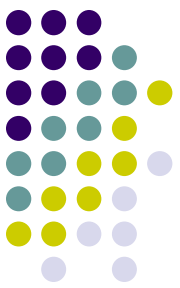


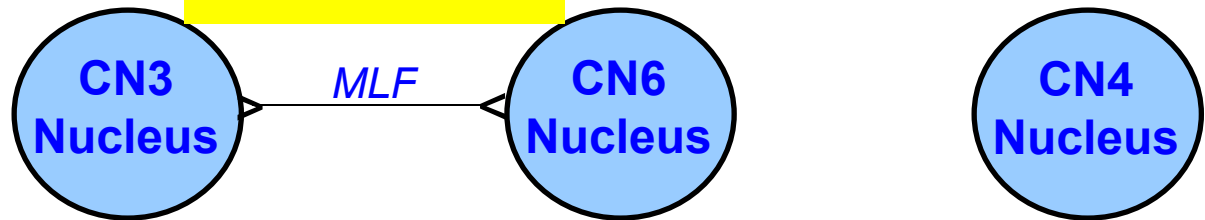
Motility Disorders: *Fascicular Syndromes*



Supranuclear

Nuclear

Internuclear



Infranuclear

Fascicular

Subarachnoid

Cavernous sinus

Orbital

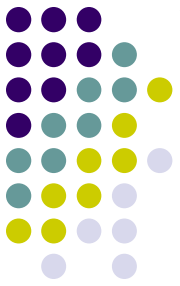
Neuromuscular junction

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: *Fascicular Syndromes*

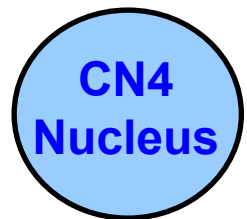
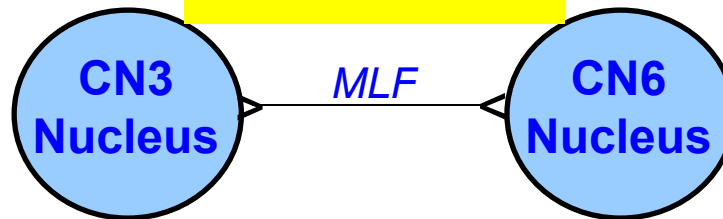
2



Supranuclear

Nuclear

Internuclear



Fascicular

In this slide-set, we'll take a look at *fascicular syndromes*

Subarachnoid

Cavernous sinus

Orbital

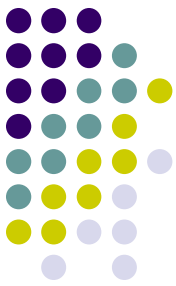
Neuromuscular junction

Extraocular muscle

Infranuclear

Motility Disorders: *Fascicular Syndromes*

3



Supranuclear

Internuclear

Nuclear

CN3
Nucleus

MLF

CN6
Nucleus

CN4
Nucleus

Fascicular

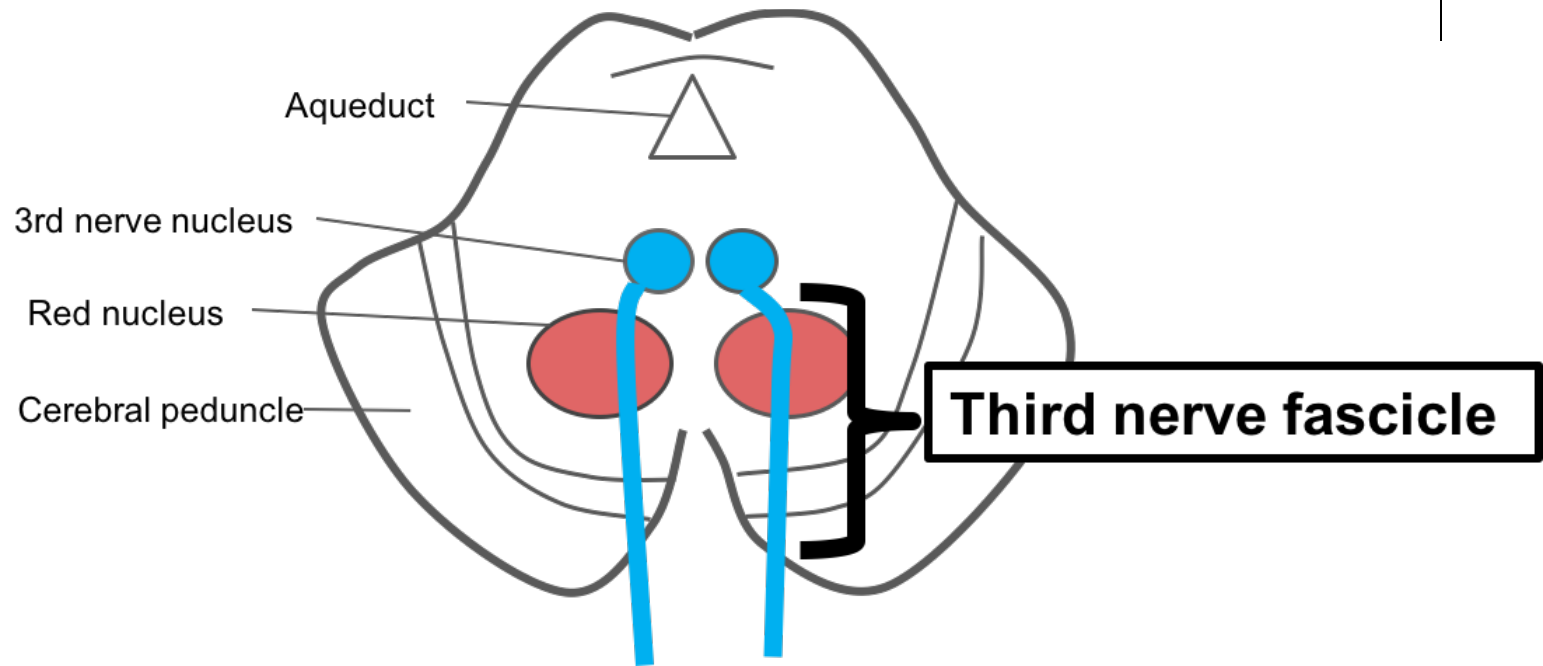
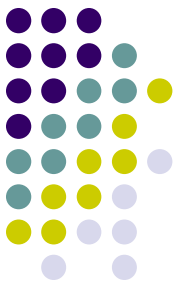
Infranuclear

As mentioned in the *Overview* slide-set, the fascicles (along with the cranial-nerve nuclei) 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 as *isolated* EOM abnormalities; ie, the ophthalmoparesis is almost always accompanied by **nonocular** signs and symptoms of CNS damage.

Neuromuscular junction

Extraocular muscle

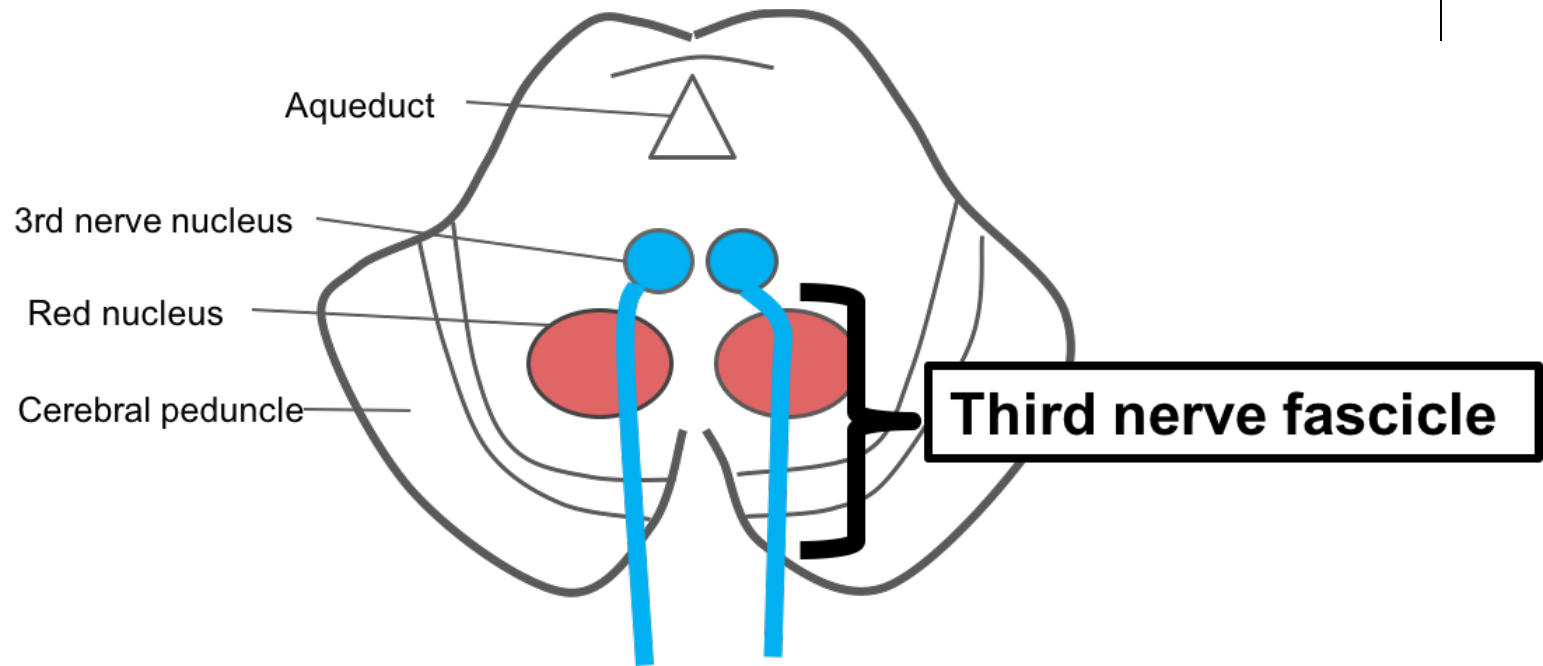
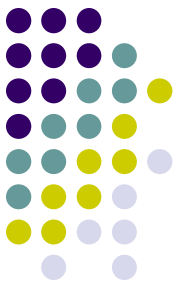
Motility Disorders: *Fascicular Syndromes*



This is a rendering of a cranial nerve **fascicle** (in this case, CN3). Like the cranial-nerve proper, a fascicle is the bundle of axons that left their nucleus headed toward the target tissue; however, we don't start calling this bundle a 'nerve' until it breaks out of the substance of the brainstem and into the subarachnoid space.

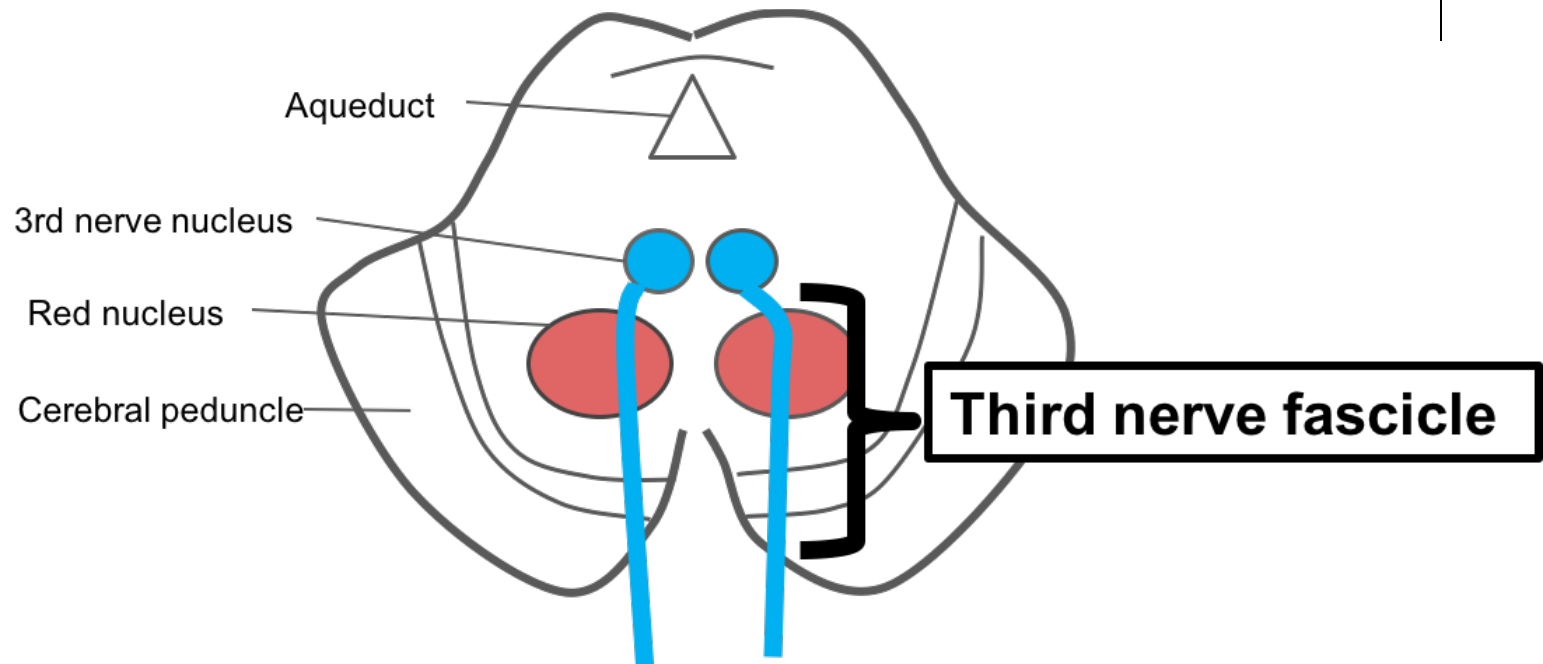
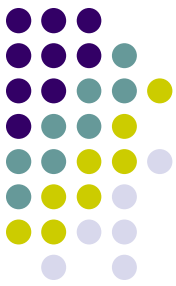
Motility Disorders: *Fascicular Syndromes*

5



This is a rendering of a cranial nerve **fascicle** (in this case, CN3). Like the cranial-nerve proper, a fascicle is the bundle of axons that left their nucleus headed toward the target tissue; however, we don't start calling this bundle a 'nerve' until it breaks out of the substance of the brainstem and into the subarachnoid space. Note that on its course, the fascicle runs through and near important CNS structures, and one can envision how damage at such locations would result in a set of S/S some of which stem from damage to the CN, and others from damage to the anatomically related CNS structure; these sets of S/S constitute the fascicular syndromes.

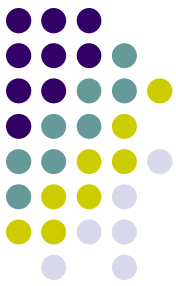
Motility Disorders: *Fascicular Syndromes*



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Motility Disorders: *Fascicular Syndromes*

7



Supranuclear

Internuclear

Nuclear

CN3
Nucleus

MLF

CN6
Nucleus

CN4
Nucleus

Fascicular

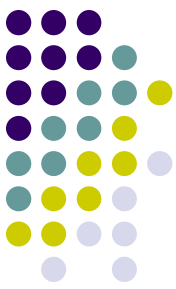
Infranuclear

As mentioned in the *Overview* slide-set, the fascicles (along with the cranial-nerve nuclei) 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 as *isolated* EOM abnormalities; ie, the ophthalmoparesis is almost always accompanied by nonocular signs and symptoms of CNS damage.

As we will see, the fascicular syndromes are defined by the nonocular CNS signs/symptoms that accompany the ophthalmoparesis

Q

Motility Disorders: *Fascicular Syndromes*



What are the three basic segments of the brainstem?

(Rostral)

--?

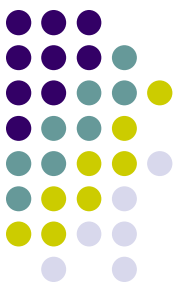
--?

--?

(Caudal)

A

Motility Disorders: *Fascicular Syndromes*



What are the three basic segments of the brainstem?

(Rostral)

--Midbrain

--Pons

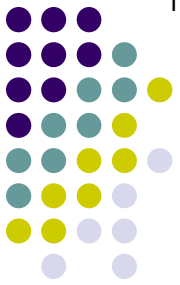
--Medulla

(Caudal)

Q

Motility Disorders: *Fascicular Syndromes*

10



CN3 Fascicular Syndromes

What are the three basic segments of the brainstem?

(Rostral)

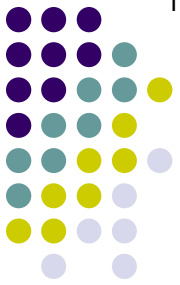
--*Midbrain?*

--*Pons?*

--*Medulla?*

(Caudal)

In which segment do all CN3 fascicular syndrome lesions reside?



CN3 Fascicular Syndromes

What are the three basic segments of the brainstem?

(Rostral)

--**Midbrain!**

--Pons

--Medulla

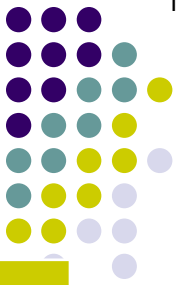
(Caudal)

In which segment do all CN3 fascicular syndrome lesions reside?

The midbrain

Q

Motility Disorders: *Fascicular Syndromes*



CN3 Fascicular Syndromes

| Syndrome | | |
|----------|--|--|
|----------|--|--|

?

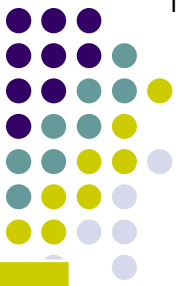
In which segment do all CN3 fascicular syndrome lesions reside?

The midbrain

How many CN3 fascicular syndromes are discussed in the Neuro book?

A

Motility Disorders: *Fascicular Syndromes*



CN3 Fascicular Syndromes

| Syndrome | | |
|----------|--|--|
| | | |
| | | |
| | | |
| | | |
| | | |

In which segment do all CN3 fascicular syndrome lesions reside?

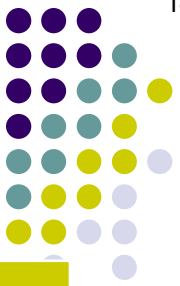
The midbrain

How many CN3 fascicular syndromes are discussed in the Neuro book?

Four



Motility Disorders: *Fascicular Syndromes*



CN3 Fascicular Syndromes

| Syndrome | | |
|----------|--|--|
| ? | | |
| ? | | |
| ? | | |
| ? | | |

In which segment do all CN3 fascicular syndrome lesions reside?

The midbrain

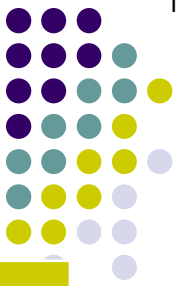
How many CN3 fascicular syndromes are discussed in the Neuro book?

Four

What are their names?

A

Motility Disorders: Fascicular Syndromes



CN3 Fascicular Syndromes

| Syndrome | | |
|------------------|--|--|
| <i>Weber</i> | | |
| <i>Benedikt</i> | | |
| <i>Claude</i> | | |
| <i>Nothnagel</i> | | |

In which segment do all CN3 fascicular syndrome lesions reside?

The midbrain

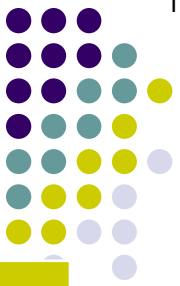
How many CN3 fascicular syndromes are discussed in the Neuro book?

Four

What are their names?



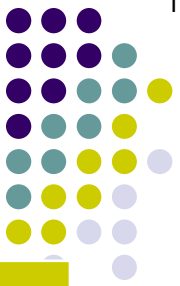
Motility Disorders: *Fascicular Syndromes*



CN3 Fascicular Syndromes

| Syndrome | <i>Ipsi- vs contralateral</i> 3 rd | |
|------------------|---|--|
| <i>Weber</i> | | |
| <i>Benedikt</i> | | |
| <i>Claude</i> | | |
| <i>Nothnagel</i> | | |

Each is composed in part by a third nerve palsy. Is the palsy ipsilateral, or contralateral to the side of the lesion?

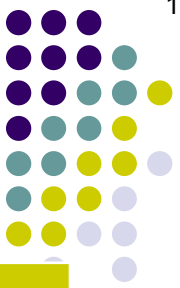
**CN3 Fascicular Syndromes**

| Syndrome | Ipsilateral 3 rd | |
|------------------|-----------------------------|--|
| <i>Weber</i> | | |
| <i>Benedikt</i> | | |
| <i>Claude</i> | | |
| <i>Nothnagel</i> | | |

Each is composed in part by a third nerve palsy. Is the palsy ipsilateral, or contralateral to the side of the lesion?

Q

Motility Disorders: *Fascicular Syndromes*



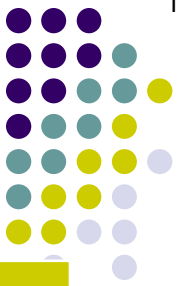
CN3 Fascicular Syndromes

| Syndrome | Ipsilateral 3 rd plus... | |
|------------------|-------------------------------------|--|
| Weber | ? | |
| <i>Benedikt</i> | | |
| <i>Claude</i> | | |
| <i>Nothnagel</i> | | |

Each has associated nonocular finding(s). What are the findings in Weber syndrome?

A

Motility Disorders: *Fascicular Syndromes*



CN3 Fascicular Syndromes

| Syndrome | Ipsilateral 3 rd plus... | |
|------------------|-------------------------------------|--|
| Weber | Contralateral hemiplegia | |
| <i>Benedikt</i> | | |
| <i>Claude</i> | | |
| <i>Nothnagel</i> | | |

Each has associated nonocular finding(s). What are the findings in Weber syndrome?



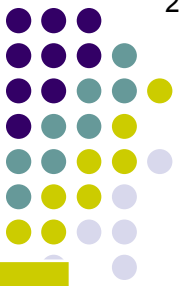
Motility Disorders: *Fascicular Syndromes*



CN3 Fascicular Syndromes

| Syndrome | Ipsilateral 3 rd plus... | |
|------------------------|-------------------------------------|--|
| <i>Weber</i> | Contralateral hemiplegia | |
| <i>Benedikt</i> | ? | |
| <i>Claude</i> | | |
| <i>Nothnagel</i> | | |

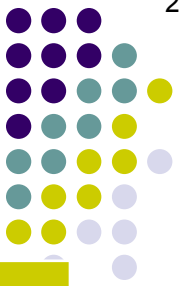
What are the nonocular findings in Benedikt syndrome?

**CN3 Fascicular Syndromes**

| Syndrome | Ipsilateral 3 rd plus... | |
|------------------------|---|--|
| <i>Weber</i> | Contralateral hemiplegia | |
| <i>Benedikt</i> | Contralateral involuntary movements (often a hand flap) | |
| <i>Claude</i> | | |
| <i>Nothnagel</i> | | |

What are the nonocular findings in Benedikt syndrome?

Motility Disorders: *Fascicular Syndromes*

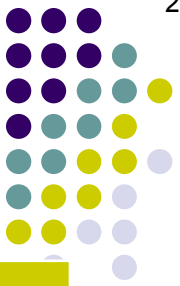


CN3 Fascicular Syndromes

| Syndrome | Ipsilateral 3 rd plus... | |
|------------------|---|--|
| <i>Weber</i> | Contralateral hemiplegia | |
| <i>Benedikt</i> | Contralateral involuntary movements (often a hand flap) | |
| <i>Claude</i> | <i>For reasons to be made clear shortly, we will skip Claude syndrome and circle back to it shortly</i> | |
| <i>Nothnagel</i> | | |

Q

Motility Disorders: *Fascicular Syndromes*



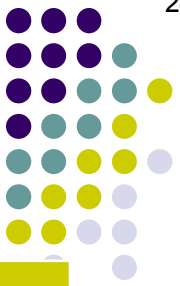
CN3 Fascicular Syndromes

| Syndrome | Ipsilateral 3 rd plus... | |
|-------------------------|---|--|
| <i>Weber</i> | Contralateral hemiplegia | |
| <i>Benedikt</i> | Contralateral involuntary movements (often a hand flap) | |
| <i>Claude</i> | | |
| <i>Nothnagel</i> | ? | |

What are the nonocular findings in Nothnagel syndrome?

A

Motility Disorders: *Fascicular Syndromes*

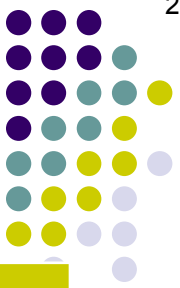


CN3 Fascicular Syndromes

| Syndrome | Ipsilateral 3 rd plus... | |
|-------------------------|---|--|
| <i>Weber</i> | Contralateral hemiplegia | |
| <i>Benedikt</i> | Contralateral involuntary movements (often a hand flap) | |
| <i>Claude</i> | | |
| <i>Nothnagel</i> | Ataxia | |

What are the nonocular findings in Nothnagel syndrome?

Motility Disorders: *Fascicular Syndromes*



CN3 Fascicular Syndromes

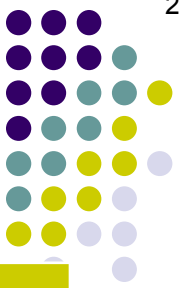
| Syndrome | Ipsilateral 3 rd plus... | |
|------------------|---|--|
| <i>Weber</i> | Contralateral hemiplegia | |
| <i>Benedikt</i> | Contralateral involuntary movements (often a hand flap) | |
| <i>Claude</i> | | |
| Nothnagel | Ataxia (<i>Ipsilateral</i>) | |

What are the nonocular findings in Nothnagel syndrome?

Note that the ataxia in Nothnagel is *ipsilateral* to the affected CN3, which is unique among the CN3 fascicular syndromes.

(No question—proceed when ready)

Motility Disorders: *Fascicular Syndromes*



CN3 Fascicular Syndromes

| Syndrome | Ipsilateral 3 rd plus... | |
|------------------|---|--|
| <i>Weber</i> | Contralateral hemiplegia | |
| <i>Benedikt</i> | Contralateral involuntary movements (often a hand flap) | |
| <i>Claude</i> | | |
| Nothnagel | Ataxia (<i>Ipsilateral</i>) | |

What are the nonocular findings in Nothnagel syndrome?

Note that the ataxia in Nothnagel is *ipsilateral* to the affected CN3, which is unique among the CN3 fascicular syndromes. **However, as the *Neuro* book does not mention this, it may not be an important factoid. Caveat emptor.**

(No question—proceed when ready)

Q

Motility Disorders: *Fascicular Syndromes*

CN3 Fascicular Syndromes

| Syndrome | Ipsilateral 3 rd plus... | |
|----------------------|---|--|
| <i>Weber</i> | Contralateral hemiplegia | |
| <i>Benedikt</i> | Contralateral involuntary movements (often a hand flap) | |
| <i>Claude</i> | ? | |
| <i>Nothnagel</i> | Ataxia | |

Circling back: What are the nonocular findings in Claude syndrome?

A

Motility Disorders: *Fascicular Syndromes*



CN3 Fascicular Syndromes

| Syndrome | Ipsilateral 3 rd plus... | |
|------------------|--|--|
| <i>Weber</i> | Contralateral hemiplegia | |
| <i>Benedikt</i> | Contralateral involuntary movements (often a hand flap) | |
| <i>Claude</i> | <div style="text-align: center;"> ↑ <i>plus</i> ↓ </div> | |
| <i>Nothnagel</i> | Ataxia | |

Circling back: What are the nonocular findings in Claude syndrome?

Claude syndrome is essentially a combination of Benedikt and Nothnagel syndromes

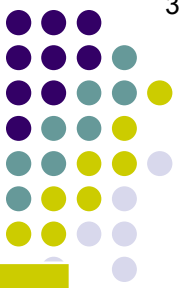
Q

Motility Disorders: *Fascicular Syndromes*

CN3 Fascicular Syndromes

| Syndrome | Ipsilateral 3 rd plus... | Adjacent damage |
|------------------|---|-----------------|
| Weber | Contralateral hemiplegia | ? |
| <i>Benedikt</i> | Contralateral involuntary movements (often a hand flap) | |
| <i>Claude</i> | <div> <div>↑</div> <i>plus</i> <div>↓</div> </div> | |
| <i>Nothnagel</i> | Ataxia | |

What structure adjacent to the CN3 fascicle is damaged in Weber syndrome?

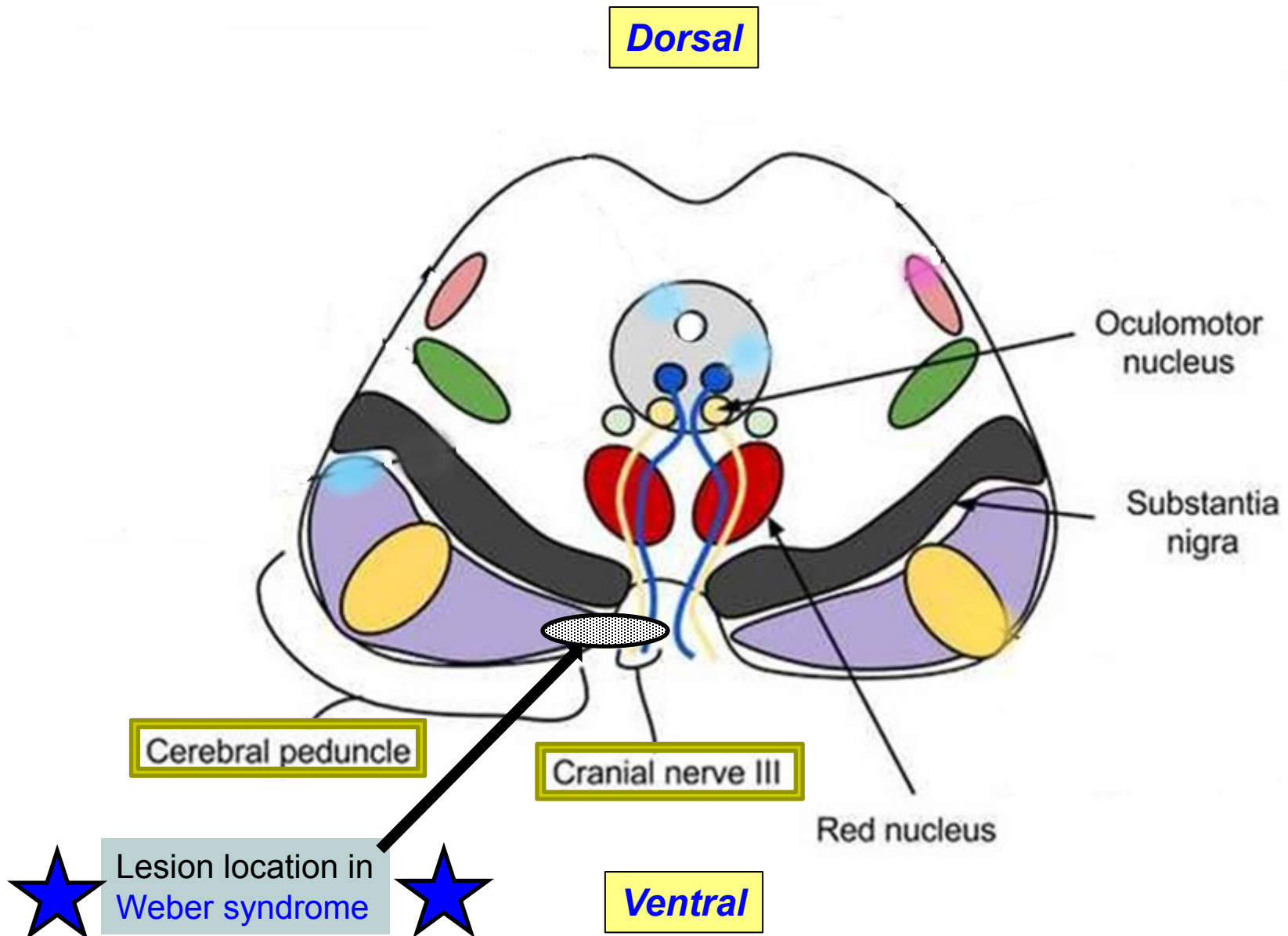


CN3 Fascicular Syndromes

| Syndrome | Ipsilateral 3 rd plus... | Adjacent damage |
|------------------|---|-------------------|
| Weber | Contralateral hemiplegia | Cerebral peduncle |
| <i>Benedikt</i> | Contralateral involuntary movements (often a hand flap) | |
| <i>Claude</i> | <div> <div>↑</div> <i>plus</i> <div>↓</div> </div> | |
| <i>Nothnagel</i> | Ataxia | |

What structure adjacent to the CN3 fascicle is damaged in Weber syndrome?

Motility Disorders: *Fascicular Syndromes*



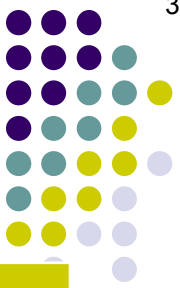
Q

Motility Disorders: Fascicular Syndromes

CN3 Fascicular Syndromes

| Syndrome | Ipsilateral 3 rd plus... | Adjacent damage |
|------------------|---|---|
| Weber | Contralateral hemiplegia | Cerebral peduncle |
| <i>Benedikt</i> | Contralateral involuntary movements (often a hand flap) | What specific component of the cerebral peduncle is involved? |
| <i>Claude</i> | ↑ <i>plus</i> ↓ | |
| <i>Nothnagel</i> | Ataxia | |

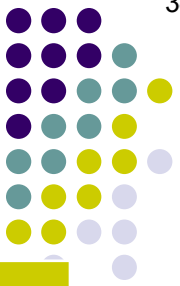
What structure adjacent to the CN3 fascicle is damaged in Weber syndrome?



CN3 Fascicular Syndromes

| Syndrome | Ipsilateral 3 rd plus... | Adjacent damage |
|------------------|---|---|
| Weber | Contralateral hemiplegia | Cerebral peduncle |
| <i>Benedikt</i> | Contralateral involuntary movements (often a hand flap) | <i>What specific component of the cerebral peduncle is involved?</i> The tract |
| <i>Claude</i> | ↑ <i>plus</i> ↓ | |
| <i>Nothnagel</i> | Ataxia | |

What structure adjacent to the CN3 fascicle is damaged in Weber syndrome?



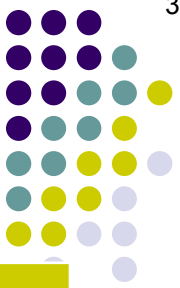
CN3 Fascicular Syndromes

| Syndrome | Ipsilateral 3 rd plus... | Adjacent damage |
|------------------|---|---|
| Weber | Contralateral hemiplegia | Cerebral peduncle |
| <i>Benedikt</i> | Contralateral involuntary movements (often a hand flap) | <i>What specific component of the cerebral peduncle is involved?</i> The corticospinal tract |
| <i>Claude</i> | <div> <div>↑</div> <i>plus</i> <div>↓</div> </div> | |
| <i>Nothnagel</i> | Ataxia | |

What structure adjacent to the CN3 fascicle is damaged in Weber syndrome?

Q

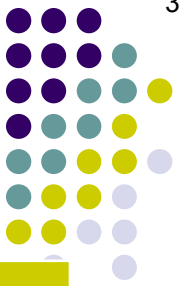
Motility Disorders: *Fascicular Syndromes*



CN3 Fascicular Syndromes

| Syndrome | Ipsilateral 3 rd plus... | Adjacent damage |
|------------------------|---|-------------------|
| <i>Weber</i> | Contralateral hemiplegia | Cerebral peduncle |
| <i>Benedikt</i> | Contralateral involuntary movements (often a hand flap) | ? |
| <i>Claude</i> | <div> <div>↑</div> <i>plus</i> <div>↓</div> </div> | |
| <i>Nothnagel</i> | Ataxia | |

What structure adjacent to the CN3 fascicle is damaged in Benedikt syndrome?



CN3 Fascicular Syndromes

| Syndrome | Ipsilateral 3 rd plus... | Adjacent damage |
|------------------------|---|--------------------------------|
| <i>Weber</i> | Contralateral hemiplegia | Cerebral peduncle |
| <i>Benedikt</i> | Contralateral involuntary movements (often a hand flap) | Red nucleus & substantia nigra |
| <i>Claude</i> | ↑ <i>plus</i> ↓ | |
| <i>Nothnagel</i> | Ataxia | |

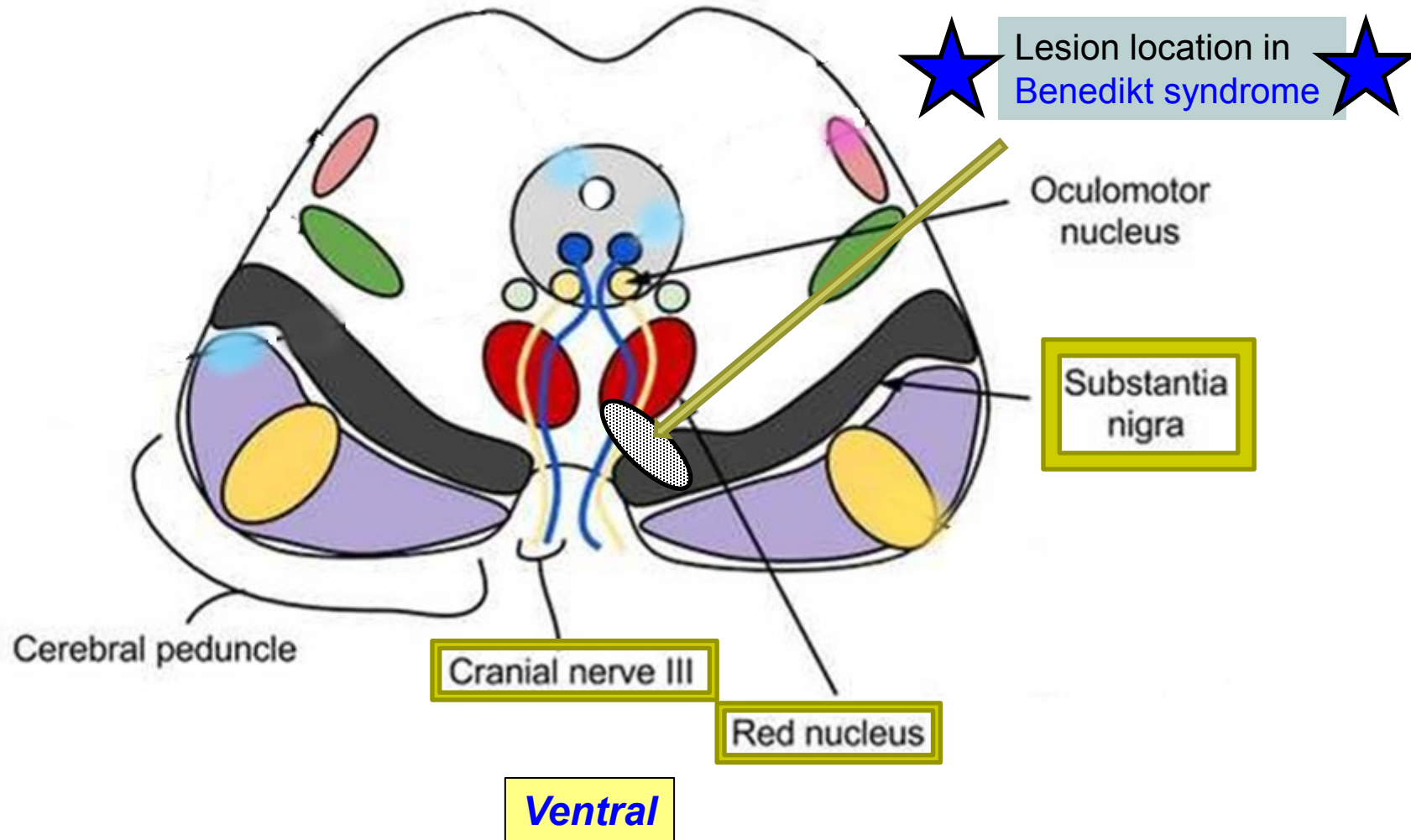
What structure adjacent to the CN3 fascicle is damaged in Benedikt syndrome?

Motility Disorders: Fascicular Syndromes

37



Dorsal



Motility Disorders: *Fascicular Syndromes*

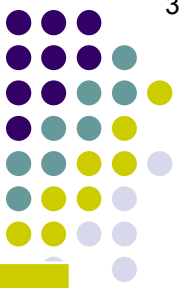
CN3 Fascicular Syndromes

| Syndrome | Ipsilateral 3 rd plus... | Adjacent damage |
|------------------|---|---------------------------------------|
| <i>Weber</i> | Contralateral hemiplegia | Cerebral peduncle |
| Benedikt | Contralateral involuntary movements (often a hand flap) | Red nucleus & substantia nigra |
| <i>Claude</i> | ↑ <i>plus</i> ↓ | |
| <i>Nothnagel</i> | Ataxia | |

What structure adjacent to the CN3 fascicle is damaged in Benedikt syndrome?

I remember this by thinking of **Benedict** Arnold, the infamous Revolutionary War traitor—ie, he was a 'Red'

Motility Disorders: *Fascicular Syndromes*



CN3 Fascicular Syndromes

| Syndrome | Ipsilateral 3 rd plus... | Adjacent damage |
|------------------|---|--------------------------------|
| <i>Weber</i> | Contralateral hemiplegia | Cerebral peduncle |
| <i>Benedikt</i> | Contralateral involuntary movements (often a hand flap) | Red nucleus & substantia nigra |
| <i>Claude</i> | | |
| <i>Nothnagel</i> | | |

Once again, we will skip over Claude syndrome momentarily

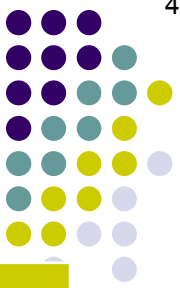
Q

Motility Disorders: *Fascicular Syndromes*

CN3 Fascicular Syndromes

| Syndrome | Ipsilateral 3 rd plus... | Adjacent damage |
|------------------|---|--------------------------------|
| <i>Weber</i> | Contralateral hemiplegia | Cerebral peduncle |
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| <i>Claude</i> | <div> <div>↑</div> <div><i>plus</i></div> <div>↓</div> </div> | |
| <i>Nothnagel</i> | Ataxia | ? |

What structure adjacent to the CN3 fascicle is damaged in Nothnagel syndrome?

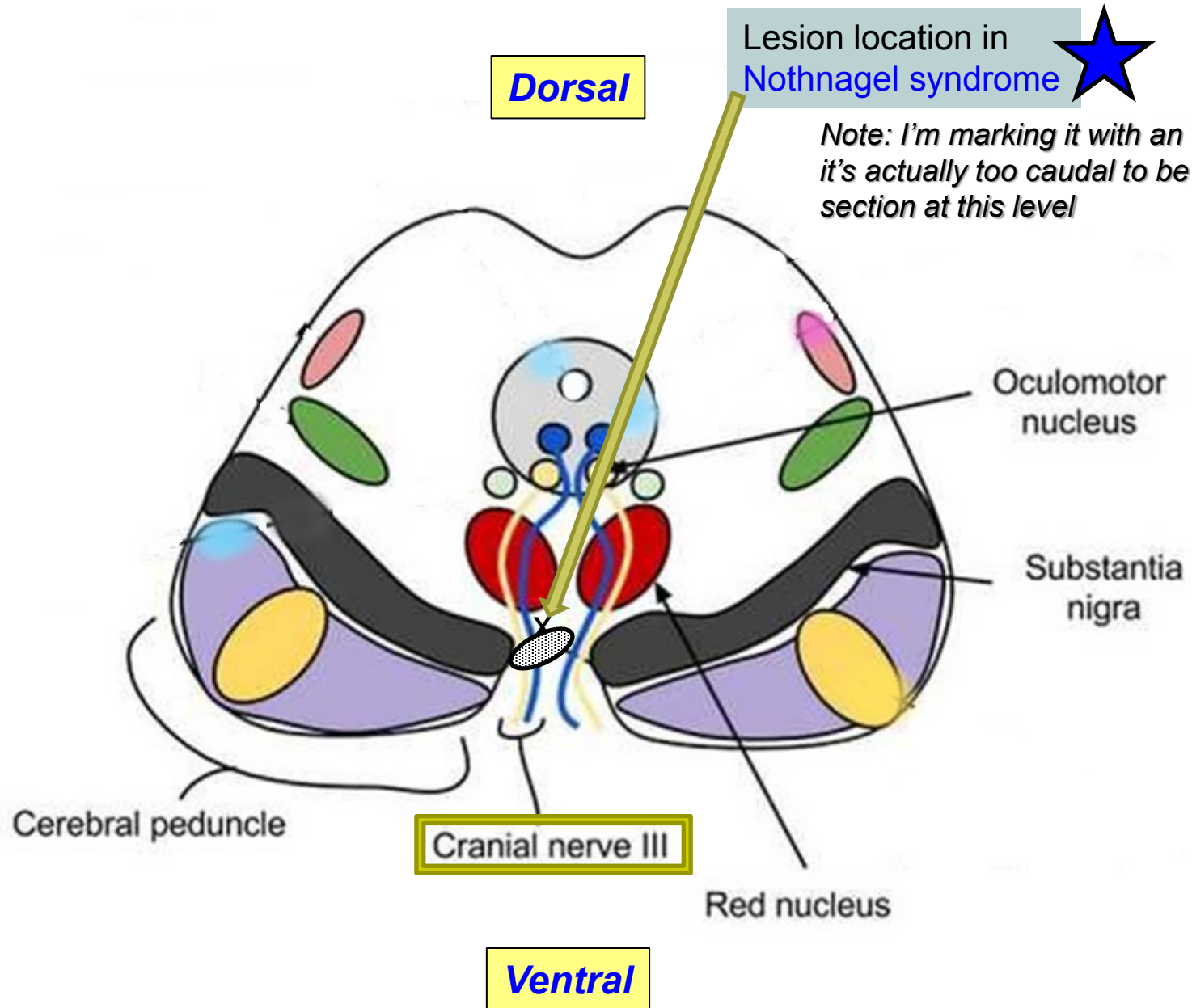


CN3 Fascicular Syndromes

| Syndrome | Ipsilateral 3 rd plus... | Adjacent damage |
|------------------|---|--------------------------------|
| <i>Weber</i> | Contralateral hemiplegia | Cerebral peduncle |
| <i>Benedikt</i> | Contralateral involuntary movements (often a hand flap) | Red nucleus & substantia nigra |
| <i>Claude</i> | <div> <div>↑</div> <div><i>plus</i></div> <div>↓</div> </div> | |
| <i>Nothnagel</i> | Ataxia | Superior cerebellar peduncle |

What structure adjacent to the CN3 fascicle is damaged in Nothnagel syndrome?

Motility Disorders: Fascicular Syndromes



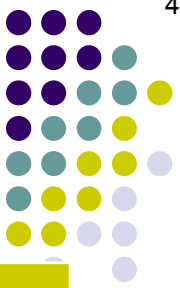
Motility Disorders: *Fascicular Syndromes*

CN3 Fascicular Syndromes

| Syndrome | Ipsilateral 3 rd plus... | Adjacent damage |
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| <i>Weber</i> | Contralateral hemiplegia | Cerebral peduncle |
| <i>Benedikt</i> | Contralateral involuntary movements (often a hand flap) | Red Nucleus substantia nigra |
| <i>Claude</i> | ↑ <i>plus</i> ↓ | |
| <i>Nothnagel</i> | Ataxia | Superior cerebellar peduncle |

Note: **Not**
the same!

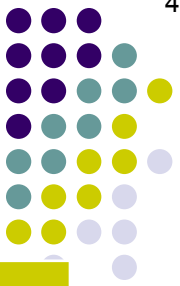
What structure adjacent to the CN3 fascicle is damaged in Nothnagel syndrome?



CN3 Fascicular Syndromes

| Syndrome | Ipsilateral 3 rd plus... | Adjacent damage |
|------------------|---|--------------------------------|
| <i>Weber</i> | Contralateral hemiplegia | Cerebral peduncle |
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| <i>Claude</i> | <div> <div>↑</div> <div><i>plus</i></div> <div>↓</div> </div> | ? |
| <i>Nothnagel</i> | Ataxia | Superior cerebellar peduncle |

What structure adjacent to the CN3 fascicle is damaged in Claude syndrome?



CN3 Fascicular Syndromes

| Syndrome | Ipsilateral 3 rd plus... | Adjacent damage |
|------------------|---|---|
| <i>Weber</i> | Contralateral hemiplegia | Cerebral peduncle |
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| <i>Nothnagel</i> | Ataxia | Superior cerebellar peduncle |

What structure adjacent to the CN3 fascicle is damaged in Claude syndrome?
 As you might expect, it is a combination of the structures involved in both Benedikt and Nothnagel syndromes

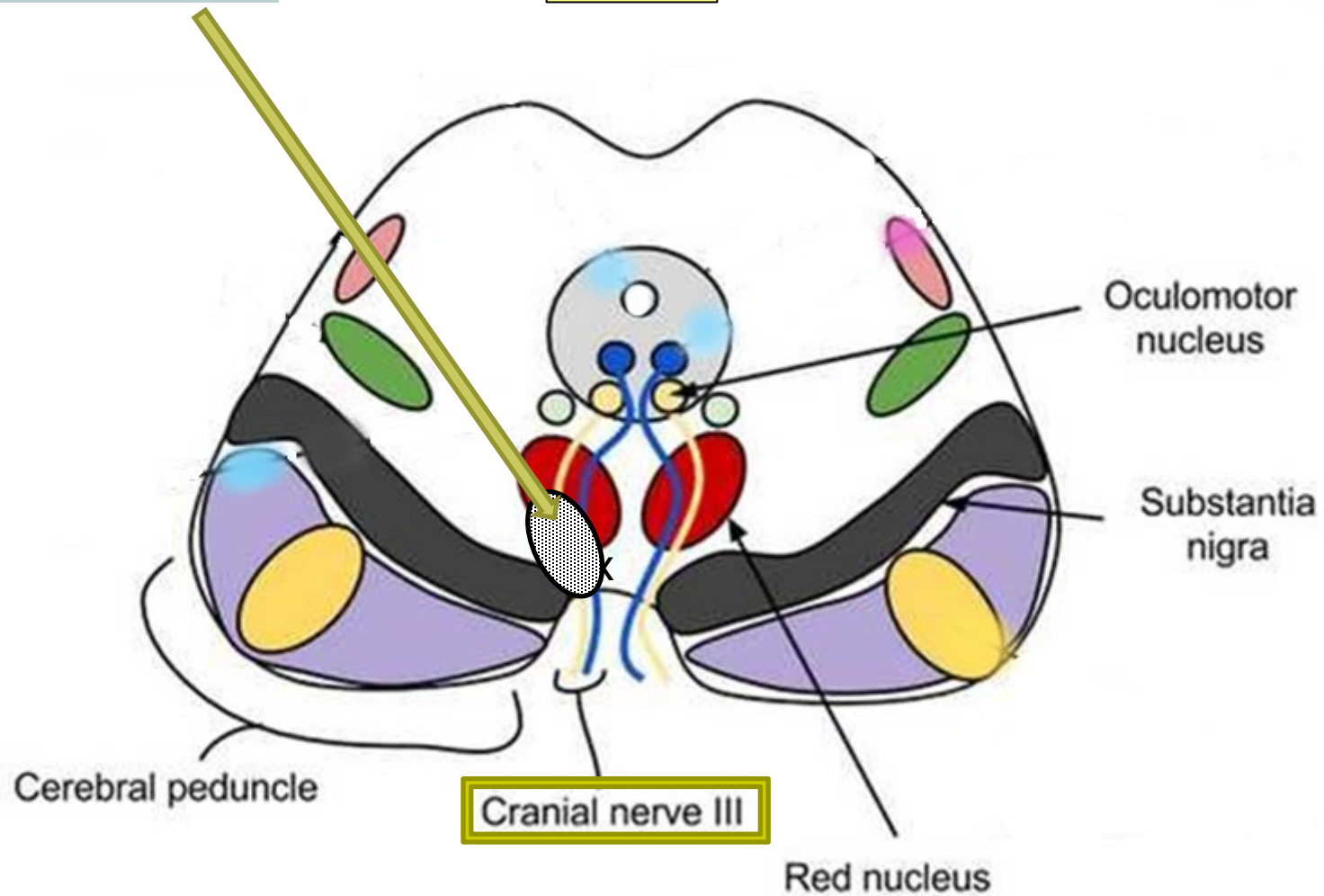


Motility Disorders: *Fascicular Syndromes*



Lesion location in
Claude syndrome

Dorsal



Ventral

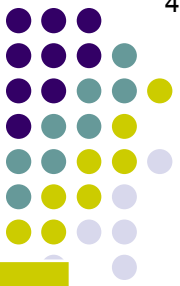
Q

Motility Disorders: *Fascicular Syndromes*

CN3 Fascicular Syndromes

| Syndrome | Ipsilateral 3 rd plus... | Adjacent damage |
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| <i>Nothnagel</i> | Ataxia | Superior cerebellar peduncle |

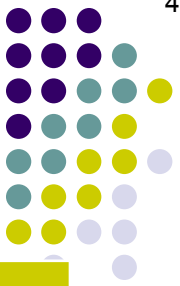
As mentioned previously, the CN3 fascicular syndromes all take place in the segment of the brainstem.



CN3 Fascicular Syndromes

| Syndrome | Ipsilateral 3 rd plus... | Adjacent damage |
|------------------|---|---|
| <i>Weber</i> | Contralateral hemiplegia | Cerebral peduncle |
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| <i>Nothnagel</i> | Ataxia | Superior cerebellar peduncle |

As mentioned previously, the CN3 fascicular syndromes all take place in the midbrain segment of the brainstem.



CN3 Fascicular Syndromes

| Syndrome | Ipsilateral 3 rd plus... | Adjacent damage |
|------------------|---|---|
| <i>Weber</i> | Contralateral hemiplegia | Cerebral peduncle |
| <i>Benedikt</i> | Contralateral involuntary movements (often a hand flap) | Red nucleus & substantia nigra |
| <i>Claude</i> | <div> <div>↑</div> <div><i>plus</i></div> <div>↓</div> </div> | <div> <div>↑</div> <div><i>plus</i></div> <div>↓</div> </div> |
| <i>Nothnagel</i> | Ataxia | Superior cerebellar peduncle |

As mentioned previously, the CN3 fascicular syndromes all take place in the midbrain segment of the brainstem. For this reason, they are often referred to collectively as *midbrain syndromes*.

Q

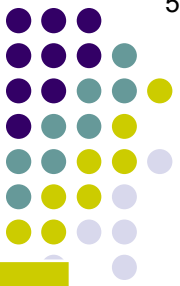
Motility Disorders: *Fascicular Syndromes*

CN3 Fascicular Syndromes

| Syndrome | Ipsilateral 3 rd plus... | Adjacent damage |
|------------------|---|--|
| <i>Weber</i> | Contralateral hemiplegia | Cerebral peduncle |
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| <i>Nothnagel</i> | Ataxia | Superior cerebellar peduncle |

As mentioned previously, the CN3 fascicular syndromes all take place in the midbrain segment of the brainstem. For this reason, they are often referred to collectively as *midbrain syndromes*.

That being said, it's important not to confuse these midbrain syndromes with the direction *midbrain syndrome*, aka structure *syndrome*, aka eponym *syndrome*.



CN3 Fascicular Syndromes

| Syndrome | Ipsilateral 3 rd plus... | Adjacent damage |
|------------------|---|--|
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| <i>Claude</i> | <div> <div>↑</div> <div>plus</div> <div>↓</div> </div> | <div> <div>↑</div> <div>plus</div> <div>↓</div> </div> |
| <i>Nothnagel</i> | Ataxia | Superior cerebellar peduncle |

As mentioned previously, the CN3 fascicular syndromes all take place in the midbrain segment of the brainstem. For this reason, they are often referred to collectively as *midbrain syndromes*.

That being said, it's important not to confuse these midbrain syndromes with the *dorsal midbrain syndrome*, aka *pretectal syndrome*, aka *Parinaud syndrome*.

Q

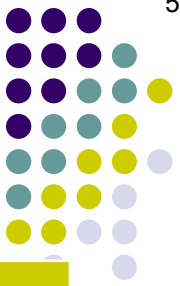
Motility Disorders: *Fascicular Syndromes*

CN3 Fascicular Syndromes

| Syndrome | Ipsilateral 3 rd plus... | Adjacent damage |
|------------------|--|--|
| <i>Weber</i> | Contralateral hemiplegia | Cerebral peduncle |
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| <i>Claude</i> | <div style="text-align: center;"> ↑ <i>plus</i> ↓ </div> | <div style="text-align: center;"> ↑ <i>plus</i> ↓ </div> |
| <i>Nothnagel</i> | Ataxia | Superior cerebellar peduncle |

As mentioned previously, the CN3 fascicular syndromes all take place in the **midbrain** segment of the brainstem. For this reason, they are often referred to collectively as *midbrain syndromes*.

That being said, it's important not to confuse these midbrain syndromes with the *dorsal midbrain syndrome*, aka *pretectal syndrome*, aka *Parinaud syndrome*. The lesion in dorsal midbrain syndrome involves the duh nuclei, which are located at the dorsalmost aspect of the midbrain (see next slide).



CN3 Fascicular Syndromes

| Syndrome | Ipsilateral 3 rd plus... | Adjacent damage |
|------------------|---|--|
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| <i>Nothnagel</i> | Ataxia | Superior cerebellar peduncle |

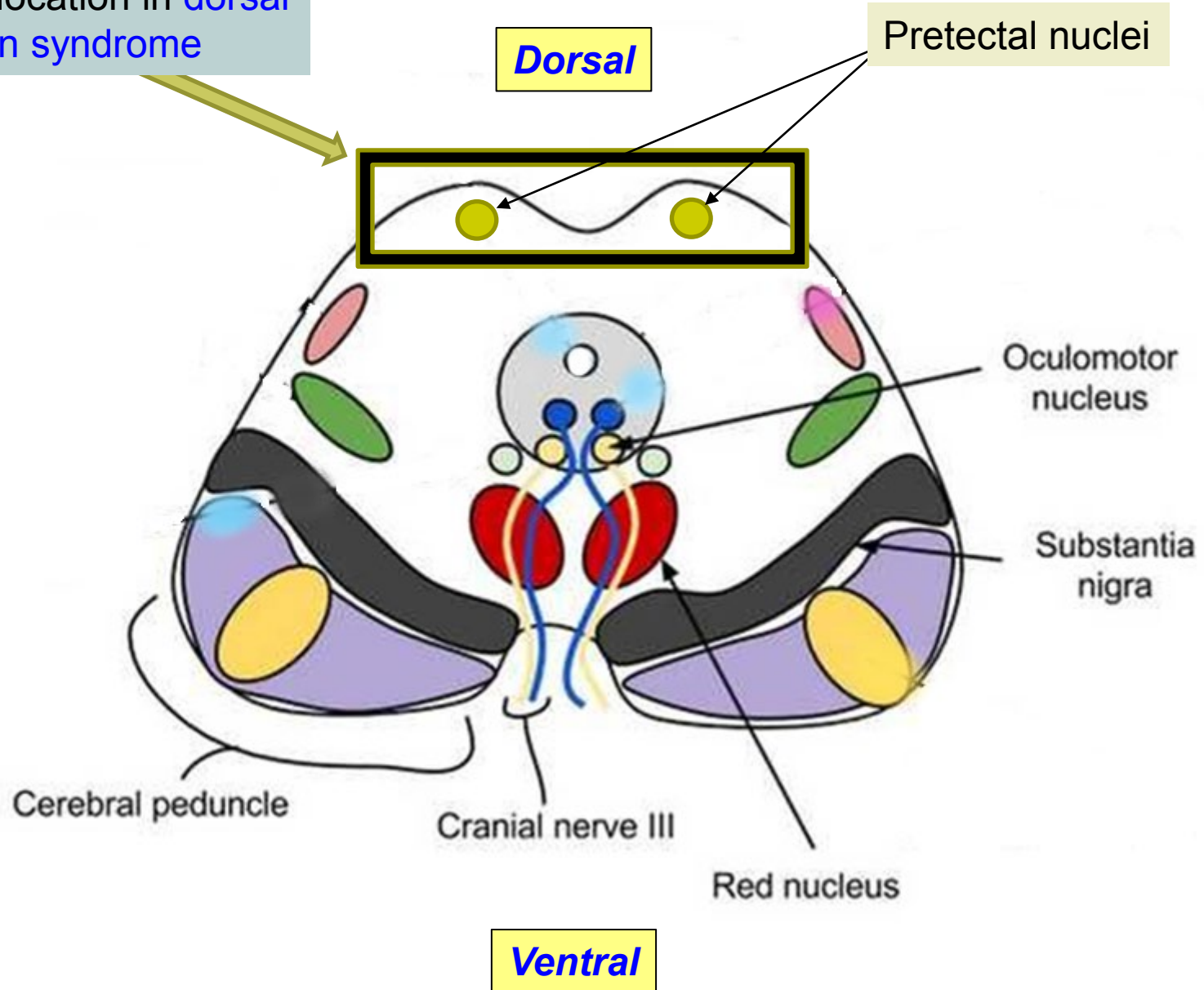
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Motility Disorders: *Fascicular Syndromes*

Lesion location in dorsal midbrain syndrome



Q

Motility Disorders: *Fascicular Syndromes*

CN3 Fascicular Syndromes

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| <i>Nothnagel</i> | Ataxia | Superior cerebellar peduncle |

If you were limited to using just two words, how would you describe Parinaud syndrome; ie, in general terms, what sort of condition is it?

I take place in the
are often referred to

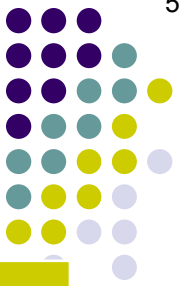
in syndromes with the

Parinaud syndrome

ctal nuclei, which
(next slide).

A

Motility Disorders: Fascicular Syndromes



CN3 Fascicular Syndromes

| Syndrome | Ipsilateral 3 rd plus... | Adjacent damage |
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| <i>Claude</i> | ↑ <i>plus</i> ↓ | ↑ <i>plus</i> ↓ |
| <i>Nothnagel</i> | Ataxia | Superior cerebellar peduncle |

If you were limited to using just two words, how would you describe Parinaud syndrome; ie, in general terms, what sort of condition is it?
It is a gaze palsy

I take place in the
are often referred to

in syndromes with the
Parinaud syndrome.
ctal nuclei, which
(next slide).

Q

Motility Disorders: *Fascicular Syndromes*

CN3 Fascicular Syndromes

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| <i>Claude</i> | ↑ <i>plus</i> ↓ | ↑ <i>plus</i> ↓ |
| <i>Nothnagel</i> | Ataxia | Superior cerebellar peduncle |

If you were limited to using just two words, how would you describe Parinaud syndrome; ie, in general terms, what sort of condition is it?

It is a gaze palsy

Is it nuclear, supranuclear, internuclear, or infranuclear?

take place in the
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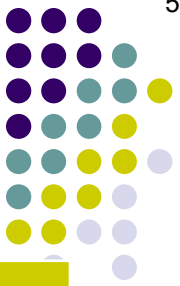
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A

Motility Disorders: Fascicular Syndromes



CN3 Fascicular Syndromes

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| <i>Nothnagel</i> | Ataxia | Superior cerebellar peduncle |

If you were limited to using just two words, how would you describe Parinaud syndrome; ie, in general terms, what sort of condition is it?

It is a gaze palsy

Is it nuclear, supranuclear, internuclear, or infranuclear?

Supranuclear

I take place in the
are often referred to

in syndromes with the

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ctal nuclei, which
(next slide).

Q

Motility Disorders: *Fascicular Syndromes*

CN3 Fascicular Syndromes

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| <i>Nothnagel</i> | Ataxia | Superior cerebellar peduncle |

If you were limited to using just two words, how would you describe Parinaud syndrome; ie, in general terms, what sort of condition is it?

It is a gaze palsy

Is it nuclear, supranuclear, internuclear, or infranuclear?

Supranuclear

Parinaud syndrome has four main features—what are they?

--?

--?

--?

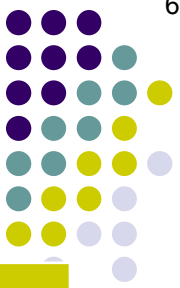
--?

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ctal nuclei, which
next slide).



CN3 Fascicular Syndromes

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| <i>Nothnagel</i> | Ataxia | Superior cerebellar peduncle |

If you were limited to using just two words, how would you describe Parinaud syndrome; ie, in general terms, what sort of condition is it?

It is a gaze palsy

Is it nuclear, supranuclear, internuclear, or infranuclear?

Supranuclear

Parinaud syndrome has four main features—what are they?

--Impaired

direction of gaze

--?

--?

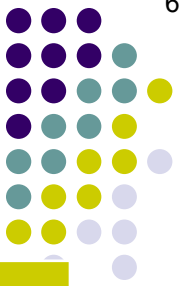
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CN3 Fascicular Syndromes

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If you were limited to using just two words, how would you describe Parinaud syndrome; ie, in general terms, what sort of condition is it?

It is a gaze palsy

Is it nuclear, supranuclear, internuclear, or infranuclear?

Supranuclear

Parinaud syndrome has four main features—what are they?

--Impaired upgaze

--?

--?

--?

I take place in the
are often referred to

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Parinaud syndrome.

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Q

Motility Disorders: *Fascicular Syndromes*

CN3 Fascicular Syndromes

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If you were limited to using just two words, how would you describe Parinaud syndrome; ie, in general terms, what sort of condition is it?

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Is it nuclear, supranuclear, internuclear, or infranuclear?

Supranuclear

Parinaud syndrome has four main features—what are they?

--Impaired upgaze

--Lid

--?

--?

I take place in the
are often referred to

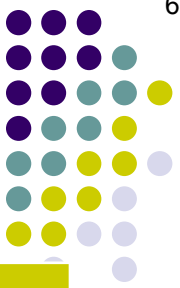
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A

Motility Disorders: Fascicular Syndromes



CN3 Fascicular Syndromes

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If you were limited to using just two words, how would you describe Parinaud syndrome; ie, in general terms, what sort of condition is it?

It is a gaze palsy

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Supranuclear

Parinaud syndrome has four main features—what are they?

--Impaired upgaze

--Lid retraction

--?

--?

I take place in the
are often referred to

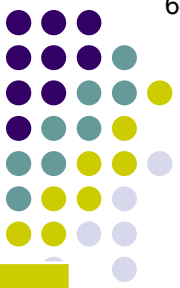
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Motility Disorders: Fascicular Syndromes



CN3 Fascicular Syndromes

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Parinaud syndrome has four main features—what are they?

--Impaired upgaze

--Lid retraction

--two-words nystagmus

--?

I take place in the
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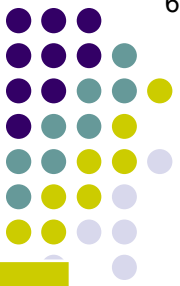
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Motility Disorders: Fascicular Syndromes



CN3 Fascicular Syndromes

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Supranuclear

Parinaud syndrome has four main features—what are they?

--Impaired upgaze

--Lid retraction

--Convergence-retraction nystagmus

--?

I take place in the
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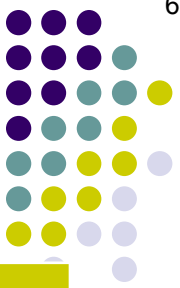
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Motility Disorders: Fascicular Syndromes



CN3 Fascicular Syndromes

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Supranuclear

Parinaud syndrome has four main features—what are they?

--Impaired upgaze

--Lid retraction

--Convergence-retraction nystagmus

--two-words dissociation

I take place in the
are often referred to

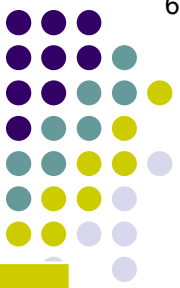
in syndromes with the

Parinaud syndrome.

ctal nuclei, which
next slide).

A

Motility Disorders: Fascicular Syndromes



CN3 Fascicular Syndromes

| Syndrome | Ipsilateral 3 rd plus... | Adjacent damage |
|------------------|---|--------------------------------|
| <i>Weber</i> | Contralateral hemiplegia | Cerebral peduncle |
| <i>Benedikt</i> | Contralateral involuntary movements (often a hand flap) | Red nucleus & substantia nigra |
| <i>Claude</i> | ↑ <i>plus</i> ↓ | ↑ <i>plus</i> ↓ |
| <i>Nothnagel</i> | Ataxia | Superior cerebellar peduncle |

If you were limited to using just two words, how would you describe Parinaud syndrome; ie, in general terms, what sort of condition is it?

It is a gaze palsy

Is it nuclear, supranuclear, internuclear, or infranuclear?

Supranuclear

Parinaud syndrome has four main features—what are they?

--Impaired upgaze

--Lid retraction

--Convergence-retraction nystagmus

--Light-near dissociation

I take place in the
are often referred to

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ctal nuclei, which
next slide).

Motility Disorders: *Fascicular Syndromes*

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If you were limited to using just two words, how would you describe

For more on Parinaud syndrome, see slide-set N16

Is it nuclear, supranuclear, internuclear, or infranuclear?

Supranuclear

Parinaud syndrome has four main features—what are they?

- Impaired upgaze
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- Light-near dissociation

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Q

Motility Disorders: *Fascicular Syndromes*

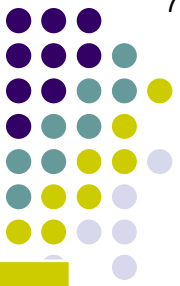
CN3 Fascicular Syndromes

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As mentioned previously, the CN3 fascicular syndromes all take place in the midbrain segment of the brainstem. For this reason, they are often referred to collectively as **midbrain** syndromes.

Do any other EOM-related CNs reside in the midbrain?

midbrain syndromes with the e, aka *Parinaud* syndrome. pretectal nuclei, which (see next slide).



CN3 Fascicular Syndromes

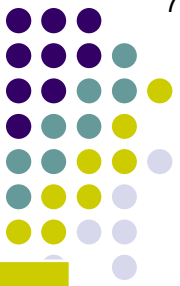
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Yes, # does

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CN3 Fascicular Syndromes

| Syndrome | Ipsilateral 3 rd plus... | Adjacent damage |
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Do any other EOM-related CNs reside in the midbrain?

Yes, CN4 does

midbrain syndromes with the e, aka *Parinaud* syndrome. pretectal nuclei, which (see next slide).

Q

Motility Disorders: Fascicular Syndromes

CN3 Fascicular Syndromes

| Syndrome | Ipsilateral 3 rd plus... | Adjacent damage |
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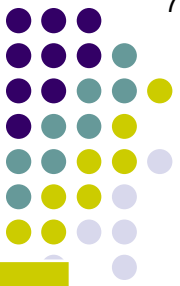
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T

a Are there any CN4 fascicular syndromes?

midbrain syndromes with the e, aka *Parinaud* syndrome. pretectal nuclei, which (see next slide).



CN3 Fascicular Syndromes

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T Do any other EOM-related CNs reside in the midbrain?

Q Yes, CN4 does

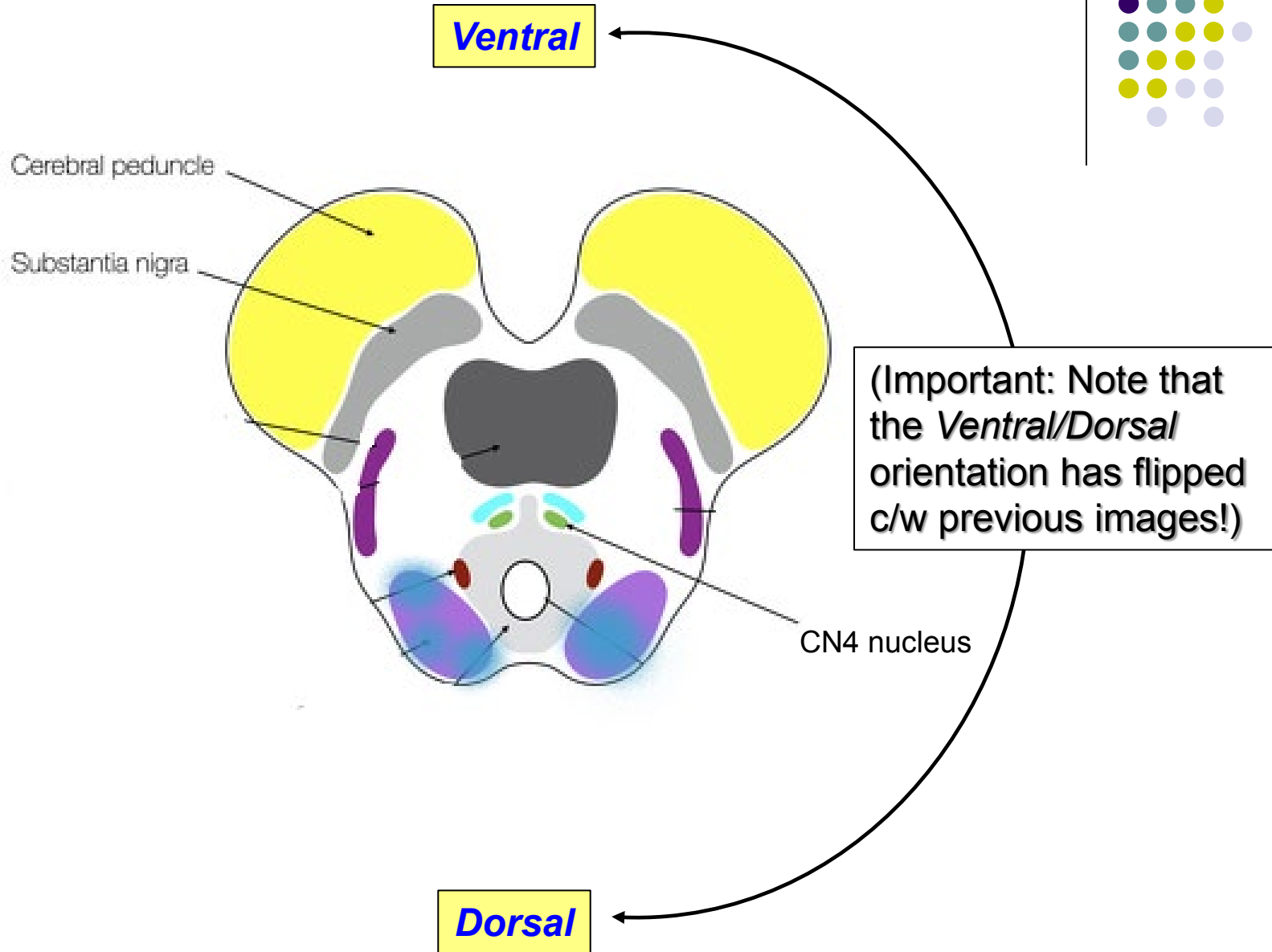
T

a Are there any CN4 fascicular syndromes?

Sorta...(will unpack this forthwith)

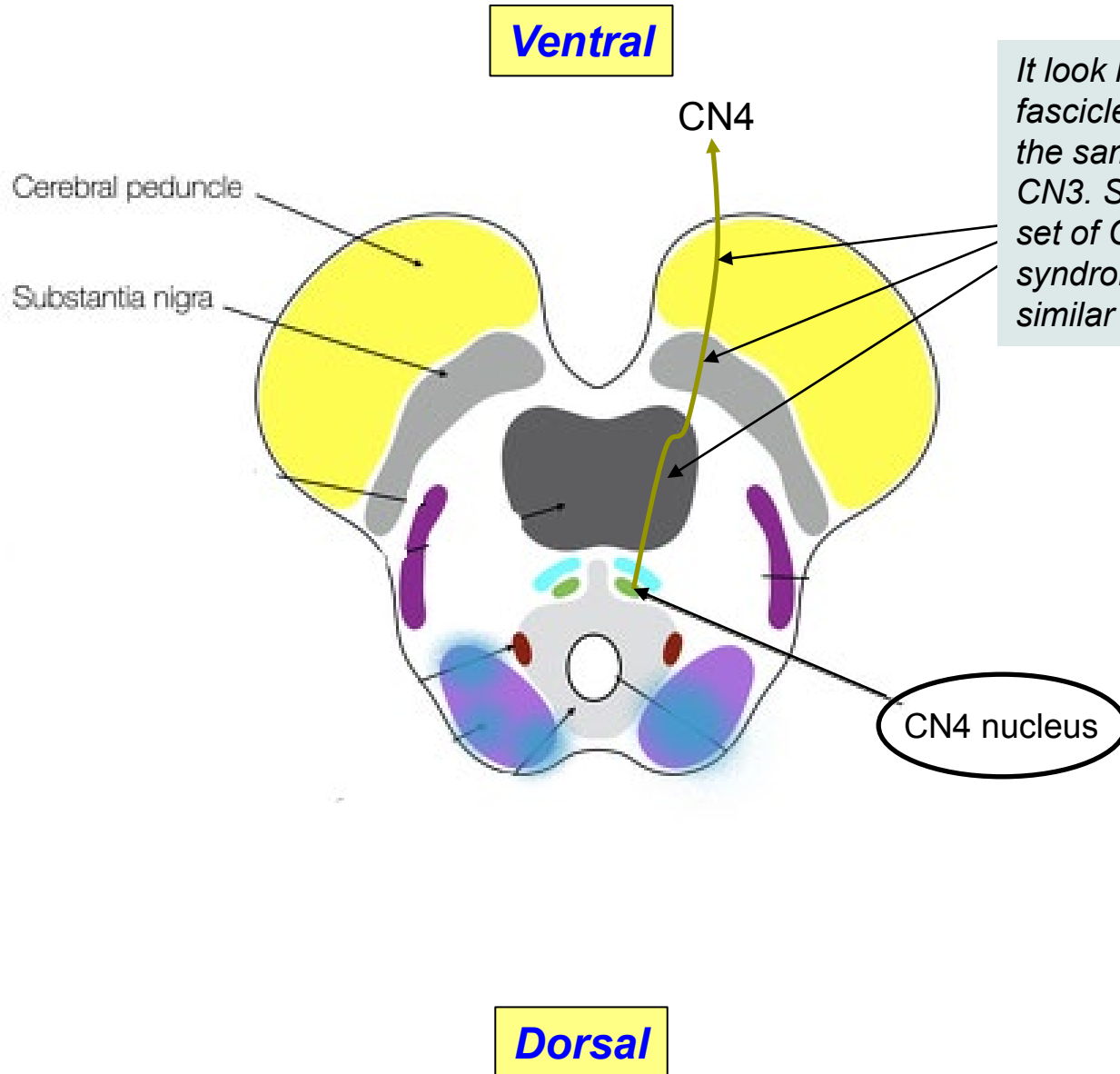
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Motility Disorders: *Fascicular Syndromes*



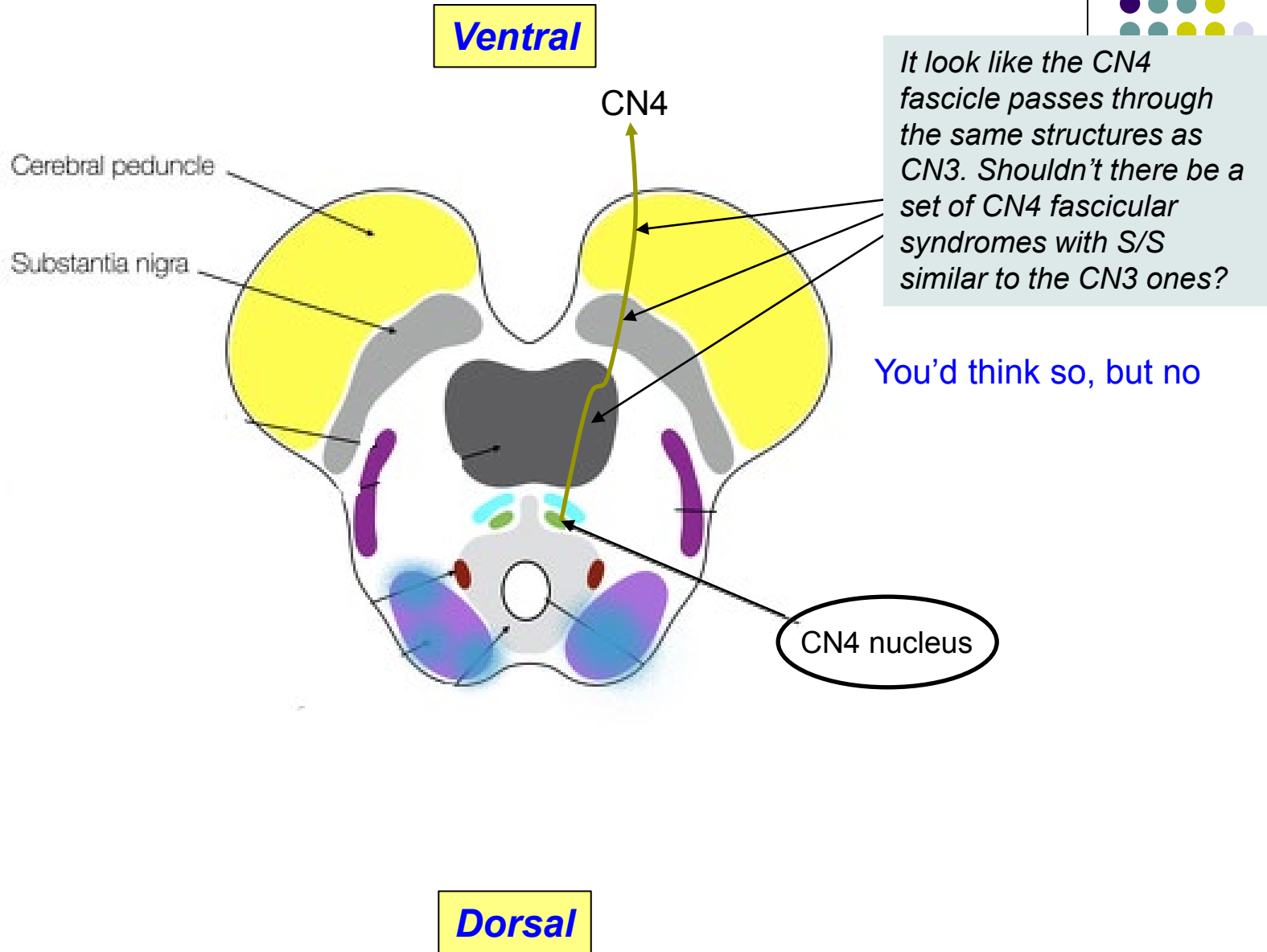
(No question—proceed when ready)

Motility Disorders: Fascicular Syndromes

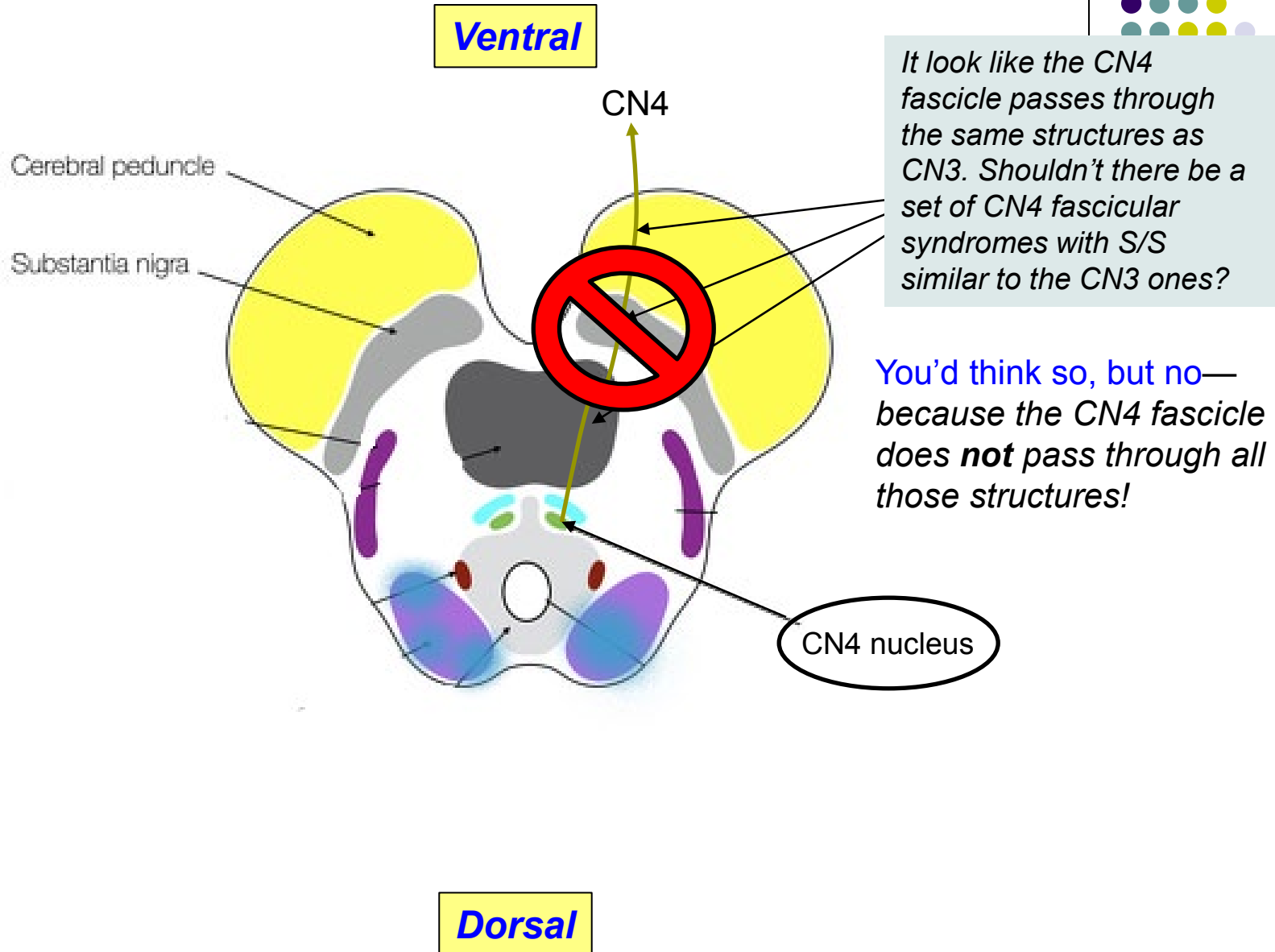


It look like the CN4 fascicle passes through the same structures as CN3. Shouldn't there be a set of CN4 fascicular syndromes with S/S similar to the CN3 ones?

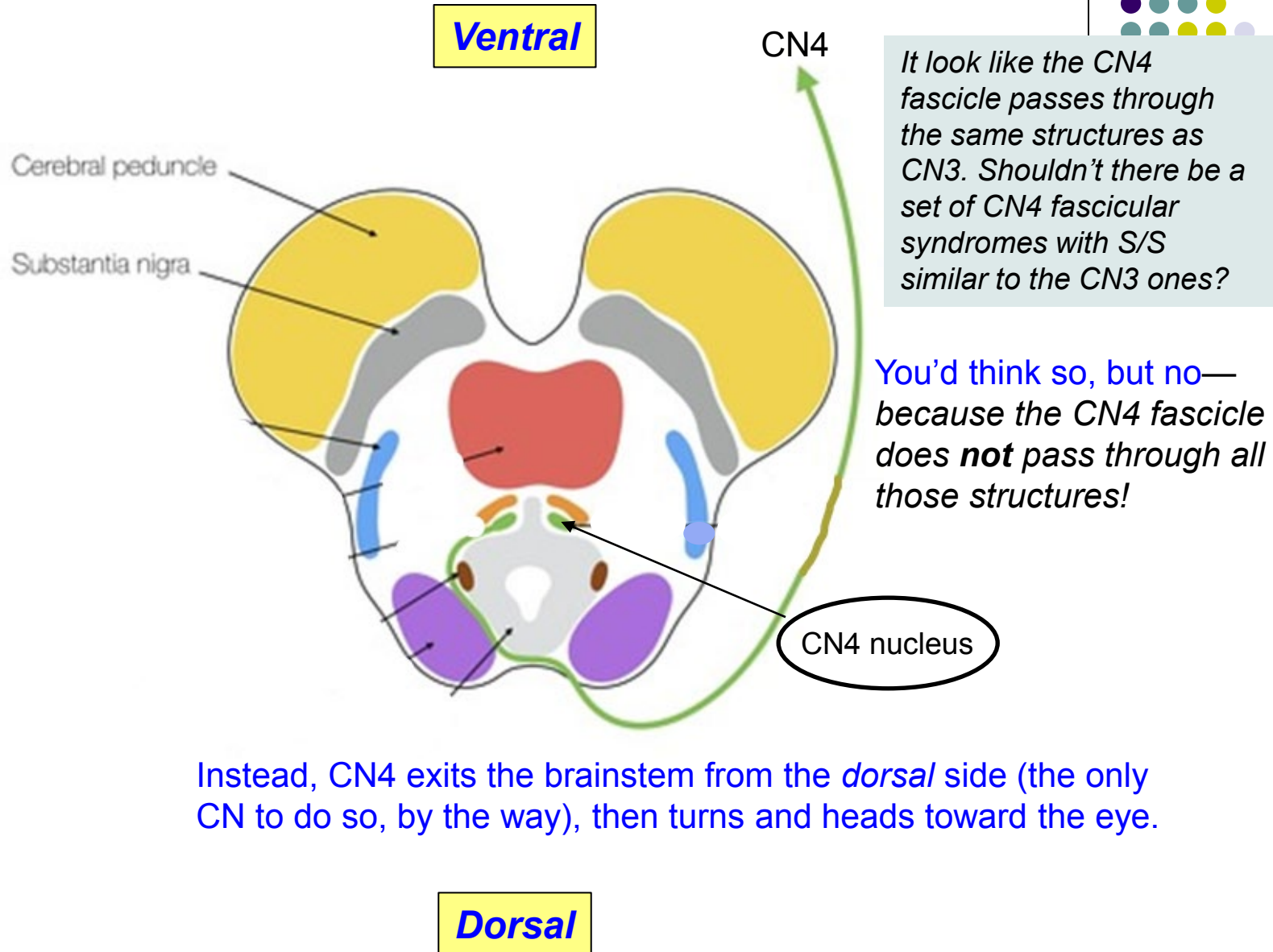
Motility Disorders: Fascicular Syndromes



Motility Disorders: Fascicular Syndromes

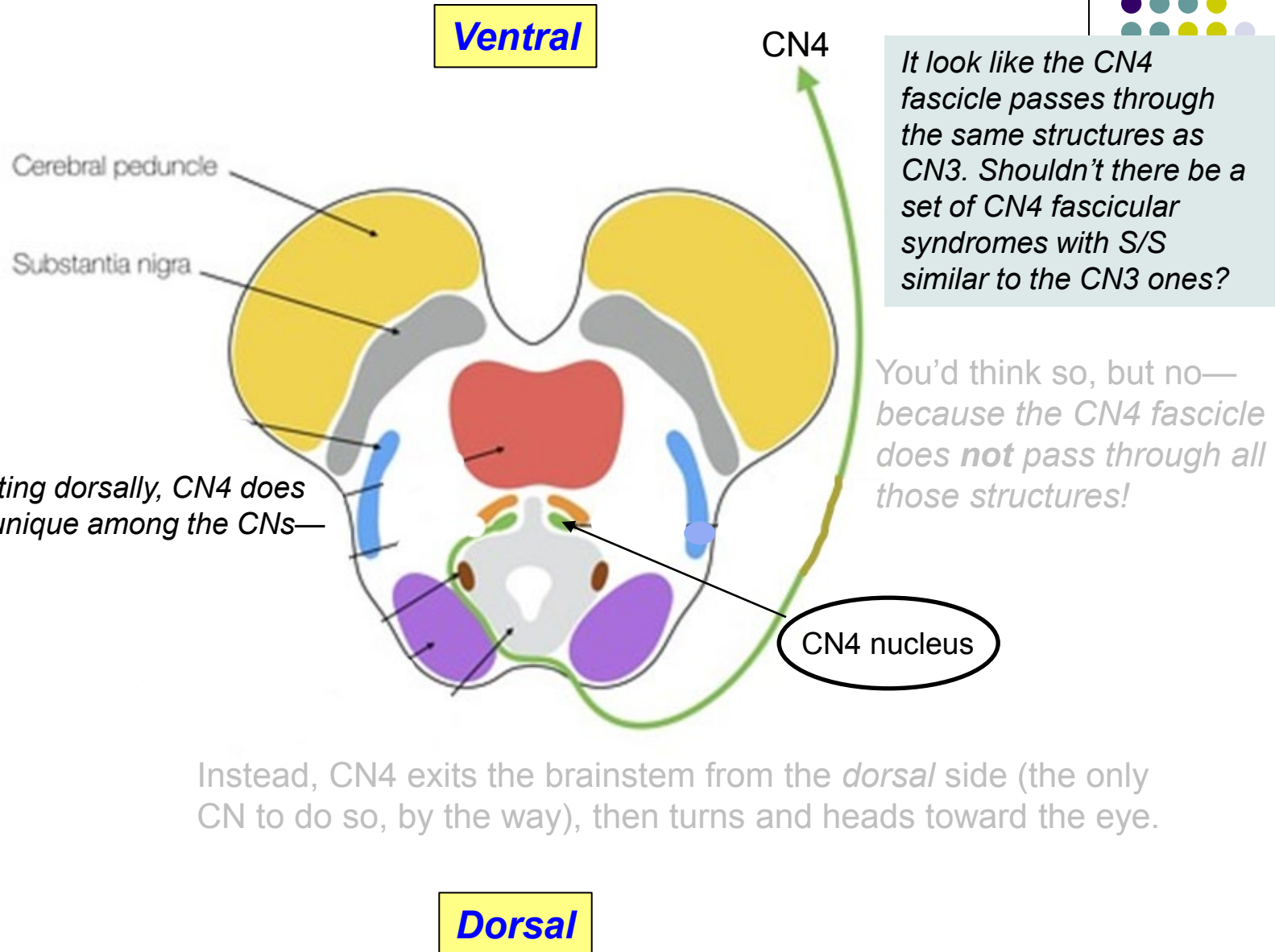


Motility Disorders: *Fascicular Syndromes*

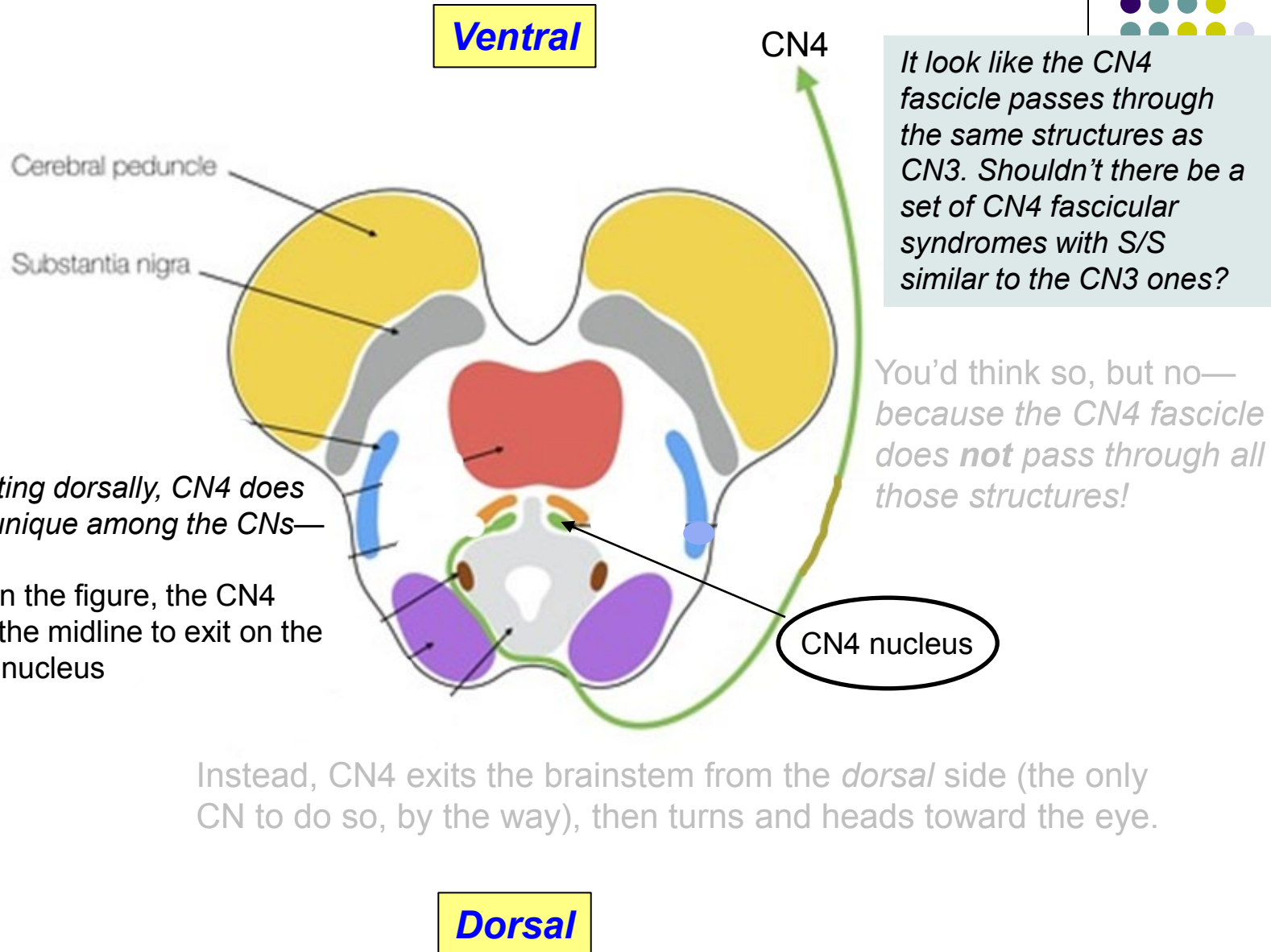


Instead, CN4 exits the brainstem from the *dorsal* side (the only CN to do so, by the way), then turns and heads toward the eye.

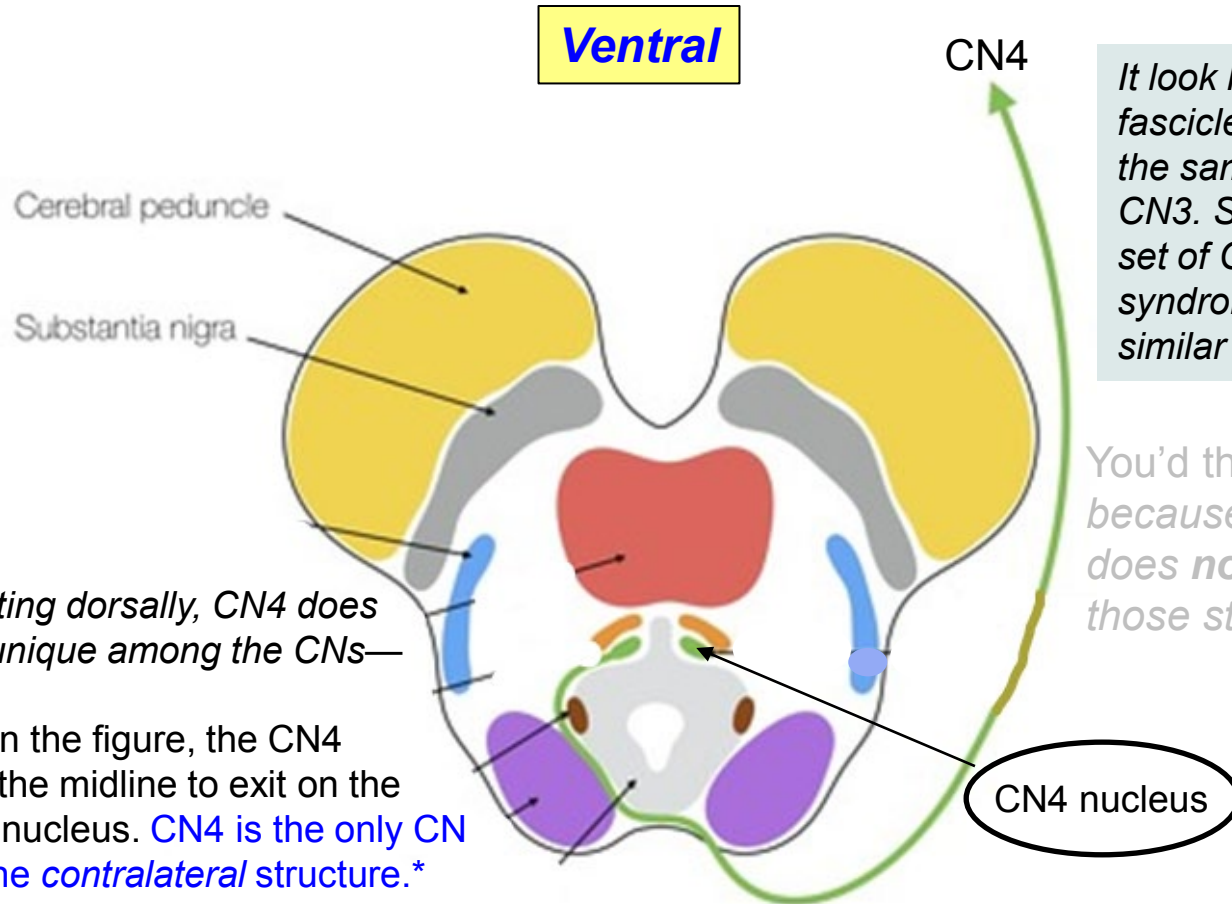
Motility Disorders: Fascicular Syndromes



Motility Disorders: Fascicular Syndromes



Motility Disorders: Fascicular Syndromes



It look like the CN4 fascicle passes through the same structures as CN3. Shouldn't there be a set of CN4 fascicular syndromes with S/S similar to the CN3 ones?

*You'd think so, but no—because the CN4 fascicle does **not** pass through all those structures!*

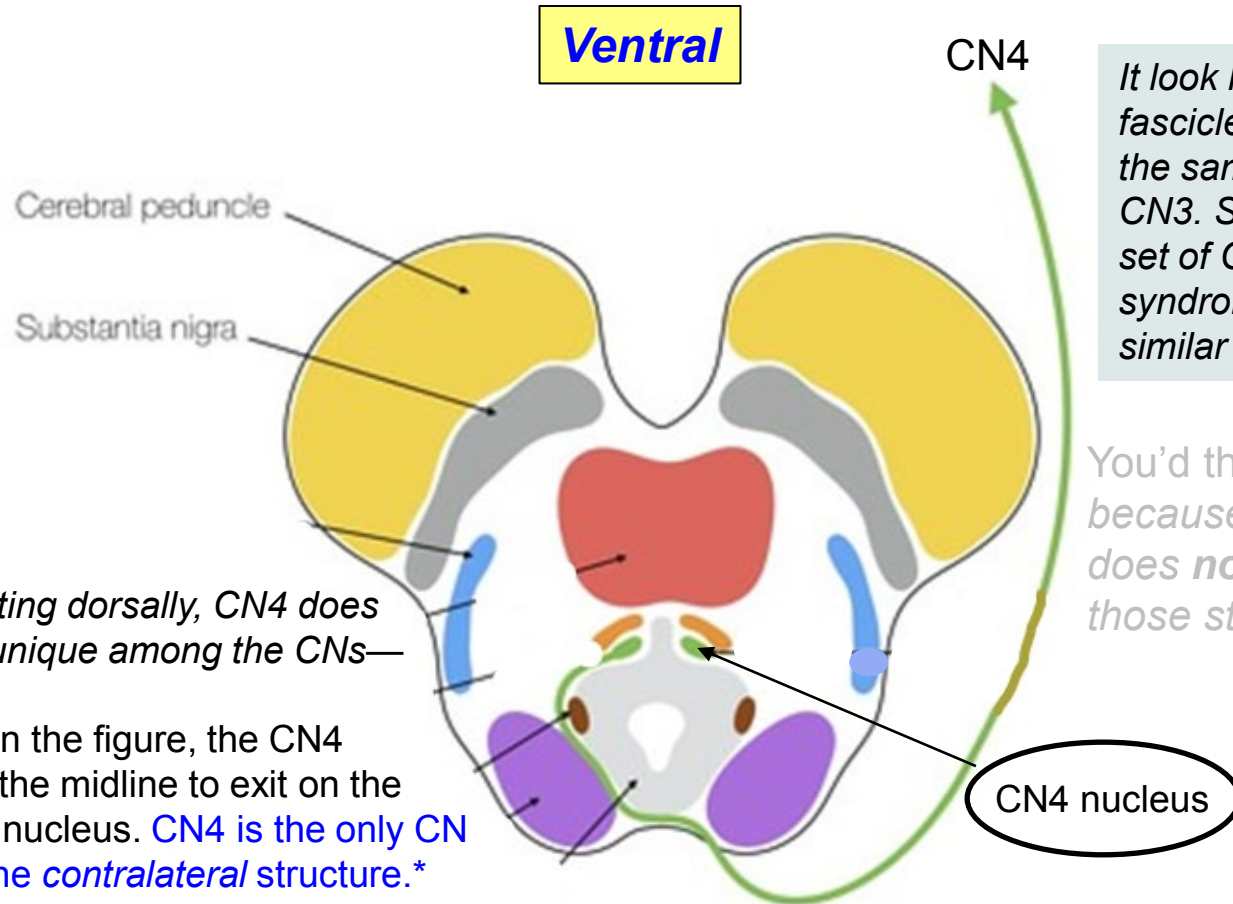
In addition to exiting dorsally, CN4 does something else unique among the CNs—what is it?

As can be seen in the figure, the CN4 fascicle crosses the midline to exit on the side opposite its nucleus. **CN4 is the only CN that innervates the *contralateral* structure.***

*The semi-exception to this is, the **two words** muscles are innervated contralaterally

the only CN to do so, by the way), then turns and heads toward the eye.

Motility Disorders: Fascicular Syndromes



It look like the CN4 fascicle passes through the same structures as CN3. Shouldn't there be a set of CN4 fascicular syndromes with S/S similar to the CN3 ones?

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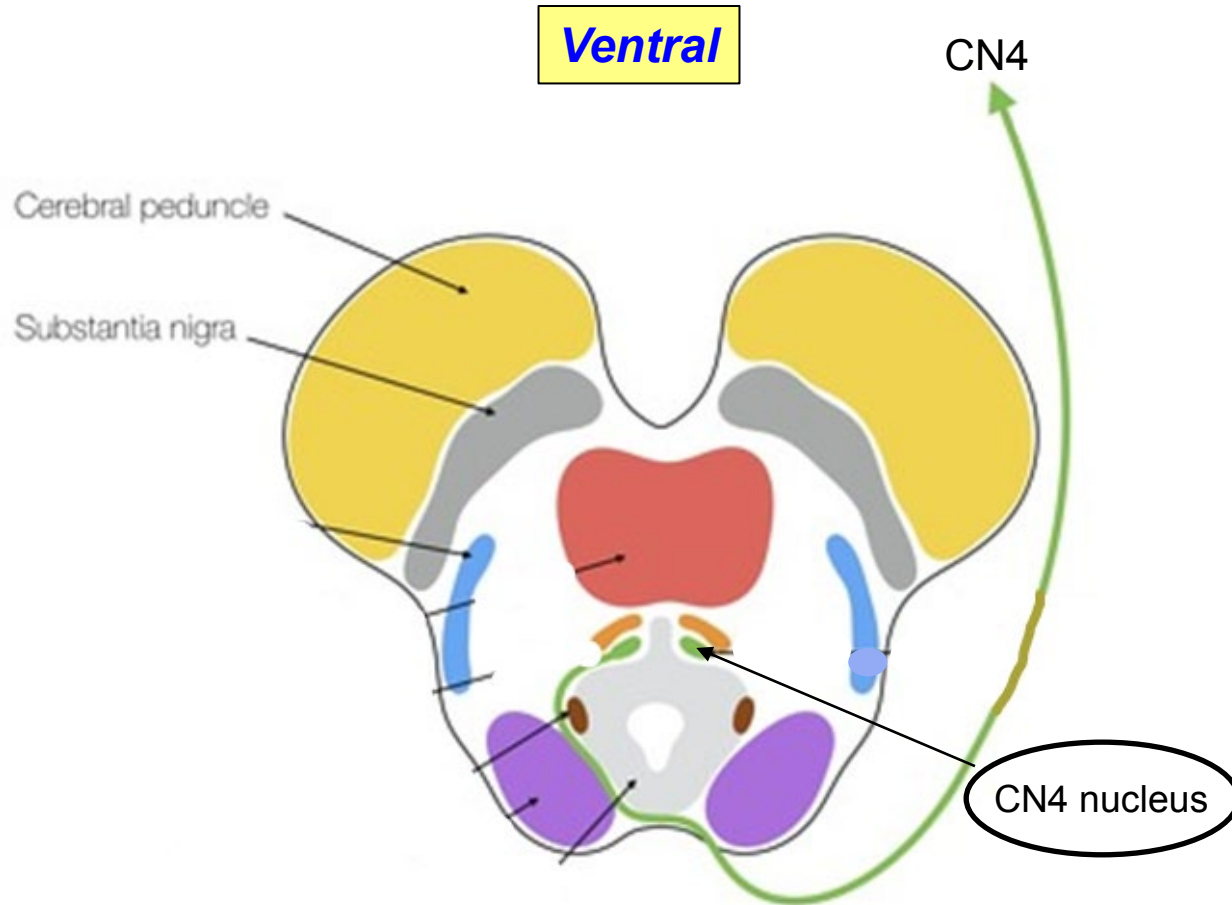
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*The semi-exception to this is, the superior rectus muscles are innervated contralaterally

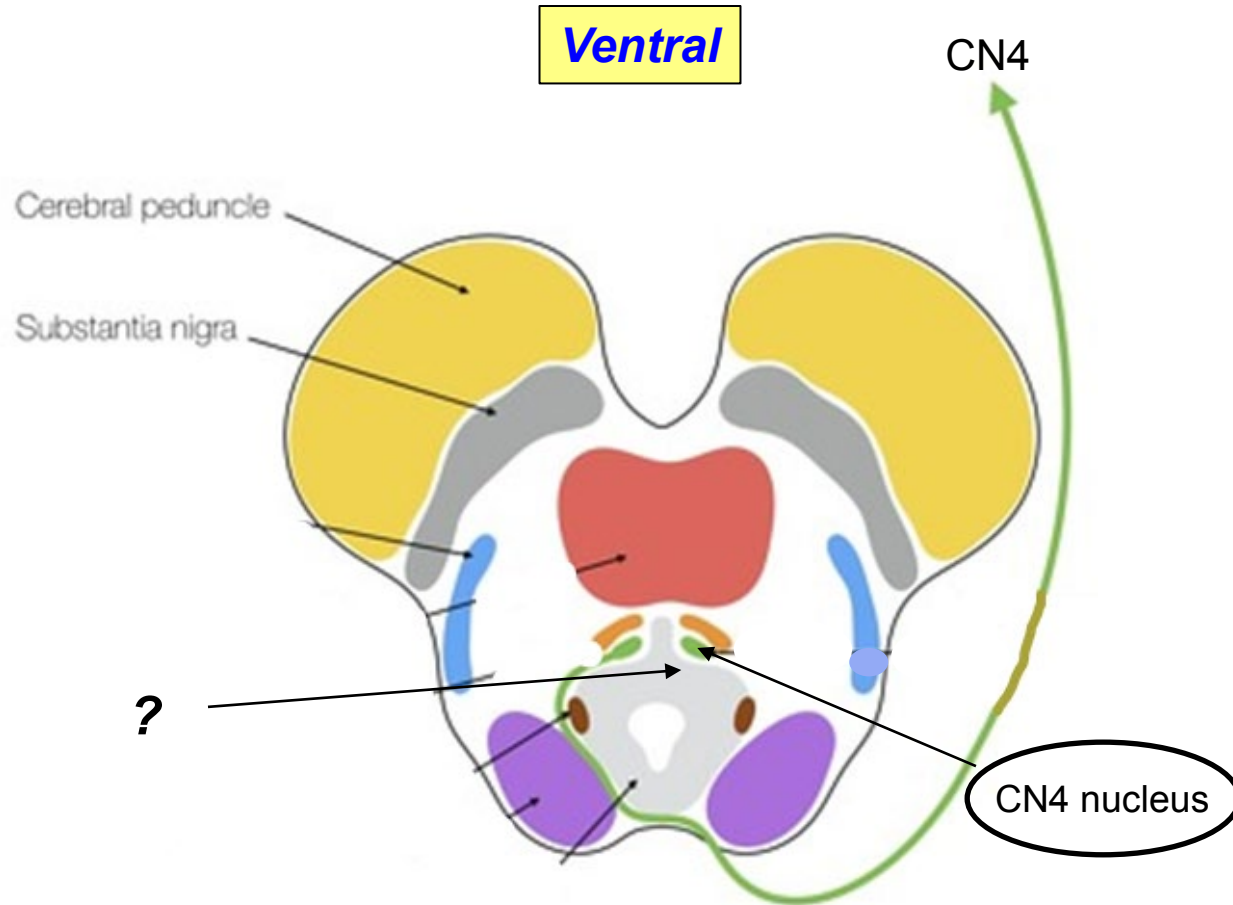
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Motility Disorders: *Fascicular Syndromes*



While not named, two CN4 fascicular syndromes get some love in the Neuro book. Conveniently, both involve the pupil. What adjacent structures are involved, and what is the pupillary manifestation for each?

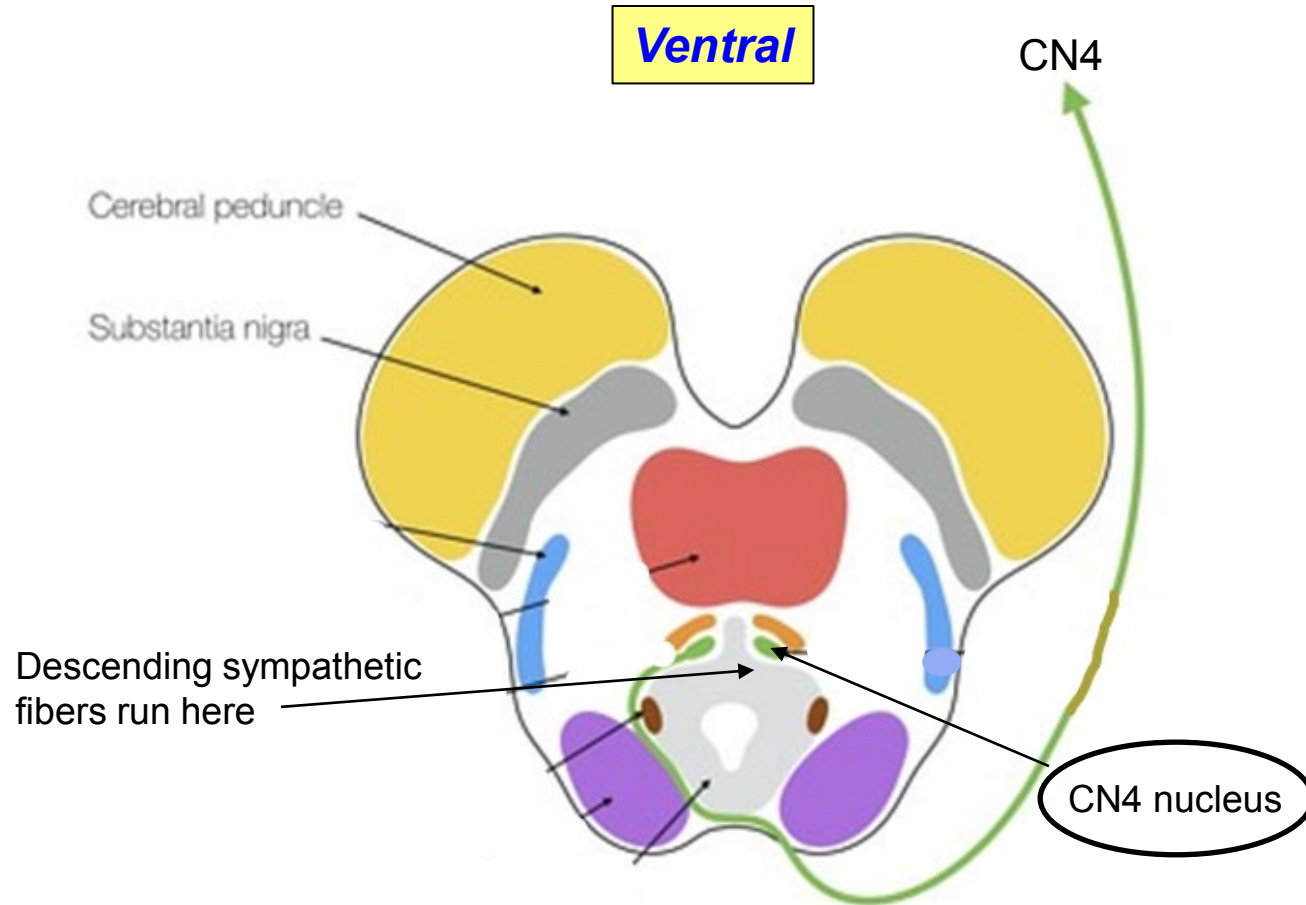
Motility Disorders: *Fascicular Syndromes*



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--The first-order fibers pass just dorsal to the CN4 nucleus and fascicle.

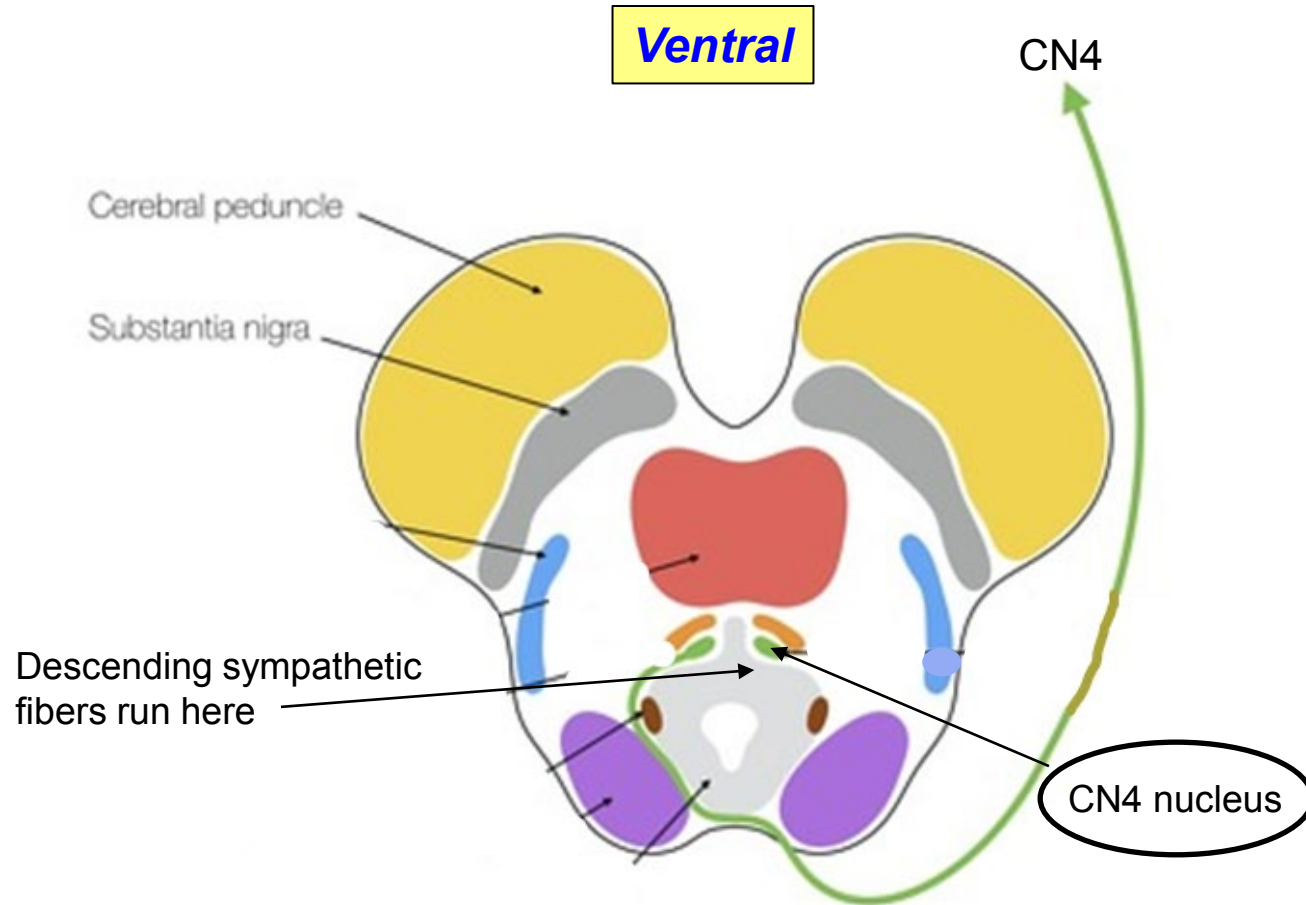
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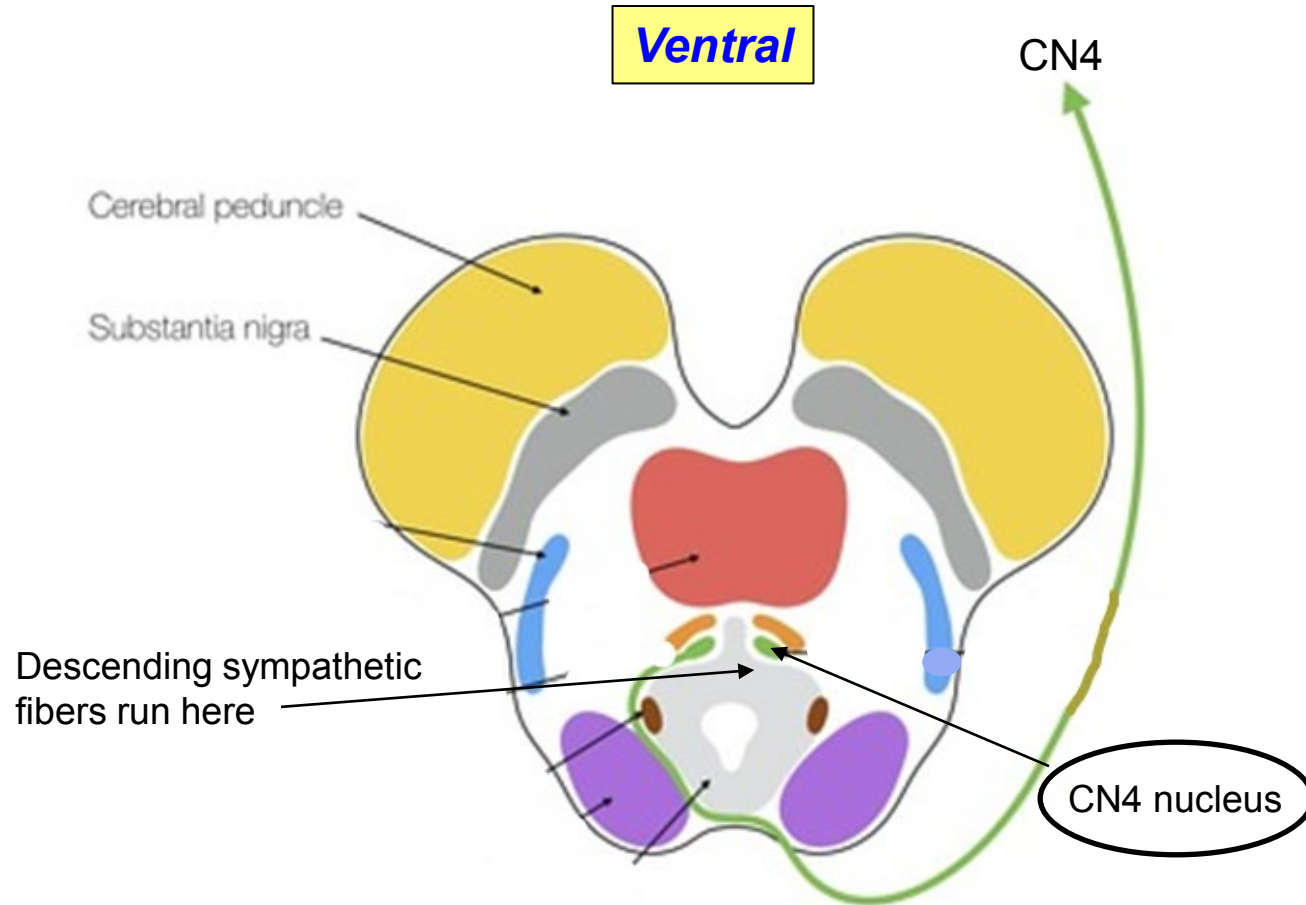
Motility Disorders: Fascicular Syndromes



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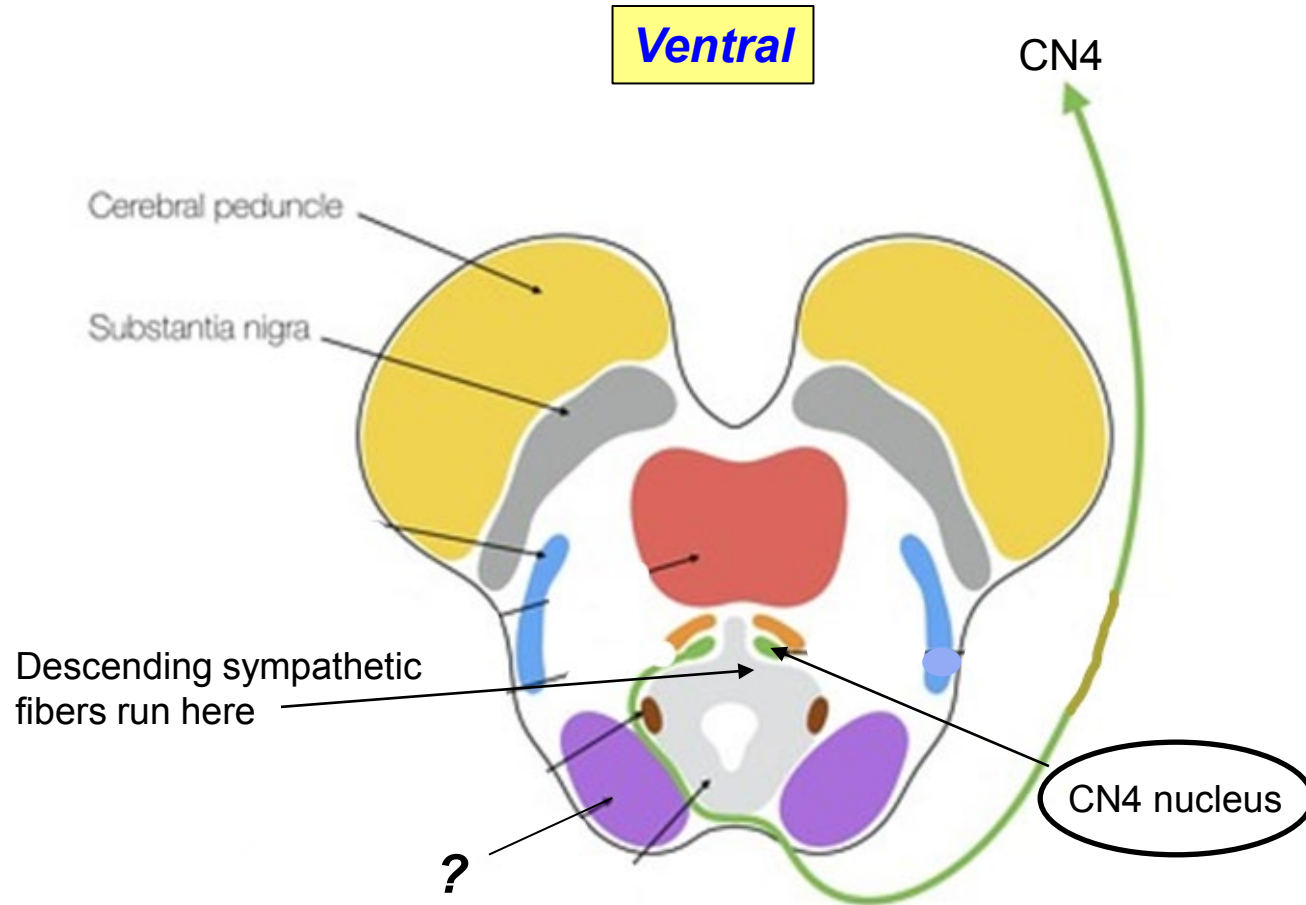
Motility Disorders: Fascicular Syndromes



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--The first-order sympathetic fibers pass just dorsal to the CN4 nucleus and fascicle. If bagged, the pt will manifest a Horner syndrome that is contralateral to the palsied SO.

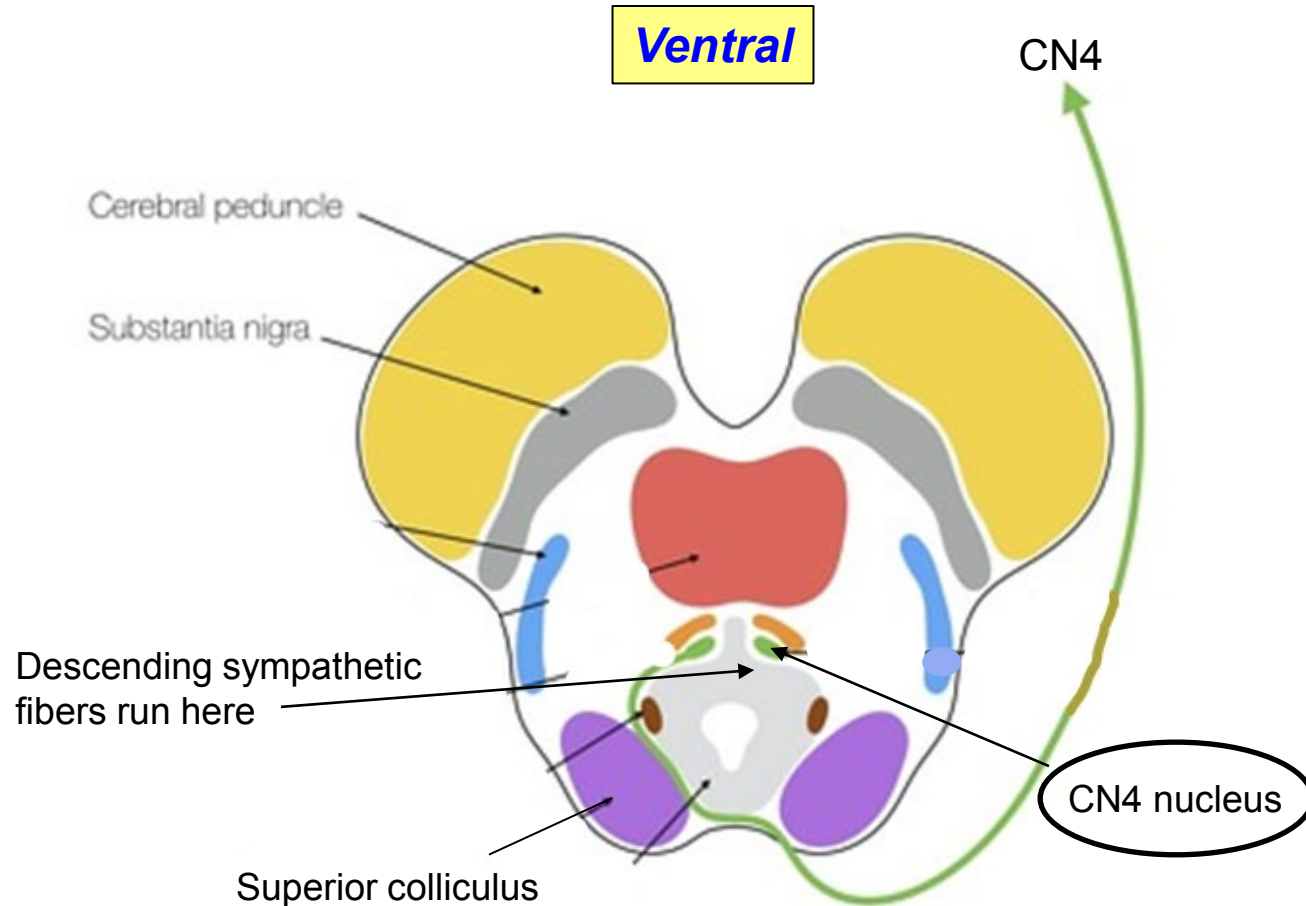
Motility Disorders: Fascicular Syndromes



While not named, two CN4 fascicular syndromes get some love in the Neuro book. Conveniently, both involve the pupil. What adjacent structures are involved, and what is the pupillary manifestation for each?

- The first-order sympathetic fibers pass just dorsal to the CN4 nucleus and fascicle. If bagged, the pt will manifest a **Horner syndrome** that is **contralateral** to the palsied SO.
- The pupillary light reflex fibers run in the nearby two words.

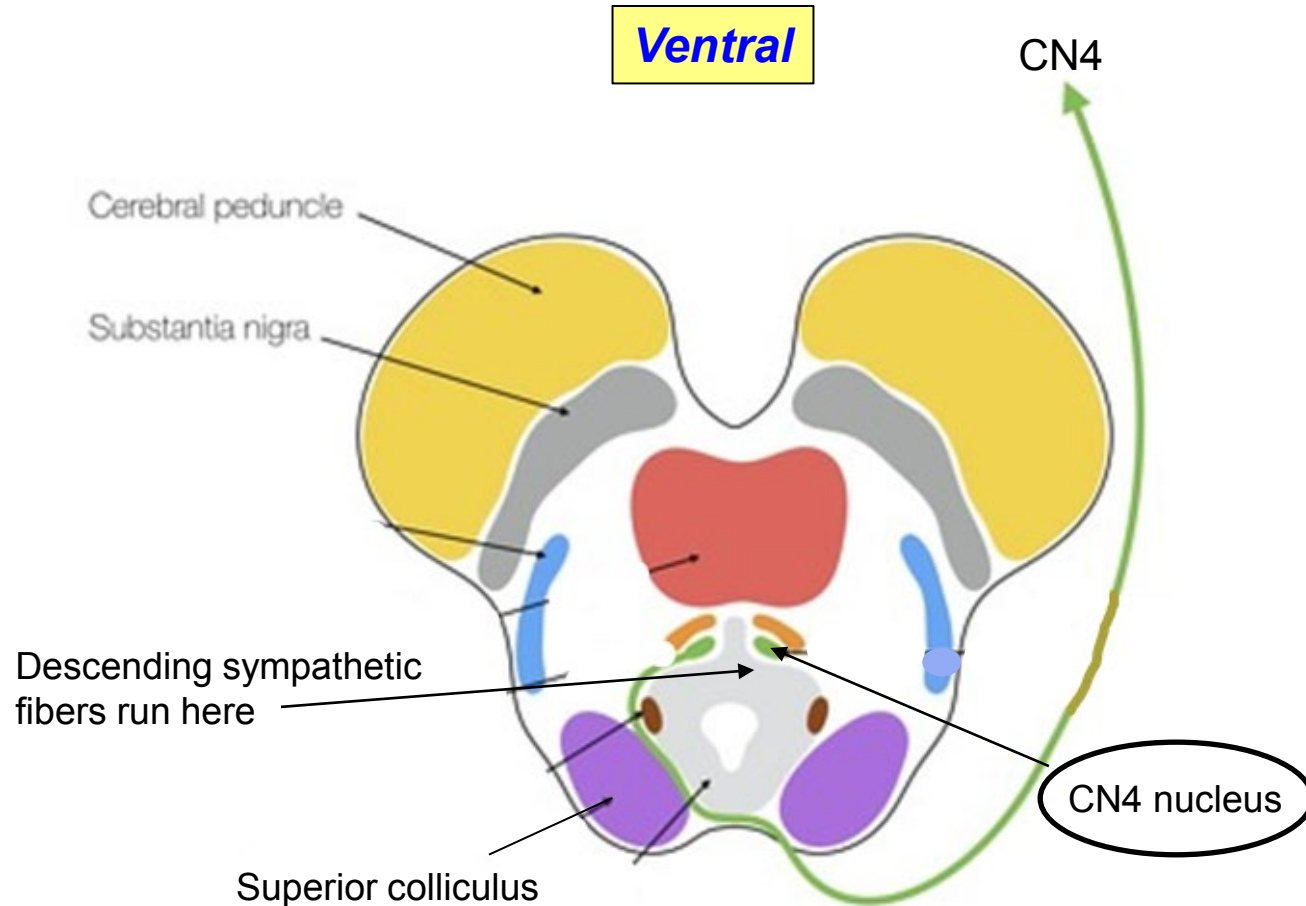
Motility Disorders: Fascicular Syndromes



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- The pupillary light reflex fibers run in the nearby superior colliculus.

Motility Disorders: Fascicular Syndromes



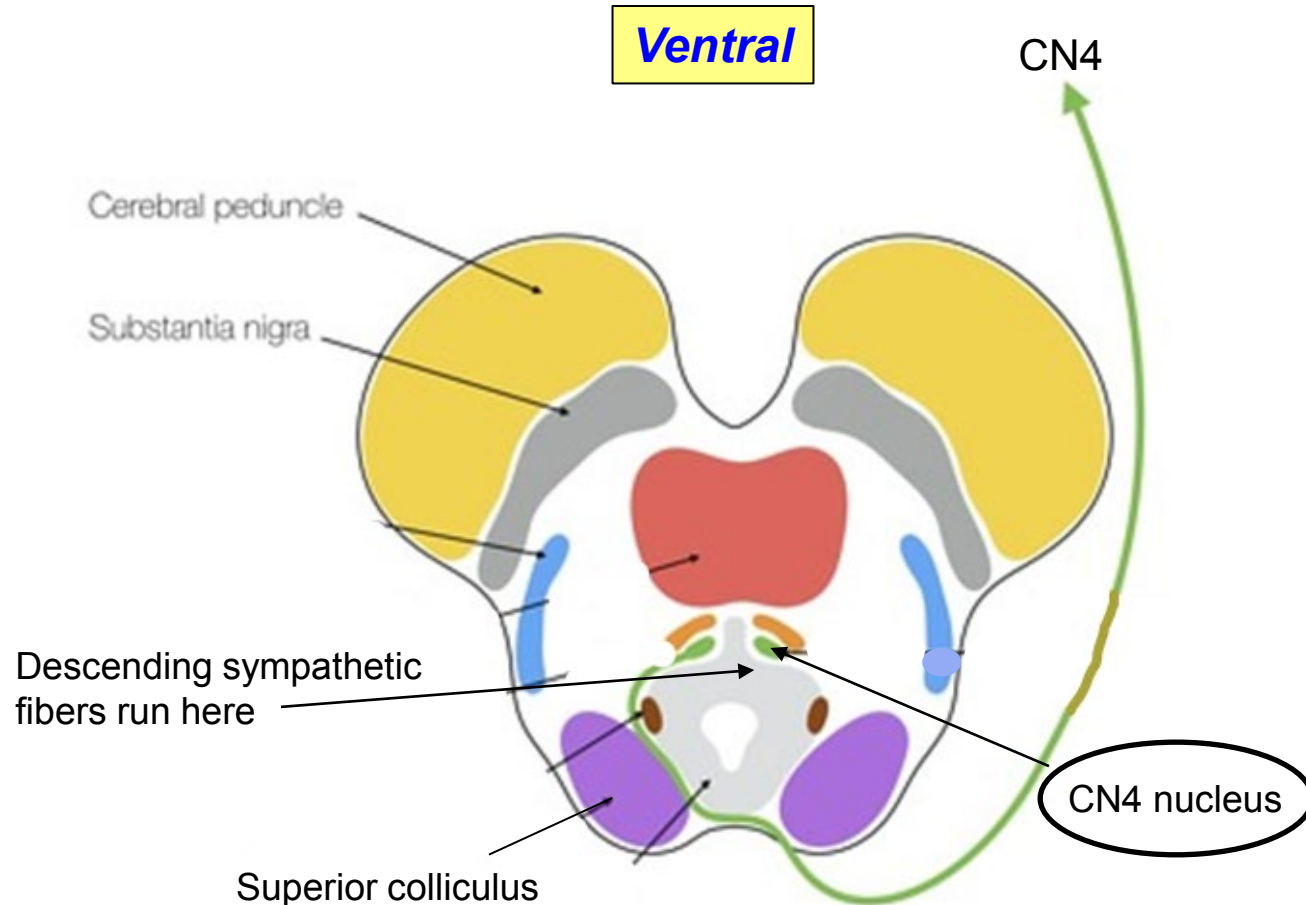
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- The pupillary light reflex fibers run in the nearby superior colliculus. If bagged, the pt will manifest an

abb. that is ipsi- v contralateral to the palsied SO.

Motility Disorders: Fascicular Syndromes



While not named, two CN4 fascicular syndromes get some love in the Neuro book. Conveniently, both involve the pupil. What adjacent structures are involved, and what is the pupillary manifestation for each?

- The first-order sympathetic fibers pass just dorsal to the CN4 nucleus and fascicle. If bagged, the pt will manifest a **Horner syndrome** that is **contralateral** to the palsied SO.
- The pupillary light reflex fibers run in the nearby superior colliculus. If bagged, the pt will manifest an **RAPD** that is **contralateral** to the palsied SO.

Q

Motility Disorders: *Fascicular Syndromes*



Remind me please: What are the three basic segments of the brainstem?

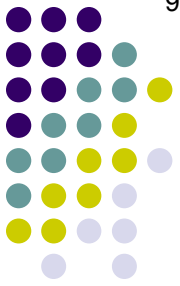
(Rostral)

--?

--?

--?

(Caudal)



Remind me please: What are the three basic segments of the brainstem?

(Rostral)

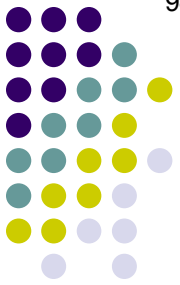
--Midbrain

--Pons

--Medulla

(Caudal)

Q

Motility Disorders: Fascicular Syndromes**CN6 Fascicular Syndromes**

Remind me please: What are the three basic segments of the brainstem?

(Rostral)

--Midbrain?

--Pons?

--Medulla?

(Caudal)

In which segment do all CN6 fascicular syndrome lesions reside?



CN6 Fascicular Syndromes

Remind me please: What are the three basic segments of the brainstem?

(Rostral)

--Midbrain

--**Pons!**

--Medulla

(Caudal)

In which segment do all CN6 fascicular syndrome lesions reside?

The pons

Q

Motility Disorders: *Fascicular Syndromes***CN6 Fascicular Syndromes**

| Syndrome | | |
|----------|--|--|
| | | |

?

In which segment do all CN6 fascicular syndrome lesions reside?

The pons

How many CN6 fascicular syndromes are discussed in the Neuro book?

A

Motility Disorders: *Fascicular Syndromes*

CN6 Fascicular Syndromes

| Syndrome | | |
|----------|--|--|
| | | |
| | | |
| | | |

In which segment do all CN6 fascicular syndrome lesions reside?

The pons

How many CN6 fascicular syndromes are discussed in the Neuro book?

Three

Q

Motility Disorders: *Fascicular Syndromes*

CN6 Fascicular Syndromes

| Syndrome | | |
|----------|--|--|
| ? | | |
| ? | | |
| ? | | |

In which segment do all CN6 fascicular syndrome lesions reside?

The pons

How many CN6 fascicular syndromes are discussed in the Neuro book?

Three

What are their names?

A

Motility Disorders: *Fascicular Syndromes*



CN6 Fascicular Syndromes

| Syndrome | | |
|-----------------------|--|--|
| <i>Raymond</i> | | |
| <i>Millard-Gubler</i> | | |
| <i>Foville</i> | | |

In which segment do all CN6 fascicular syndrome lesions reside?

The pons

How many CN6 fascicular syndromes are discussed in the Neuro book?

Three

What are their names?

Q

Motility Disorders: Fascicular Syndromes

CN6 Fascicular Syndromes

| Syndrome | <i>Ipsi- vs contralateral</i> 6 th | |
|-----------------------|---|--|
| <i>Raymond</i> | | |
| <i>Millard-Gubler</i> | | |
| <i>Foville</i> | | |

Each is composed in part by a sixth nerve palsy. Is the palsy ipsilateral, or contralateral to the side of the lesion?

A

Motility Disorders: *Fascicular Syndromes*

CN6 Fascicular Syndromes

| Syndrome | Ipsilateral 6 th | |
|-----------------------|-----------------------------|--|
| <i>Raymond</i> | | |
| <i>Millard-Gubler</i> | | |
| <i>Foville</i> | | |

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Q

Motility Disorders: *Fascicular Syndromes*

CN6 Fascicular Syndromes

| Syndrome | Ipsilateral 6 th plus... | |
|-----------------------|-------------------------------------|--|
| <i>Raymond</i> | ? | |
| <i>Millard-Gubler</i> | | |
| <i>Foville</i> | | |

Each has associated nonocular S/S. What is/are the S/S for Raymond syndrome?

A

Motility Disorders: *Fascicular Syndromes*

CN6 Fascicular Syndromes

| Syndrome | Ipsilateral 6 th plus... | |
|-----------------------|-------------------------------------|--|
| <i>Raymond</i> | Contralateral hemiplegia | |
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Motility Disorders: *Fascicular Syndromes*

CN6 Fascicular Syndromes

| Syndrome | Ipsilateral 6 th plus... | |
|-----------------------|-------------------------------------|--|
| <i>Raymond</i> | Contralateral hemiplegia | |
| <i>Millard-Gubler</i> | Contralateral hemiplegia + ? | |
| <i>Foville</i> | | |

Like Raymond syndrome, Millard-Gubler includes contralateral hemiplegia, but another S/S is present. What is it?

Q/A

Motility Disorders: *Fascicular Syndromes*

CN6 Fascicular Syndromes

| Syndrome | Ipsilateral 6 th plus... | |
|-----------------------|--|--|
| <i>Raymond</i> | Contralateral hemiplegia | |
| <i>Millard-Gubler</i> | Contralateral hemiplegia + ipsilateral CN | |
| <i>Foville</i> | | |

Like Raymond syndrome, Millard-Gubler includes contralateral hemiplegia, but another S/S is present. What is it?
Ipsilateral CN palsy

A

Motility Disorders: *Fascicular Syndromes*

CN6 Fascicular Syndromes

| Syndrome | Ipsilateral 6 th plus... | |
|-----------------------|--|--|
| <i>Raymond</i> | Contralateral hemiplegia | |
| <i>Millard-Gubler</i> | Contralateral hemiplegia + ipsilateral CN7 | |
| <i>Foville</i> | | |

Like Raymond syndrome, Millard-Gubler includes contralateral hemiplegia, but another S/S is present. What is it?
Ipsilateral CN7 palsy

Motility Disorders: *Fascicular Syndromes*

CN6 Fascicular Syndromes

| Syndrome | Ipsilateral 6 th plus... | |
|-----------------------|--|--|
| <i>Raymond</i> | Contralateral hemiplegia | |
| <i>Millard-Gubler</i> | Contralateral hemiplegia + ipsilateral CN7 | |
| <i>Foville</i> | Contralateral hemiplegia | |

Like Raymond syndrome, Foville includes contralateral hemiplegia.

Motility Disorders: *Fascicular Syndromes*

CN6 Fascicular Syndromes

| Syndrome | Ipsilateral 6 th plus... | |
|-----------------------|--|--|
| <i>Raymond</i> | Contralateral hemiplegia | |
| <i>Millard-Gubler</i> | Contralateral hemiplegia + ipsilateral CN7 | |
| <i>Foville</i> | Contralateral hemiplegia + ipsilateral CN7 | |

Like Raymond syndrome, Foville includes contralateral hemiplegia. And like Millard-Gubler, it also includes an ipsilateral CN7.

Q

Motility Disorders: Fascicular Syndromes

CN6 Fascicular Syndromes

| Syndrome | Ipsilateral 6 th plus... | |
|-----------------------|---|--|
| <i>Raymond</i> | Contralateral hemiplegia | |
| <i>Millard-Gubler</i> | Contralateral hemiplegia + ipsilateral CN7 | |
| <i>Foville</i> | Contralateral hemiplegia + ipsilateral CN7 + ? | |

Like Raymond syndrome, Foville includes contralateral hemiplegia. And like Millard-Gubler, it also includes an ipsilateral CN7. Another set of signs/symptoms are present. What are they?

Q/A

Motility Disorders: *Fascicular Syndromes*

CN6 Fascicular Syndromes

| Syndrome | Ipsilateral 6 th plus... | |
|-----------------------|--|--|
| <i>Raymond</i> | Contralateral hemiplegia | |
| <i>Millard-Gubler</i> | Contralateral hemiplegia + ipsilateral CN7 | |
| <i>Foville</i> | Contralateral hemiplegia + ipsilateral CN7 + <div>location</div> hypoesthesia + loss of taste to <div>anterior vs posterior</div> tongue | |

Like Raymond syndrome, Foville includes contralateral hemiplegia.

And like Millard-Gubler, it also includes an ipsilateral CN7.

Another set of signs/symptoms are present. What are they?

location

hypoesthesia + loss of taste to

anterior vs posterior

tongue

A

Motility Disorders: Fascicular Syndromes

CN6 Fascicular Syndromes

| Syndrome | Ipsilateral 6 th plus... | |
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| <i>Raymond</i> | Contralateral hemiplegia | |
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| <i>Foville</i> | Contralateral hemiplegia + ipsilateral CN7 + facial hypoesthesia + loss of taste to anterior tongue | |

Like Raymond syndrome, Foville includes contralateral hemiplegia.

And like Millard-Gubler, it also includes an ipsilateral CN7.

Another set of signs/symptoms are present. What are they?

Facial hypoesthesia + loss of taste to anterior tongue

Q

Motility Disorders: *Fascicular Syndromes*

CN6 Fascicular Syndromes

| Syndrome | Ipsilateral 6 th plus... | Adjacent damage |
|-----------------------|---|-----------------|
| <i>Raymond</i> | Contralateral hemiplegia | ? |
| <i>Millard-Gubler</i> | Contralateral hemiplegia + ipsilateral CN7 | |
| <i>Foville</i> | Contralateral hemiplegia + ipsilateral CN7 + facial hypoesthesia + loss of taste to anterior tongue | |

What structure adjacent to the CN6 fascicle is damaged in Raymond syndrome?

A

Motility Disorders: *Fascicular Syndromes*

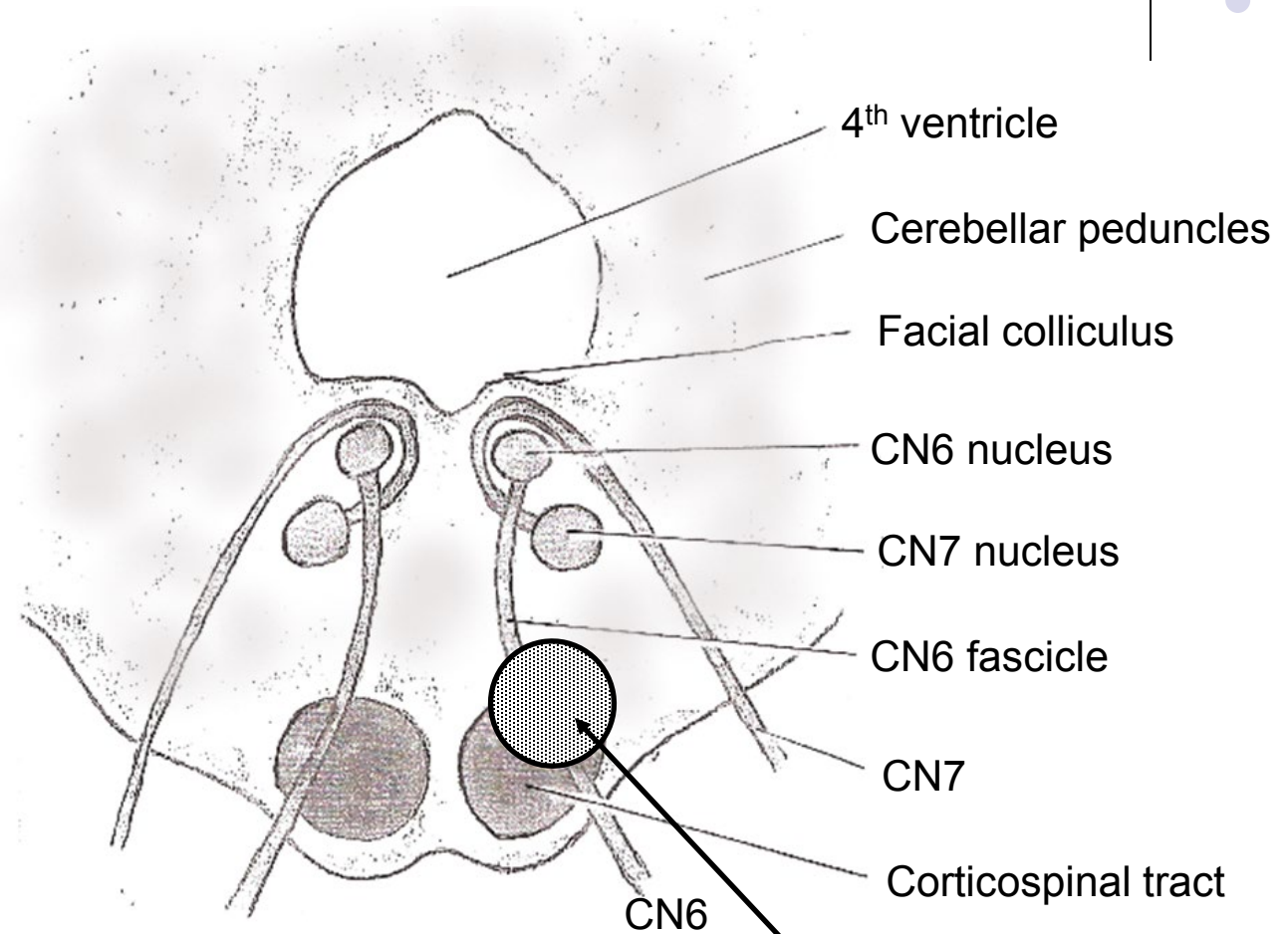
CN6 Fascicular Syndromes

| Syndrome | Ipsilateral 6 th plus... | Adjacent damage |
|-----------------------|---|---------------------|
| <i>Raymond</i> | Contralateral hemiplegia | Corticospinal tract |
| <i>Millard-Gubler</i> | Contralateral hemiplegia + ipsilateral CN7 | |
| <i>Foville</i> | Contralateral hemiplegia + ipsilateral CN7 + facial hypoesthesia + loss of taste to anterior tongue | |

What structure adjacent to the CN6 fascicle is damaged in Raymond syndrome?

Motility Disorders: *Fascicular Syndromes*

Dorsal



Lesion in **Raymond syndrome** bagging the CN6 fascicle and the corticospinal tract

Ventral

Motility Disorders: *Fascicular Syndromes*

CN6 Fascicular Syndromes

| Syndrome | Ipsilateral 6 th plus... | Adjacent damage |
|-----------------------|---|---------------------|
| <i>Raymond</i> | Contralateral hemiplegia | Corticospinal tract |
| <i>Millard-Gubler</i> | Contralateral hemiplegia + ipsilateral CN7 | Corticospinal tract |
| <i>Foville</i> | Contralateral hemiplegia + ipsilateral CN7 + facial hypoesthesia + loss of taste to anterior tongue | |

The corticospinal tract is bagged in Millar-Gubler as well.

Q

Motility Disorders: Fascicular Syndromes

CN6 Fascicular Syndromes

| Syndrome | Ipsilateral 6 th plus... | Adjacent damage |
|-----------------------|---|----------------------------|
| <i>Raymond</i> | Contralateral hemiplegia | Corticospinal tract |
| <i>Millard-Gubler</i> | Contralateral hemiplegia + ipsilateral CN7 | Corticospinal tract + ? |
| <i>Foville</i> | Contralateral hemiplegia + ipsilateral CN7 + facial hypoesthesia + loss of taste to anterior tongue | |

The corticospinal tract is bagged in Millar-Gubler as well. *What other structure adjacent to the CN6 fascicle is damaged in Millar-Gubler syndrome?*

A

Motility Disorders: Fascicular Syndromes

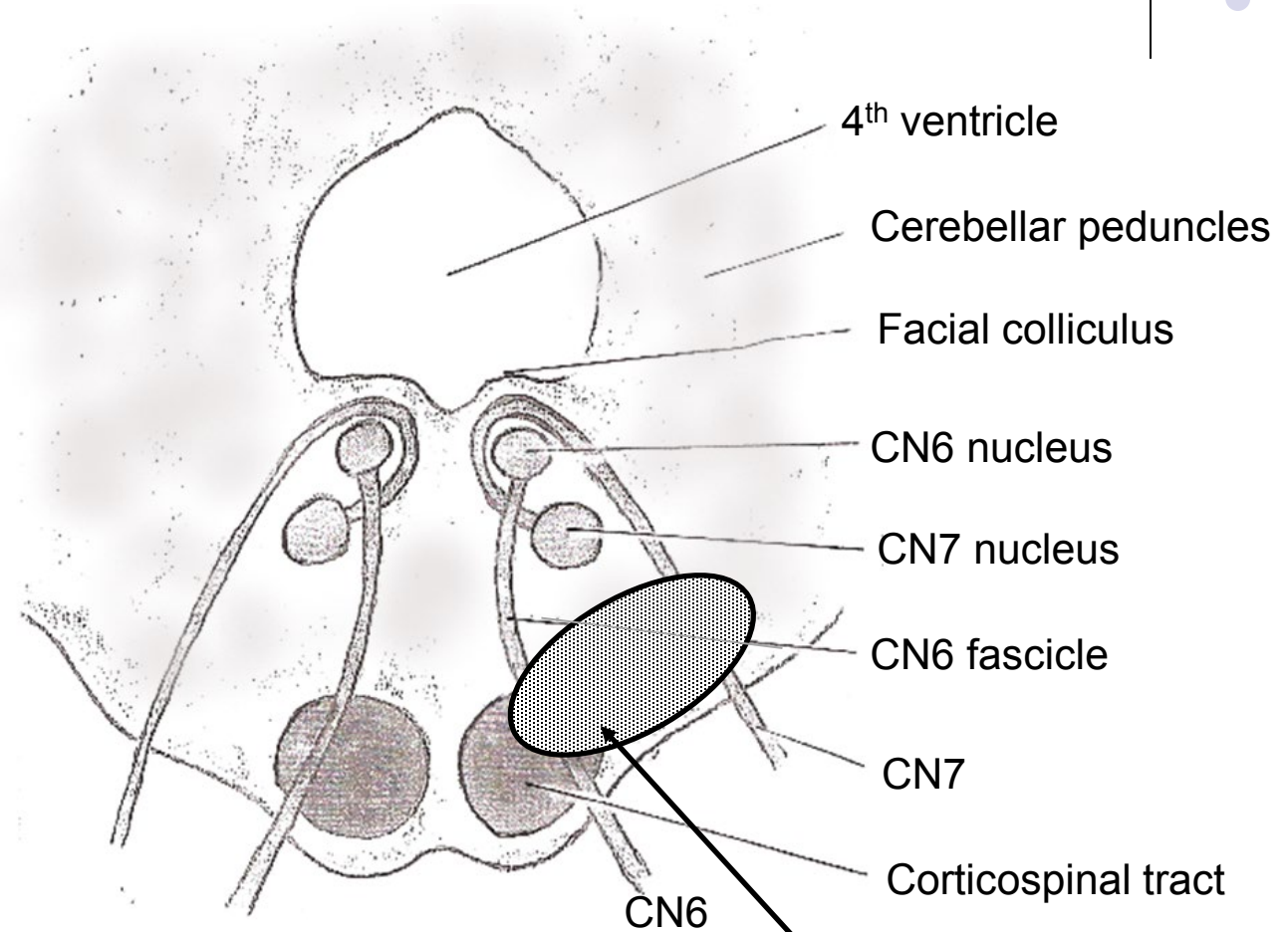
CN6 Fascicular Syndromes

| Syndrome | Ipsilateral 6 th plus... | Adjacent damage |
|-----------------------|---|------------------------------------|
| <i>Raymond</i> | Contralateral hemiplegia | Corticospinal tract |
| <i>Millard-Gubler</i> | Contralateral hemiplegia + ipsilateral CN7 | Corticospinal tract + CN7 fascicle |
| <i>Foville</i> | Contralateral hemiplegia + ipsilateral CN7 + facial hypoesthesia + loss of taste to anterior tongue | |

The corticospinal tract is bagged in Millar-Gubler as well. *What other structure adjacent to the CN6 fascicle is damaged in Millar-Gubler syndrome?*

Motility Disorders: *Fascicular Syndromes*

Dorsal



Lesion in **Millard Gubler syndrome** bagging the CN6 fascicle, the corticospinal tract, and the CN7 fascicle

Ventral

Motility Disorders: *Fascicular Syndromes*

CN6 Fascicular Syndromes

| Syndrome | Ipsilateral 6 th plus... | Adjacent damage |
|-----------------------|---|------------------------------------|
| <i>Raymond</i> | Contralateral hemiplegia | Corticospinal tract |
| <i>Millard-Gubler</i> | Contralateral hemiplegia + ipsilateral CN7 | Corticospinal tract + CN7 fascicle |
| <i>Foville</i> | Contralateral hemiplegia + ipsilateral CN7 + facial hypoesthesia + loss of taste to anterior tongue | Corticospinal tract + CN7 fascicle |

Both the corticospinal tract and CN7 fascicle are bagged in Foville as well.

Q

Motility Disorders: Fascicular Syndromes

CN6 Fascicular Syndromes

| Syndrome | Ipsilateral 6 th plus... | Adjacent damage |
|-----------------------|---|--|
| <i>Raymond</i> | Contralateral hemiplegia | Corticospinal tract |
| <i>Millard-Gubler</i> | Contralateral hemiplegia + ipsilateral CN7 | Corticospinal tract + CN7 fascicle |
| <i>Foville</i> | Contralateral hemiplegia + ipsilateral CN7 + facial hypoesthesia + loss of taste to anterior tongue | Corticospinal tract + CN7 fascicle + ? |

Both the corticospinal tract and CN7 fascicle are bagged in Foville as well.

What other CN6-adjacent structure is damaged in Foville syndrome?

A

Motility Disorders: Fascicular Syndromes

CN6 Fascicular Syndromes

| Syndrome | Ipsilateral 6 th plus... | Adjacent damage |
|-----------------------|---|---|
| <i>Raymond</i> | Contralateral hemiplegia | Corticospinal tract |
| <i>Millard-Gubler</i> | Contralateral hemiplegia + ipsilateral CN7 | Corticospinal tract + CN7 fascicle |
| <i>Foville</i> | Contralateral hemiplegia + ipsilateral CN7 + facial hypoesthesia + loss of taste to anterior tongue | Corticospinal tract + CN7 fascicle + tractus solitarius |

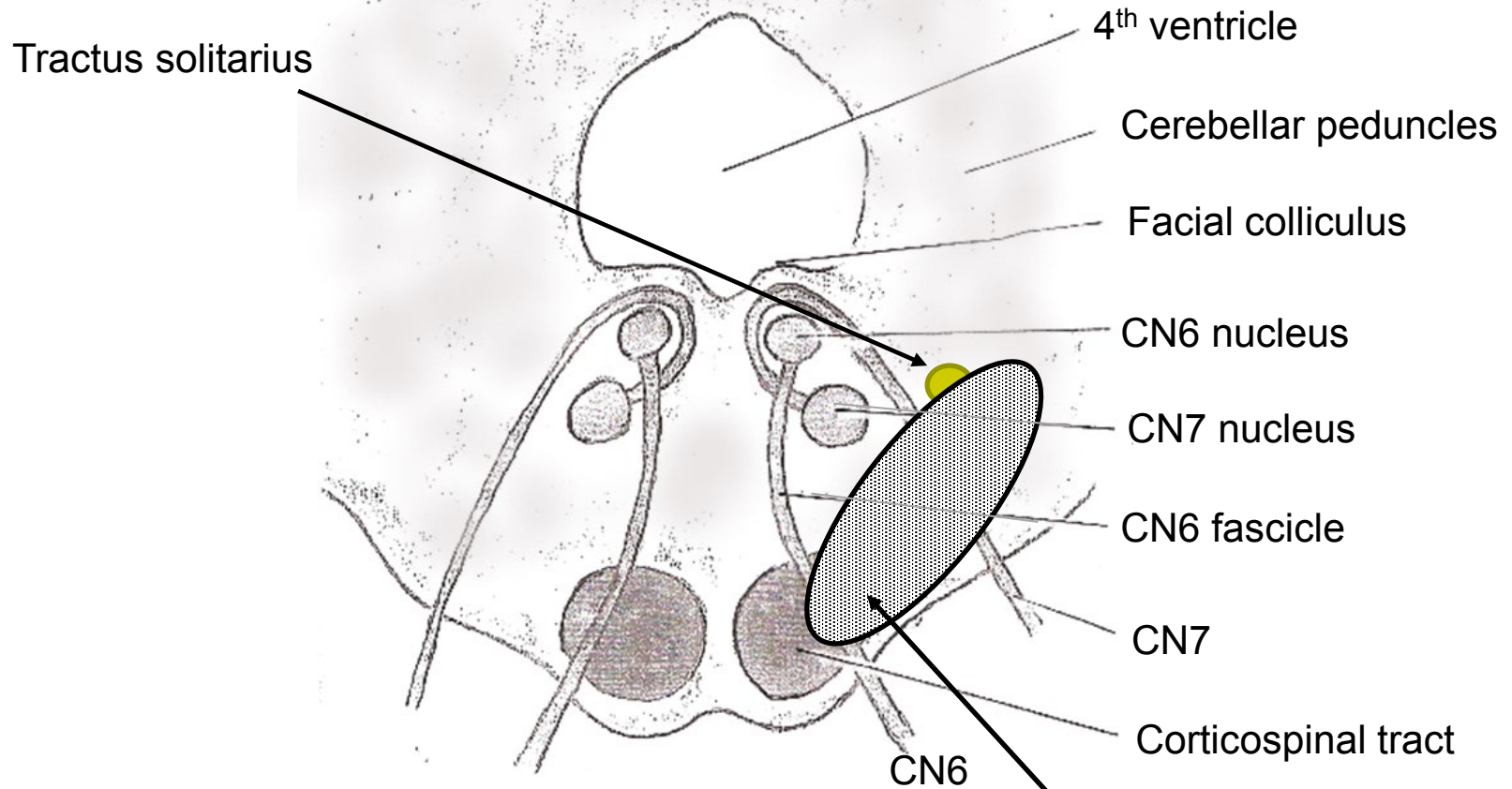
Both the corticospinal tract and CN7 fascicle are bagged in Foville as well.

What other CN6-adjacent structure is damaged in Foville syndrome?

The tractus solitarius

Motility Disorders: Fascicular Syndromes

Dorsal



Lesion in **Foville syndrome** bagging the CN6 fascicle, the corticospinal tract, the CN7 fascicle, and the tractus solitarius

Ventral

Motility Disorders: *Fascicular Syndromes* summary slide

CN6 Fascicular Syndromes

| Syndrome | Ipsilateral 6 th plus... | Adjacent damage |
|-----------------------|---|---|
| <i>Raymond</i> | Contralateral hemiplegia | Corticospinal tract |
| <i>Millard-Gubler</i> | Contralateral hemiplegia + ipsilateral CN7 | Corticospinal tract + CN7 fascicle |
| <i>Foville</i> | Contralateral hemiplegia + ipsilateral CN7 + facial hypoesthesia + loss of taste to anterior tongue | Corticospinal tract + CN7 fascicle + tractus solitarius |

CN3 Fascicular Syndromes

| Syndrome | Ipsilateral 3 rd plus... | Adjacent damage |
|------------------|---|--------------------------------|
| <i>Weber</i> | Contralateral hemiplegia | Cerebral peduncle |
| <i>Benedikt</i> | Contralateral involuntary movements (often a hand flap) | Red nucleus & substantia nigra |
| <i>Claude</i> | ↑ <i>plus</i> ↓ | ↑ <i>plus</i> ↓ |
| <i>Nothnagel</i> | Ataxia | Superior cerebellar peduncle |

Also, don't forget the unnamed **CN4 +/- APD +/- Horner syndrome** syndrome!

Motility Disorders: *Fascicular Syndromes*

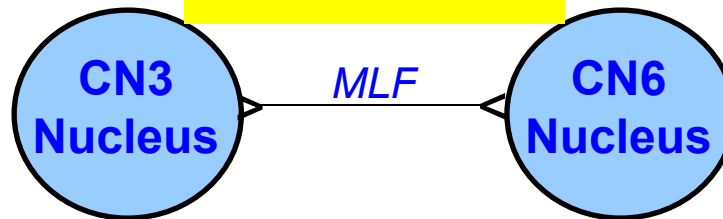
Gradenigo

Supranuclear



Nuclear

Internuclear



CN4 Nucleus

Infranuclear

~~Fascicular~~

Subarachnoid

Cavernous sinus

Orbital

Neuromuscular junction

Extraocular muscle

Finally, we will discuss *Gradenigo syndrome*.

Gradenigo's is not, repeat **not**, a fascicular syndrome (because the nerve fascicle is not involved).

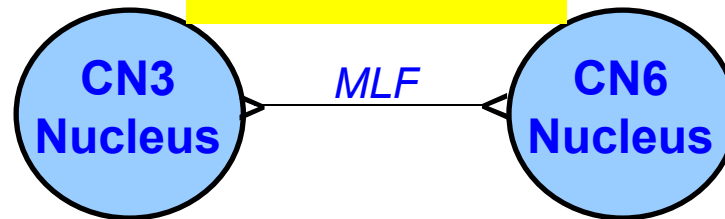
Motility Disorders: *Fascicular Syndromes*

Gradenigo

Supranuclear

Nuclear

Internuclear



~~Fascicular~~

Subarachnoid

Cavernous sinus

Orbital

Neuromuscular junction

Extraocular muscle

Infranuclear

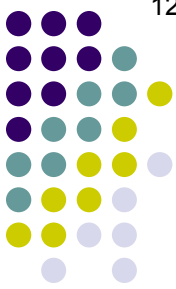
Finally, we will discuss *Gradenigo syndrome*.

Gradenigo's is not, repeat **not**, a fascicular syndrome (because the nerve fascicle is not involved). Rather, it involves the **subarachnoid** course of the nerve. (We're discussing Gradenigo's in this slide-set only because it doesn't fit well in any other.)

Q

Motility Disorders: *Fascicular Syndromes*

Gradenigo



Gradenigo Syndrome

| Syndrome | ? | |
|-----------|---|--|
| Gradenigo | | |

Which oculo-motor nerve is involved in Gradenigo syndrome?

A**Motility Disorders: *Fascicular Syndromes****Gradenigo***Gradenigo Syndrome**

| Syndrome | 6 th | |
|------------------|-----------------|--|
| <i>Gradenigo</i> | | |

Which oculo-motor nerve is involved in Gradenigo syndrome?

Q

Motility Disorders: *Fascicular Syndromes*

Gradenigo



Gradenigo Syndrome

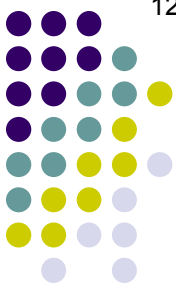
| Syndrome | <i>Ipsi- vs contralateral</i> 6 th | |
|------------------|---|--|
| <i>Gradenigo</i> | | |

Gradenigo syndrome involves a sixth nerve palsy. Is the palsy ipsilateral, or contralateral to the side of the lesion?

A

Motility Disorders: *Fascicular Syndromes*

Gradenigo



Gradenigo Syndrome

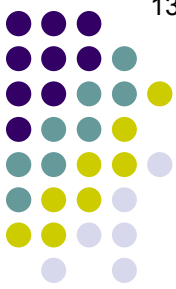
| Syndrome | Ipsilateral 6 th | |
|-----------|-----------------------------|--|
| Gradenigo | | |

Gradenigo syndrome involves a sixth nerve palsy. Is the palsy ipsilateral, or contralateral to the side of the lesion?

Q

Motility Disorders: *Fascicular Syndromes*

Gradenigo



Gradenigo Syndrome

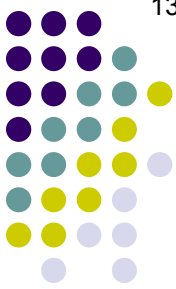
| Syndrome | Ipsilateral 6 th plus... | |
|------------------|-------------------------------------|--|
| <i>Gradenigo</i> | ? | |

Gradenigo syndrome has an associated nonocular finding. What is it?

A

Motility Disorders: *Fascicular Syndromes*

Gradenigo

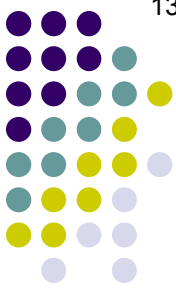


Gradenigo Syndrome

| Syndrome | Ipsilateral 6 th plus... | |
|------------------|-------------------------------------|--|
| <i>Gradenigo</i> | Ipsilateral facial pain | |

Gradenigo syndrome has an associated nonocular finding. What is it?

Q

Motility Disorders: *Fascicular Syndromes**Gradenigo***Gradenigo Syndrome**

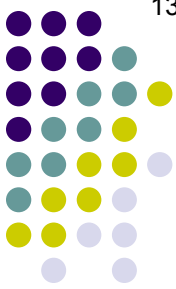
| Syndrome | Ipsilateral 6 th plus... | Lesion location |
|------------------|-------------------------------------|-----------------|
| <i>Gradenigo</i> | Ipsilateral facial pain | ? |

Where is the lesion located?

A

Motility Disorders: *Fascicular Syndromes*

Gradenigo



Gradenigo Syndrome

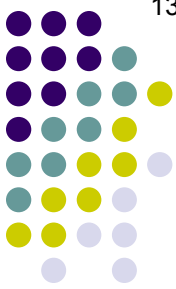
| Syndrome | Ipsilateral 6 th plus... | Lesion location |
|------------------|-------------------------------------|---------------------|
| <i>Gradenigo</i> | Ipsilateral facial pain | Petrous bone |

Where is the lesion located?

Q

Motility Disorders: *Fascicular Syndromes*

Gradenigo



Gradenigo Syndrome

| Syndrome | Ipsilateral 6 th plus... | Lesion location |
|------------------|-------------------------------------|-----------------|
| <i>Gradenigo</i> | Ipsilateral facial pain | Petrous bone |

What is the fundamental pathogenesis in Gradenigo's?

A

Motility Disorders: *Fascicular Syndromes*

Gradenigo



Gradenigo Syndrome

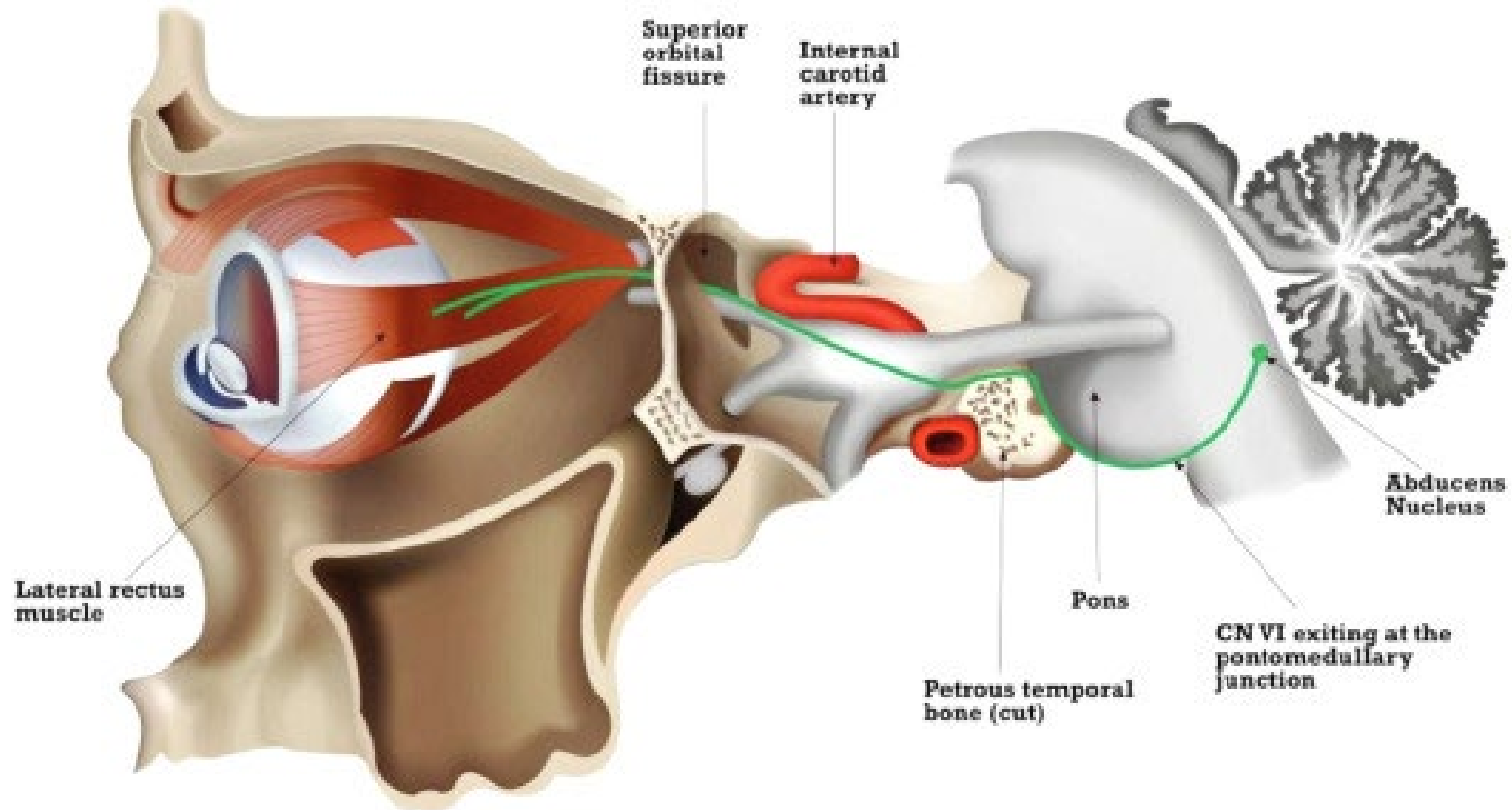
| Syndrome | Ipsilateral 6 th plus... | Lesion location |
|------------------|-------------------------------------|-----------------|
| <i>Gradenigo</i> | Ipsilateral facial pain | Petrous bone |

What is the fundamental pathogenesis in Gradenigo's?

Chronic inflammation in the mastoid air cells of the petrous portion of the temporal bone knocks out CN6 and portions of CN5

Motility Disorders: *Fascicular Syndromes*

Gradenigo



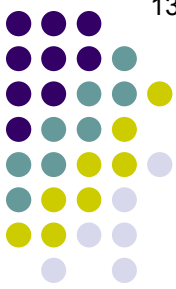
Done by : Wuilliams Escalona
For: Juan Quesada

Gradenigo syndrome. Note that CN5 (gray) and CN6 (green line) run together adjacent to the petrous bone

Q

Motility Disorders: *Fascicular Syndromes*

Gradenigo



Gradenigo Syndrome

| Syndrome | Ipsilateral 6 th plus... | Lesion location |
|------------------|-------------------------------------|-----------------|
| <i>Gradenigo</i> | Ipsilateral facial pain | Petrous bone |

What is the fundamental pathogenesis in Gradenigo's?

Chronic inflammation in the mastoid air cells of the petrous portion of the temporal bone knocks out CN6 and portions of CN5

By what noneponymous name is Gradenigo's syndrome also known?

A

Motility Disorders: *Fascicular Syndromes*

Gradenigo



Gradenigo Syndrome

| Syndrome | Ipsilateral 6 th plus... | Lesion location |
|------------------|-------------------------------------|-----------------|
| <i>Gradenigo</i> | Ipsilateral facial pain | Petrous bone |

What is the fundamental pathogenesis in Gradenigo's?

Chronic inflammation in the mastoid air cells of the petrous portion of the temporal bone knocks out CN6 and portions of CN5

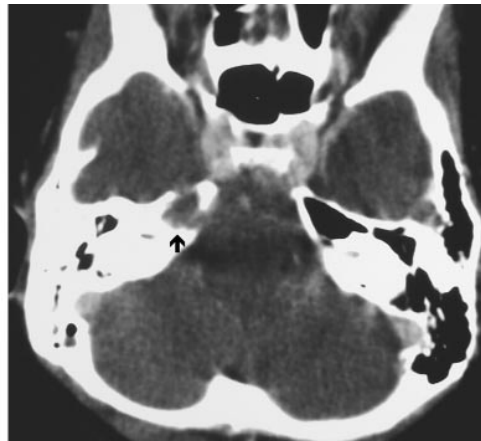
By what noneponymous name is Gradenigo's syndrome also known?
Petrous apex syndrome

Motility Disorders: *Fascicular Syndromes*

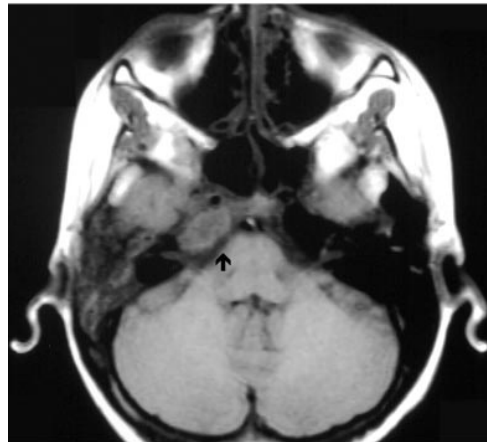
Gradenigo



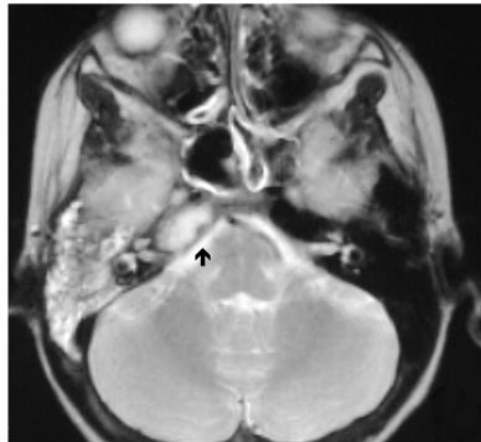
a.



b.



c.



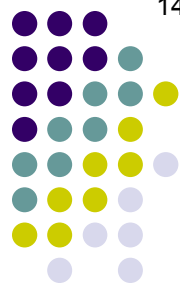
d.

Petrous apicitis in a 7-year-old girl with fever, right-sided facial pain, and diplopia. (a) CT of the temporal bone shows increased attenuation of the mastoid air cells and erosion of the right petrous apex (arrow) with a well-pneumatized left petrous apex. (b) CT scan obtained with the soft-tissue algorithm shows a hypoattenuating area (arrow) without a significant enhancing soft-tissue mass. (c, d) Axial T1-weighted (c) and T2-weighted (d) MR images show a lesion (arrow) with low (c) and high (d) signal intensity.

Q

Motility Disorders: *Fascicular Syndromes*

Gradenigo



Gradenigo Syndrome

| Syndrome | Ipsilateral 6 th plus... | Lesion location |
|------------------|-------------------------------------|-----------------|
| <i>Gradenigo</i> | Ipsilateral facial pain | Petrous bone |

What is the fundamental pathogenesis in Gradenigo's?

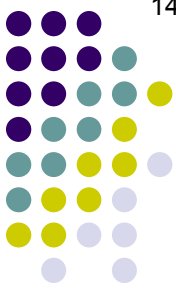
Chronic inflammation in the mastoid air cells of the petrous portion of the temporal bone knocks out CN6 and portions of CN5

Which population is especially at risk?

A

Motility Disorders: *Fascicular Syndromes*

Gradenigo



Gradenigo Syndrome

| Syndrome | Ipsilateral 6 th plus... | Lesion location |
|------------------|-------------------------------------|-----------------|
| <i>Gradenigo</i> | Ipsilateral facial pain | Petrous bone |

What is the fundamental pathogenesis in Gradenigo's?

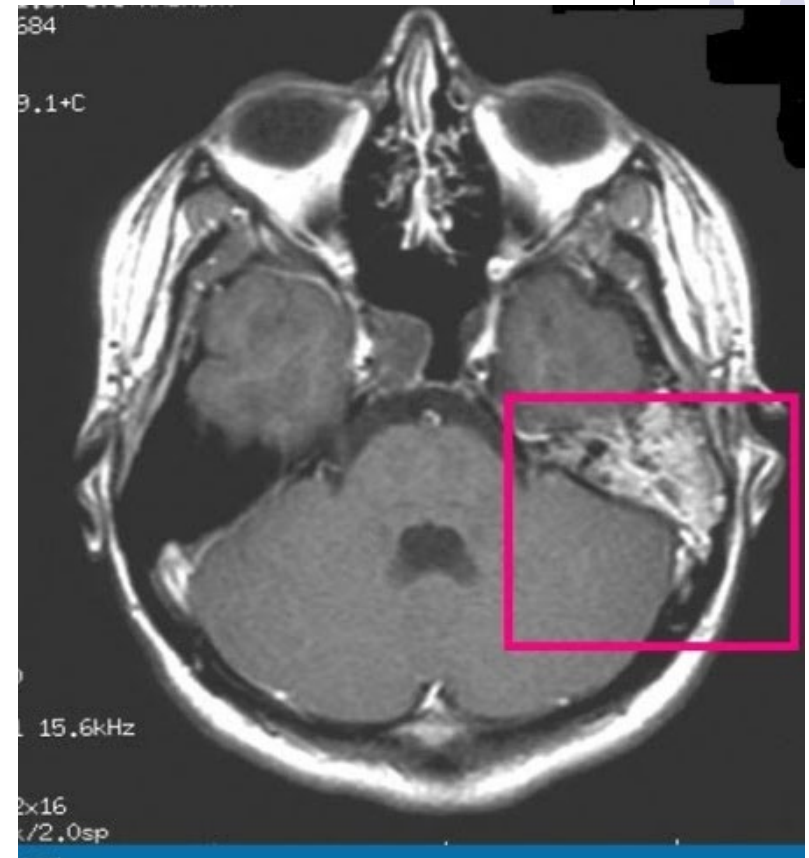
Chronic inflammation in the mastoid air cells of the petrous portion of the temporal bone knocks out CN6 and portions of CN5

Which population is especially at risk?

Children

Motility Disorders: *Fascicular Syndromes*

Gradenigo



Gradenigo syndrome

Q

Motility Disorders: *Fascicular Syndromes*

Gradenigo



Gradenigo Syndrome

| Syndrome | Ipsilateral 6 th plus... | Lesion location |
|------------------|-------------------------------------|-----------------|
| <i>Gradenigo</i> | Ipsilateral facial pain | Petrous bone |

What is the fundamental pathogenesis in Gradenigo's?

Chronic inflammation in the mastoid air cells of the petrous portion of the temporal bone knocks out CN6 and portions of CN5

Which population is especially at risk?

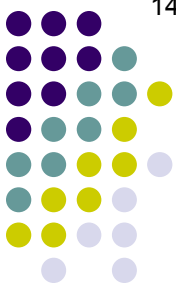
Children

Which group of children is especially at risk?

Q/A

Motility Disorders: *Fascicular Syndromes*

Gradenigo



Gradenigo Syndrome

| Syndrome | Ipsilateral 6 th plus... | Lesion location |
|------------------|-------------------------------------|-----------------|
| <i>Gradenigo</i> | Ipsilateral facial pain | Petrous bone |

What is the fundamental pathogenesis in Gradenigo's?

Chronic inflammation in the mastoid air cells of the petrous portion of the temporal bone knocks out CN6 and portions of CN5

Which population is especially at risk?

Children

Which group of children is especially at risk?

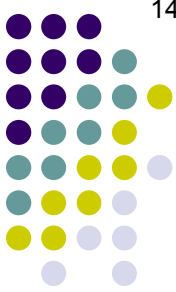
Those who suffer chronic and recurrent bouts of

two words

A

Motility Disorders: *Fascicular Syndromes*

Gradenigo



Gradenigo Syndrome

| Syndrome | Ipsilateral 6 th plus... | Lesion location |
|------------------|-------------------------------------|-----------------|
| <i>Gradenigo</i> | Ipsilateral facial pain | Petrous bone |

What is the fundamental pathogenesis in Gradenigo's?

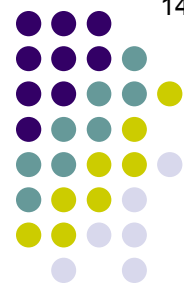
Chronic inflammation in the mastoid air cells of the petrous portion of the temporal bone knocks out CN6 and portions of CN5

Which population is especially at risk?

Children

Which group of children is especially at risk?

Those who suffer chronic and recurrent bouts of otitis media

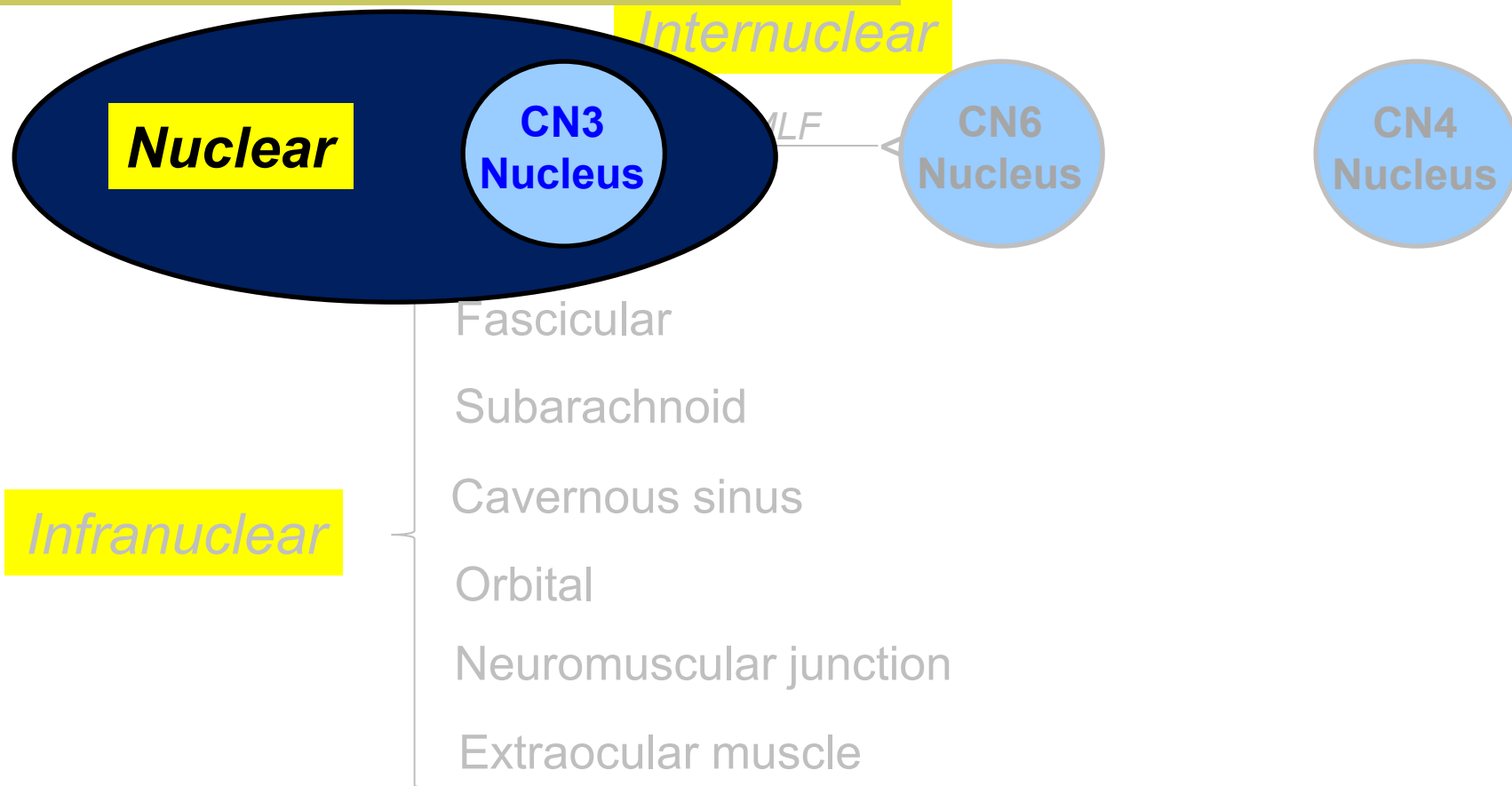


Motility Disorders: *Fascicular Syndromes*

Supranuclear

Before we go, let's cover an entity the Academy seems to consider important, that being an **isolated nuclear third palsy**.

Internuclear



(No question—proceed when ready)



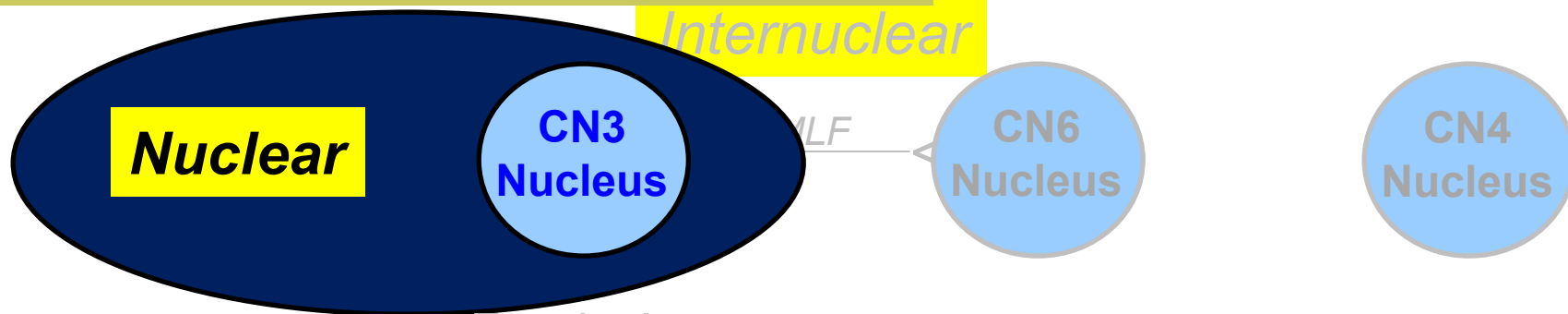
Motility Disorders: *Fascicular Syndromes*

Q

Supranuclear

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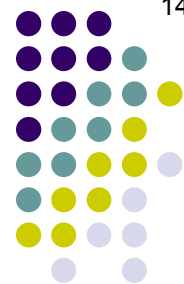
Internuclear



Basics review: Which EOMs are controlled by CN3?

--?
--?
--?
--?
--?

on



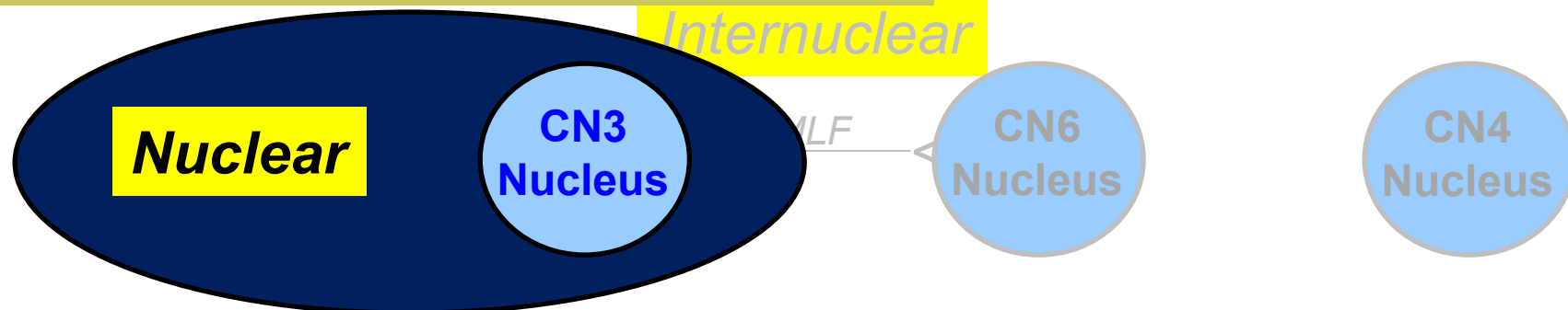
Motility Disorders: *Fascicular Syndromes*

A

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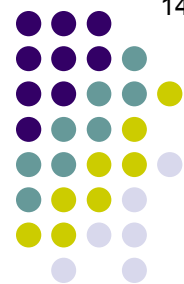
Internuclear



Basics review: Which EOMs are controlled by CN3?

- SR
- MR
- IR
- IO
- The levator

on

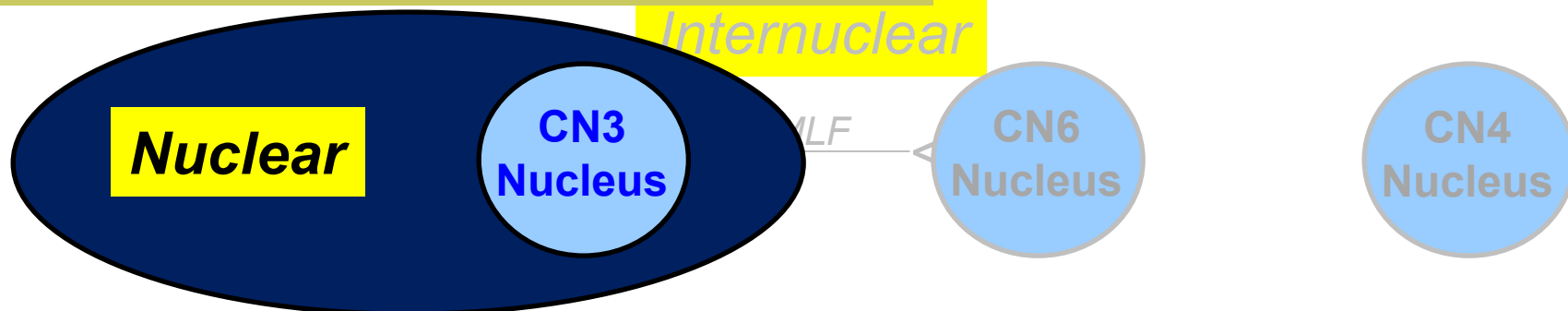


Motility Disorders: *Fascicular Syndromes*

Supranuclear

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Internuclear



Basics review: Which EOMs are controlled by CN3?

- SR
- MR
- IR
- IO
- The levator

Recall that EOMs are controlled by subnuclei.

(No question yet—proceed)



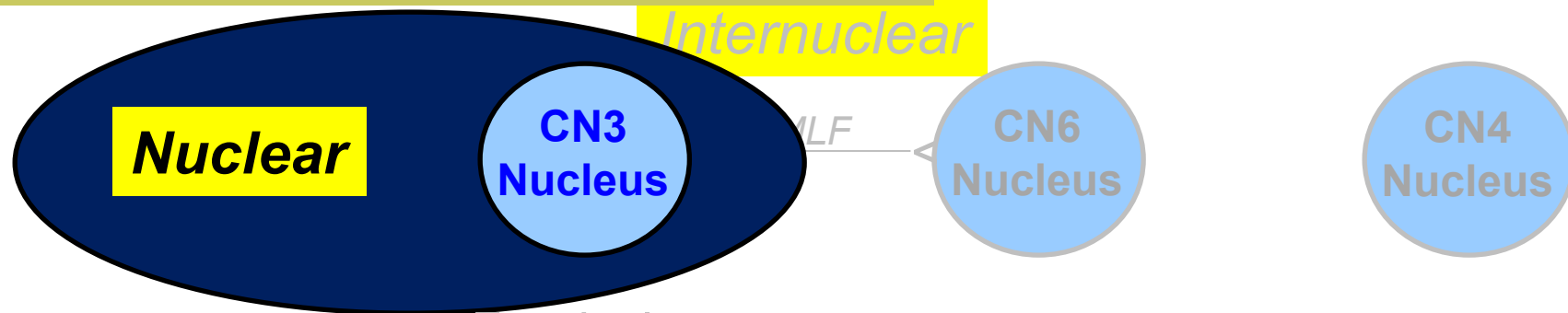
Motility Disorders: *Fascicular Syndromes*

Q

Supranuclear

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Internuclear



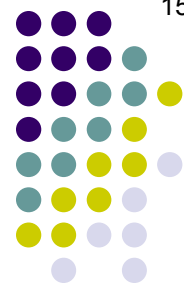
Basics review: Which EOMs are controlled by CN3?

- SR
- MR
- IR
- IO
- The levator

Recall that EOMs are controlled by subnuclei.

Between the two CN3 nuclei that are found in the normal human head, how many subnuclei are there?

on



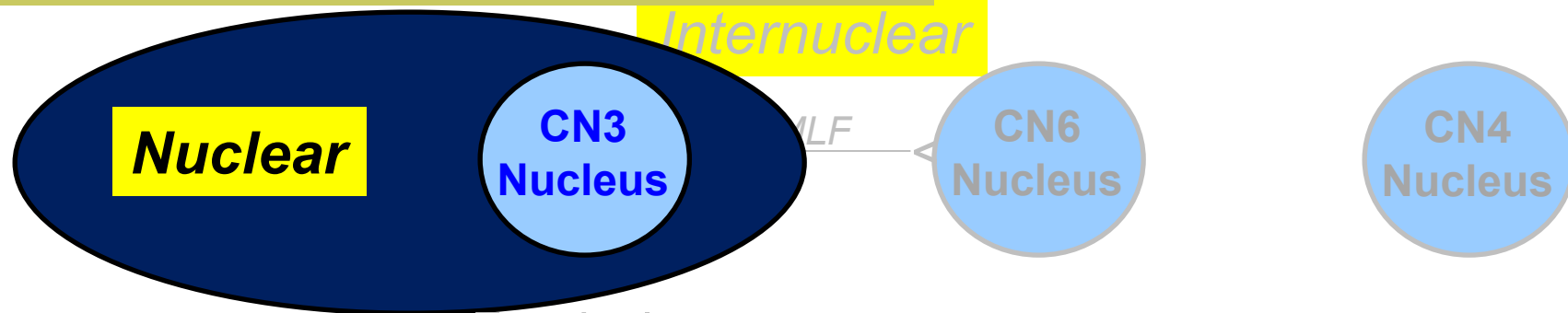
Motility Disorders: *Fascicular Syndromes*

A

Supranuclear

Before we go, let's cover an entity the Academy seems to consider important, that being an **isolated nuclear third palsy**.

Internuclear



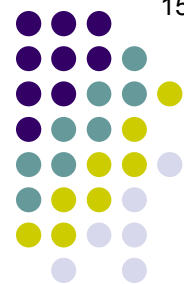
Basics review: Which EOMs are controlled by CN3?

- SR
- MR
- IR
- IO
- The levator

Recall that EOMs are controlled by subnuclei.

Between the two CN3 nuclei that are found in the normal human head, how many subnuclei are there?

Nine



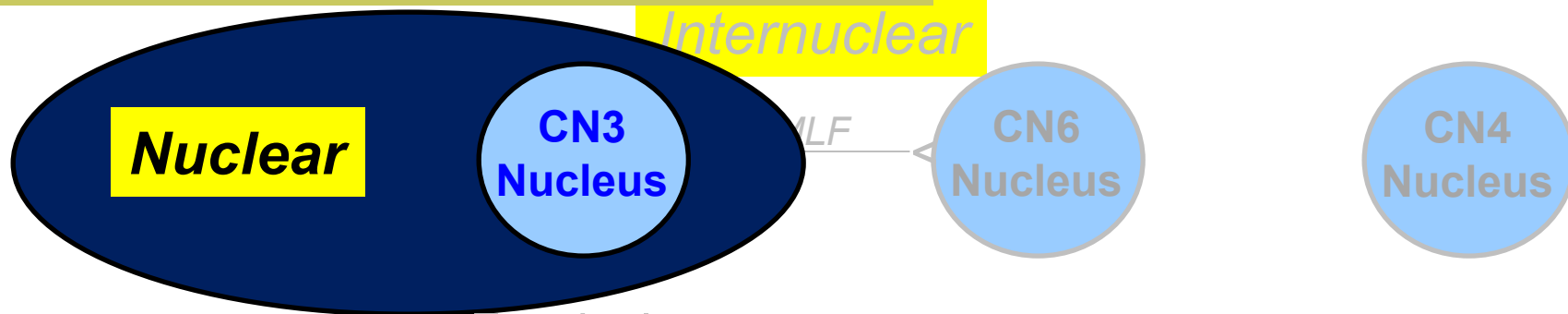
Motility Disorders: *Fascicular Syndromes*

Q

Supranuclear

Before we go, let's cover an entity the Academy seems to consider important, that being an **isolated nuclear third palsy**.

Internuclear



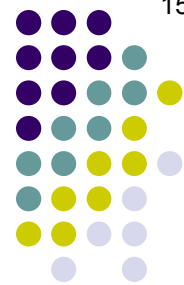
Basics review: Which EOMs are controlled by CN3?

- SR
- MR
- IR
- IO
- The levator

Nine??!! There are five CN3-controlled EOMs on each side. Shouldn't there be $5 + 5 = 10$ CN3 subnuclei?

Recall that EOMs are controlled by subnuclei. Between the two CN3 nuclei that are found in a normal human head, how many subnuclei

Nine



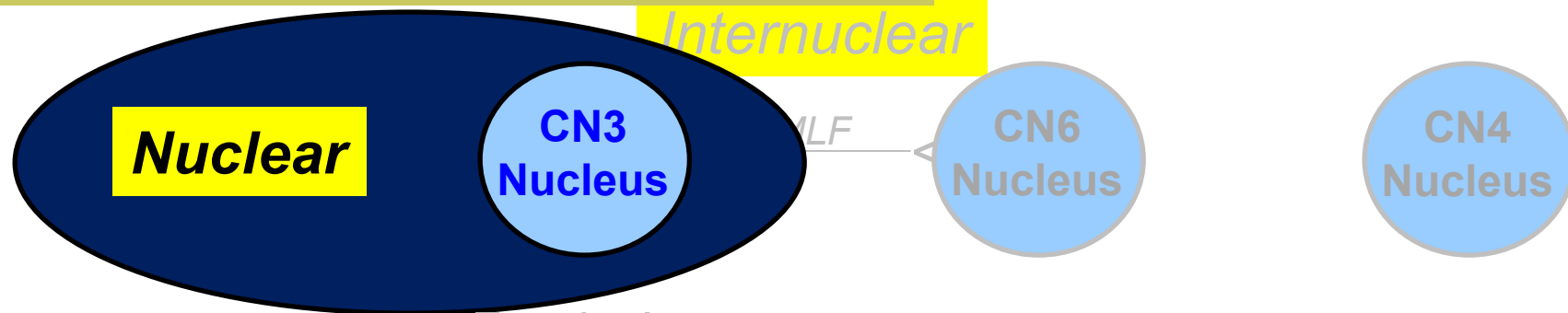
Motility Disorders: *Fascicular Syndromes*

A

Supranuclear

Before we go, let's cover an entity the Academy seems to consider important, that being an **isolated nuclear third palsy**.

Internuclear



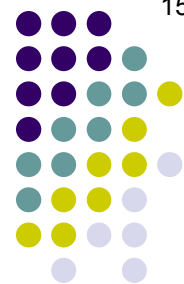
Basics review: Which EOMs are controlled by CN3?

- SR
- MR
- IR
- IO
- The levator

Nine??!! There are five CN3-controlled EOMs on each side. Shouldn't there be $5 + 5 = 10$ CN3 subnuclei? You'd think so, but no.

Recall that EOMs are controlled by subnuclei. Between the two CN3 nuclei that are found in a normal human head, how many subnuclei

Nine



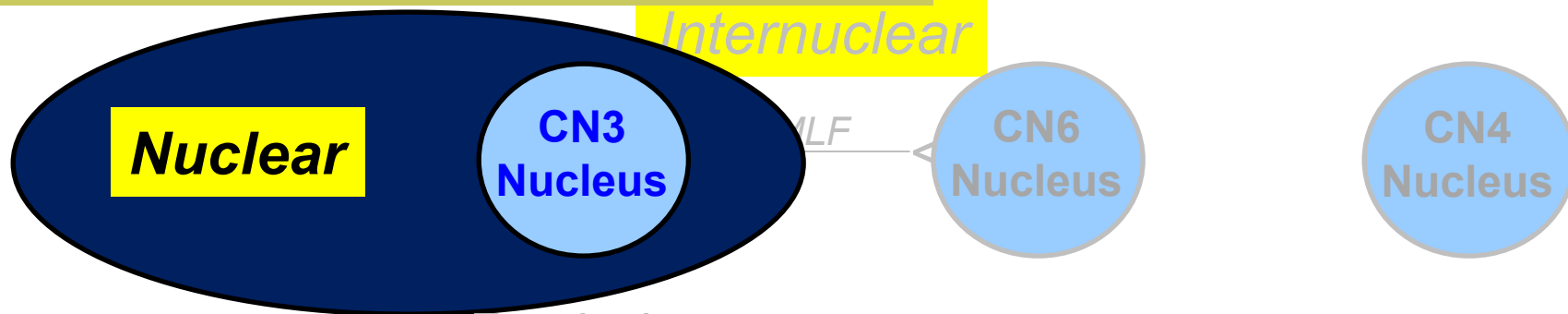
Motility Disorders: Fascicular Syndromes

A

Supranuclear

Before we go, let's cover an entity the Academy seems to consider important, that being an **isolated nuclear third palsy**.

Internuclear



Basics review: Which EOMs are controlled by CN3?

- SR
 - MR
 - IR
 - IO
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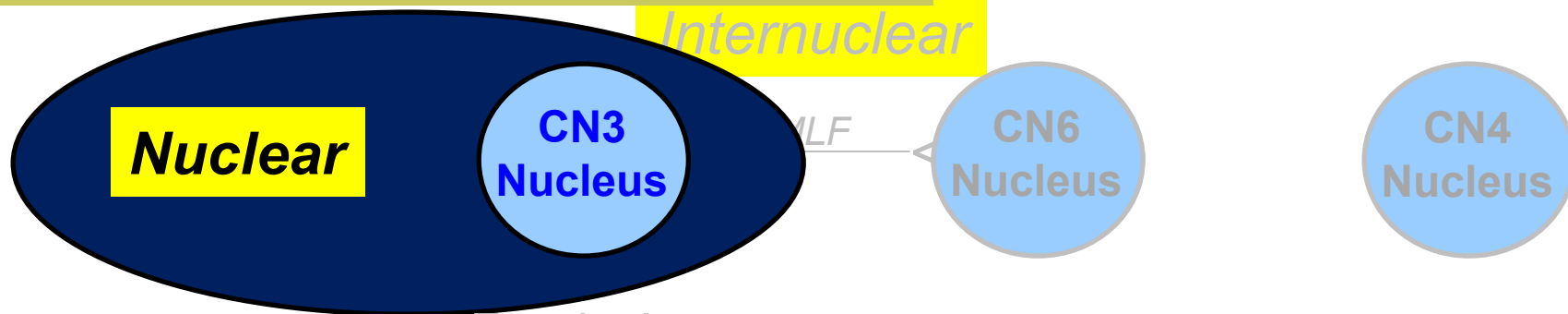
Motility Disorders: *Fascicular Syndromes*

Q

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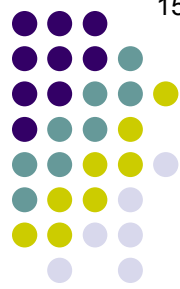
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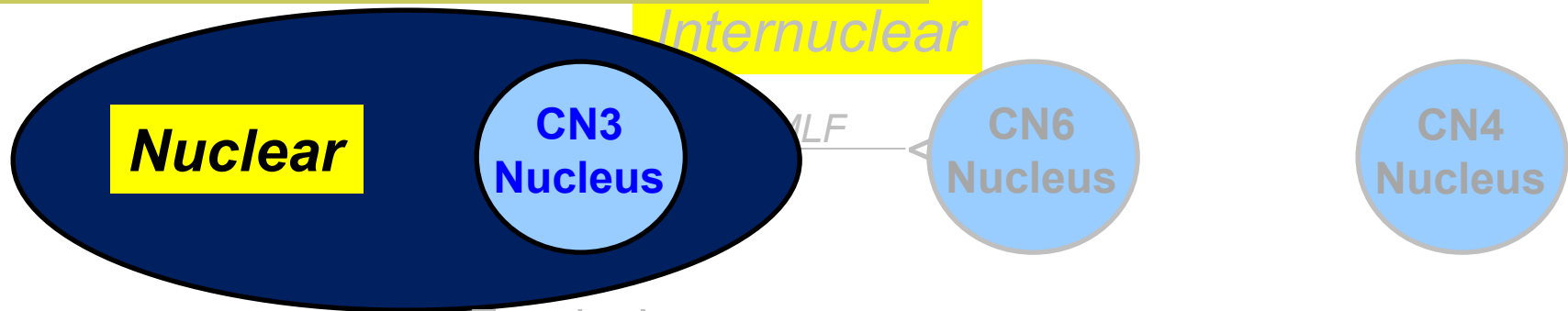
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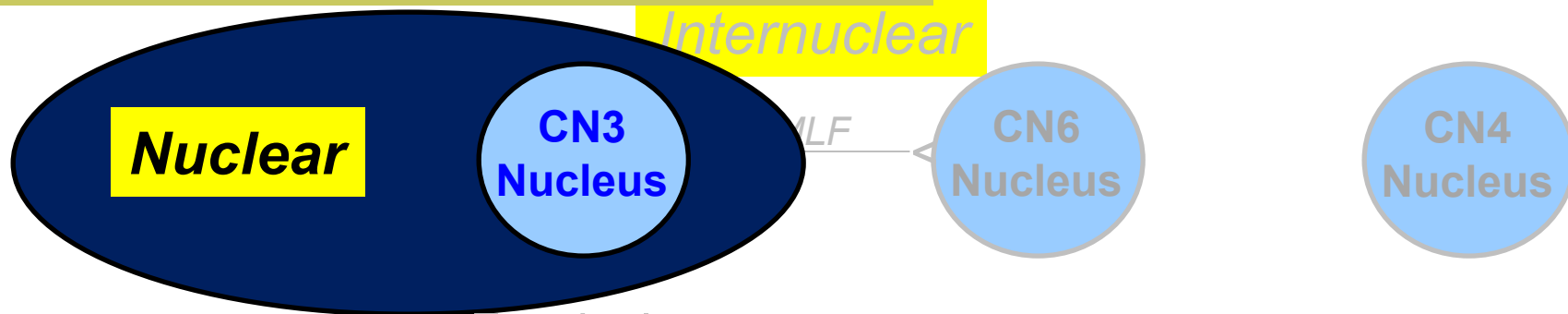
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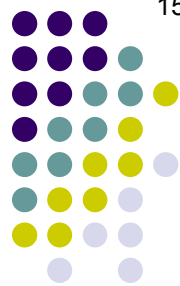
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What does this imply about levator involvement in an isolated nuclear third?

Nine



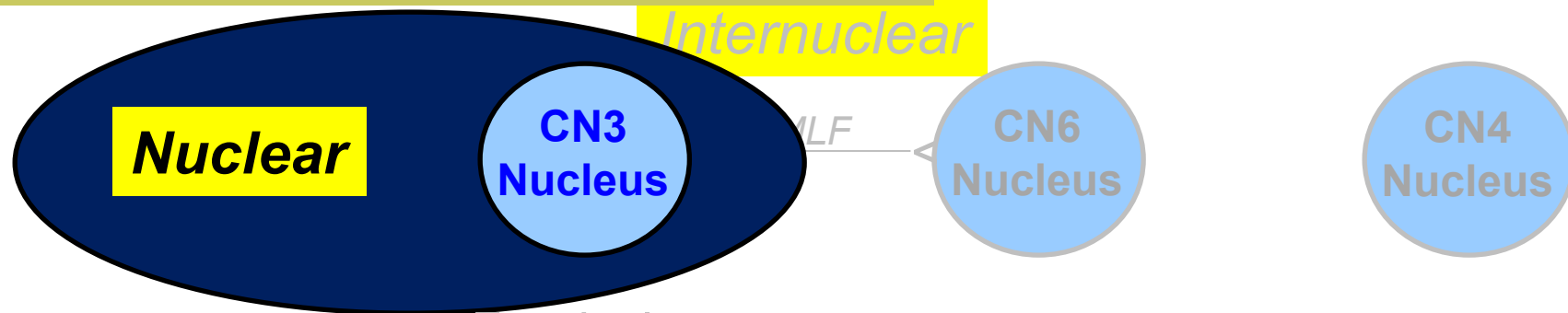
Motility Disorders: *Fascicular Syndromes*

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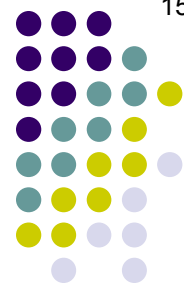
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It implies that either *both* levators will be bagged, or *neither* will be



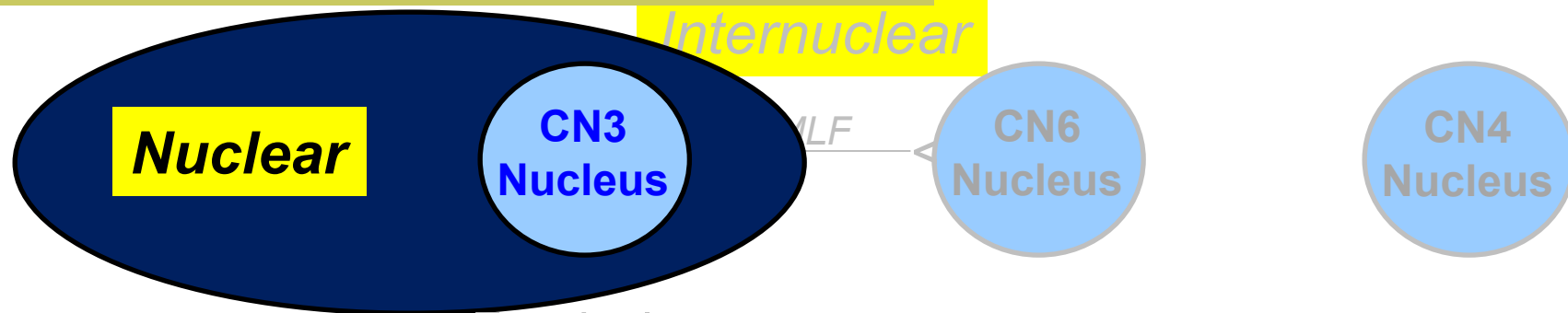
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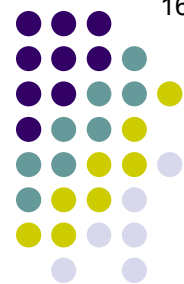
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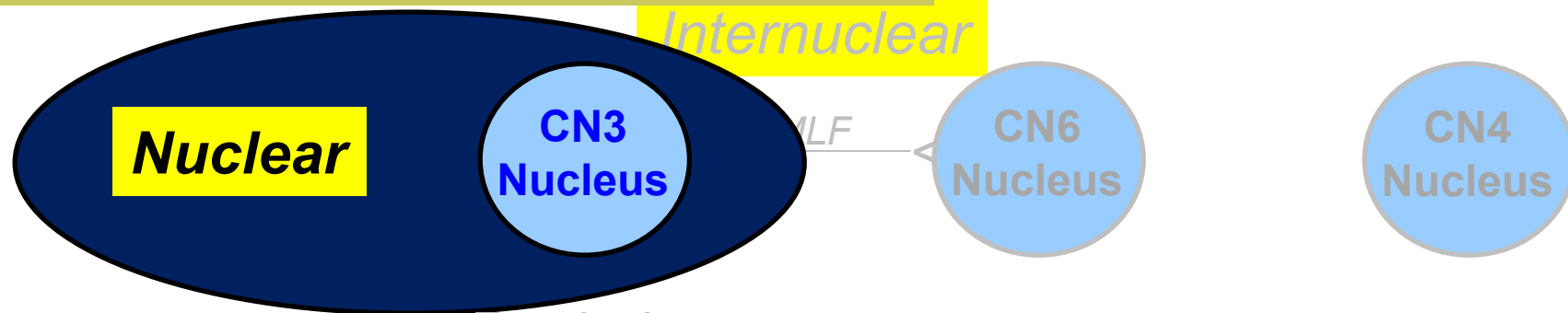
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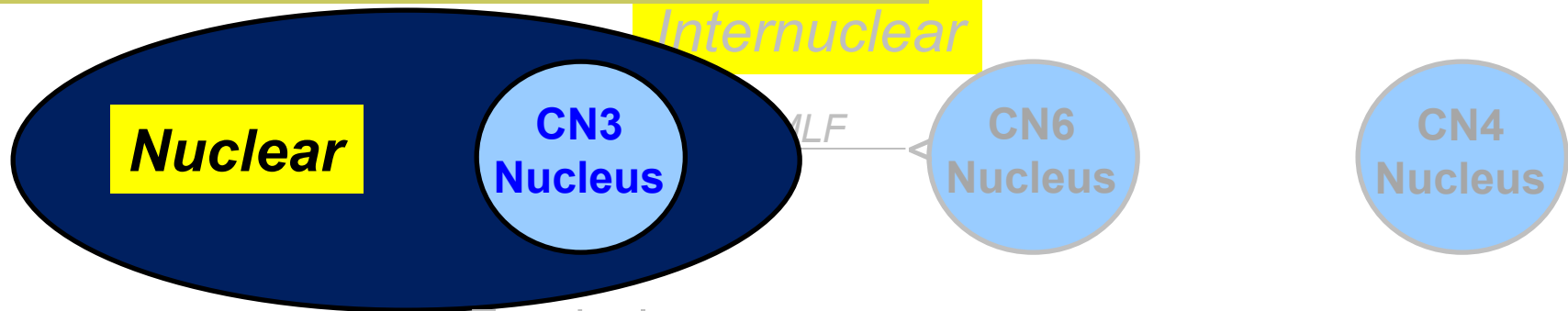
Motility Disorders: Fascicular Syndromes

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And as mentioned earlier in the set, let us recall that the SR muscles are controlled *contralaterally*.

Each has its own subnucleus.

Five CN3-controlled EOMs on each side.

Shouldn't there be $5 + 5 = 10$ CN3 subnuclei?

Putting it all together: An isolated nuclear third will present with:

--?

--?

--?

Recall that

Between the two CN3 nuclei that are found in a normal human head, how many subnuclei are there?

Nine

isolated nuclear third?

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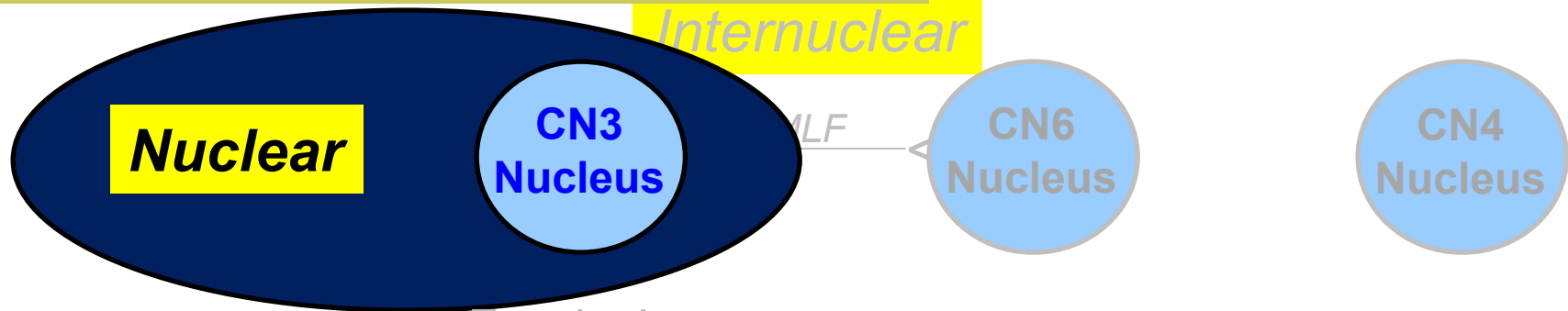
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Putting it all together: An isolated nuclear third will present with:

--Ipsilateral palsy of the...

--?

--?

have their controlled (s).

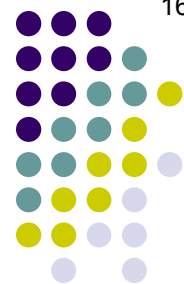
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Nine



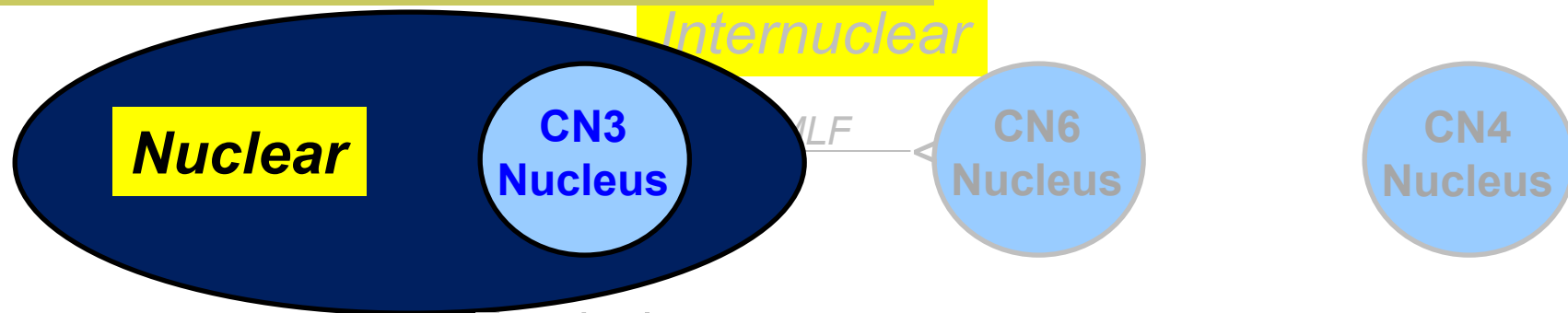
Motility Disorders: *Fascicular Syndromes*

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Internuclear



Basics

--SR
--MR
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And as mentioned earlier in the set, let us recall that the SR muscles are controlled *contralaterally*.

Each has its own subnucleus.

Give CN3-controlled EOMs on each side.

Shouldn't there be 5 + 5 = 10 CN3 subnuclei?

Putting it all together: An isolated nuclear third will present with:

--Ipsilateral palsy of the...MR, IR, and IO

--?

--?

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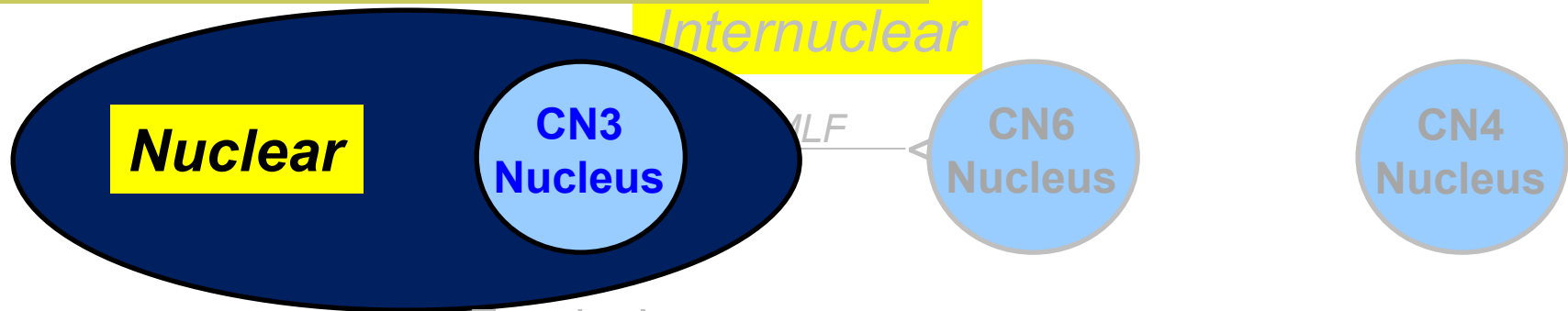
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Internuclear



Basics

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- The levators

And as mentioned earlier in the set, let us recall that the SR muscles are controlled *contralaterally*.

Each has its own subnucleus.

Five CN3-controlled EOMs on each side.

Shouldn't there be $5 + 5 = 10$ CN3 subnuclei?

Putting it all together: An isolated nuclear third will present with:

- Ipsilateral palsy of the...MR, IR, and IO
- Contralateral palsy of the...

--?

Recall that

Between the two CN3 nuclei that are found in a normal human head, how many subnuclei are there?

Nine

isolated nuclear third?

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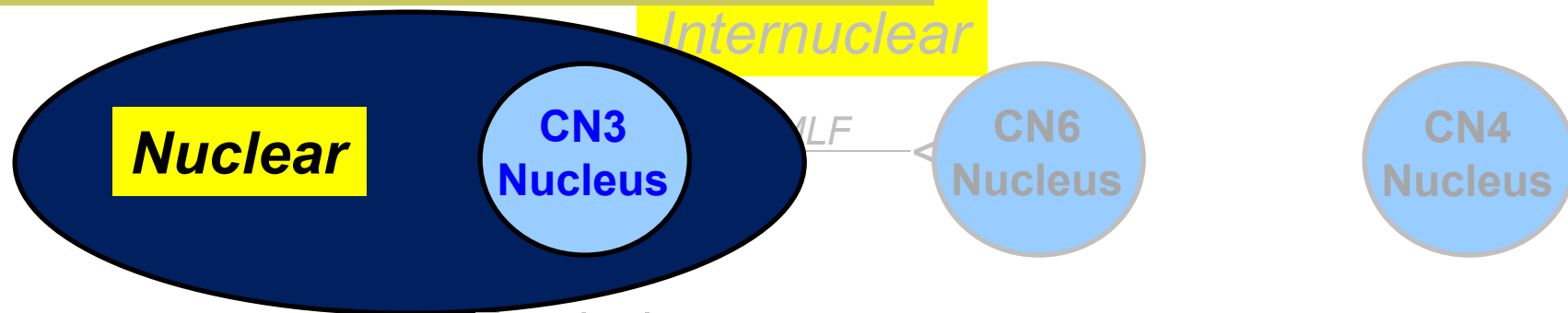
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Internuclear



Basics

--SR

--MR

--IR

--IO

--The levator

And as mentioned earlier in the set, let us recall

that the SR muscles are controlled *contralaterally* to the CN3-controlled EOMs on each side.

Each has its own subnucleus.

Shouldn't there be 5 + 5 = 10 CN3 subnuclei?

Putting it all together: An isolated nuclear third will present with:

--Ipsilateral palsy of the...MR, IR, and IO

--Contralateral palsy of the...SR

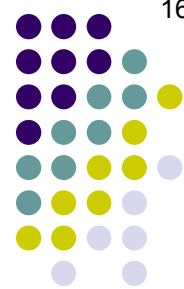
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Between the two CN3 nuclei that are found in the isolated nuclear third?

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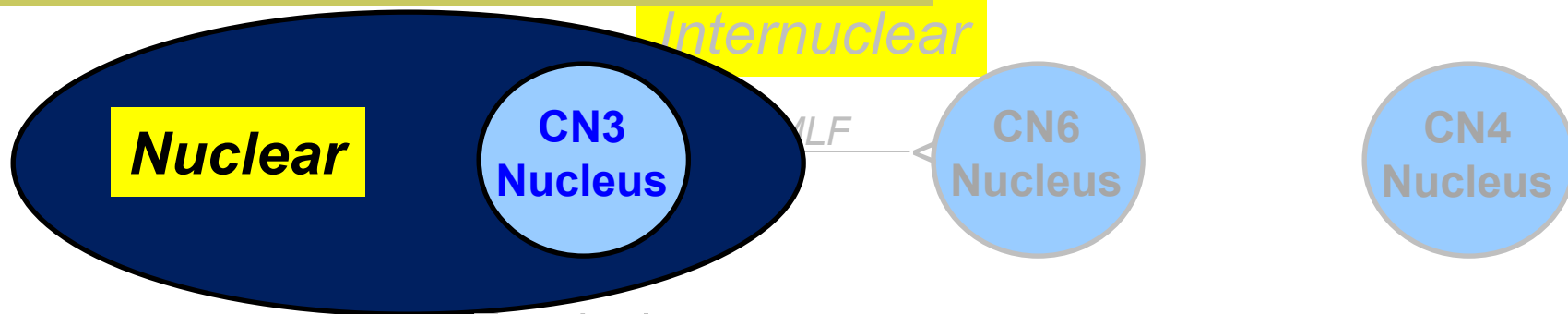
Motility Disorders: Fascicular Syndromes

Q

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Internuclear



Basics

- SR
- MR
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- IO
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Each has its own subnucleus.

Give CN3-controlled EOMs on each side.

Shouldn't there be $5 + 5 = 10$ CN3 subnuclei?

Putting it all together: An isolated nuclear third will present with:

- Ipsilateral palsy of the...MR, IR, and IO
- Contralateral palsy of the...SR
- Bilateral involvement (or not!) of the...

have their controlled (s).

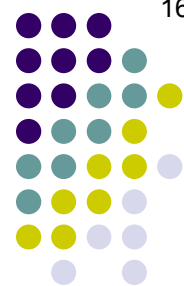
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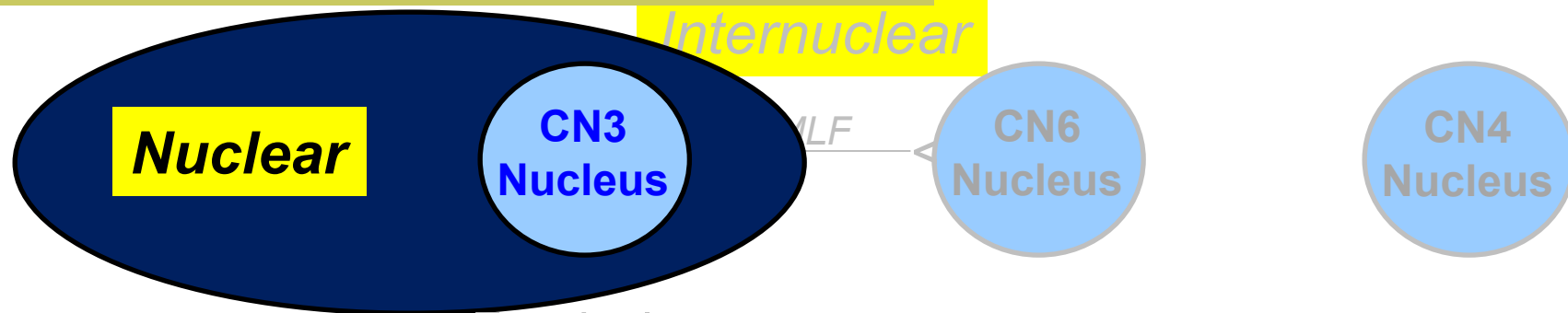
Motility Disorders: Fascicular Syndromes

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isolated nuclear third?

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Nine



Motility Disorders: *Fascicular Syndromes*

Supranuclear

Nuclear

And finally, let's tease another Academy favorite: the **isolated nuclear sixth palsy**

**CN6
Nucleus**

**CN4
Nucleus**

Infranuclear

Fascicular

Subarachnoid

Cavernous sinus

Orbital

Neuromuscular junction

Extraocular muscle

(No question yet—proceed)



Motility Disorders: *Fascicular Syndromes*

Q

Supranuclear

Nuclear

And finally, let's tease another Academy favorite: the **isolated nuclear sixth palsy**

**CN6
Nucleus**

**CN4
Nucleus**

How does a nuclear sixth present?

Infranuclear

Cavernous sinus

Orbital

Neuromuscular junction

Extraocular muscle



Motility Disorders: *Fascicular Syndromes*

Q/A
Supranuclear

Nuclear

And finally, let's tease another Academy favorite: the **isolated nuclear sixth palsy**

**CN6
Nucleus**

**CN4
Nucleus**

How does a nuclear sixth present?

As a lateral gaze vs rectus palsy

Infranuclear

Cavernous sinus

Orbital

Neuromuscular junction

Extraocular muscle



Motility Disorders: *Fascicular Syndromes*

A
Supranuclear

Nuclear

And finally, let's tease another Academy favorite: the **isolated nuclear sixth palsy**

**CN6
Nucleus**

**CN4
Nucleus**

How does a nuclear sixth present?
As a lateral gaze palsy

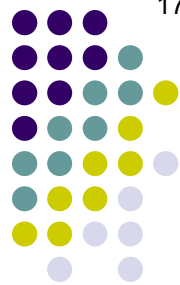
Infranuclear

Cavernous sinus

Orbital

Neuromuscular junction

Extraocular muscle



Motility Disorders: *Fascicular Syndromes*

Q

Supranuclear

Nuclear

And finally, let's tease another Academy favorite: the **isolated nuclear sixth palsy**

**CN6
Nucleus**

**CN4
Nucleus**

How does a nuclear sixth present?

As a lateral gaze palsy ipsilateral vs
contralateral to the lesion

Infranuclear

Cavernous sinus

Orbital

Neuromuscular junction

Extraocular muscle



Motility Disorders: *Fascicular Syndromes*

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Supranuclear

Nuclear

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How does a nuclear sixth present?

As a lateral gaze palsy ipsilateral to the lesion

Infranuclear

Cavernous sinus

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Motility Disorders: *Fascicular Syndromes*

Q

Supranuclear

Nuclear

And finally, let's tease another Academy favorite: the **isolated nuclear sixth palsy**

**CN6
Nucleus**

**CN4
Nucleus**

How does a nuclear sixth present?

As a lateral gaze palsy ipsilateral to the lesion

Huh? How could an isolated nuclear lesion present with a gaze palsy?

Infranuclear

Cavernous sinus

Orbital

Neuromuscular junction

Extraocular muscle



Motility Disorders: *Fascicular Syndromes*

A
Supranuclear

Nuclear

And finally, let's tease another Academy favorite: the **isolated nuclear sixth palsy**

**CN6
Nucleus**

**CN4
Nucleus**

How does a nuclear sixth present?

As a lateral gaze palsy ipsilateral to the lesion

Huh? How could an isolated nuclear lesion present with a gaze palsy?

Good question! See slide-set *N20* for the explanation.

Infranuclear

Cavernous sinus

Orbital

Neuromuscular junction

Extraocular muscle