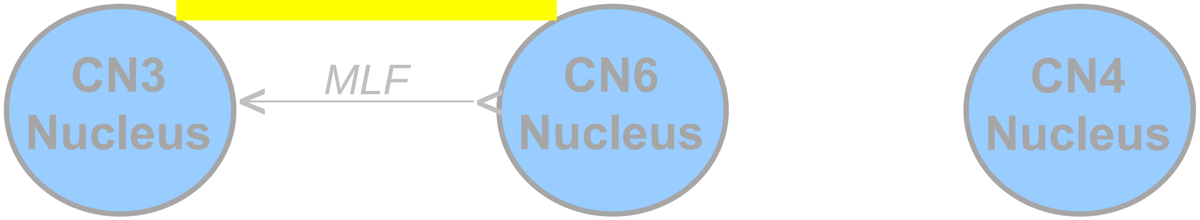
Motility Disorders: Overview

Supranuclear

Internuclear

Nuclear



Infranuclear

- Fascicular
- Subarachnoid
- **Cavernous sinus**
- *?*
- *?*
- *?*

What is the hallmark of ophthalmoplegia 2ndry to a cavernous sinus process?
The involvement of two or more cranial nerves simultaneously

Which nerves may be involved?

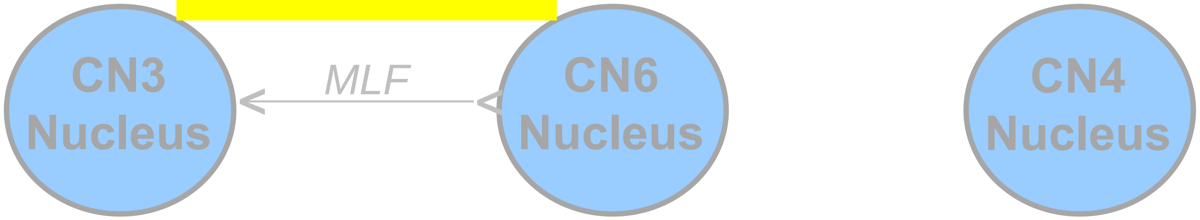
--
-- } Involvement manifests as
--
--
-- } Involvement manifests as
-- ← Involvement manifests as

Motility Disorders: Overview

Supranuclear

Internuclear

Nuclear



Infranuclear

- Fascicular
- Subarachnoid
- **Cavernous sinus**
- *?*
- *?*
- *?*

What is the hallmark of ophthalmoplegia 2ndry to a cavernous sinus process?

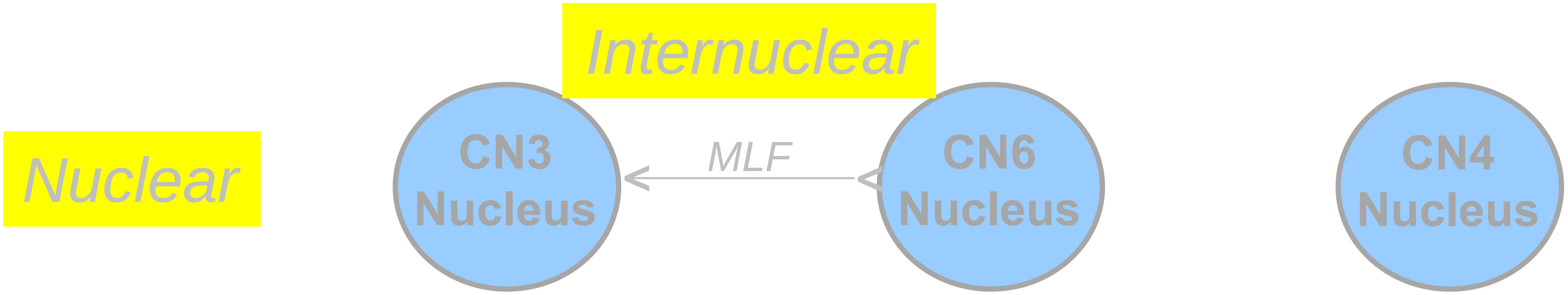
The involvement of two or more cranial nerves simultaneously

Which nerves may be involved?

--
-- Involvement manifests as ophthalmoplegia
--
-- Involvement manifests as facial hypoesthesia
--
-- ← Involvement manifests as Horners

Motility Disorders: Overview

Supranuclear



Infranuclear

- Fascicular
- Subarachnoid
- **Cavernous sinus**
- *?*
- *?*
- *?*

What is the hallmark of ophthalmoplegia 2ndry to a cavernous sinus process?

The involvement of two or more cranial nerves simultaneously

Which nerves may be involved?

--CN3
--CN4
--CN6
Involvement manifests as ophthalmoplegia

--V_1
--V_2
Involvement manifests as facial hypoesthesia

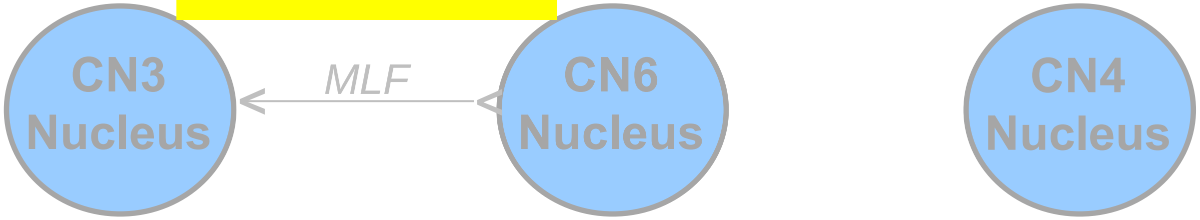
--Sympathetics ← Involvement manifests as Horners

Motility Disorders: Overview

Supranuclear

Internuclear

Nuclear



Infranuclear

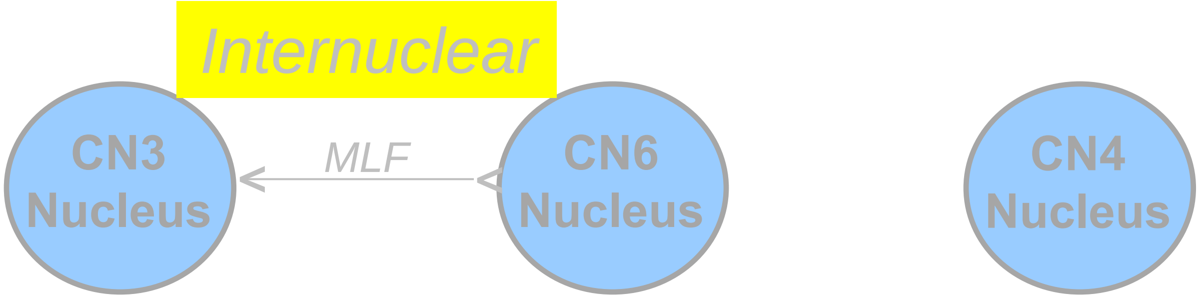
- Fascicular
- Subarachnoid
- Cavernous sinus
- ***?***
- *?*
- *?*

Getting pretty close now. Post-cavernous sinus, another well-defined space.

Motility Disorders: Overview

Supranuclear

Nuclear



Infranuclear

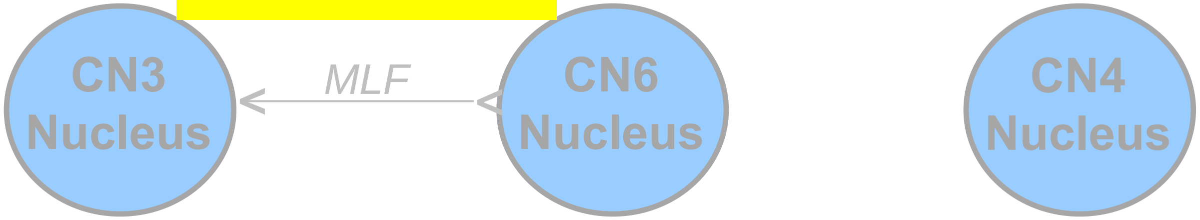
- Fascicular
- Subarachnoid
- Cavernous sinus
- **Orbital** ← *Getting pretty close now. Post-cavernous sinus, another well-defined space.*
- *?*
- *?*

Motility Disorders: Overview

Supranuclear

Internuclear

Nuclear



Infranuclear

- Fascicular
- Subarachnoid
- Cavernous sinus
- Superior orbital fissure
- Orbital
- ?
- ?

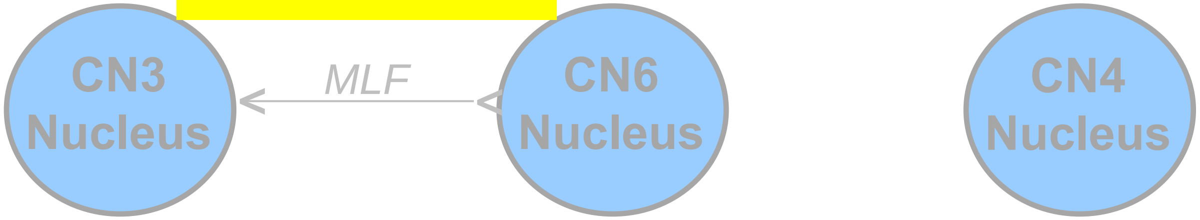
The answer *superior orbital fissure* is just as good here (if not better, as the *Neuro* book breaks out the fissure as a separate structure in the pathway)

Motility Disorders: Overview

Supranuclear

Internuclear

Nuclear



Infranuclear

- Fascicular
- Subarachnoid
- Cavernous sinus
  - Superior orbital fissure
  - Orbital apex
- Orbital
- ?
- ?

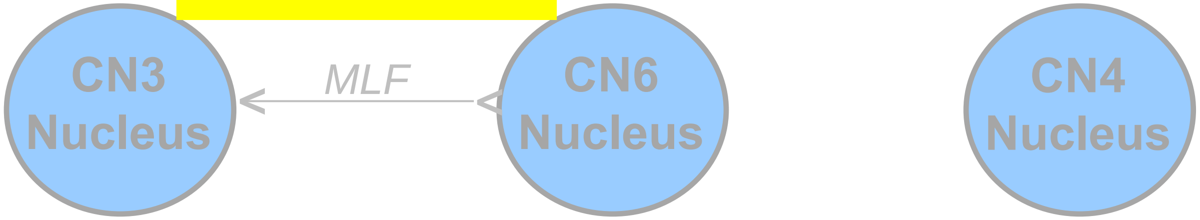
Likewise, the answer *orbital apex* would also be reasonable at this junction

Motility Disorders: Overview

Supranuclear

Internuclear

Nuclear



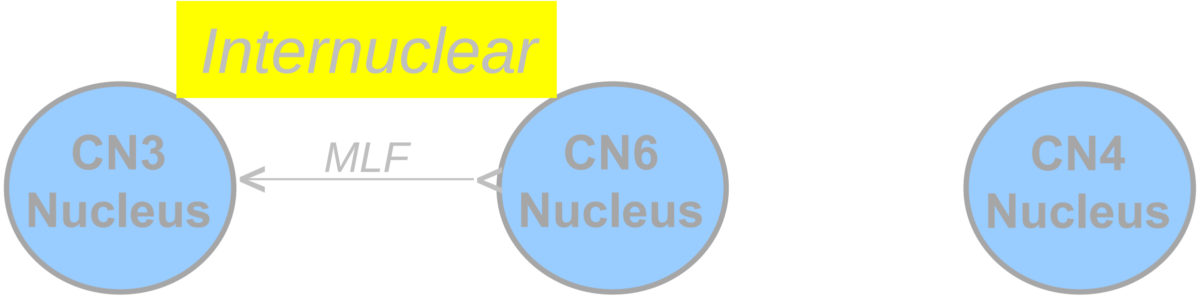
Infranuclear

- Fascicular
- Subarachnoid
- Cavernous sinus
- Superior orbital fissure
- Orbital apex
- Orbital
- *?*
- *?*

Motility disorders 2ndry to pathology in these areas are addressed in detail in their own slide-set (N19)

Motility Disorders: Overview

Supranuclear



Nuclear

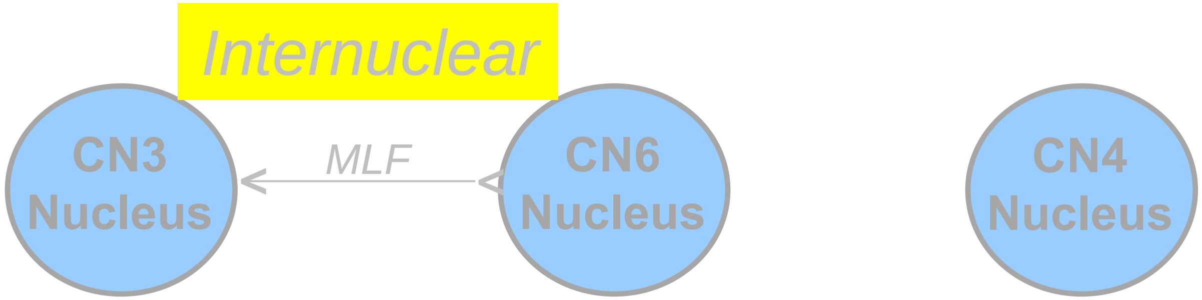
Infranuclear

- Fascicular
- Subarachnoid
- Cavernous sinus
- Orbital
- ***?*** ← *Where the journey ends for the nerves.*
- *?*

Motility Disorders: Overview

Supranuclear

Nuclear



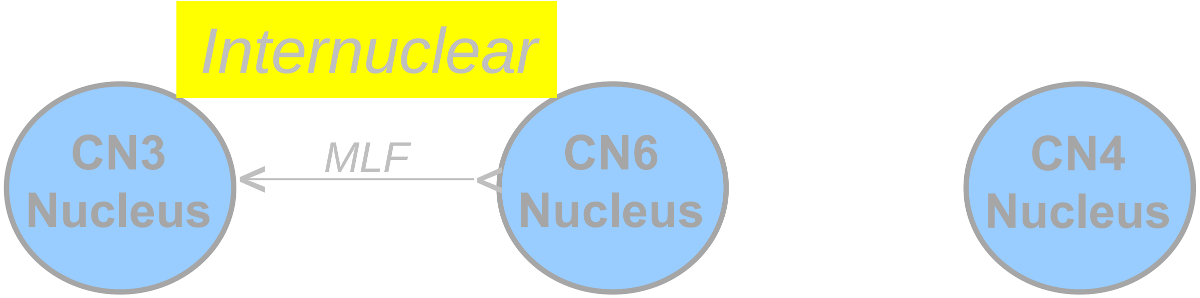
Infranuclear

- Fascicular
- Subarachnoid
- Cavernous sinus
- Orbital
- **Neuromuscular junction** ← *Where the journey ends for the nerves.*
- *?*

Motility Disorders: Overview

Supranuclear

Nuclear



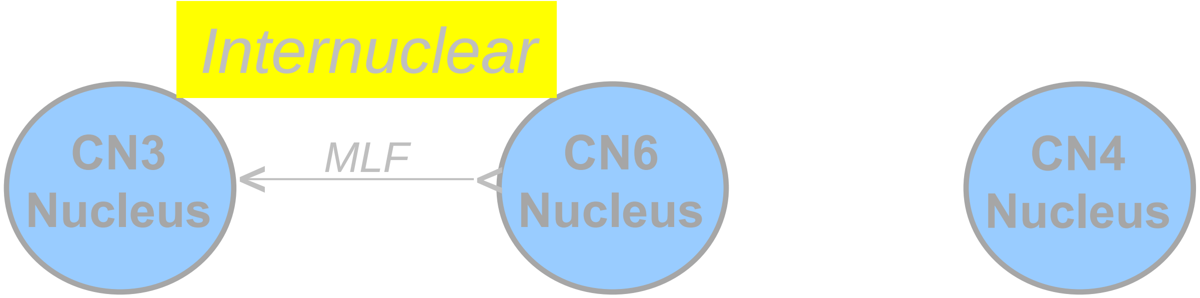
Infranuclear

- Fascicular
- Subarachnoid
- Cavernous sinus
- Orbital
- **Neuromuscular junction**
- *?*

Per the Neuro *book, what is the “prototypical” disease of the neuromuscular junction?*

Motility Disorders: Overview

Supranuclear



Nuclear

Infranuclear

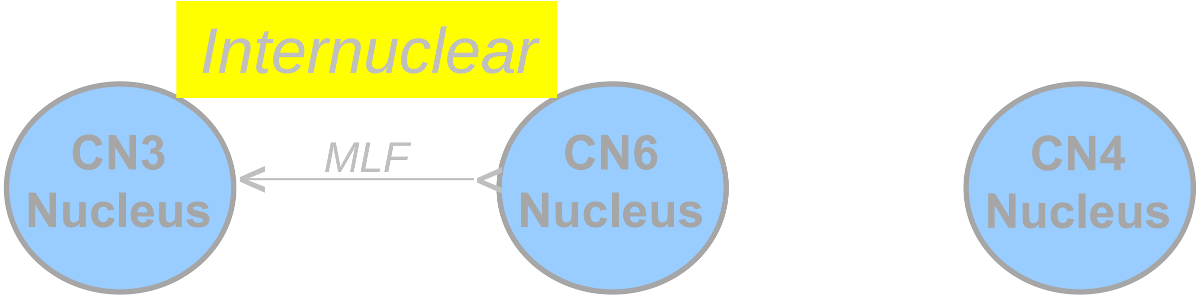
- Fascicular
- Subarachnoid
- Cavernous sinus
- Orbital
- **Neuromuscular junction**
- *?*

Per the Neuro *book, what is the "prototypical" disease of the neuromuscular junction?*
Myasthenia gravis

Motility Disorders: Overview

Supranuclear

Nuclear



Internuclear

CN3 Nucleus

MLF

CN6 Nucleus

CN4 Nucleus

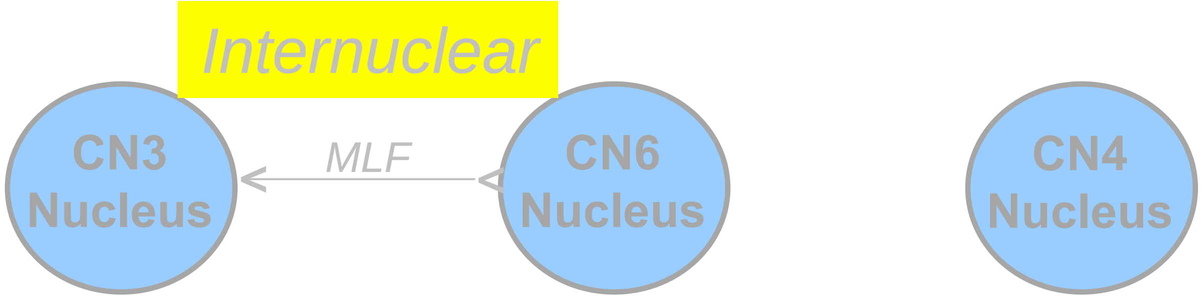
Infranuclear

- Fascicular
- Subarachnoid
- Cavernous sinus
- Orbital
- Neuromuscular junction
- ***?***

And finally…Don't forget pathology here when evaluating motility disorders!

Motility Disorders: Overview

Supranuclear



Nuclear

Infranuclear

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

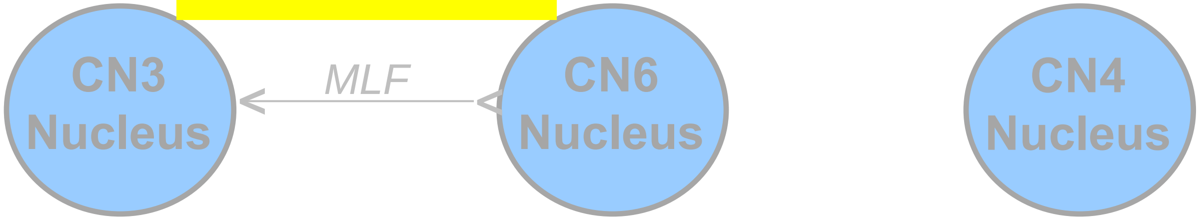
And finally…Don't forget pathology here when evaluating motility disorders!

Motility Disorders: Overview

Supranuclear

Internuclear

Nuclear

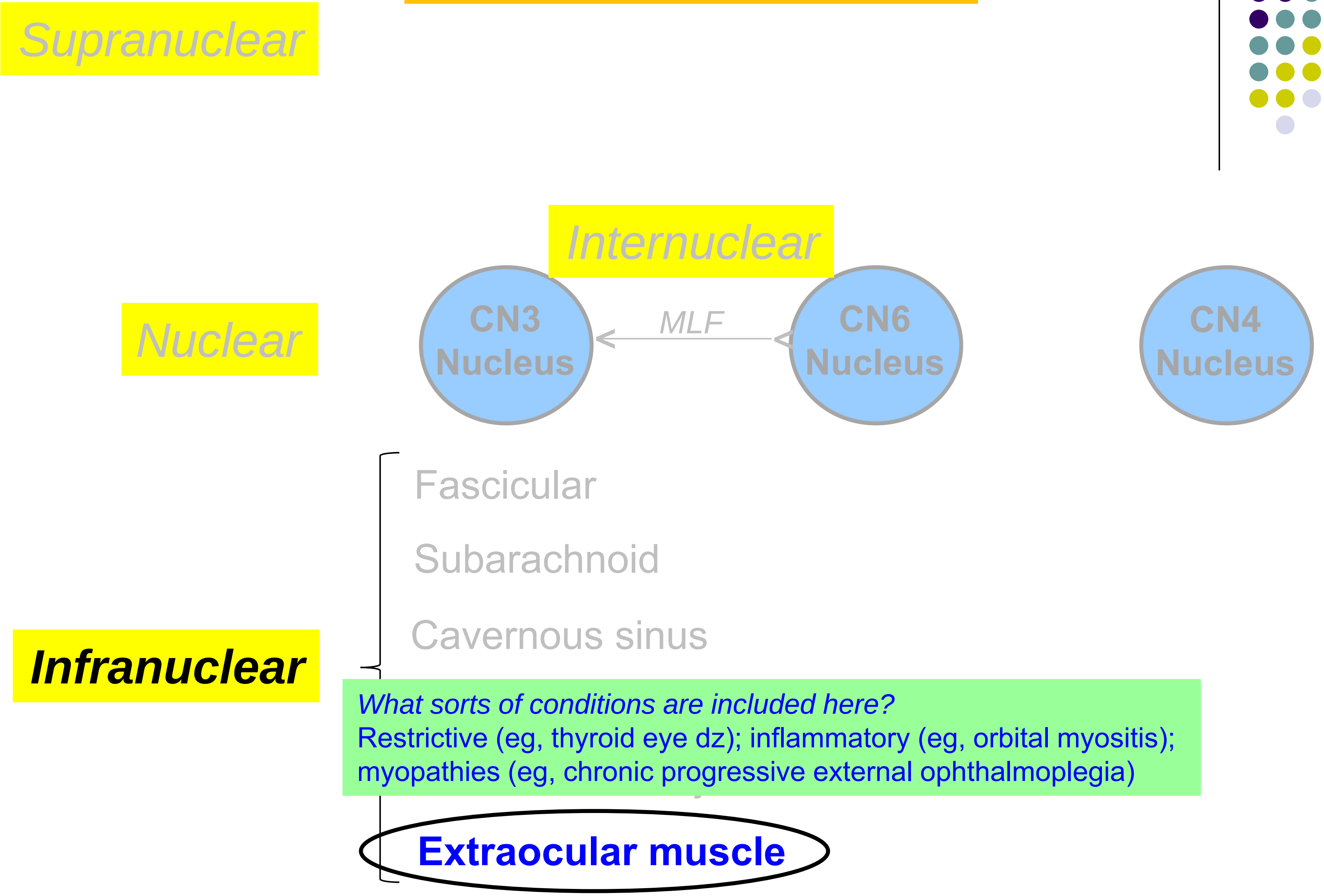


Infranuclear

- Fascicular
- Subarachnoid
- Cavernous sinus
- **Extraocular muscle**

What sorts of conditions are included here?

Motility Disorders: Overview



Supranuclear

Internuclear

Nuclear

CN3 Nucleus

MLF

CN6 Nucleus

CN4 Nucleus

Infranuclear

Fascicular

Subarachnoid

Cavernous sinus

What sorts of conditions are included here?
Restrictive (eg, thyroid eye dz); inflammatory (eg, orbital myositis); myopathies (eg, chronic progressive external ophthalmoplegia)

Extraocular muscle

Supranuclear

Before discussing **supranuclear lesions**, we need to define the role of the efferent (ie, motor) component of the visual system. But before we do *that*, we have to define the role of the *afferent* system.

Infranuclear

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

Supranuclear

Before discussing **supranuclear lesions**, we need to define the role of the efferent (ie, motor) component of the visual system. But before we do *that*, we have to define the role of the *afferent* system.

In primates, vision has two purposes: 1) to **detect** objects of interest (eg, things you may want to eat, or may want to eat you), and 2) to **scrutinize** objects of interest (ie, to determine definitively whether it's an eat-er vs an eat-ee).

Infranuclear

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

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Infranuclear

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

Supranuclear

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But let's consider what it takes to accomplish these tasks. Scrutinizing an object requires steady bifixation—but not *too* steady, or the photoreceptors (PRs) will fatigue and the image will disappear.

Supranuclear

Before discussing **supranuclear lesions**, we need to define the role of the efferent (ie, motor) component of the visual system. But before we do *that*, we have to define the role of the *afferent* system.

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Extraocular muscle

Supranuclear

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Extraocular muscle

Supranuclear

The *supranuclear pathways* consist of six systems in the primate CNS that deal with these fixation-related issues. Thus, lesions of a supranuclear pathway manifest as difficulties with either the **maintenance** or **acquisition** of bifixation.

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Extraocular muscle

Supranuclear

six systems in the primate CNS that deal with these fixation-related issues

Internuclear

1) The two words ***system*** is responsible for maintaining a high-quality image of a stationary object when the head is still.

Infranuclear

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

Supranuclear

six systems in the primate CNS that deal with these fixation-related issues

Internuclear

1) The ***ocular fixation system*** is responsible for maintaining a high-quality image of a stationary object when the head is still.

Infranuclear

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

Supranuclear

six systems in the primate CNS that deal with these fixation-related issues

Internuclear

1) The ***ocular fixation system*** is responsible for maintaining a high-quality image of a stationary object when the head is still. It does this via continuous *microsaccadic refixation movements,* which produce a constant shifting among the PRs regarding which are responsible for the retinal image. This shifting prevents PR fatigue (and subsequent image loss) from occurring.

Infranuclear

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

Supranuclear

six systems in the primate CNS that deal with these fixation-related issues

Internuclear

1) The **_ocular fixation system_**

2) The two words **_system_** is responsible for maintaining fixation on a moving object. When it is impaired pursuit movements may either lag behind the object or jump ahead of it.

Infranuclear

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

Supranuclear

six systems in the primate CNS that deal with these fixation-related issues

Internuclear

1) The ***ocular fixation system***

2) The ***smooth-pursuit system*** is responsible for maintaining fixation on a moving object. When it is impaired pursuit movements may either lag behind the object or jump ahead of it.

Infranuclear

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

Supranuclear

six systems in the primate CNS that deal with these fixation-related issues

Internuclear

1) The ***ocular fixation system***

2) The ***smooth-pursuit system*** is responsible for maintaining fixation on a moving object. When it is impaired pursuit movements may either lag behind the object or jump ahead of it. Of note, that this is the only supranuclear pathway that is activated voluntarily.

Infranuclear

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

Supranuclear

six systems in the primate CNS that deal with these fixation-related issues

Internuclear

1) The ***ocular fixation system***

2) The ***smooth-pursuit system***

3) The ***system*** is responsible for maintaining fixation on an object that is moving toward or away from the eyes, thus necessitating they converge or diverge.

Subarachnoid

Infranuclear

Cavernous sinus

Orbital

Neuromuscular junction

Extraocular muscle

Supranuclear

six systems in the primate CNS that deal with these fixation-related issues

Internuclear

1) The ***ocular fixation system***

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3) The ***vergence system*** is responsible for maintaining fixation on an object that is moving toward or away from the eyes, thus necessitating they converge or diverge.

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Supranuclear

six systems in the primate CNS that deal with these fixation-related issues

Internuclear

1) The **ocular fixation system**

2) The **smooth-pursuit system**

3) The ***vergence system*** is responsible for maintaining fixation on an object that is moving toward or away from the eyes, thus necessitating they converge or diverge. Many forms of vergence dysfunction can occur, including *convergence insufficiency, divergence insufficiency*, *accommodative esotropia*, and *spasm of the near*.

Infranuclear

- Subarachnoid
- Cavernous sinus
- Orbital
- Neuromuscular junction
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Supranuclear

six systems in the primate CNS that deal with these fixation-related issues

Internuclear

1) The **ocular fixation system**

2) The **smooth-pursuit system**

3) The **vergence system**

4) The three words ***system*** and the 5) two words ***system*** are responsible for holding an image steady during head rotations—either brief and rapid (VOR) or slower and sustained (OKN).

Infranuclear

- Cavernous sinus
- Orbital
- Neuromuscular junction
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Supranuclear

six systems in the primate CNS that deal with these fixation-related issues

Internuclear

1) The **ocular fixation system**

2) The **smooth-pursuit system**

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4) The **vestibulo-ocular reflex (VOR) system** and the 5) **optokinetic nystagmus (OKN) system** are responsible for holding an image steady during head rotations—either brief and rapid (VOR) or slower and sustained (OKN).

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six systems in the primate CNS that deal with these fixation-related issues

Internuclear

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4) The ***vestibulo-ocular reflex (VOR) system*** and the 5) ***optokinetic nystagmus (OKN) system*** are responsible for holding an image steady during head rotations—either brief and rapid (VOR) or slower and sustained (OKN). The VOR is controlled by the vestibular labyrinth, ie, the semicircular canals and otoliths. In contrast, the OKN system is driven by images sweeping across the retina.

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Supranuclear

six systems in the primate CNS that deal with these fixation-related issues

Internuclear

1) The ***ocular fixation system***

2) The ***smooth-pursuit system***

3) The ***vergence system***

4) The ***vestibulo-ocular reflex (VOR) system*** and the 5) ***optokinetic nystagmus (OKN) system***

6) The ***system*** is responsible for rapidly shifting fixation from the current object of interest to a new one located in the visual periphery.

Infranuclear

- Cavernous sinus
- Orbital
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Supranuclear

six systems in the primate CNS that deal with these fixation-related issues

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1) The **ocular fixation system**

2) The **smooth-pursuit system**

3) The **vergence system**

4) The **vestibulo-ocular reflex (VOR) system** and the 5) **optokinetic nystagmus (OKN) system**

6) The **saccadic system** is responsible for rapidly shifting fixation from the current object of interest to a new one located in the visual periphery.

Infranuclear

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- Orbital
- Neuromuscular junction
- Extraocular muscle

Supranuclear

six systems in the primate CNS that deal with these fixation-related issues

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4) The **_vestibulo-ocular reflex (VOR) system_** and the 5) **_optokinetic nystagmus (OKN) system_**

6) The **_saccadic system_**

An important rule-of-thumb can be stated regarding supranuclear motility disorders and diplopia—what is it?

Orbital

Neuromuscular junction

Extraocular muscle

Supranuclear

six systems in the primate CNS that deal with these fixation-related issues

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1) The **_ocular fixation system_**

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It is this: With four important exceptions, supranuclear pts do not complain of diplopia

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Neuromu

Why don't most pts with supranuclear disorders have diplopia?

Extraocular muscle

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Why don't most pts with supranuclear disorders have diplopia?

Because most supranuclear disorders affect **both** eyes in a **symmetric** fashion

Neuromu

Extraocular muscle

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What are some of the supranuclear disorders that present typically, ie, without diplopia?

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--Gaze palsies, eg, Parinaud syndrome
--Congenital ocular motor apraxia (COMA)
--Progressive supranuclear palsy (PSP)
--Saccadic disorders

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--**Saccadic disorders**

Orbital

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Why d t most pts with supranuclear disorders have diplopia?
Beca e most supranuclear disorders affect **both** eyes in a **sy etric** fashion

Each of these is addressed in detail in other slide-sets—check the ToC

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What are the four supranuclear disorders in which pts c/o diplopia?

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What are the four supranuclear disorders in which pts c/o diplopia?

--Skew deviation
--Divergence insufficiency
--Convergence insufficiency
--Convergence spasm