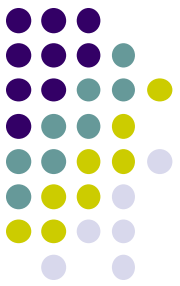
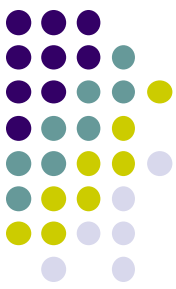


Comitant Esotropia



Esotropia (ET) is a form of strabismus in which the eyes are 'turned in' with respect to one another. It is the most common form of strabismus encountered in clinical practice.

Comitant Esotropia

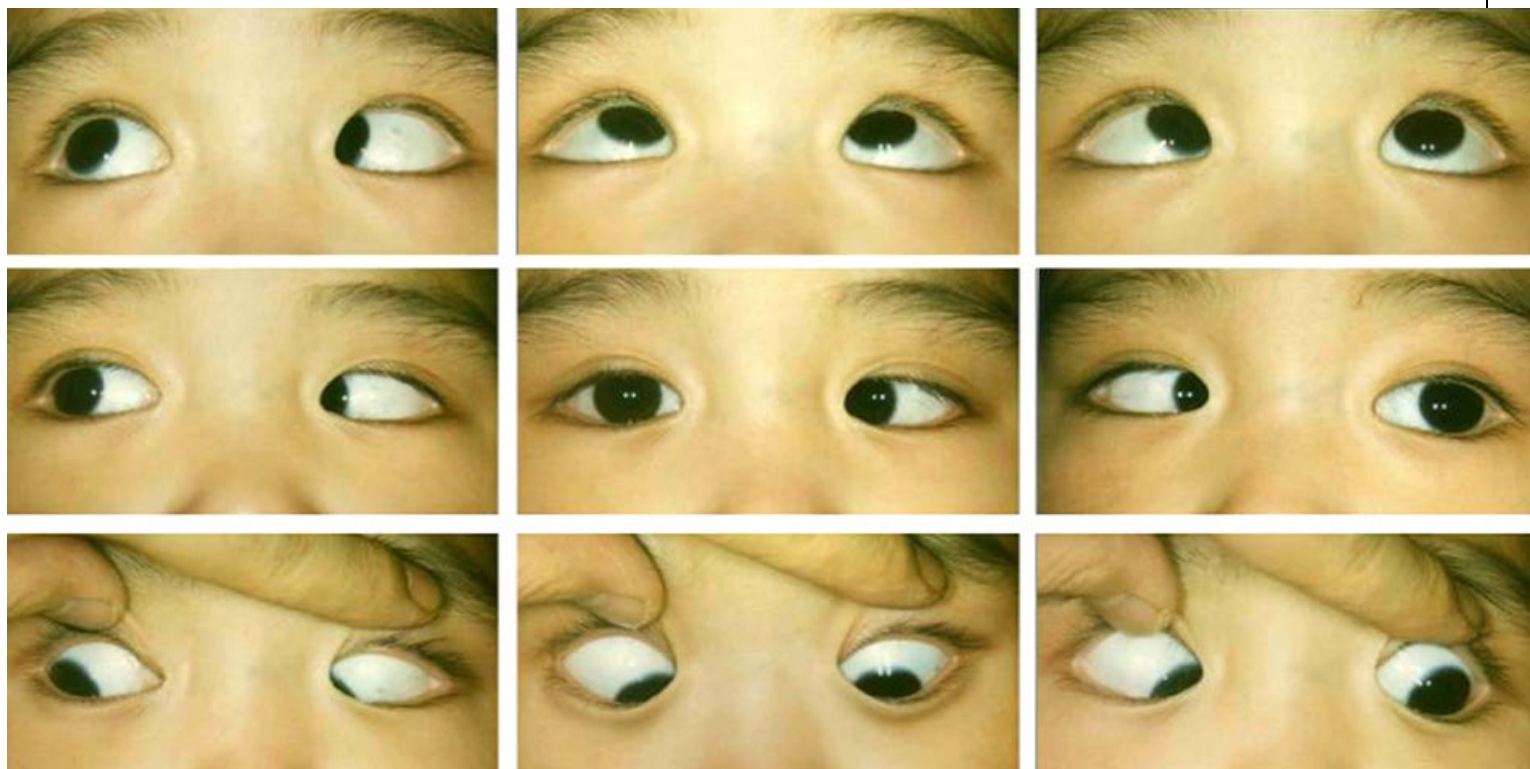


Esotropia (ET) is a form of strabismus in which the eyes are ‘turned in’ with respect to one another. It is the most common form of strabismus encountered in clinical practice.

One useful way to classify esotropia is with respect to *comitance*. A **comitant ET** is one in which the magnitude (in prism-diopters) of the esotropia is the same in all fields of gaze. For example, the run-of-the-mill ET typically found in a very young child is usually comitant.

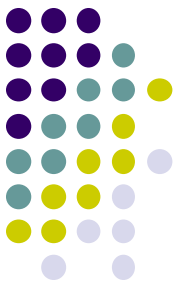
(Prism-diopters are represented by a delta Δ ; eg, 50Δ = 50 prism-diopters)

Comitant Esotropia



~50Δ of comitant esotropia

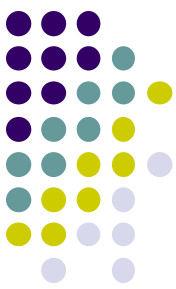
Comitant Esotropia



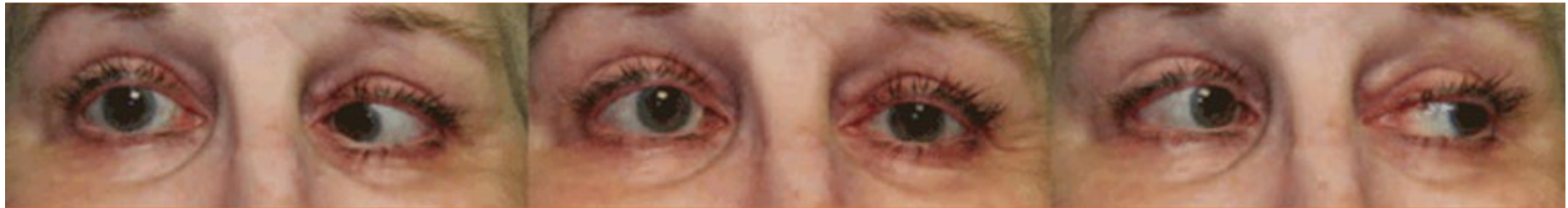
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Comitant Esotropia



5



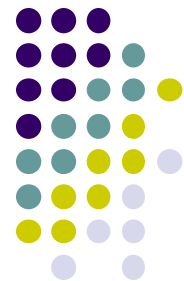
Huge ET in right gaze

Moderate ET in primary gaze

Almost no ET in left gaze

Incomitant ET 2ndry to right CN6 palsy

Comitant Esotropia

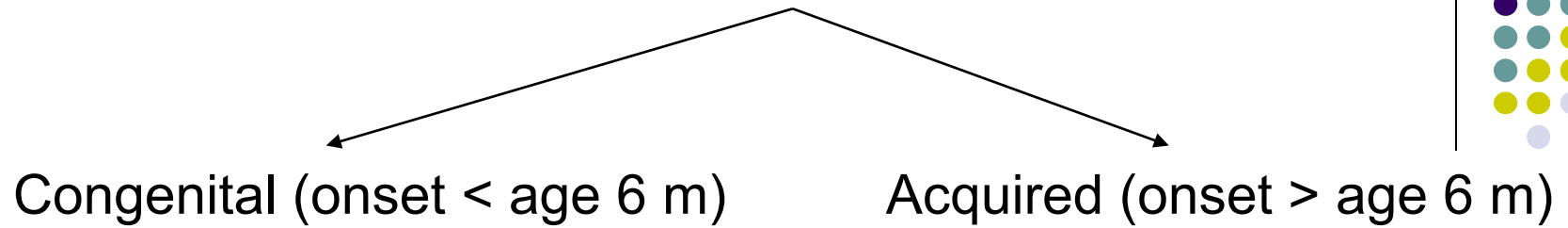


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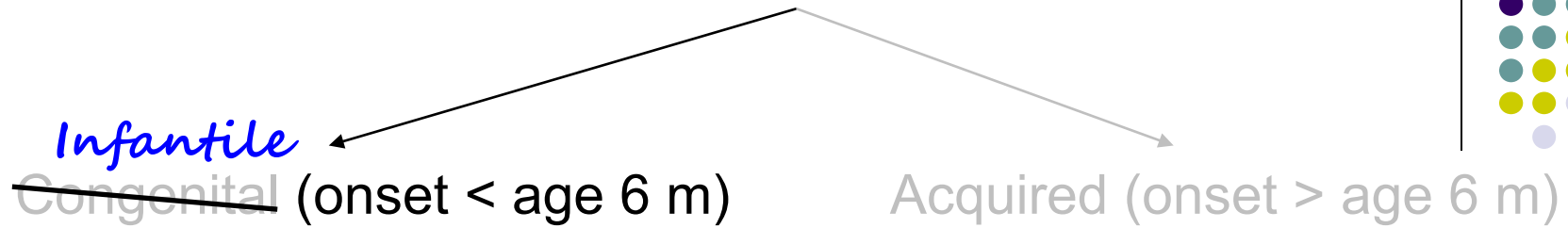
This slide-set will focus on comitant ET. There is no gender predilection for comitant ET; however, there is a racial one: Incidence in White and Black infants is roughly equal, and both are higher than that for infants of Asian descent.

Comitant Esotropia



This is the first step in how we think about comitant ET: Whether it presented congenitally (defined as before age 6 months) or whether it was acquired (later than age 6 months).

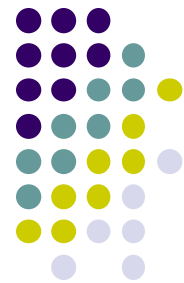
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Comitant Esotropia



Congenital (onset < age 6 m)

Acquired (onset > age 6 m)

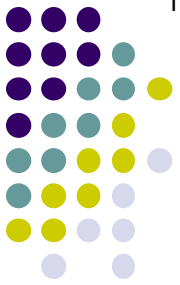
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It's important to note here that brief strabismic episodes are commonly seen in the first few (especially two) months of life. Further, it's not uncommon for the same infant to manifest short periods of both ET *and* XT; this is referred to as *ocular instability of infancy*.

Comitant Esotropia

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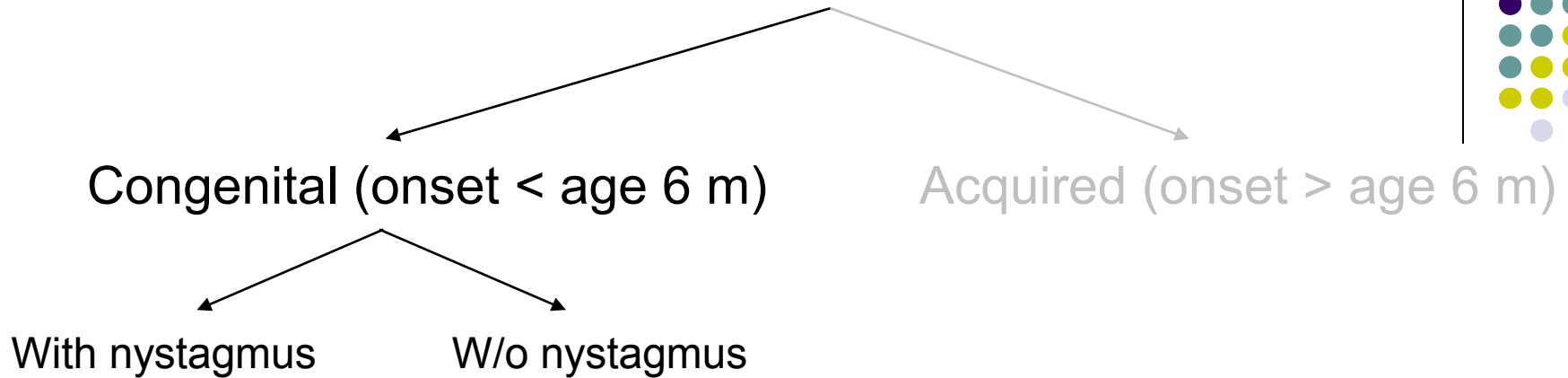
Acquired (onset > age 6 m)



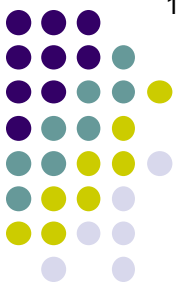
This is the first step in how we think about comitant ET: Whether it presented congenitally (defined as before age 6 months) or whether it was acquired (later than age 6 months). Note that *congenital* is a misnomer here in that, technically, a congenital disorder must be present at birth—it can't show up 6 months later. (For this reason, some clinicians refer to these cases not as 'congenital,' but rather as **infantile** esotropia.)

It's important to note here that brief strabismic episodes are commonly seen in the first few (especially two) months of life. Further, it's not uncommon for the same infant to manifest short periods of both ET *and* XT; this is referred to as *ocular instability of infancy*. However, if the ET is 1) present after age 2 months; 2) constant; and/or 3) large, it probably represents a congenital ET.

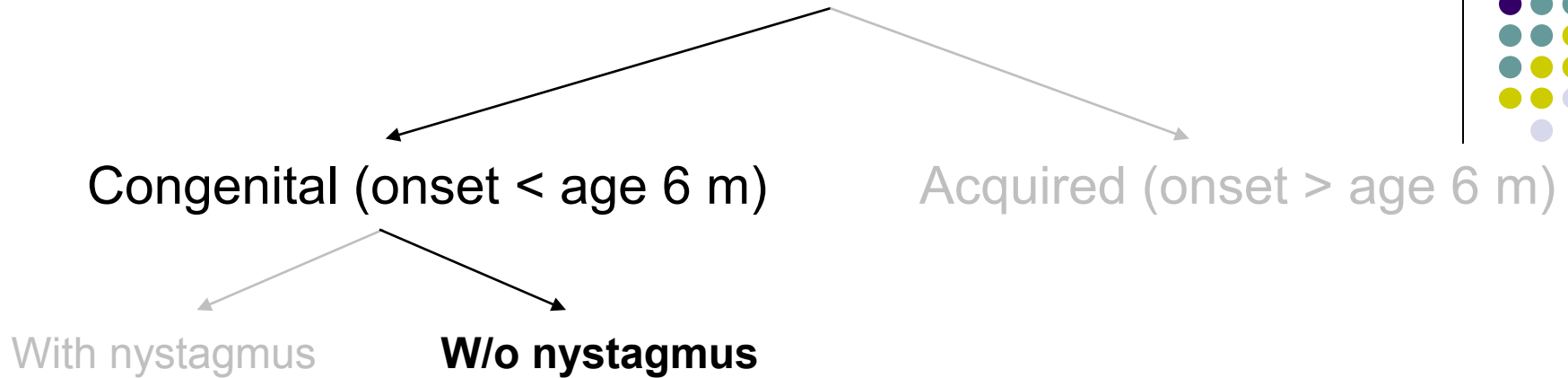
Comitant Esotropia



We divvy congenital ET into two groups:
Those presenting *with* nystagmus, and
those presenting *without* it

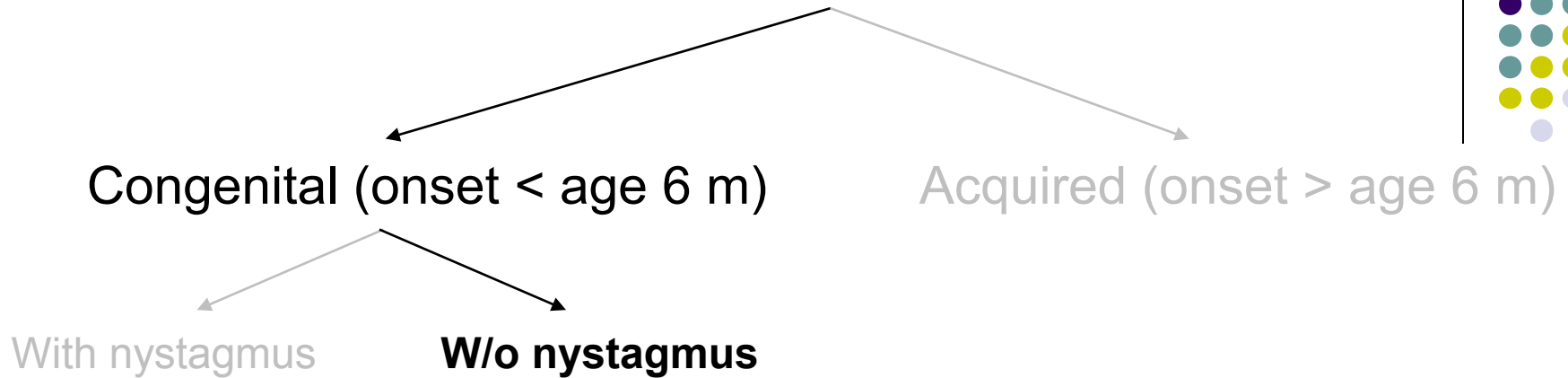


Comitant Esotropia



Congenital ET without nystagmus is your garden-variety 'my baby's eyes have been crossed since birth' esotropia. The deviation tends to be large—30Δ or more. A family history is often present.

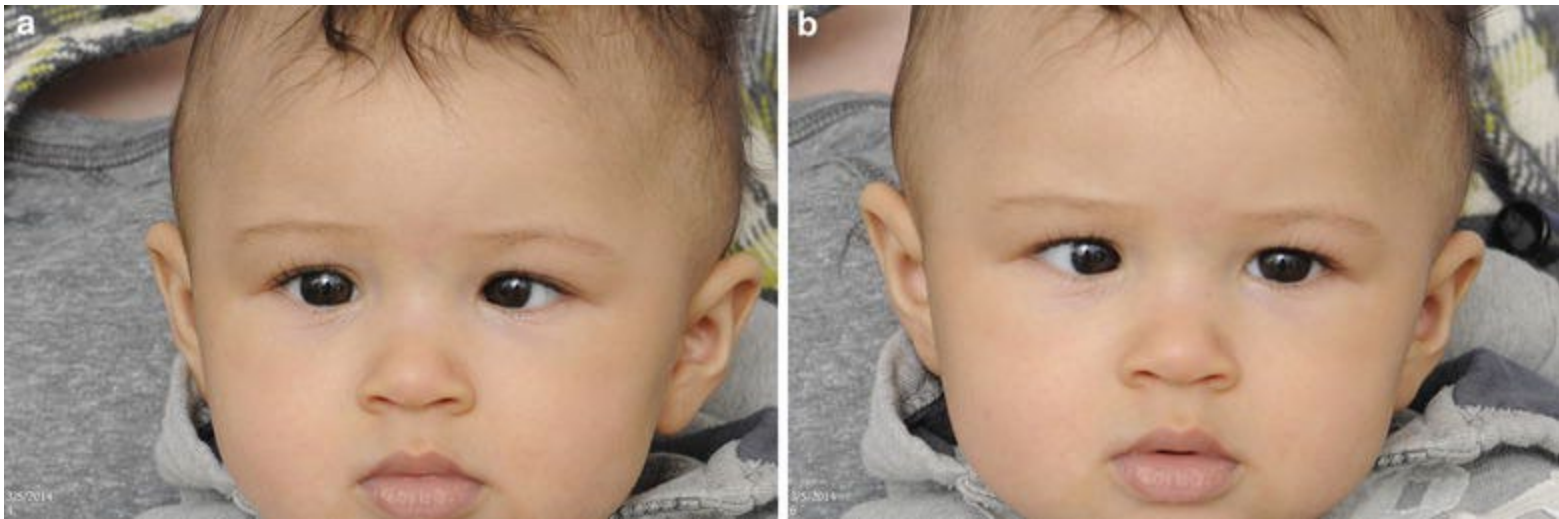
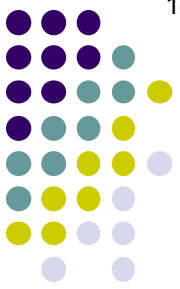
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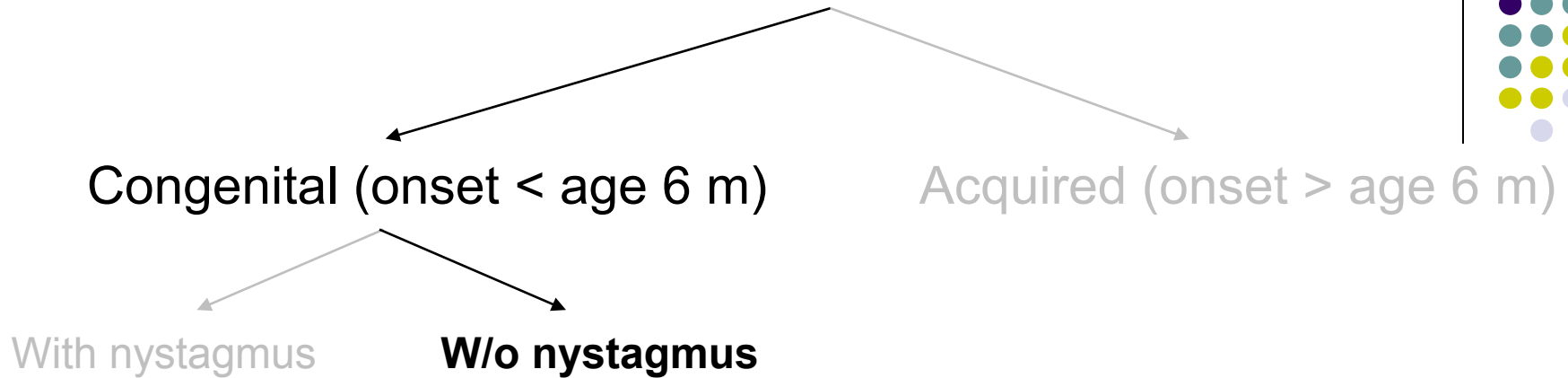
If vision is equal bilaterally, these infants frequently employ *cross fixation*, meaning they will use their (crossed) right eye to look at objects to their left, and their (crossed) left eye to look at those to the right.

Comitant Esotropia



ET with cross-fixation

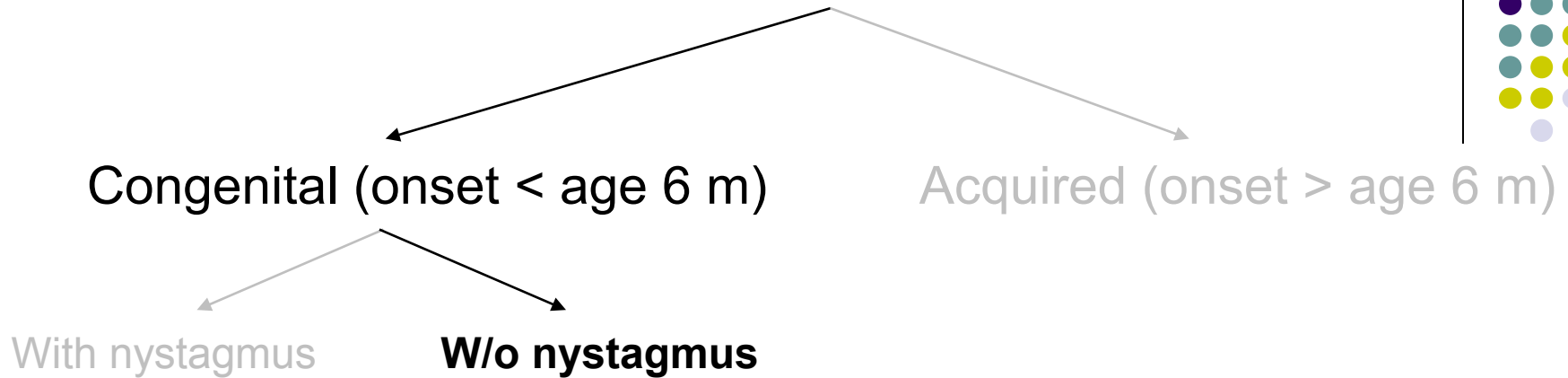
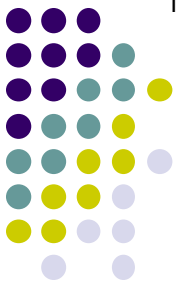
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Comitant Esotropia

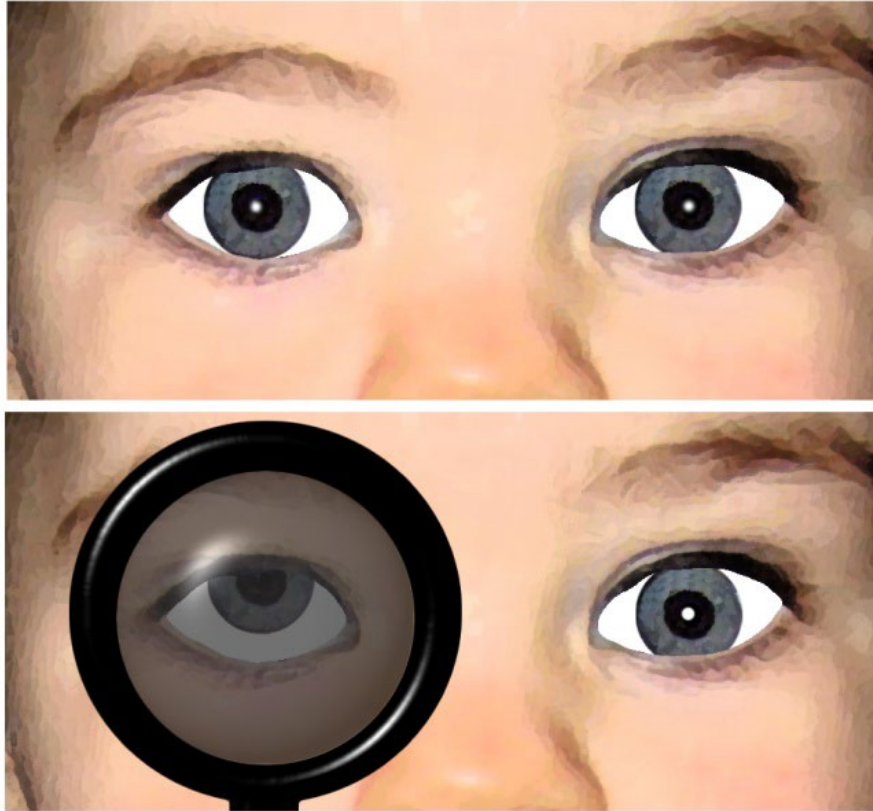
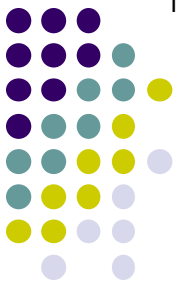


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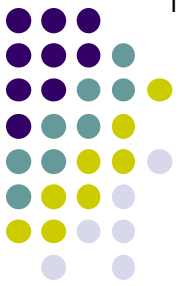
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Another common finding in these infants is *dissociated vertical deviation* (DVD), the phenomenon in which one eye slowly elevates and extorts. This may occur spontaneously (*manifest* DVD), or only when the eye is occluded (*latent* DVD).

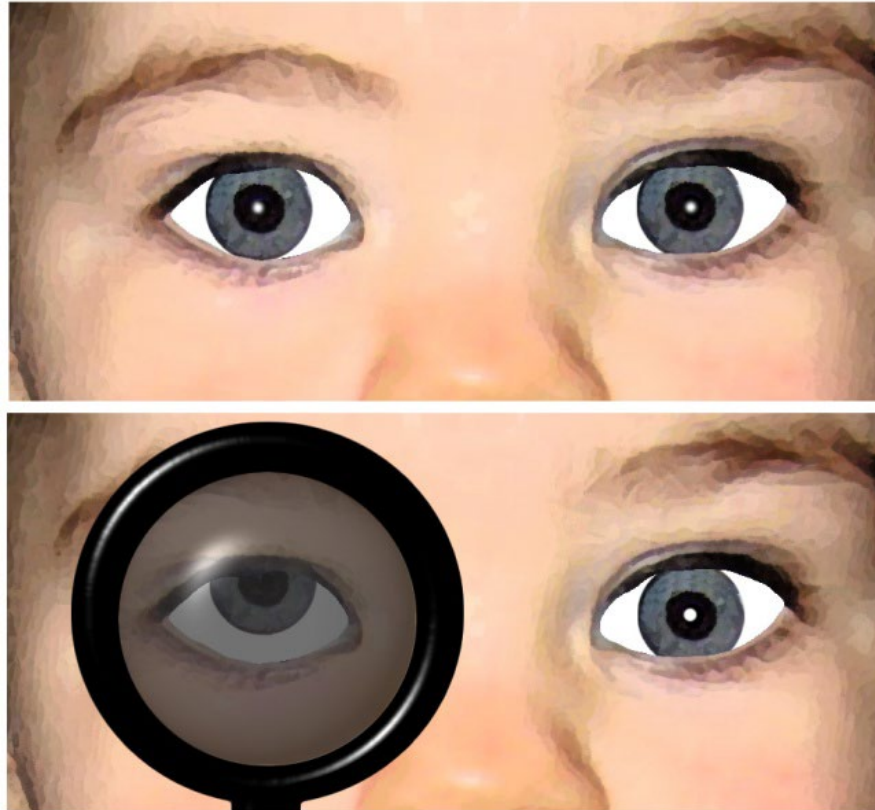
Comitant Esotropia



(Latent) DVD

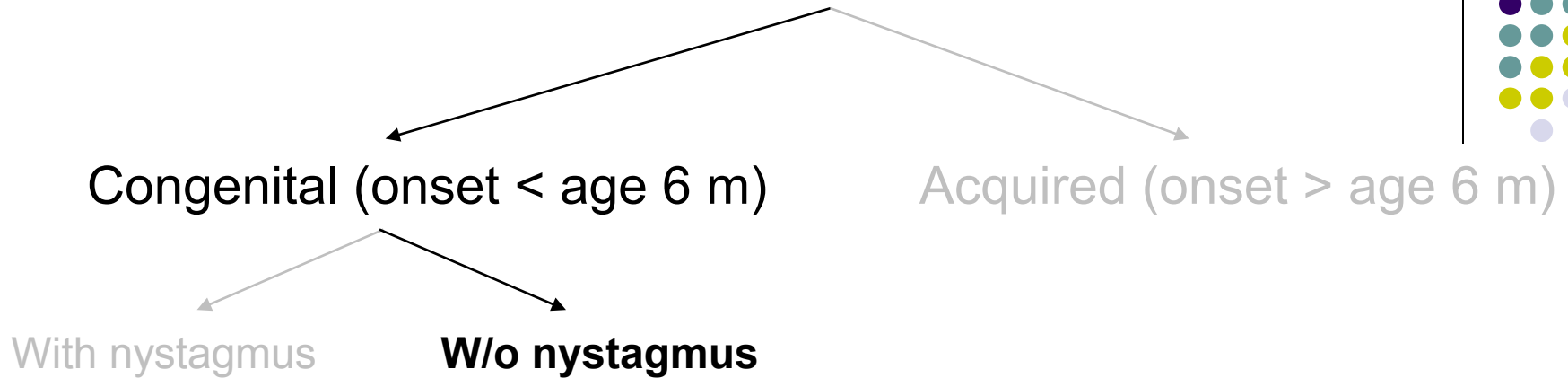
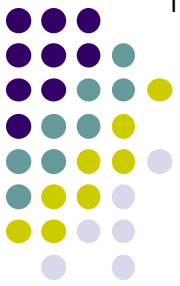


Comitant Esotropia



For more on DVD, see slide-set P7 (see also the set concerning Sherrington's and Hering's law, FELT3)

Comitant Esotropia



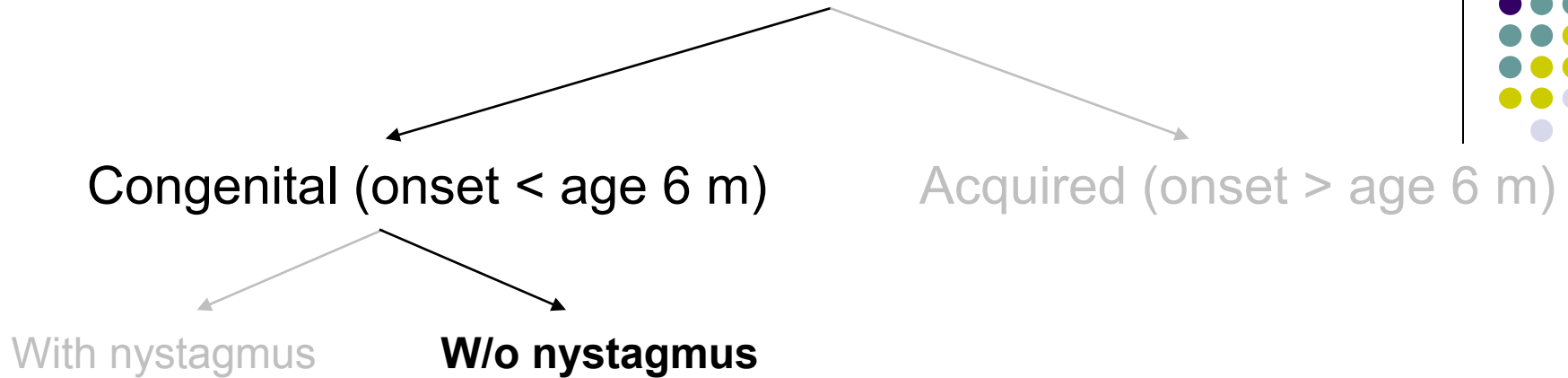
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Management of congenital ET w/o nystagmus is usually surgical via bilateral medial rectus recession. It is generally agreed that surgery should occur before the child’s 2nd birthday if possible.

Comitant Esotropia



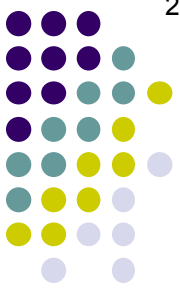
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Management of congenital ET w/o nystagmus is usually surgical via bilateral medial rectus recession. It is generally agreed that surgery should occur before the child’s 2nd birthday if possible. High-grade stereopsis is not a realistic outcome to expect; rather, *monofixation syndrome* is the hope-for outcome.

Comitant Esotropia



Congenital (onset < age 6 m)

Acquired (onset > age 6 m)

With nystagmus

W/o nystagmus

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If vision is equal bilaterally, these infants frequently employ *cross fixation*, meaning they will use their right eye. In order to both prevent diplopia and provide some degree of binocular cooperation, the immature visual system responds to strabismus with some combination of three adaptations:

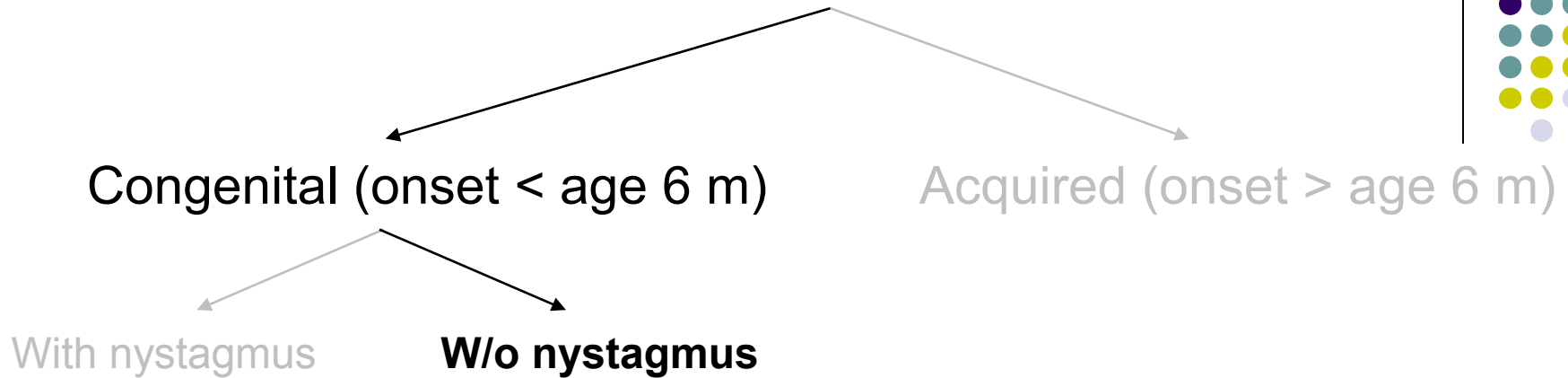
Suppression

Anomalous retinal correspondence (ARC)

Monofixation syndrome

stereopsis is **monofixation syndrome** is the hope-for outcome.

Comitant Esotropia



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In order to both prevent diplopia and provide some degree of binocular cooperation, the immature visual system responds to strabismus with some combination of three adaptations:

[Suppression refers to the prevention of an image in one eye from reaching conscious awareness.](#)

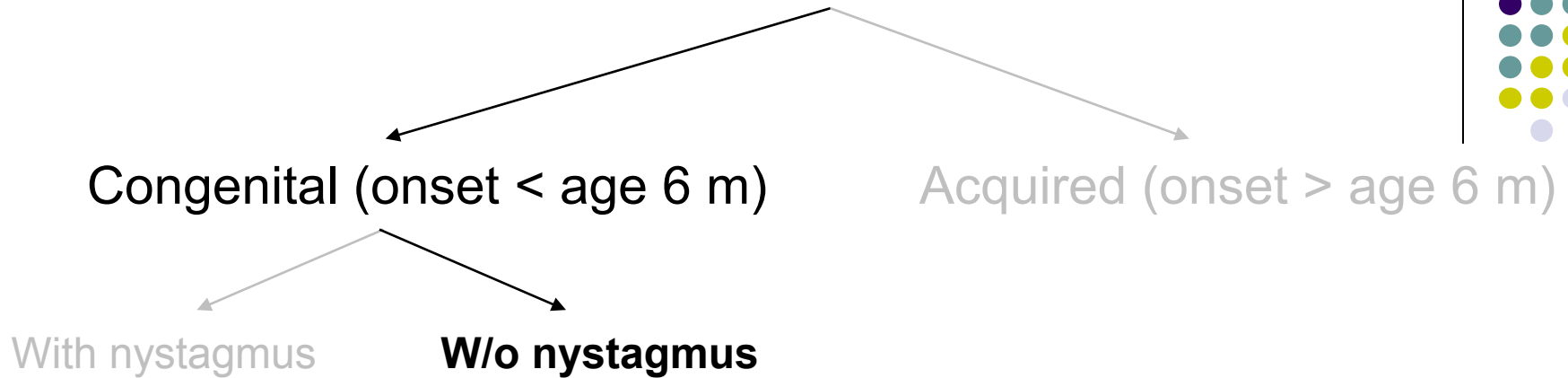
[It is one of the three sensory adaptations to strabismus that was mentioned previously](#)

Anomalous retinal correspondence (ARC)

Monofixation syndrome

generally agree that early, consistent correction of the child's strabismus is preferable; however, if severe stereopsis is not a realistic outcome to expect; rather, **monofixation syndrome** is the hope-for outcome.

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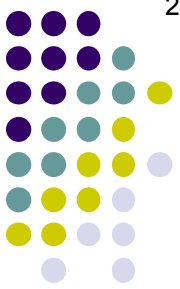
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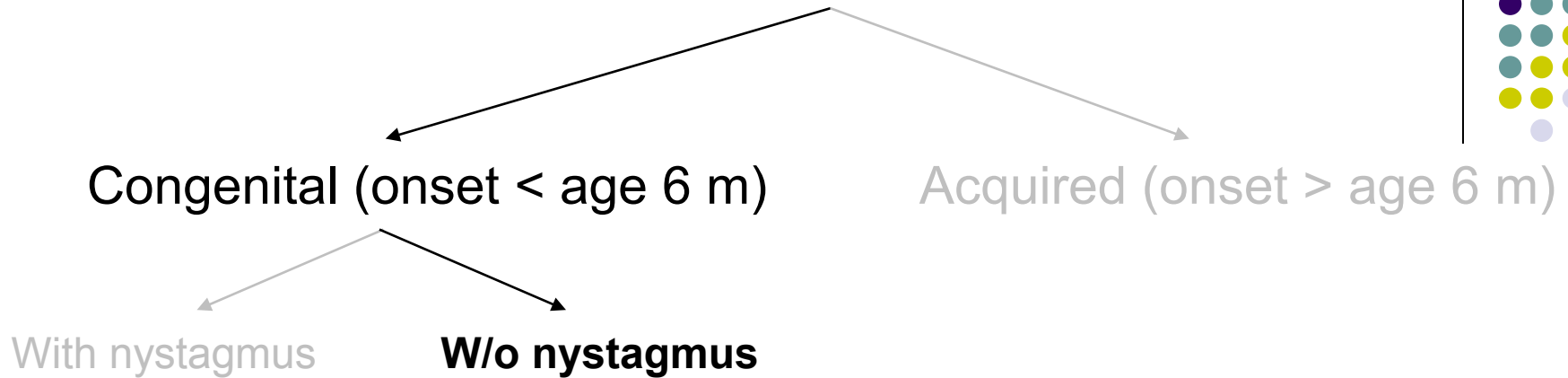
Anomalous retinal correspondence (ARC) is the development of a common visual direction between noncorresponding locations on the two retinas; eg, in ET the fovea in one eye will 'align' with a macular location in the fellow eye that is nasal to its fovea.

Monofixation syndrome

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Comitant Esotropia



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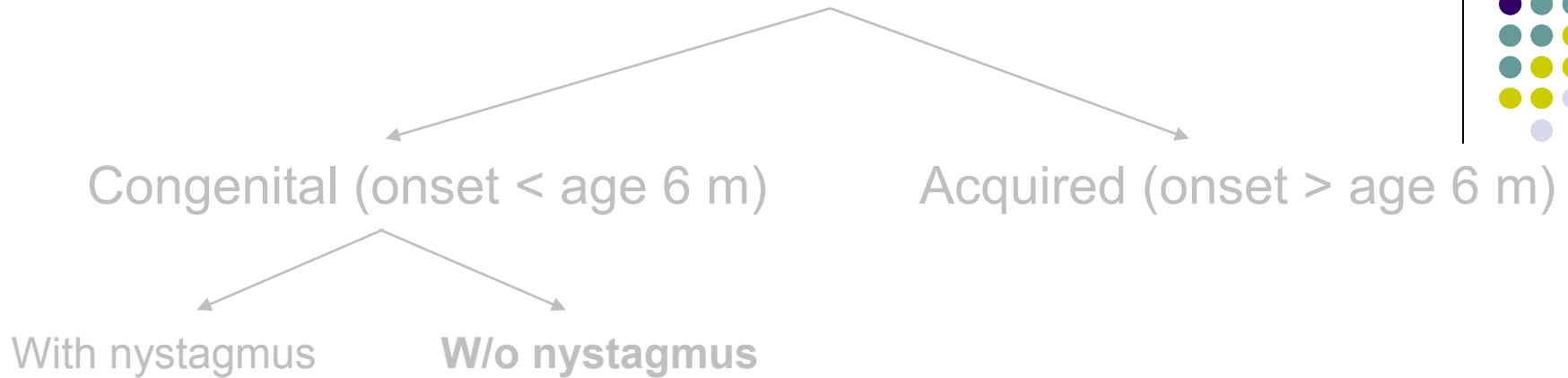
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Monofixation syndrome is a condition in which the pt develops a combination of a small-angle ET along with a small suppression scotoma.

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For more on sensory adaptations to strabismus, see slide-set P14

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Comitant Esotropia



Nystagmus refers to involuntary, rhythmic, back-and-forth oscillations of the eyes. The oscillation may be in any plane, including torsional.

Comitant Esotropia



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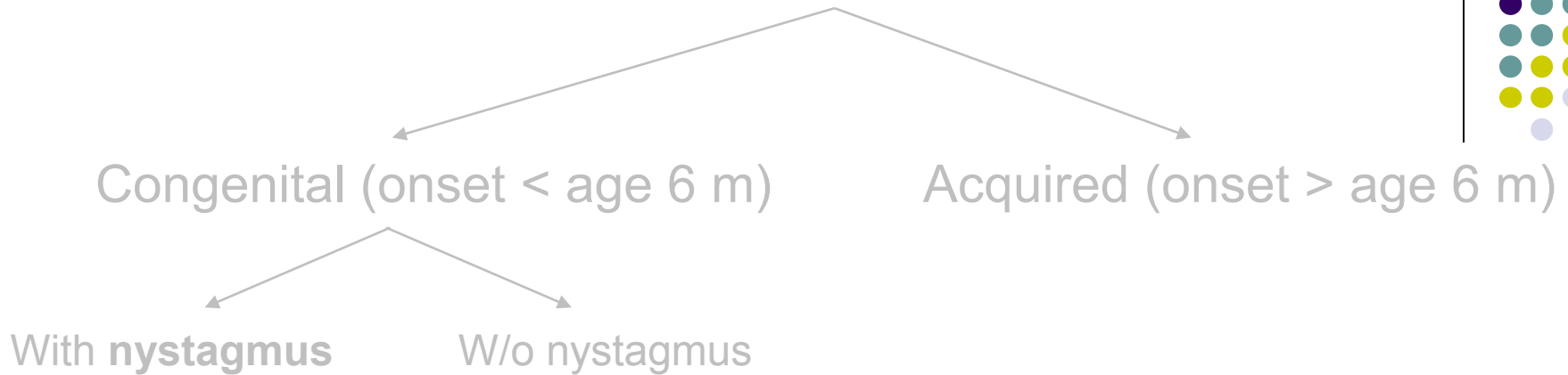
Acquired nystagmus is often accompanied by oscillopsia, the sensory impression that the visual world is jumping around. (Not surprisingly, this symptom is extremely disruptive.)

Comitant Esotropia



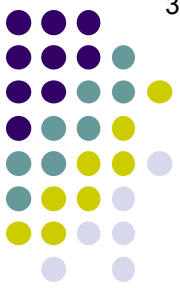
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Comitant Esotropia



Nystagmus refers to involuntary, rhythmic, back-and-forth oscillations of the eyes. The oscillation may be in any plane, including torsional. By definition, a nystagmus starts with a corrective movement away from the target, followed by a corrective movement back towards it. The corrective move can be fast or slow; if it's fast the oscillation is called a *jerk* nystagmus; if slow, a *pendular* nystagmus. The nature of a nystagmus may change with direction of gaze; ie, a jerk nystagmus may morph into a pendular one in a different field of gaze. Acquired nystagmus is often accompanied by oscillopsia, the sensory impression that the visual world is jumping around. (Not surprisingly, this symptom is extremely disruptive.) However, pts with *congenital* nystagmus do not exhibit signs of such disruption as infants, nor do they describe oscillopsia once they gain the ability to report symptoms verbally.

For more on nystagmus, see slide-set P4



Comitant Esotropia

Congenital (onset < age 6 m)

Acquired (onset > age 6 m)

With nystagmus

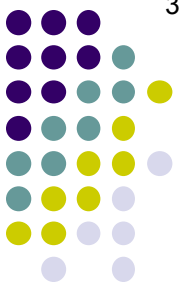
W/o nystagmus

Nystagmus blockage syndrome

Latent nystagmus

Ciaccia syndrome

The *Peds/Strabismus* book covers these three forms of **congenital ET with nystagmus**



Comitant Esotropia

Congenital (onset < age 6 m)

Acquired (onset > age 6 m)

With nystagmus

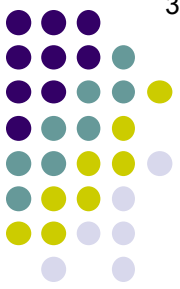
W/o nystagmus

Nystagmus blockage syndrome

- Latent nystagmus

- Ciancia syndrome

Nystagmus blockage syndrome is the esotropia that develops in pts with *congenital motor nystagmus (CMN)*.



Comitant Esotropia

Congenital (onset < age 6 m)

Acquired (onset > age 6 m)

With nystagmus

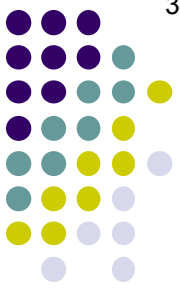
W/o nystagmus

Nystagmus blockage syndrome

-Latent nystagmus

-Ciancia syndrome

Nystagmus blockage syndrome is the esotropia that develops in pts with *congenital motor nystagmus (CMN)*. CMN is a form of nystagmus that arises in the first few months of life. Unlike most forms of nystagmus, it is not secondary to either vision loss or CNS pathology— it just kinda 'is.'



Comitant Esotropia

Congenital (onset < age 6 m)

Acquired (onset > age 6 m)

With nystagmus

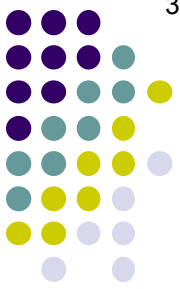
W/o nystagmus

Nystagmus blockage syndrome

-Latent nystagmus

-Ciancia syndrome

Nystagmus blockage syndrome is the esotropia that develops in pts with *congenital motor nystagmus (CMN)*. CMN is a form of nystagmus that arises in the first few months of life. Unlike most forms of nystagmus, it is not secondary to either vision loss or CNS pathology— it just kinda 'is.' Pts with congenital motor nystagmus usually have pretty good vision (rule of thumb: If a pt has nystagmus + good VA, it's probably CMN). It is virtually always horizontal.



Comitant Esotropia

Congenital (onset < age 6 m)

Acquired (onset > age 6 m)

With nystagmus

W/o nystagmus

Nystagmus blockage syndrome

-Latent nystagmus

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So why does CMN lead to esotropia? Because early in life, the visual system 'realizes' that the nystagmus is minimized (and thus acuity is maximized) when the eyes are converged.



Comitant Esotropia

Congenital (onset < age 6 m)

Acquired (onset > age 6 m)

With nystagmus

W/o nystagmus

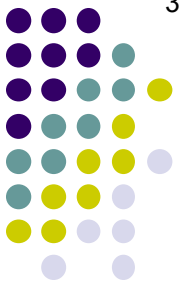
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Comitant Esotropia

Congenital (onset < age 6 m)

Acquired (onset > age 6 m)

With nystagmus

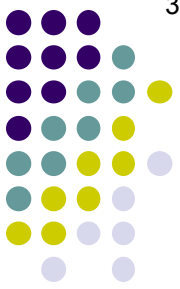
W/o nystagmus

-Nystagmus blockage syndrome

-**Latent nystagmus**

-Ciancia syndrome

Latent nystagmus is an interesting phenomenon in which no nystagmus is present when vision is binocular, but commences if/when one eye is occluded.



Comitant Esotropia

Congenital (onset < age 6 m)

Acquired (onset > age 6 m)

With nystagmus

W/o nystagmus

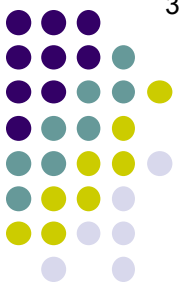
-Nystagmus blockage syndrome

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Ciancia syndrome

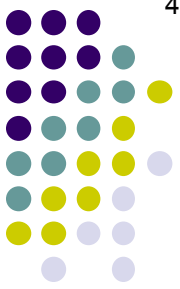
Ciancia syndrome has two features that give it away:
The first is, the ET is very large—usually 50Δ or more.
Second, the nystagmus intensifies if the pt attempts to abduct either eye.

Comitant Esotropia



Ciancia syndrome

Comitant Esotropia



Congenital (onset < age 6 m)

Acquired (onset > age 6 m)

With nystagmus

W/o nystagmus

Accommodative

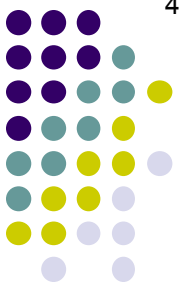
Nonaccommodative

— Nystagmus blockage syndrome

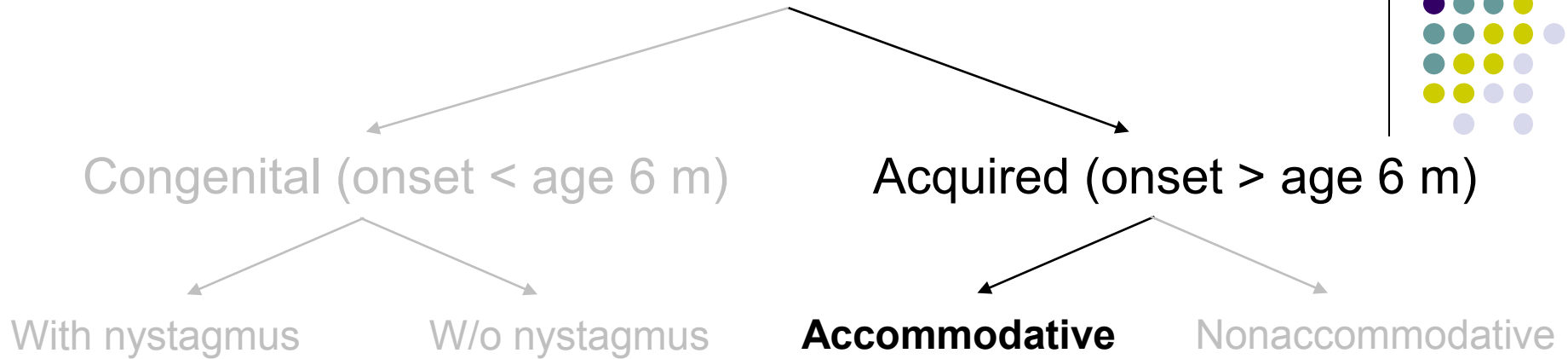
— Latent nystagmus

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Acquired ET is also divided into two groups:
Those that are *accommodative* in nature,
and those that are *nonaccommodative*

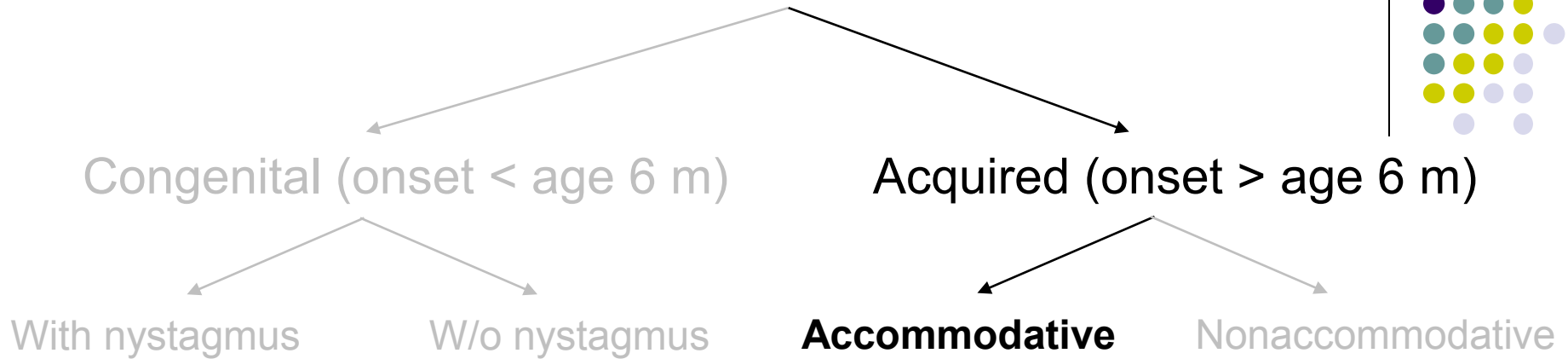
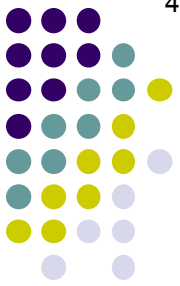


Comitant Esotropia



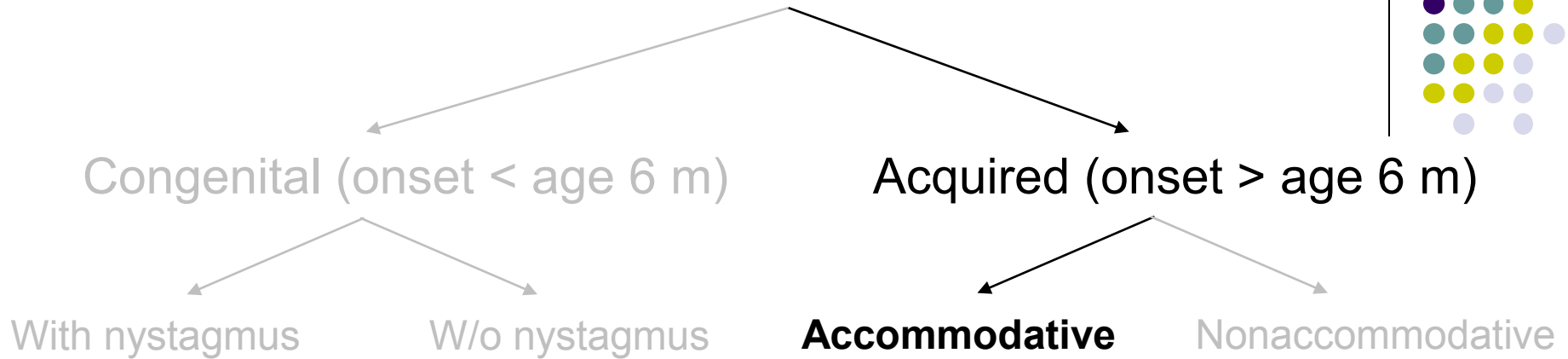
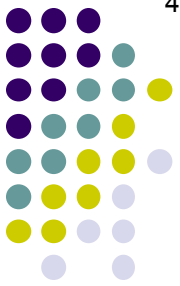
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Comitant Esotropia



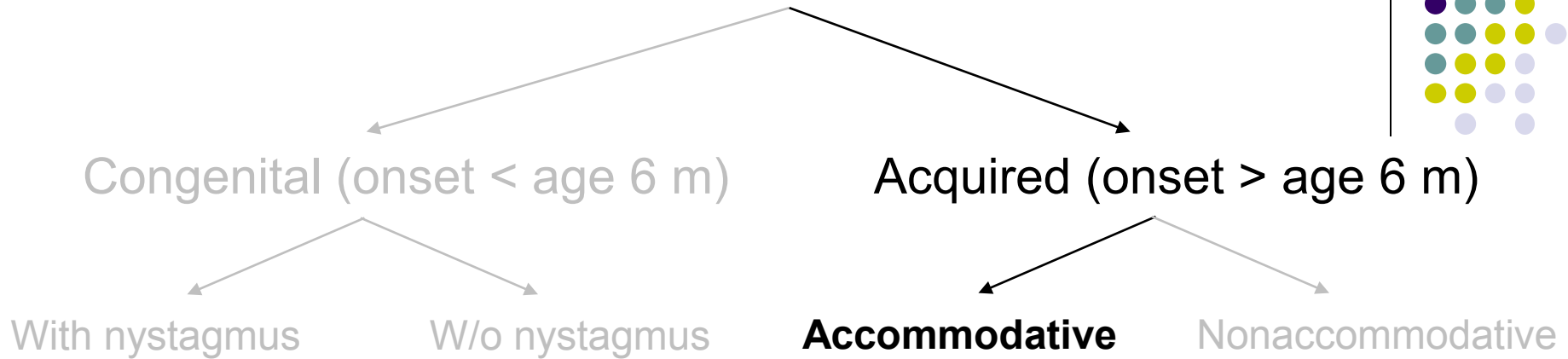
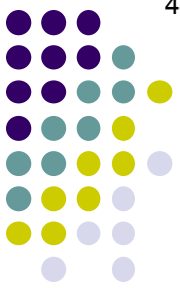
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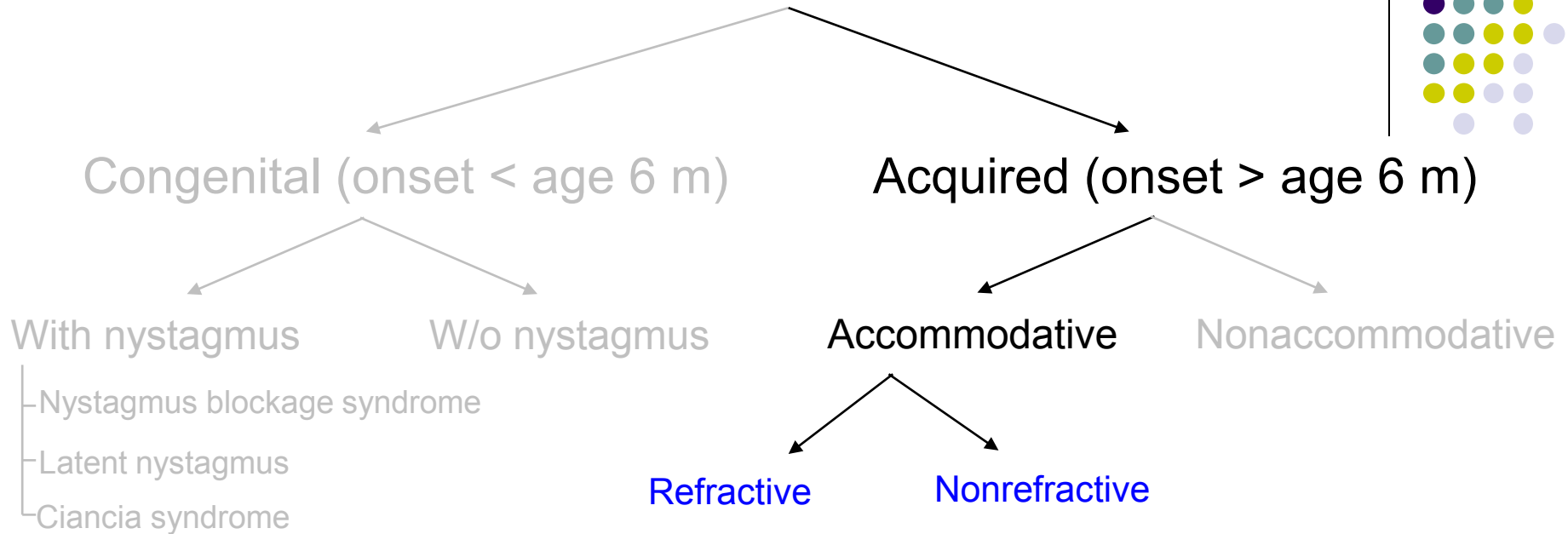
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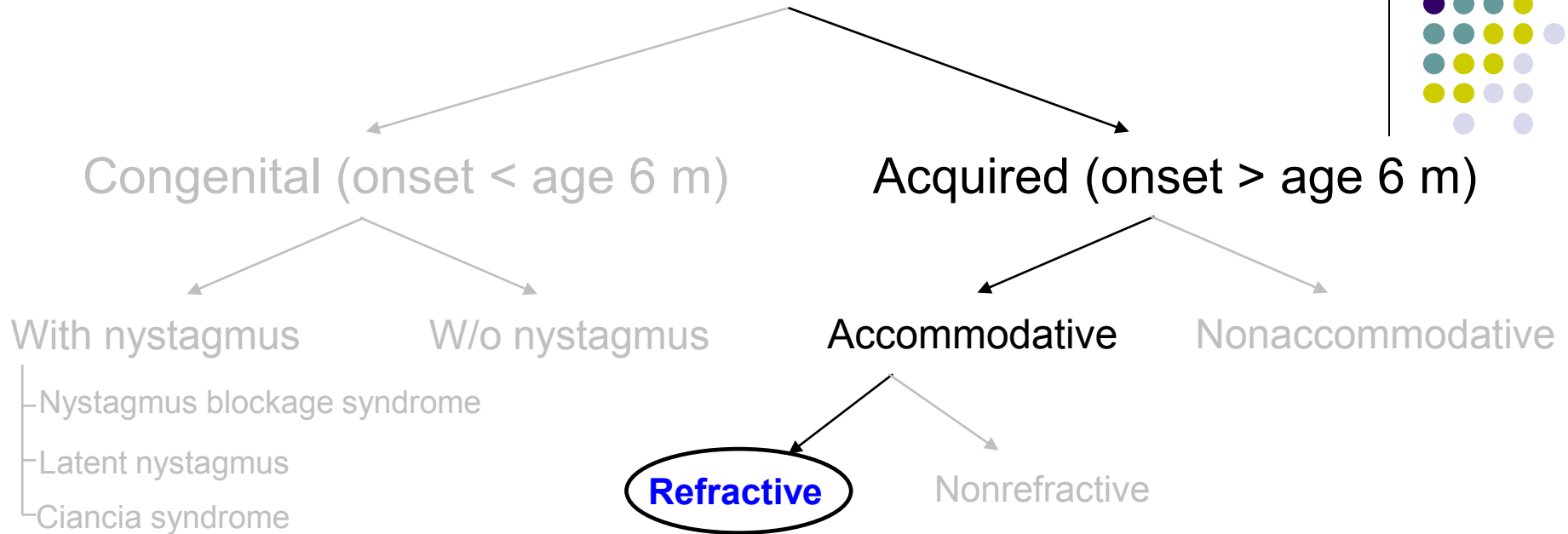
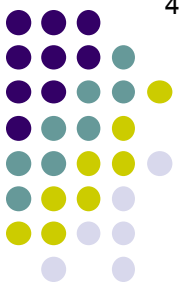
Accommodative ET typically arises around age 2-3 years. It is intermittent initially, eventually progressing to become constant. The child will often complain of diplopia at first, but stops after developing a facultative suppression scotoma. (A *facultative* suppression scotoma is one that is active only while the eye is deviated.) Amblyopia is common.

Comitant Esotropia



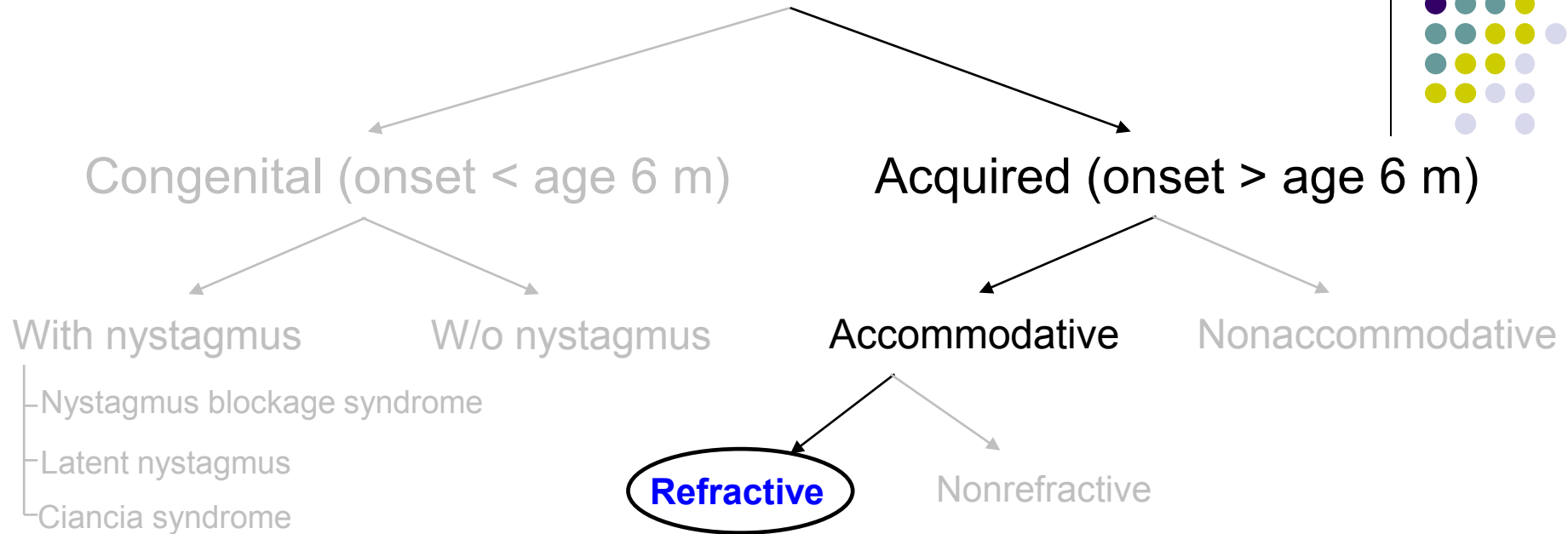
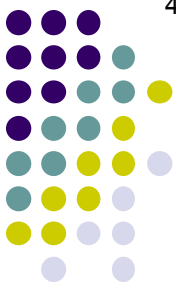
Accommodative ET is further divvied into two forms: *Refractive*, and ***Nonrefractive***

Comitant Esotropia

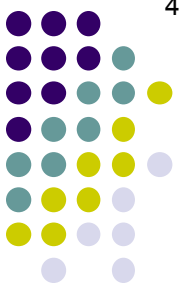


Refractive accommodative esotropia is pretty straightforward: It is due primarily to being a high hyperope (average ~4D). For these kids, the severe accommodative exertion required to overcome their hyperopia stimulates so much convergence (via the near reflex) that their divergence inputs get swamped, and their eyes turn in.

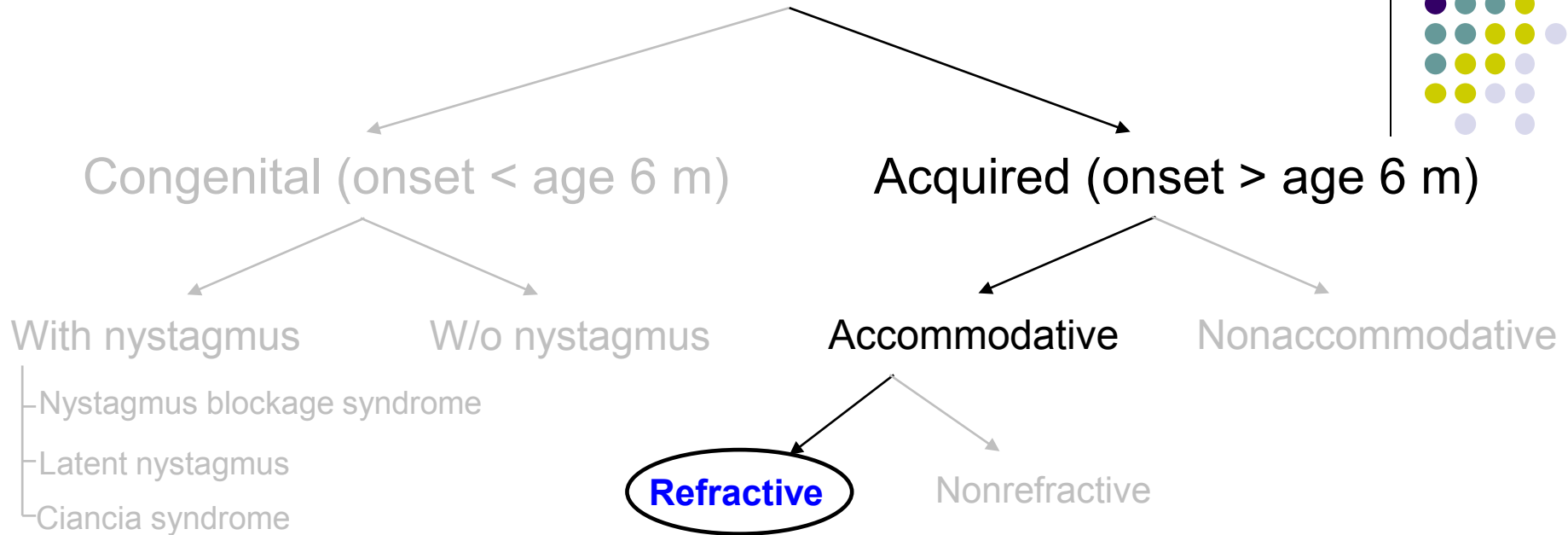
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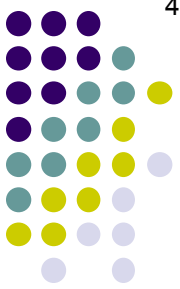


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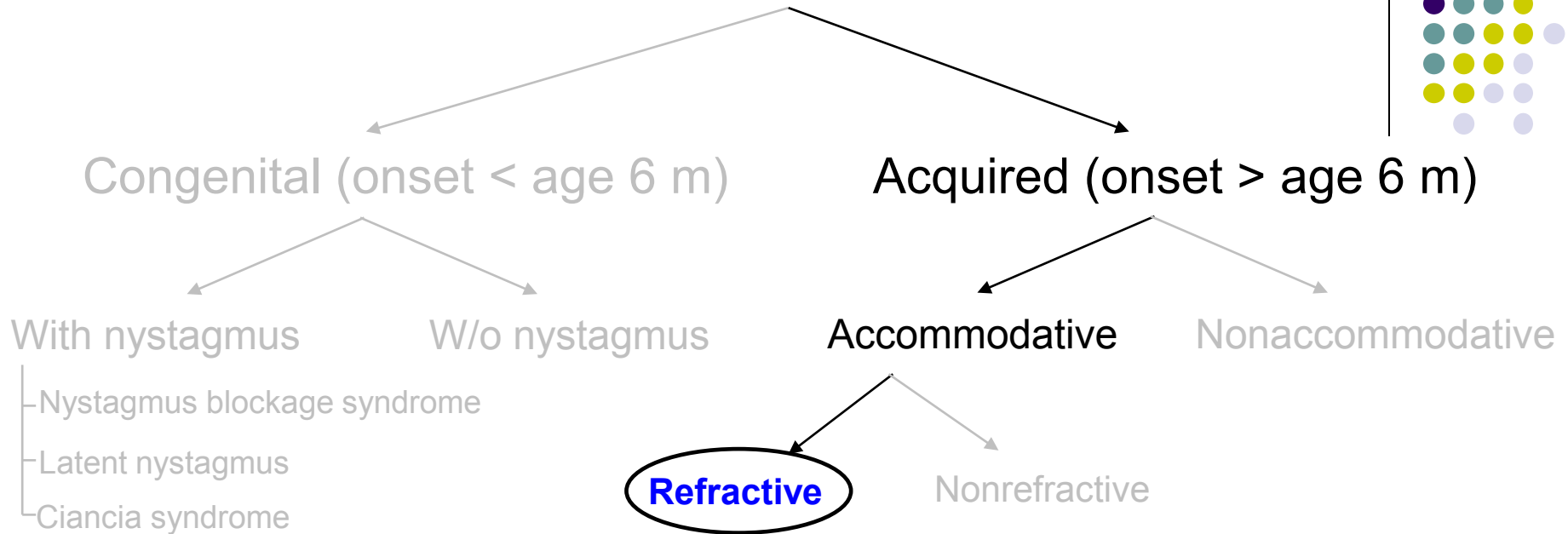


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Refractive accommodative ET is managed by prescribing the full cycloplegic refraction, which should eliminate the accommodation→convergence→ET chain at the source. If residual ET' is present, a bifocal should be employed.



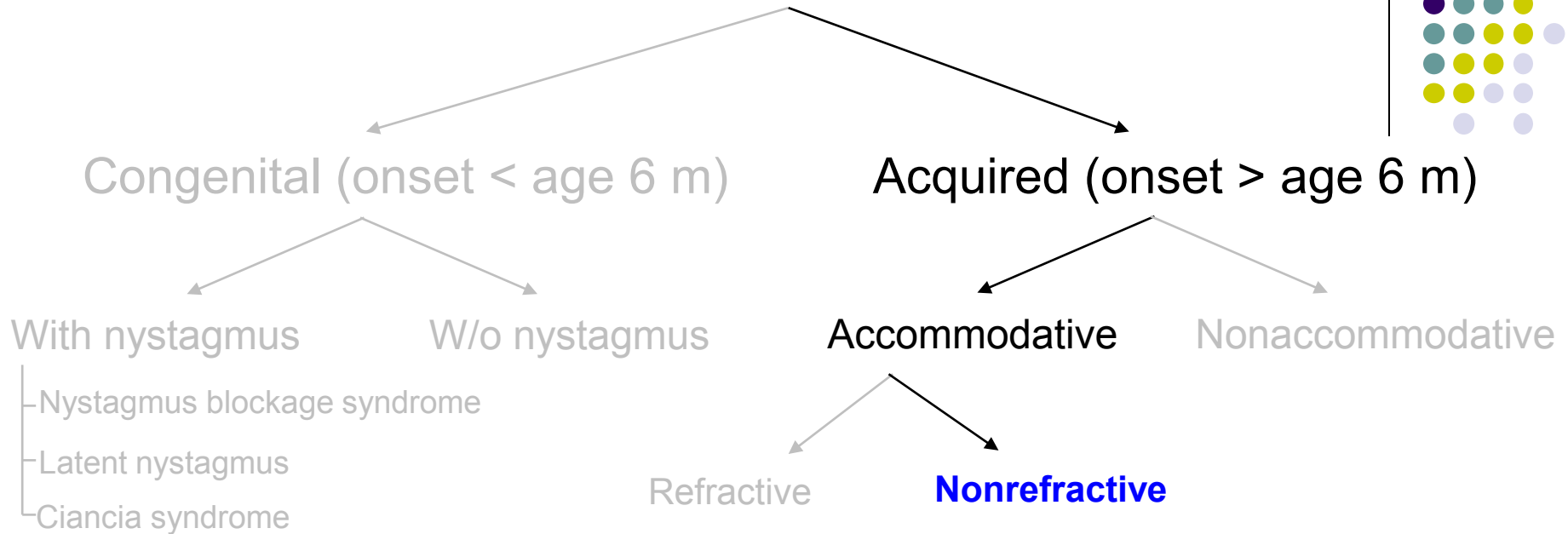
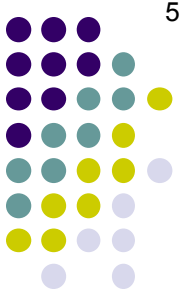
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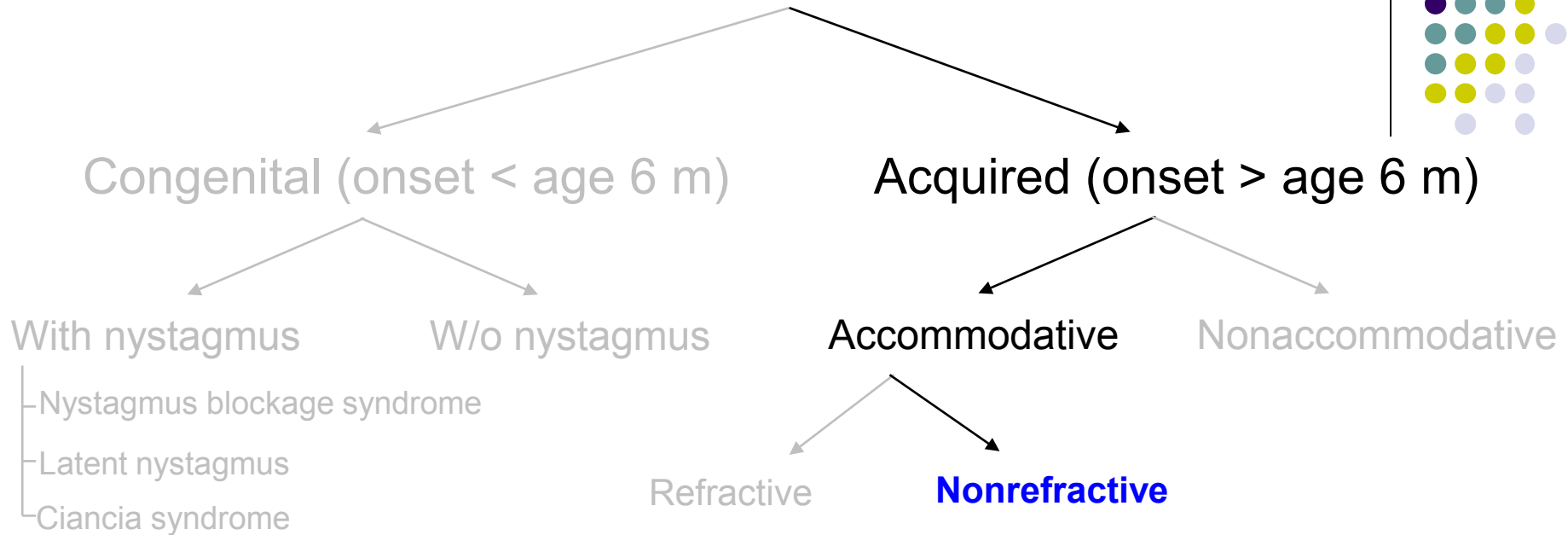
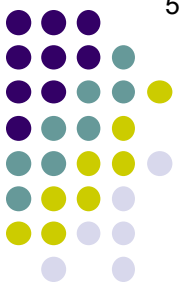
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Comitant Esotropia



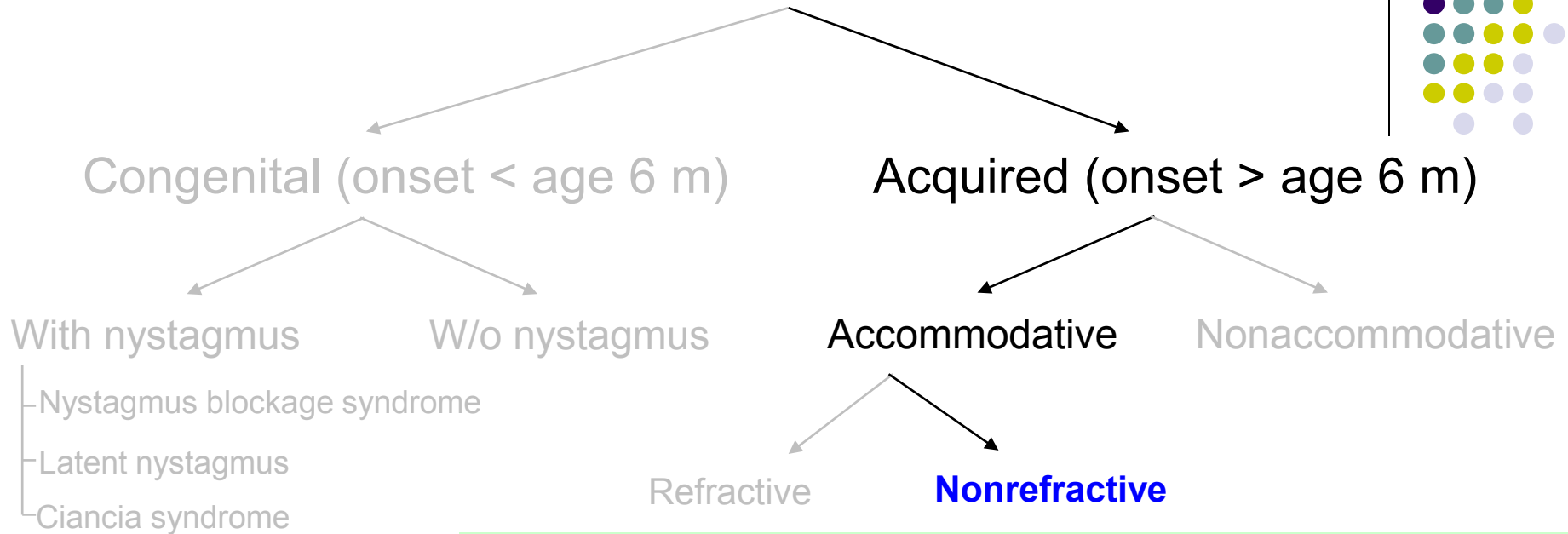
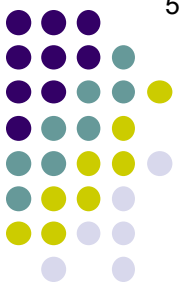
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Comitant Esotropia



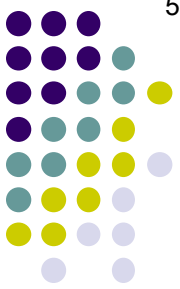
The mechanism underlying **nonrefractive accommodative esotropia** is less straightforward. As in its refractive cousin, nonrefractive accommodative esotropia is secondary to convergence induced by accommodation for which divergence inputs are insufficient to keep the eyes straight. However, the underlying issue is not one of high hyperopia per se, but rather of a clinical issue called a *high AC/A ratio*. Let's unpack this important concept.

Comitant Esotropia

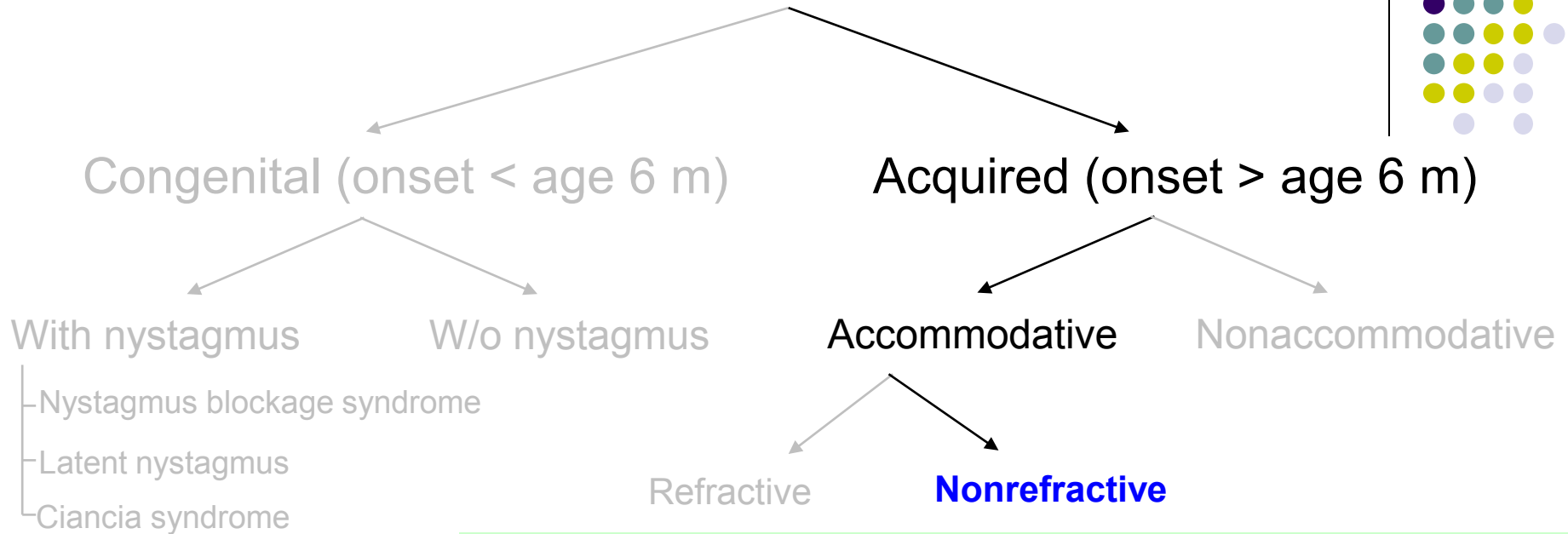


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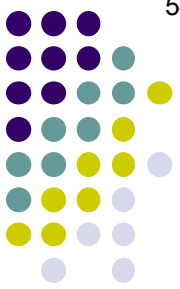


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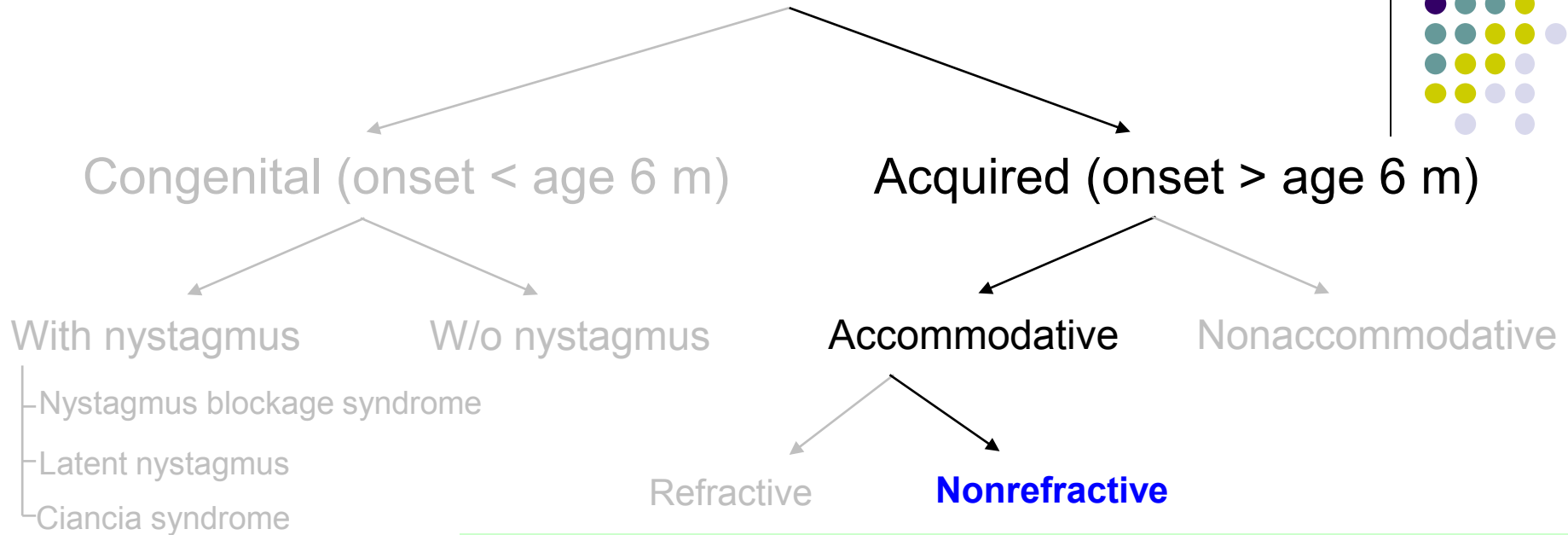


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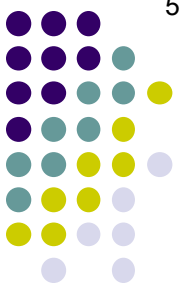


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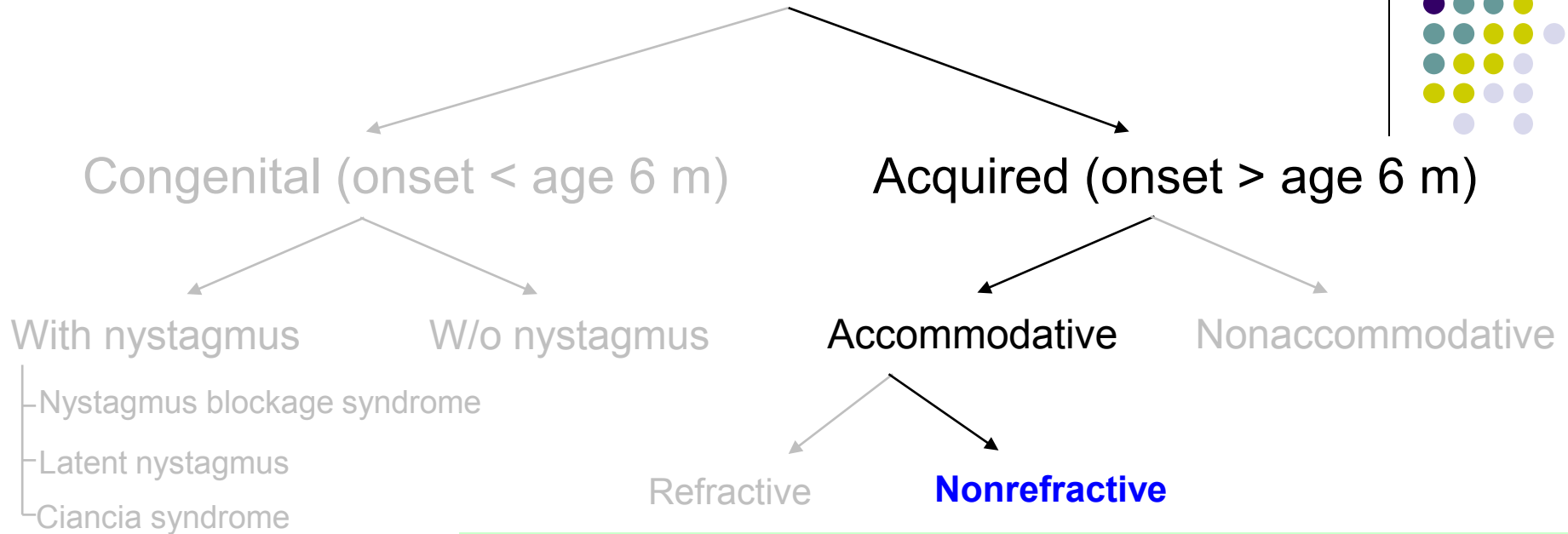


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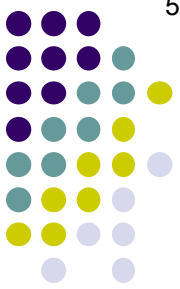


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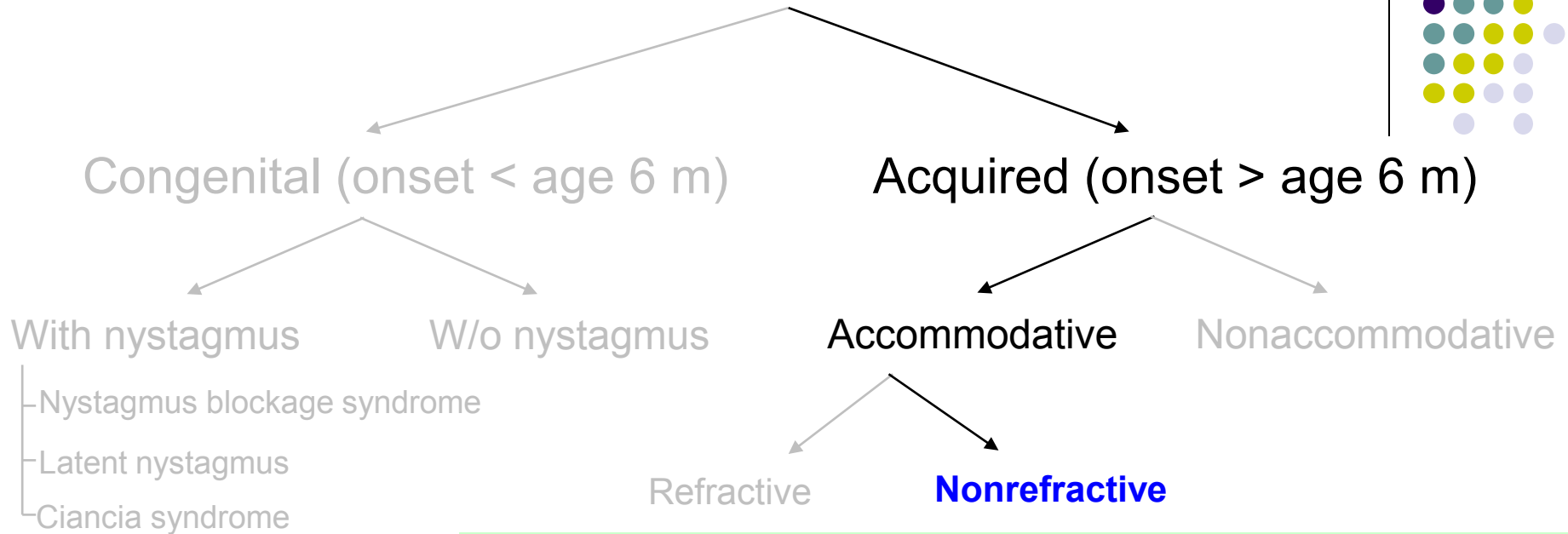


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Comitant Esotropia

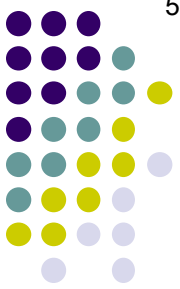


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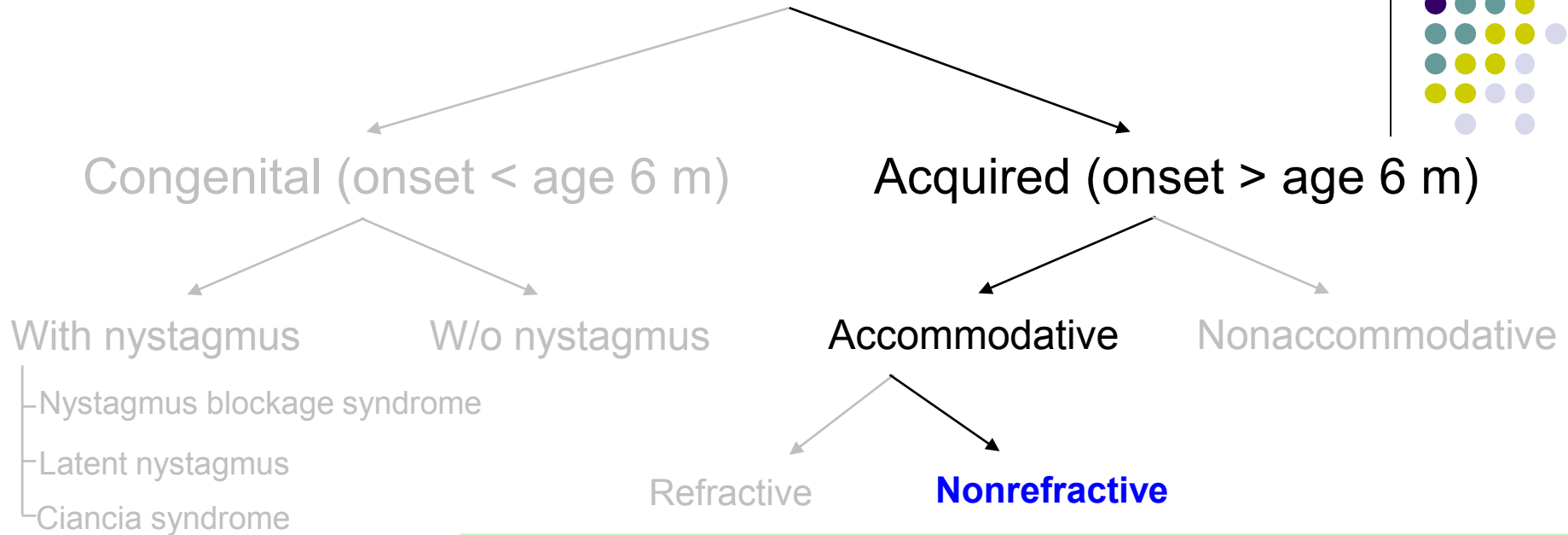
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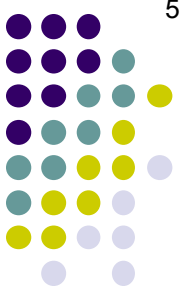


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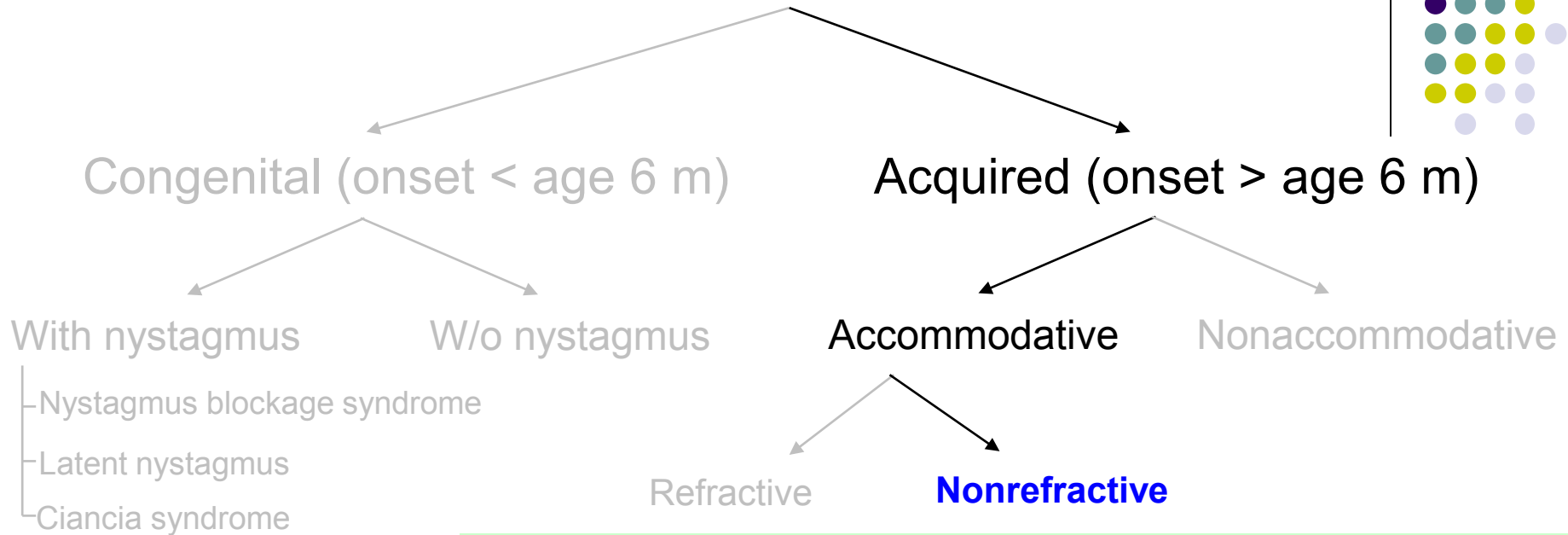
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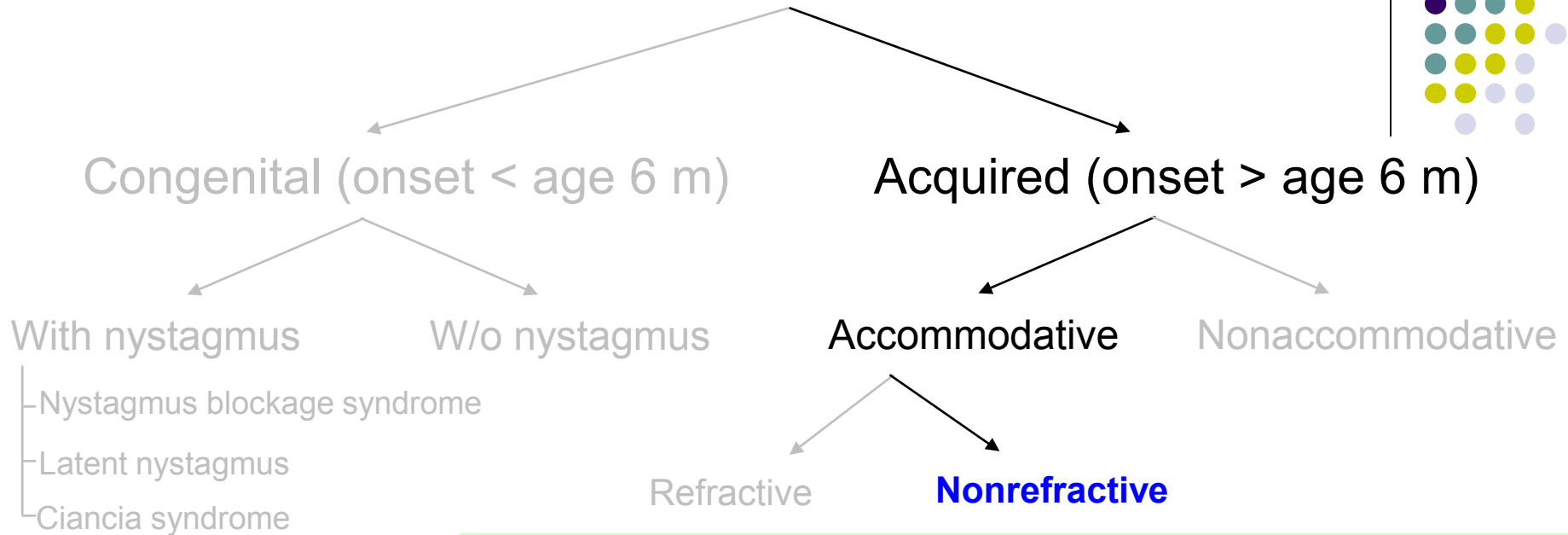
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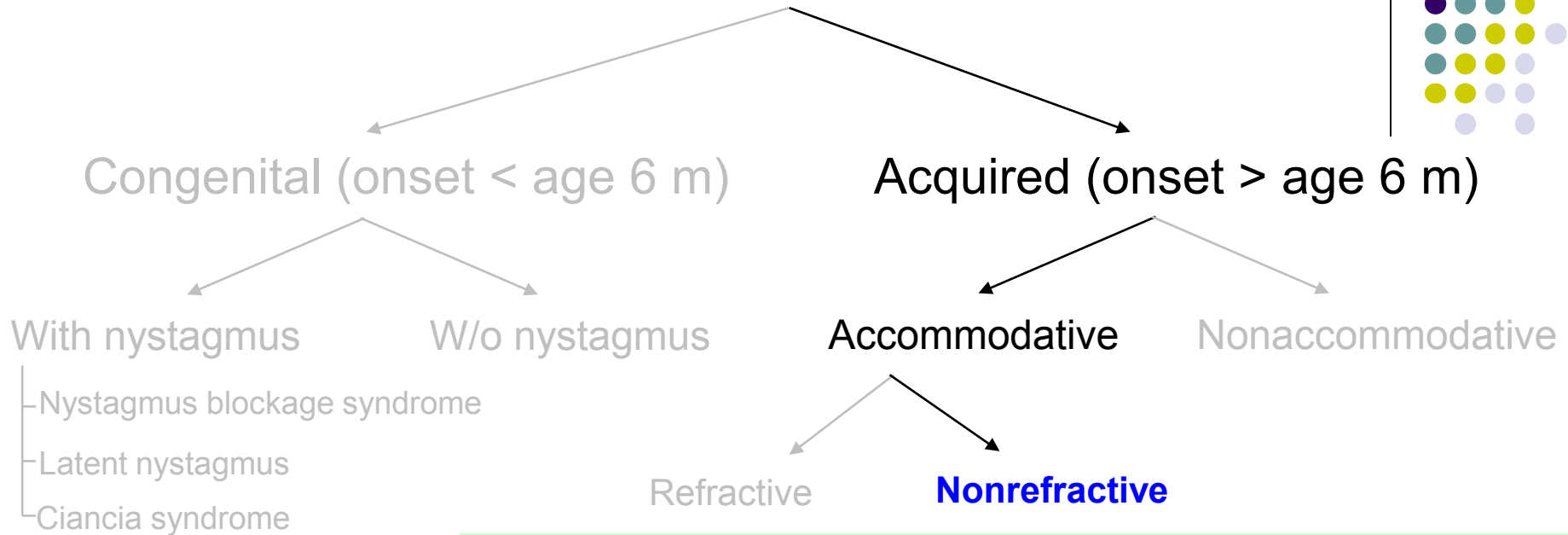
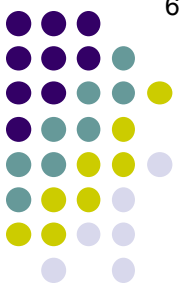
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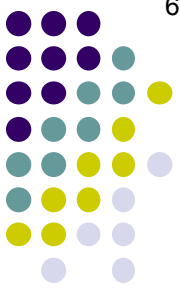


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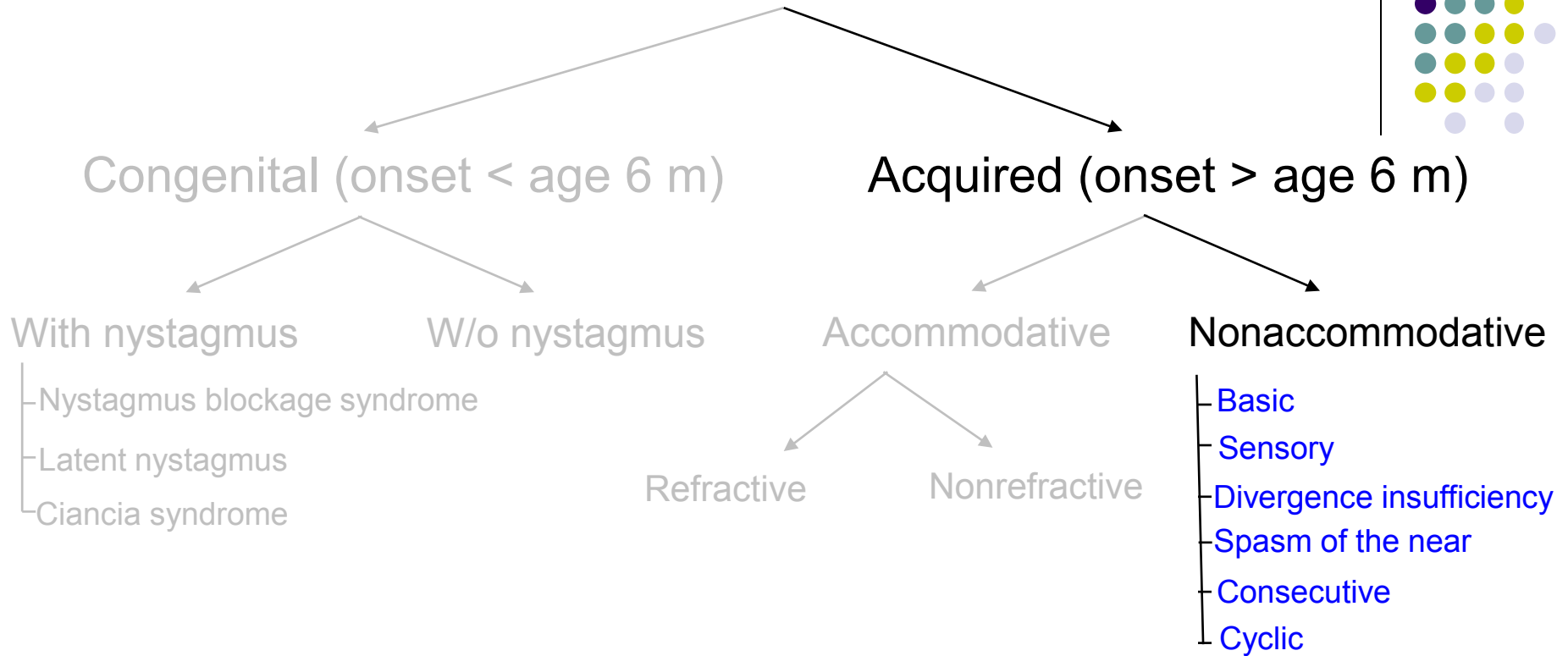
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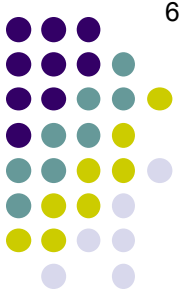
Recall that a key feature of magnitude of the ET was secondary to a high AC/A the more the child accommodates, the greater their ET will be. It follows that, because near vision requires more accommodation than does distance, $ET < ET'$ in high AC/A ratio esotropia. (Rule of thumb: ET' will be at least 10Δ greater than ET .)



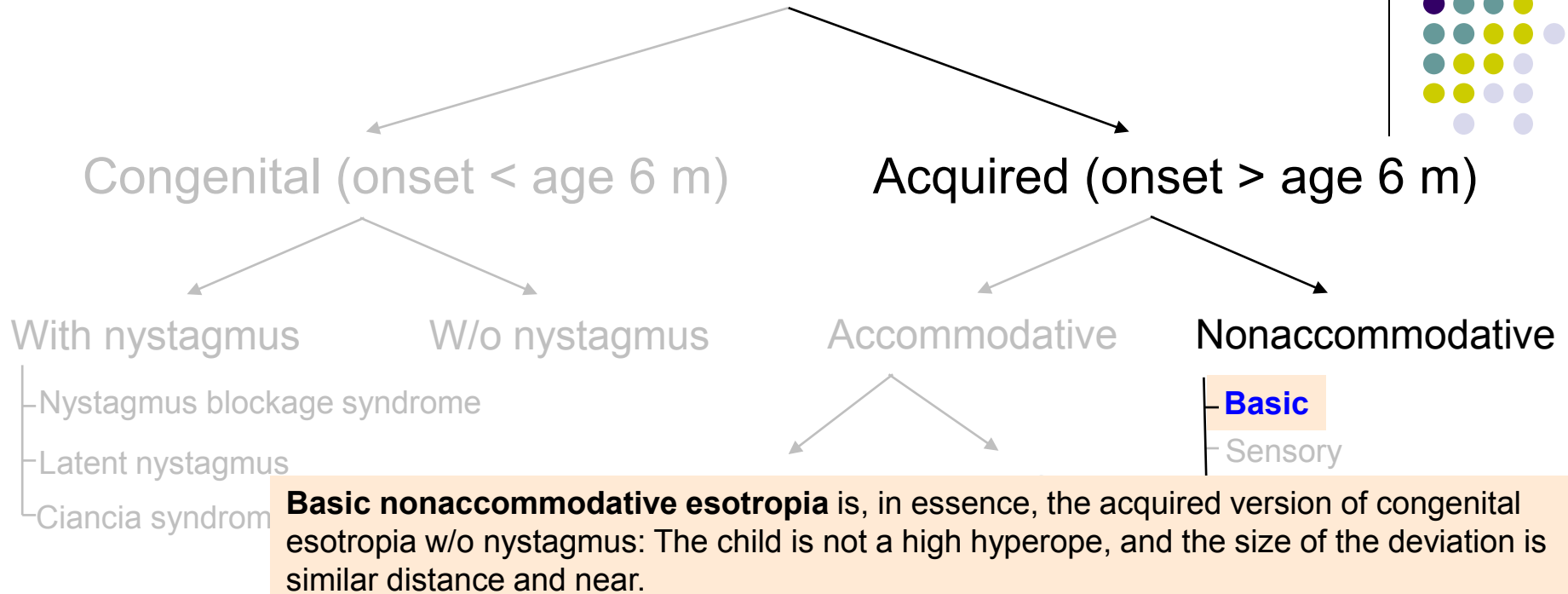
Comitant Esotropia

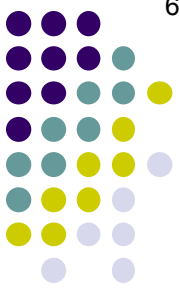


The *Peds* book discusses several forms of **acquired nonaccommodative esotropia**.

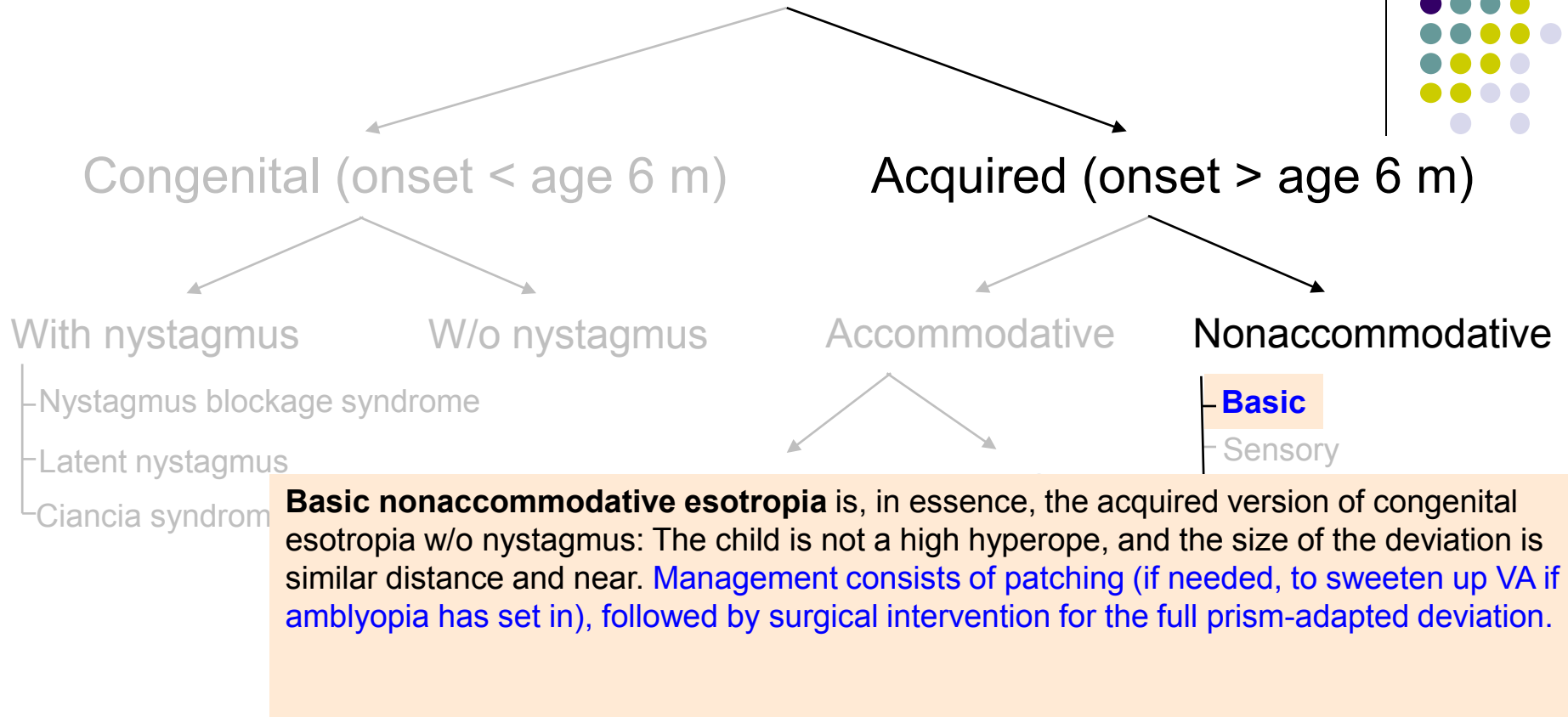


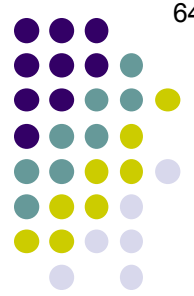
Comitant Esotropia



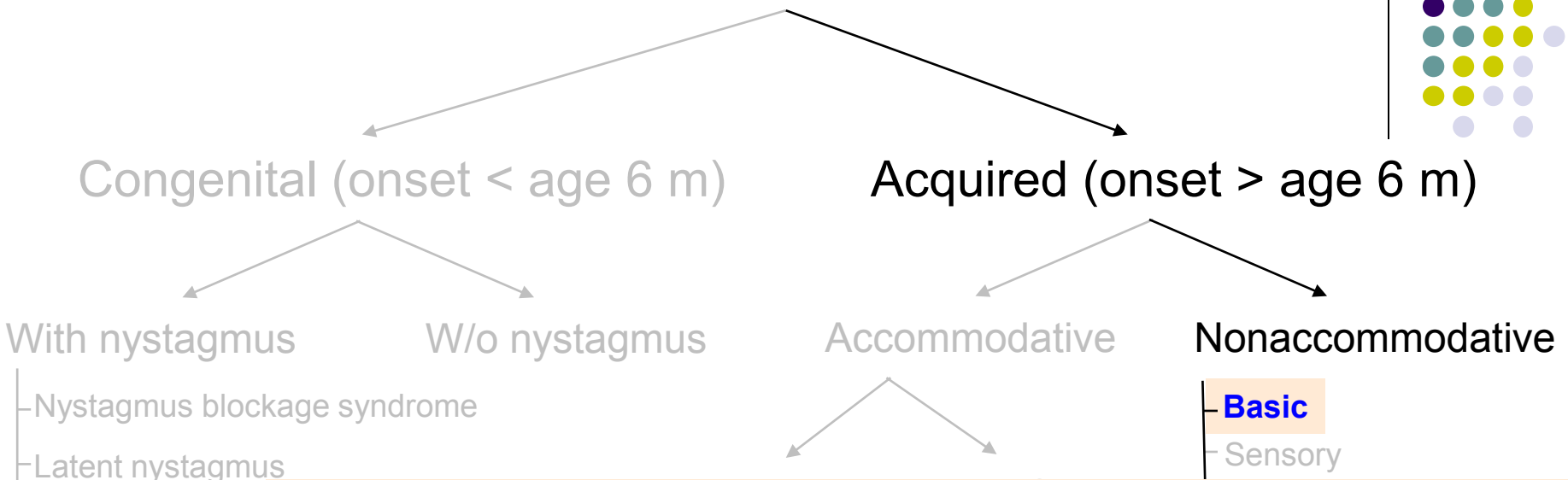


Comitant Esotropia





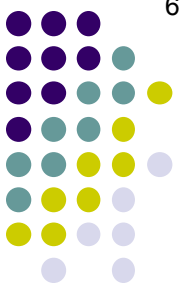
Comitant Esotropia



Prism adaptation is a process in which the pt is prescribed the full prism needed to nullify their ET, then re-evaluated periodically to determine whether additional ET has been 'uncovered.' If it has, the prescription is updated to nullify the additional ET.

Basic nonaccommodative esotropia is, in essence, the acquired version of congenital. The size of the deviation is needed, to sweeten up VA if prism-adapted deviation.

Comitant Esotropia



Congenital (onset < age 6 m)

Acquired (onset > age 6 m)

With nystagmus

W/o nystagmus

Accommodative

Nonaccommodative

-Nystagmus blockage syndrome

-Latent nystagmus

-Basic

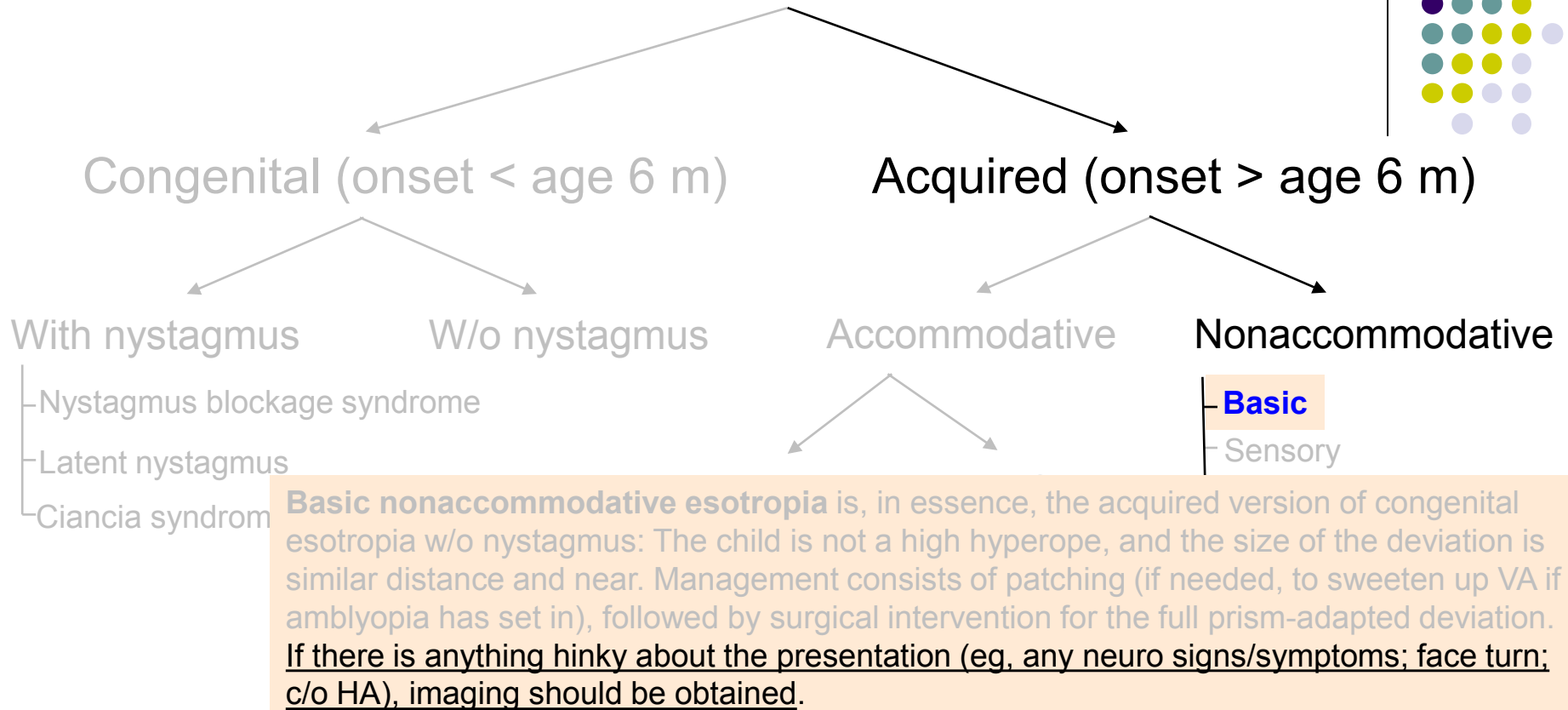
-Sensory

Prism adaptation is a process in which the pt is prescribed the full prism needed to nullify their ET, then re-evaluated periodically to determine whether additional ET has been 'uncovered.' If it has, the prescription is updated to nullify the additional ET. This is repeated until the prism prescription is stable, at which time surgery is performed to correct the full final prism prescription.

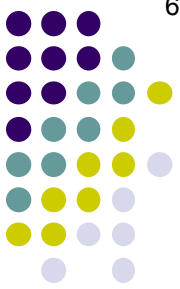
Basic nonaccommodative esotropia is, in essence, the acquired version of congenital. The size of the deviation is needed, to sweeten up VA if prism-adapted deviation.



Comitant Esotropia



Comitant Esotropia



Congenital (onset < age 6 m)

Acquired (onset > age 6 m)

With nystagmus

W/o nystagmus

Accommodative

Nonaccommodative

— Nystagmus blockage syndrome

— Latent nystagmus

— Ciancia syndrome

Refractive

Nonrefractive

— Basic

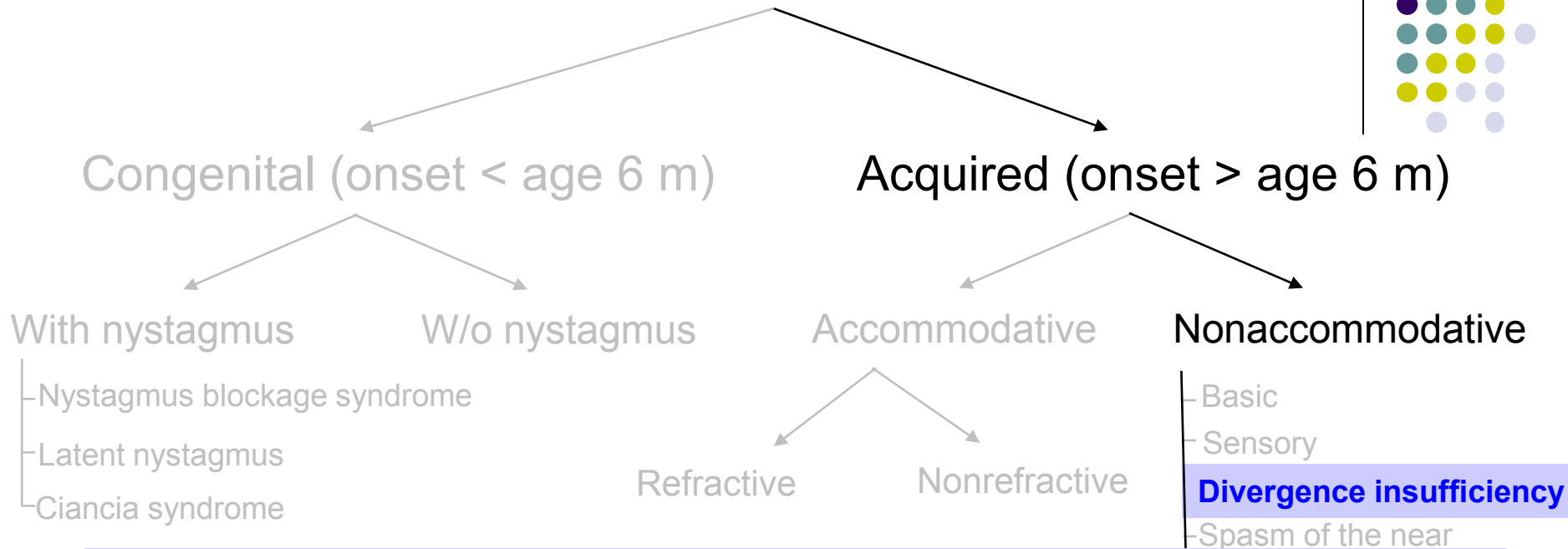
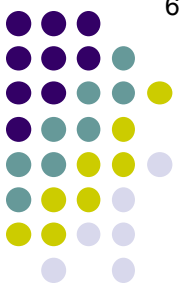
— **Sensory**

— Divergence insufficiency

— Spasm of the near

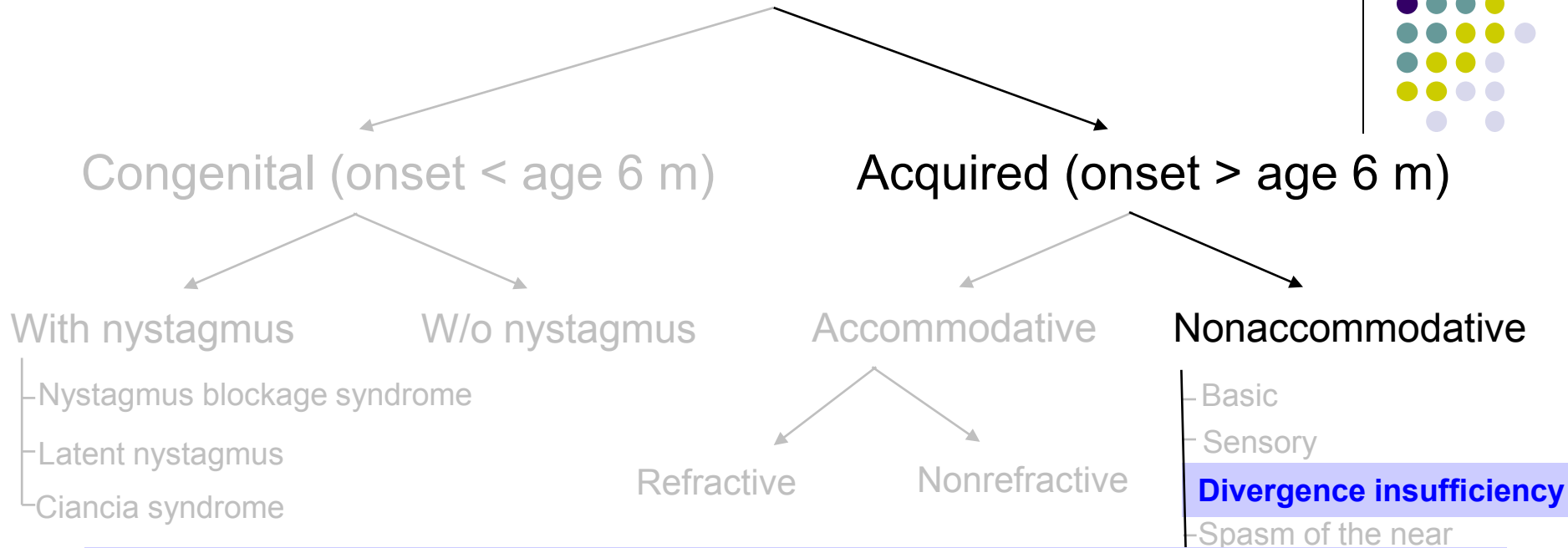
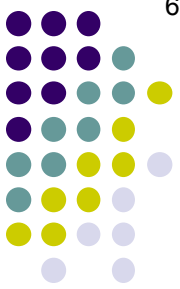
Sensory (aka *deprivational*) **nonaccommodative esotropia** develops in response to monocular vision loss. Common causes include cataracts, corneal clouding, and retinal or optic nerve disorders. The lack of symmetric visual stimulation leads to amblyopia, followed by a breakdown in fusion.

Comitant Esotropia



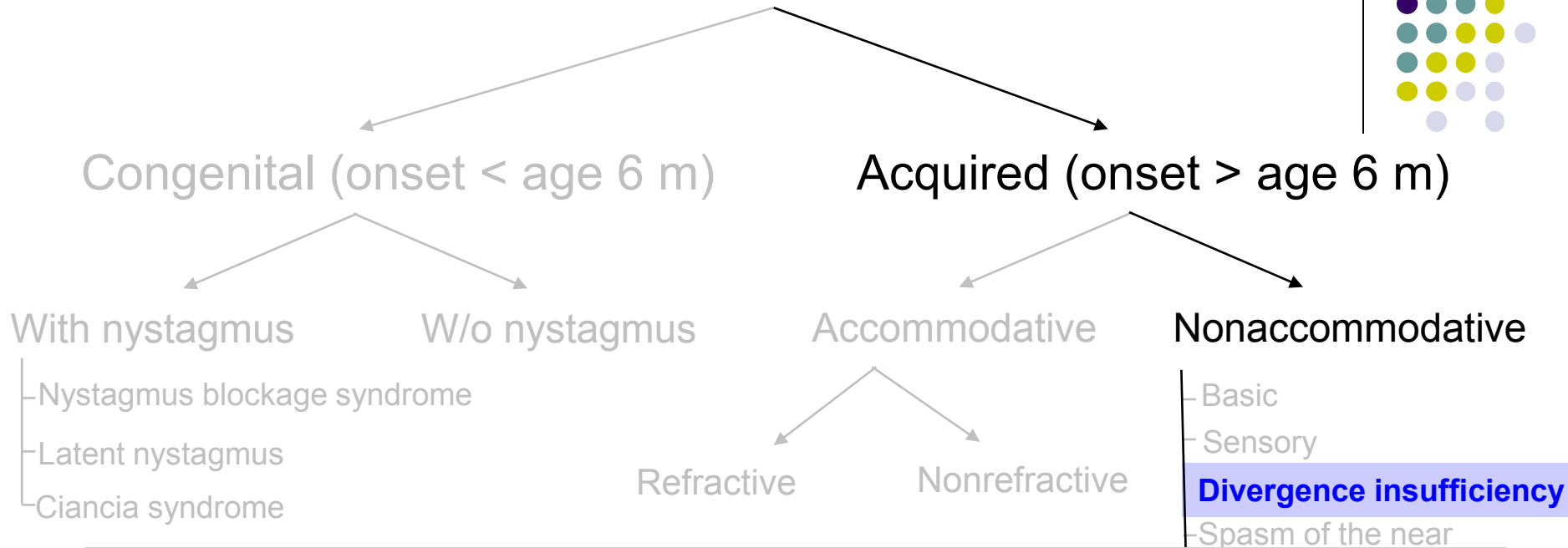
Earlier in this slide-set we mentioned supranuclear divergence inputs that prevent overconvergence. In **divergence insufficiency**, a lack of robustness on the part of these inputs allows the eyes to turn in a bit, resulting in a modest esotropia.

Comitant Esotropia



Earlier in this slide-set we mentioned supranuclear divergence inputs that prevent overconvergence. In **divergence insufficiency**, a lack of robustness on the part of these inputs allows the eyes to turn in a bit, resulting in a modest esotropia. The classic presentation is that of an esotropia that is present at distance, but not at near.

Comitant Esotropia



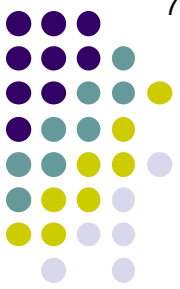
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Note that these conditions can be differentiated on the basis of the relative magnitude of the esotropia as a function of whether it is measured at distance vs near:

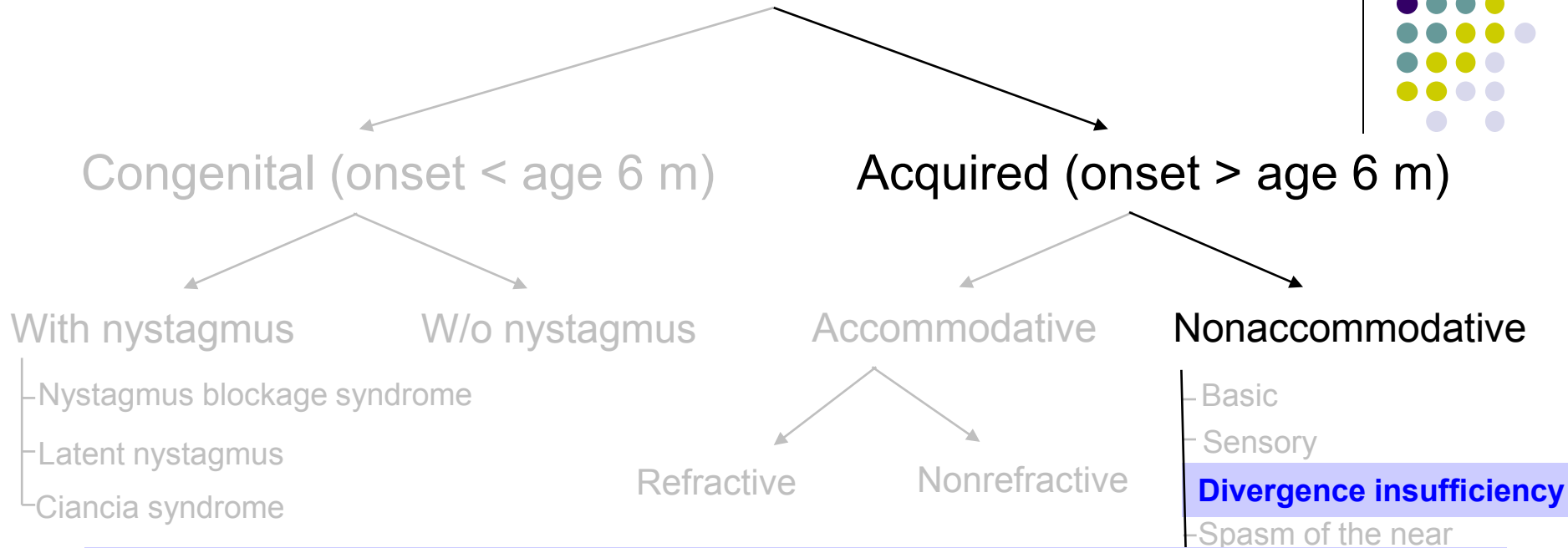
Accommodative refractive esotropia: $ET \approx ET'$

Accommodative nonrefractive (high AC/A ratio) esotropia: $ET < ET'$

Divergence insufficiency: $ET > ET'$

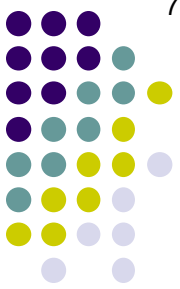


Comitant Esotropia



Earlier in this slide-set we mentioned supranuclear divergence inputs that prevent overconvergence. In **divergence insufficiency**, a lack of robustness on the part of these inputs allows the eyes to turn in a bit, resulting in a modest esotropia. The classic presentation is that of an esotropia that is present at distance, but not at near. The most common form of this develops in older individuals—hence its alternative name, *age-related distance esotropia*. In some pts, imaging reveals age-related structural changes to the EOMs or orbital ligamentous support structures. Prisms, Botox injection, and surgery have all proven safe and effective interventions.

Comitant Esotropia



Congenital (onset < age 6 m)

Acquired (onset > age 6 m)

With nystagmus

W/o nystagmus

Accommodative

Nonaccommodative

— Nystagmus blockage syndrome

— Latent nystagmus

— Ciancia syndrome

Refractive

Nonrefractive

— Basic

— Sensory

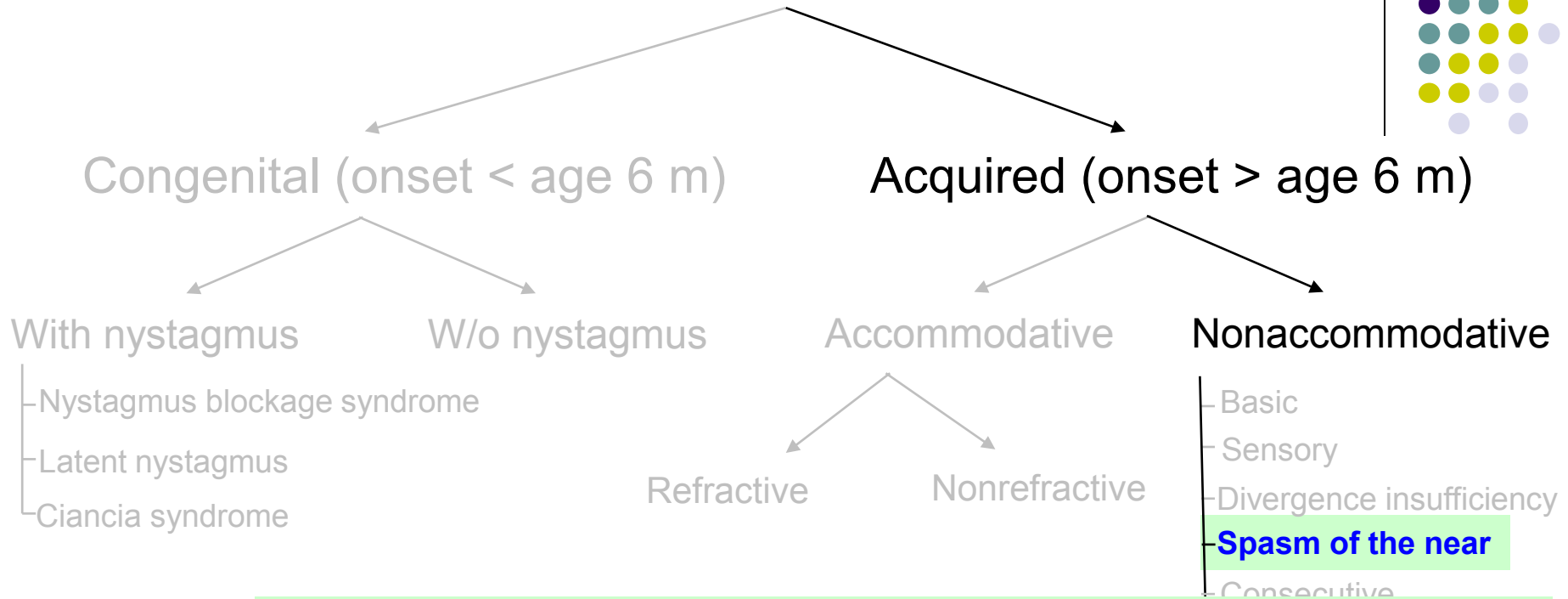
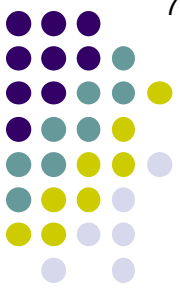
— Divergence insufficiency

— **Spasm of the near**

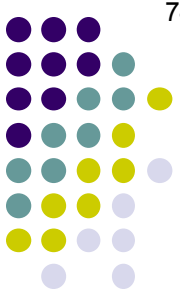
— Consecutive

Spasm of the near (aka *convergence spasm*) is almost always a functional response to psychosocial stressors. All three components of the near triad (convergence, miosis and accommodation) can usually be demonstrated. The esotropia may alternate with periods of orthotropia. Abduction will be poor or absent when the eyes are tested simultaneously, but full when tested monocularly.

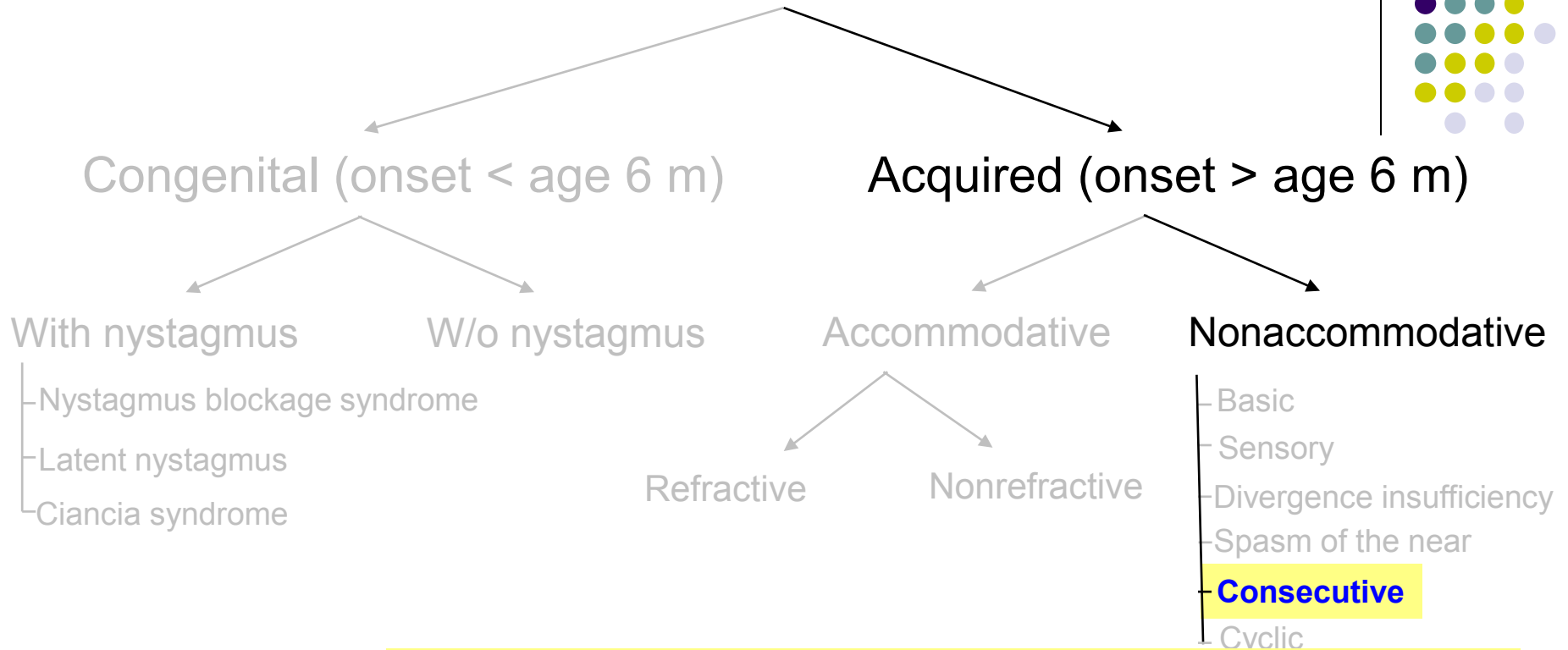
Comitant Esotropia



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Comitant Esotropia



Consecutive esotropia refers to esotropia that develops in someone with a history of exotropia. In almost all cases, consecutive esotropia is post-surgical, ie, it represents an apparent overcorrection in someone who underwent strab surgery for exotropia.

Comitant Esotropia



Congenital (onset < age 6 m)

Acquired (onset > age 6 m)

With nystagmus

W/o nystagmus

Accommodative

Nonaccommodative

- Nystagmus blockage syndrome
- Latent nystagmus
- Ciancia syndrome

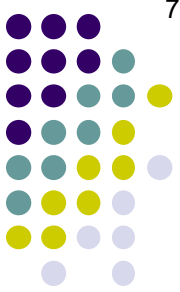
Refractive

Nonrefractive

- Basic
- Sensory
- Divergence insufficiency
- Spasm of the near
- **Consecutive**
- Cyclic

Consecutive esotropia refers to esotropia that develops in someone with a history of exotropia. In almost all cases, consecutive esotropia is post-surgical, ie, it represents an apparent overcorrection in someone who underwent strab surgery for exotropia. That said, consecutive esotropia often resolves spontaneously, so unless it is very large (in which case it likely represents a slipped/lost muscle), observation is usually the preferred management option.

Comitant Esotropia



Congenital (onset < age 6 m)

Acquired (onset > age 6 m)

With nystagmus

W/o nystagmus

Accommodative

Nonaccommodative

— Nystagmus blockage syndrome

— Latent nystagmus

— Ciancia syndrome

Refractive

Nonrefractive

— Basic

— Sensory

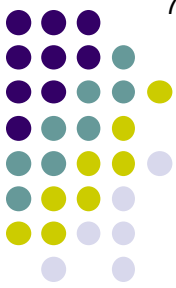
— Divergence insufficiency

— Spasm of the near

— Consecutive

— **Cyclic**

Cyclic esotropia is a rare disorder in which a comitant ET is present intermittently, usually every other day. The typical pt is pre-school age. Surgical correction of the maximum observed ET is the treatment of choice.



That's it! Go through this slide-set a couple of times (at least) until you feel like you have a handle on it. **When you're ready, do slide-set P5, which covers this material in a Q&A format (and more detail).**