

Sleep in Autism

IACC Workshop on Under-Recognized Co-Occurring Conditions

Beth A. Malow, M.D., M.S.

Burry Chair in Cognitive Childhood Development

Professor of Neurology and Pediatrics

Director, Sleep Disorders Division

Vanderbilt University



Have you seen this child?

- Alex is a 6-year-old boy with autism spectrum disorder (ASD). He takes hours to fall asleep. His parents state that “he can’t shut his brain down.” He drinks Mountain Dew with dinner, and plays video games after dinner. He can’t settle down to go to sleep and leaves his room repeatedly to find his parents.
- Once asleep, he awakens multiple times during the night. Sometimes he awakens his parents. Other times he wanders around the house, goes to the kitchen to eat, and falls asleep in a different room.
- It is “nearly impossible” to awaken Alex in the morning for school. His parents are exhausted and very overwhelmed. Alex’s teacher describes him as being hyperactive and disruptive in class.

Framing Questions

- What do we know about sleep in autism?
- What is the evidence linking biological causes of sleep disturbance with features of ASD?
- What do we need to learn in order to treat sleep disturbance in ASD? What are the gaps? What are the opportunities?
- What autism-specific features affect proper diagnosis and treatment?

What Have We Learned?

- High prevalence of parent-reported sleep concerns in ASD, across cognitive levels.
 - Courturier (2005): **78% ASD** (TD 26%)
 - Krakowiak (2008): **53% ASD** (DD 46%, TD 32%)
 - Souders (2009): **66% ASD** (TD 45%)
- Sleep disturbance associated with child behavior/family functioning
- Insomnia is the most prevalent sleep disturbance
 - ✓ Prolonged time to fall asleep
 - ✓ Preference for delayed bedtime (older children)
 - ✓ Bedtime resistance (younger children)
 - ✓ Increased arousals and awakenings
 - ✓ Decreased sleep duration

Reynolds AM & Malow BA. (2011), Richdale AL & Schreck KA. (2009)

What Have We Learned?

- ✓ Multiple causes of insomnia; many are treatable.
- ✓ Medical (GI) & Neurological (epilepsy)
- ✓ Psychiatric: Anxiety, bipolar disorder, depression, obsessive compulsive or ADHD symptomatology
- ✓ Medications: Serotonin reuptake inhibitors, stimulants, some antiepileptic drugs
- ✓ Other Sleep Disorders: Obstructive sleep apnea, parasomnias, restless legs syndrome
- ✓ Behavioral: poor sleep habits...and also features related to ASD such as difficulty with transitions and sensory sensitivities.
Exhausted parents may think poor sleep is part of autism and be unaware that behavioral approaches can help.
- ✓ Other causes related to ASD: Neurotransmitter abnormalities, including in melatonin pathway, possibly GABA and serotonin

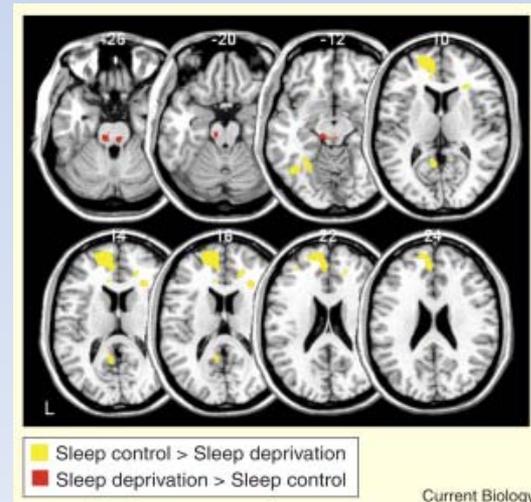
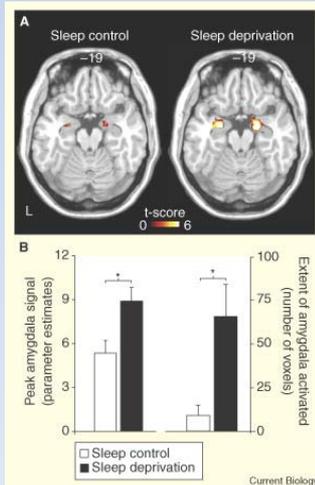
Framing Questions

- What do we know and what have we learned about sleep in autism?
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Biology of Sleep Disturbance and ASD: Emotional Regulation

Sleep deprivation affects the neural circuitry underlying emotional regulation, including connectivity of the amygdala and prefrontal cortex. (reviewed in Maski, 2013). This abnormal connectivity also exists in ASD.

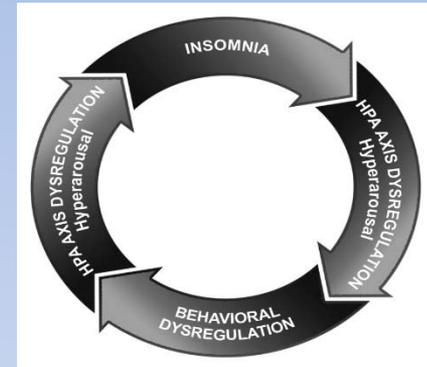
- ✓ An fMRI study in which sleep-deprived healthy adult participants were compared with those who had slept showed increased amygdala activation after viewing images that were emotionally aversive. (Yoo, 2007)
- ✓ In addition, the functional connectivity was stronger between the medial-prefrontal cortex and the amygdala in the sleep control group, and the autonomic brainstem regions and the amygdala in the sleep deprived group.



Biology of Sleep Disturbance and ASD: Arousal Dysregulation

➤ Arousal dysregulation (hyperarousal) may tie together several features of ASD (Mazurek, 2013)

- ✓ Anxiety
 - ✓ Sensory over-responsivity
 - ✓ Functional GI problems
- Insomnia?



➤ Dysregulation of the hypothalamic-pituitary-adrenal (HPA) axis occurs in both insomnia and ASD, in association with daytime stressors (Buckley, 2005 and Corbett, 2008 and 2009).

➤ Studies of autonomic function provide additional evidence for hyperarousal (elevated baseline heart rate; Kushki, 2013)

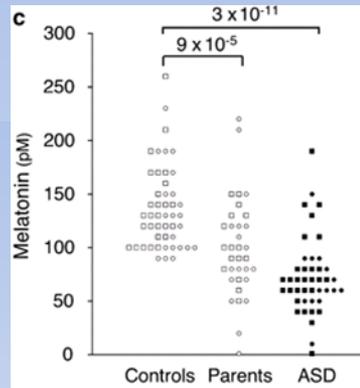
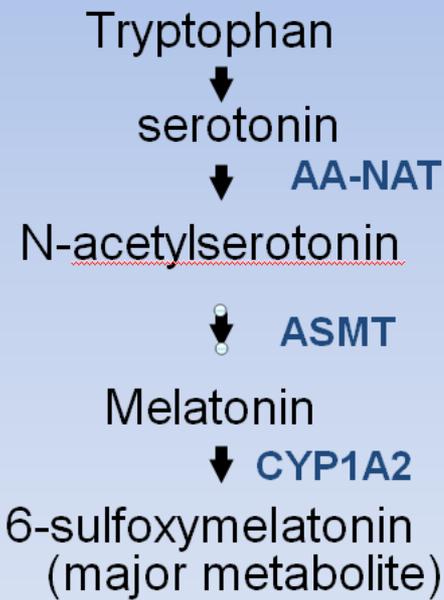
➤ Insomnia treatment studies designed to target hyperarousal provide an opportunity to measure biological markers of autonomic and HPA dysfunction

Biology of Sleep Disturbance and ASD: Melatonin

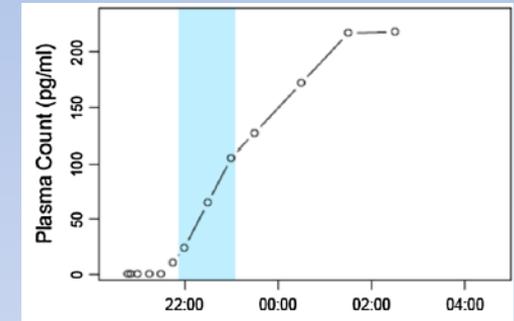
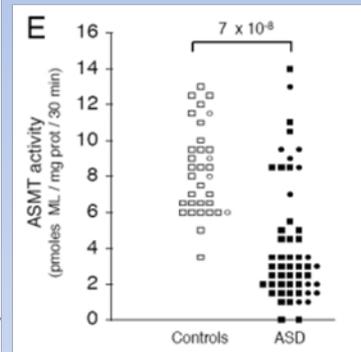
- Endogenous melatonin, produced by the pineal gland, promotes sleep and stabilizes circadian rhythms through actions on receptors of the SCN. (Pandi-Perumal, 2006)
- Apart from hypnotic and circadian properties, melatonin inhibits ACTH responses in the human adrenal gland. (Campino, 2011)
- Melatonin processing appears to be altered in ASD.

Biology of Sleep Disturbance and ASD: Melatonin

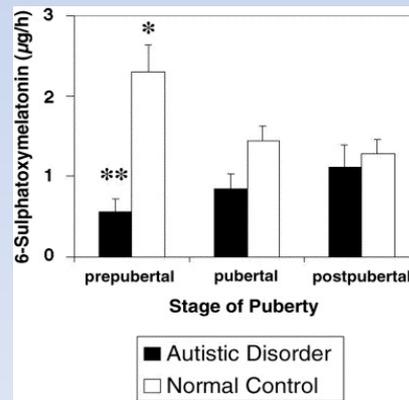
Examine melatonin synthesis and degradation pathways with both biochemical and molecular approaches



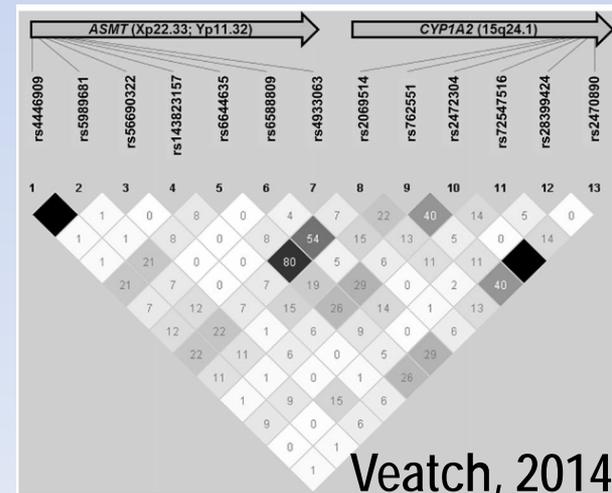
Melke, 2008



Goldman, 2014



Tordjman, 2005



Veatch, 2014

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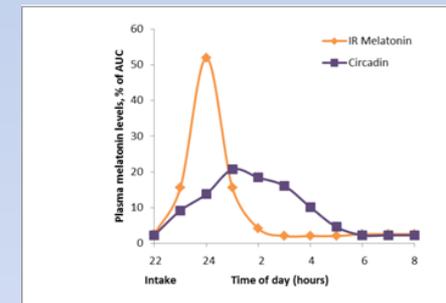
Gaps and Opportunities in Treatment

Autism Speaks Autism Treatment Network (AS ATN) Practice Pathway for Management of Insomnia– Supplement in *Pediatrics* (Malow, 2012)

- ✓ Clinicians need to ask about sleep.
- ✓ Medical co-occurring conditions need to be identified and treated.
- ✓ Behavioral sleep education works (Vriend, 2011; Malow, 2014)
(and also improves child behavior and family functioning)
- ✓ Limited studies of sleep medications for ASD; none FDA-approved.

Under study:

- ✓ Melatonin agonists
(Tasimelteon®, Vanda Pharmaceuticals)
- ✓ Prolonged release melatonin minitabket preparations that children can easily swallow
(Circadin®, Neurim Pharmaceuticals)

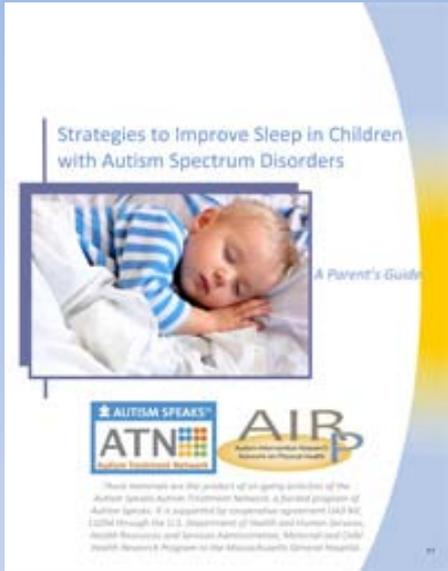


Zisapel, 2010

Measures of baseline sleep status and treatment response

- ✓ Polysomnography
- ✓ Actigraphy
- ✓ Sleep Questionnaires and Diaries

Autism Speaks Autism Treatment Network Toolkits



Sleep Strategies for Teens with Autism Spectrum Disorder



A Guide for Parents

Sleep Tips for Children with Autism who have Limited Verbal Skills

Ideas in the sleep toolkit may help all children with autism. Here are other ideas that might help children who are nonverbal or have minimal verbal skills. It may also help to be extra aware of your child's sensory needs. What may be calming to one child may be exciting to another. Watch how your child behaves when you try different ideas. You may need to use trial and error to learn what works best for your child.

During the Day:

- Help your child get plenty of natural light and exercise. Here are some ideas:
 - Play games such as wheelbarrow walking, crab walking, seat scoots, and tug of war.
 - Carry heavy objects (such as groceries, a backpack filled with heavy items).
 - Pull or push a wagon or cart filled with heavy items.
 - Squeeze objects that provide resistance (a balloon filled with flour or corn starch, a stress ball, play dough, or silly putty).

Before Bed:

- Try to engage your child in relaxing activities at least an hour before bedtime. These might involve movement, touch, sound, vision, smell, or taste:
 - Rocking and Swinging
 - Snuggling
 - Massaging
 - Reading
 - Listening to music
 - Calming scents
 - Eating a light snack
 - Wearing a weighted vest
 - Chewing gum, vinyl tubing, or crunchy/chewy food
 - Keeping the lights down low

In the Bedroom:

- Make sure bedtime clothing is comfortable.
 - Use sheets and blankets with fabrics that your child likes.
 - Arrange blankets to provide the right amount of pressure for your child. Consider using a weighted blanket, a sleeping bag, large stuffed animals, or body pillows.
 - Think about using an air mattress, foam mattress, or a bed tent.
 - Night lights may be calming.
 - White noise (such as a fan) may be helpful; it should stay on all night if it is on at bedtime.

Sample Images for Visual Schedule

<p>Take a bath</p>	<p>Take a shower</p>	<p>Wash hair</p>
<p>Put on pajamas</p>	<p>Brush teeth</p>	<p>Get a drink</p>
<p>Go to the bathroom</p>	<p>Go to bed</p>	<p>Go to sleep</p>

Sample Images for Bedtime Pass



Schedule Boards:

Some children are not able to use a visual schedule that uses words, photos, or icons. It may help to use objects instead.

Here's an example: Here is how to use an object board. A sample bedtime routine might include using the toilet, taking a bath, washing hair, brushing hair, getting a massage, and listening to music. You would then put the following items near the bathroom or bedroom: a roll of toilet paper, a bar of soap, a bottle of shampoo, a hairbrush, a bottle of lotion, and a CD. Your child would get each object before the start of an activity and use this to guide his or her actions. It may be helpful to save a special object just for bedtime. This might be a special blanket, pillow, or stuffed animal. Once your child has this favored object, he or she should go into his or her bed. Even if you do not use objects, write down your child's schedule so that you are going through the same steps each night and staying with a routine. Use single words or two-word phrases to label or describe what you are doing ("Bath time", "Wash hair", "Go sleep", etc.).



<http://www.autismspeaks.org/science/resources-programs/autism-treatment-network/tools-you-can-use/sleep-tool-kit>
 Or search for Autism Speaks Sleep Toolkit

Summary and Future Directions

What we know:

- ✓ Sleep disturbance, especially insomnia, is common in ASD (50-80%)
- ✓ Sleep disturbance associated with child behavior/family functioning
- ✓ There are many treatable causes of insomnia

What we think we know (more data are needed):

- ✓ Improving sleep impacts favorably on children and families

What we still need to know:

- ✓ How do we best measure sleep and improvements in sleep?
- ✓ What treatments are effective? And in which children?
- ✓ Which children need medications for sleep?
(vs. sleep education alone)
- ✓ Whether biological markers of sleep disturbance (e.g., cortisol, melatonin, genetic variability) predict treatment response.