Developmental social neuroscience meets public health challenge: A new system of healthcare delivery for infants and toddlers with autism spectrum disorder

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Thank You

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- Warren Jones and many wonderful colleagues and students
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- The Marcus Foundation
- The JB Whitehead and Woodruff Foundations
- The Children's Healthcare of Atlanta Foundation
- The Georgia Research Alliance
- as well as
- The National Institute of Child Health and Human Development
- The Autism Science Foundation

Marcus Autism Center



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Marcus Autism and other developmental delays AUTISM CENTER NIH Autism Center are a Public Health Challenge of Excellence * Prevalence: 1:68 autism; 1:10 developmental delays ★ Autism Societal Cost/Year in the US: \$ 136 billion ★ Autism Lifetime Cost of Care Per Child: \$ 2.4 - 3.6 million ★ Importance of early diagnosis and intervention for lifelong outcome and cost of care * American Academy of Pediatrics recommends screening for autism at 18 and 24 months * Autism Median age of diagnosis in US: 4-6 to 5.7 years * % of primary care providers who routinely screen not known \star <20% of children identified before age 3 years CDC, 2014; Peacock et al., 2012; Cidav et al., 2012; Mandell et al., 2015; 2009; 2013; 2014; Wang et al., 2013; Buescher et al., 2014; Wiggins et al., 2006; Shattuck et al., 2009; Honigfeld et al., 2012; Heidgerken et al., 2005; Dosreis et al., 2006; Johnson & Myers, 2007;



Sociality: the evolutionary roots of our social brain





















Attention to Biological Motion Toddler with Autism, 100 15 months 75 % Looking Time 50 not significantly different from chance, p > .0525 :: 6 Y. 0 INV UP 1.1.1 Typically-Developing Toddler, 15 months Typically-Developing Toddler, 9 months 100 100 75 75 % Looking Time % Looking Time 50 50 25 25 ÷ 0 UP INV INV

Klin A & Jones W. (2008). Dev Science, 1: 40-46.

UP =





















Patterns of visual fixation to approaching caregiver





Watching a Face... But Seeing Physical Contingencies?



Caregiver



Audiovisual Synchrony Looking at Eyes and Mouth As a Function of Audiovisual Synchrony



Social Interaction is the Platform for Brain Development



synaptic density quadruples.

(Gilmore et al, 2007; Pfefferbaum et al, 1994; Huttenlocher, 1979; Petanjek et al, 2011)

















































Severity of ASD: Prognostic Indicators



Translational Opportunities



 High-throughput, low-cost, deployment of universal screening in the community

• Early detection, early intervention, optimal outcome

 Prevention or attenuation of intellectual disability in ASD

Public Health Opportunities



- Support a system that does not have sufficient expert clinicians
- A new, promising view of autism, with universal design implications
- Genetic influence informs modality of early treatment

 Reduce the child, family, health, education, and societal costs of autism



Objectifying and quantifying diagnosis in toddlers: community-viable proxies





- High-throughput, low-cost, deployment of universal screening in the community
- · Objective, quantitative measures of risk
- Early detection, early intervention, optimal outcome
- Prevention or attenuation of intellectual disability in ASD

Quantitative Measures of Social Disability



From High-Impact Publication to FDAregistered Clinical Trial of Diagnostic



Intended Indication for Use

- The Social Developmental Testing Device is a medical device designed to measure visual attention to social information in the environment relative to normative, age-specific benchmarks.
- These measurements assess
 - <u>presence</u> (primary efficacy outcome) &
 - <u>severity</u> (secondary efficacy outcome)
- of Autism Spectrum Disorder (ASD) in 16- to 30-month-old children.





A Bioethical Imperative: Access to Early Treatment -Promoting Social Engagement

Reciprocal Social Interaction



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New science informing modality of treatment - Genetic influences over social visual engagement





Typically Developing 5-month old baby

5-month-old baby later diagnosed with ASD

How to link these quantifications of behavior to the genetic bases of autism? Measuring the genetic structure of social visual engagement





Concordance in social visual engagement as a function of zygosity.









MZ concordance of looking behavior at timescales of milliseconds





When watching complex social scenes

MZ twins are more likely than DZ twin

- + to shift their eyes at the same moment
- + in the same direction
- + onto the same targets

They are creating their social world of experiences





The markers of social visual engagement that are most highly heritable...



typically-developing children from those with autism.

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The markers of social visual engagement that are most highly heritable...



... are also those that most clearly distinguish typically-developing children from those with autism.

Autism Cent

































"Our brains become who we are." (J LeDoux) Brain structure and function are physical instantiations of lived experience.



Neonates preferentially orient towards stimuli that...







Neonates preferentially orient towards stimuli that...



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Typically-Developing 5-Month-Old











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Eye-Looking in Typically-Developing Infants and Infants Later Diagnosed with ASD 70 r 60 Fixation Time (%) 50 TD eyes 40 30 20 mean 10 95% CI Λ 23456 9 12 15 18 24 Change in Fixation (% per month) Age (in months) Dt TD eyes Decreasing TD, N=63

23456

9

12

15

Age (in months)

18

24











