

# *PANDAS/PANS & Related Neuropsychiatric Disorders: Science Basics for Parents and Patients*

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*London, UK*

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*May 12, 2018*

# Topics We will Cover

## **1. Definition of PANDAS/PANS**

- PANDAS Parent Survey
- Nomenclature and alternative nomenclature
- Proposed mechanism
- What is the controversy?

## **2. Brief clinical presentation and symptoms associated with PANDAS/PANS**

- Some common infectious triggers

## **3. Anti-neuronal antibodies in the Cunningham Panel**

- Biomarker selection
- Patient population study
- Swedish study conclusions and issues

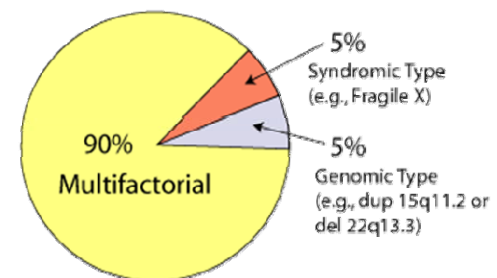
## **4. Closing Thoughts for Parents with Children with Infection-Triggered Autoimmune Encephalopathies**

# Despair of Parents having Children with Neuropsychiatric Disorders

- “We watch hopelessly as our dear children lose chunks of their childhood to something so few currently understand”
- Parents seeking answers but not getting proper help
- Some spend tens of thousands of dollars on medical costs and treatments
- Most resort to coping because of minor improvements
- May receive an Autism or other diagnosis
  - But only 10% of Autism has a known genetic origin



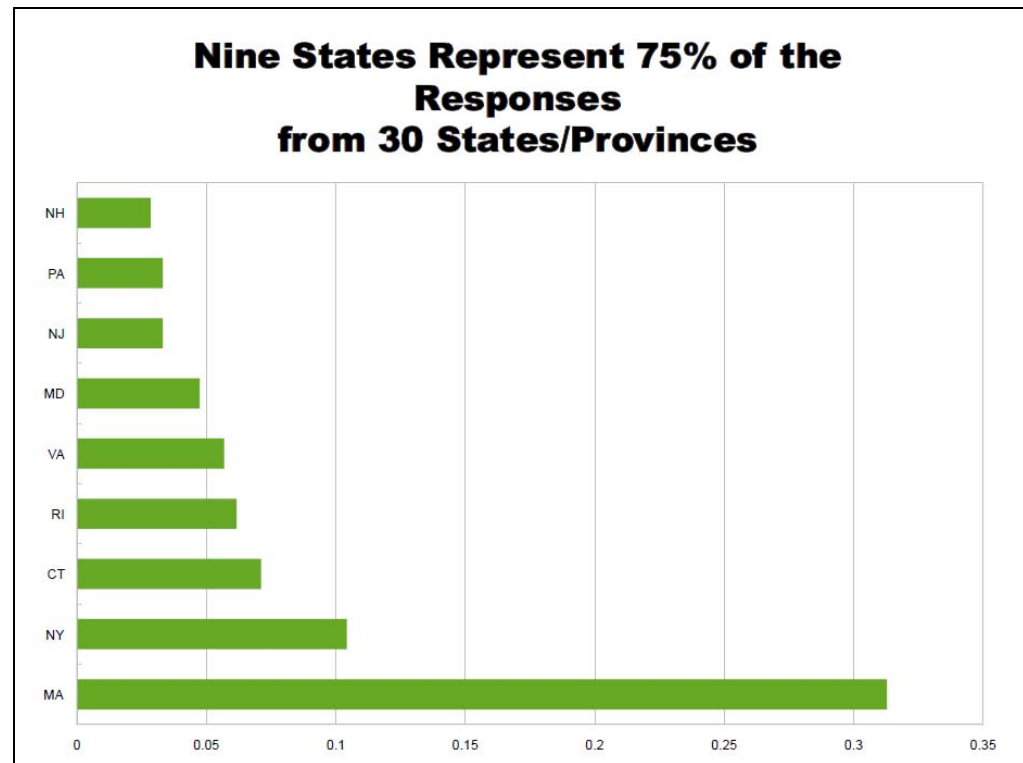
Identifiable Causes of Autism



# PANDAS Parent Survey 2013

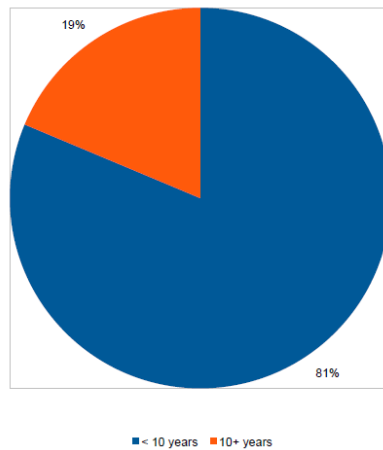
## NE PANDAS Parents

Conference Survey  
November 2013

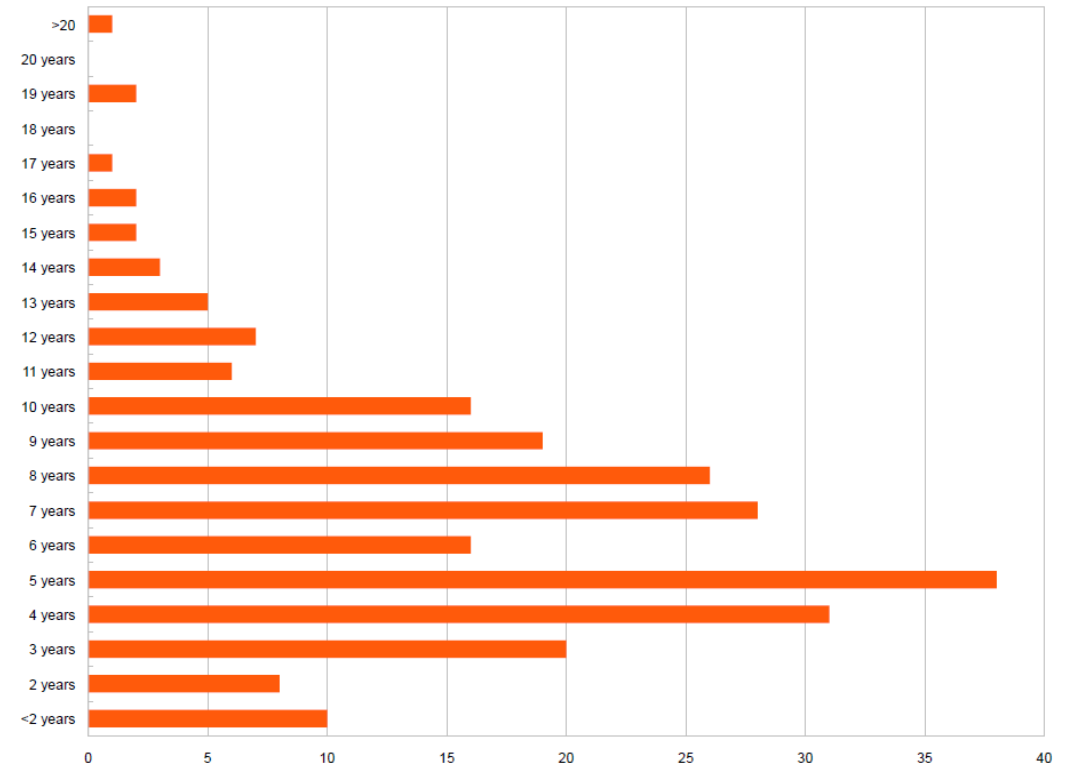


# PANDAS Parent Survey 2013

## PANDAS/PANS Age of Onset

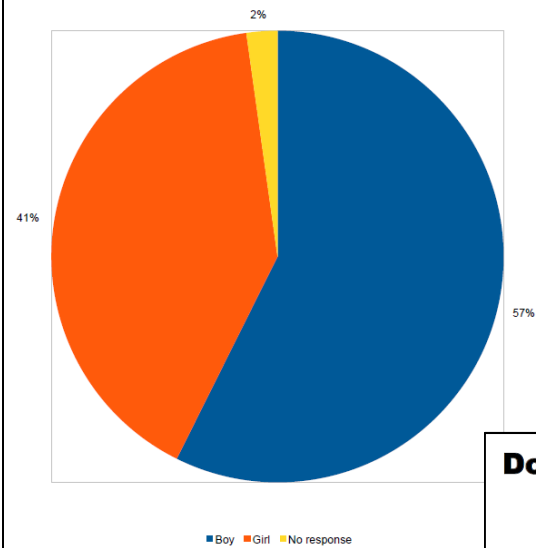


## What do you believe was the age of onset?

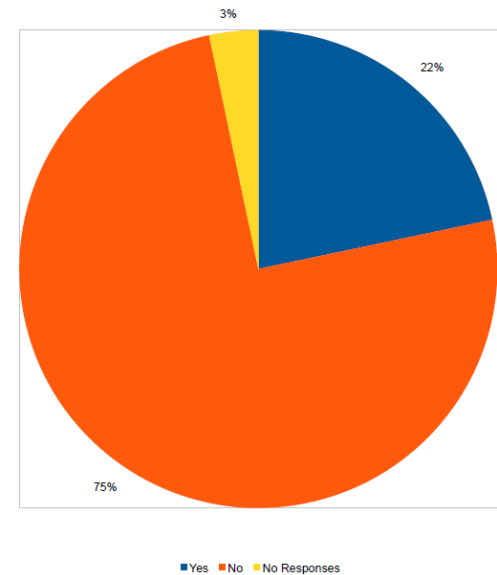


# PANDAS Parent Survey 2013

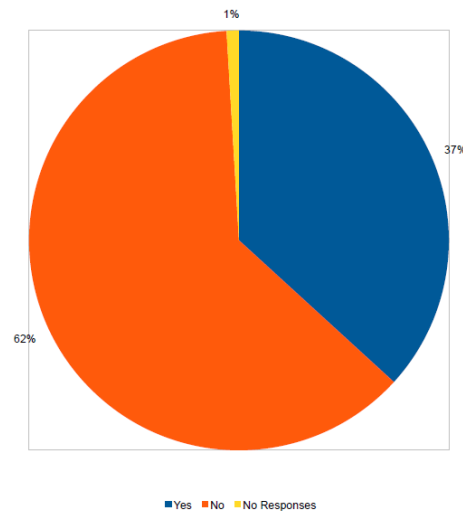
**Gender**



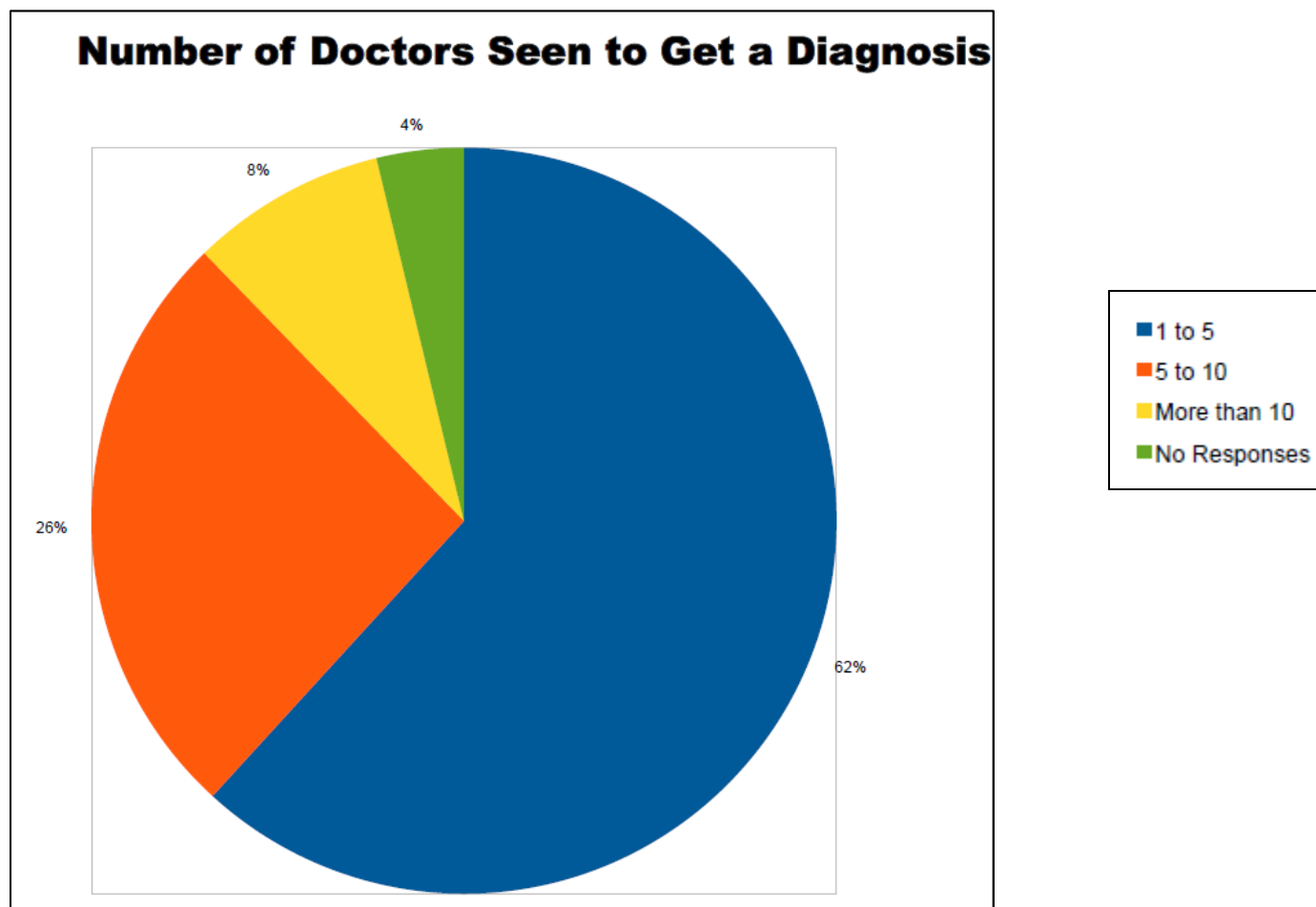
**Did your pediatrician diagnose or suggest PANDAS/PANS?**



**Do you think/know you have more than one child with PANDAS/PANS?**

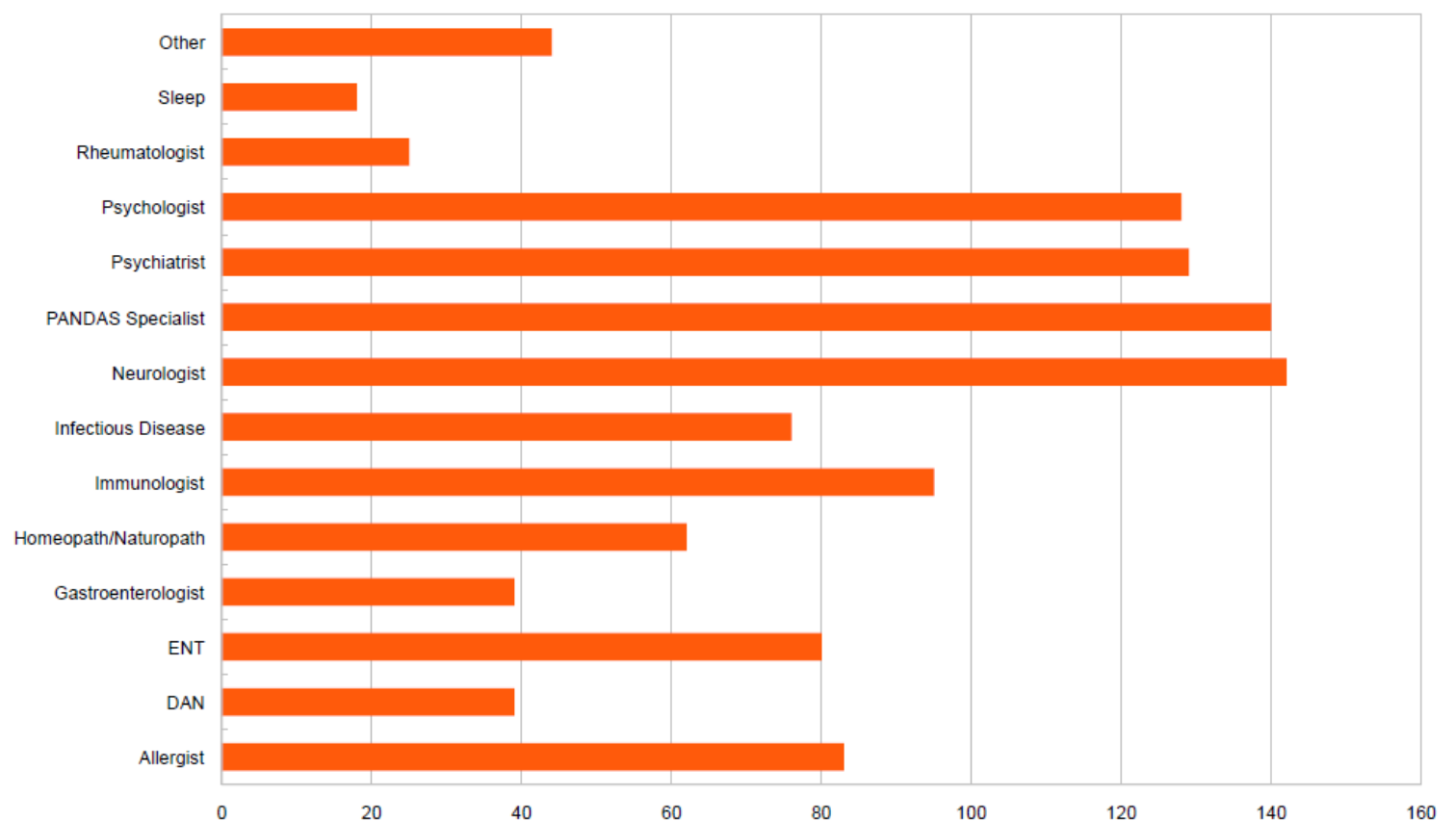


# PANDAS Parent Survey 2013



# PANDAS Parent Survey 2013

## What specialists have you seen during your experience with PANDAS/PANS?





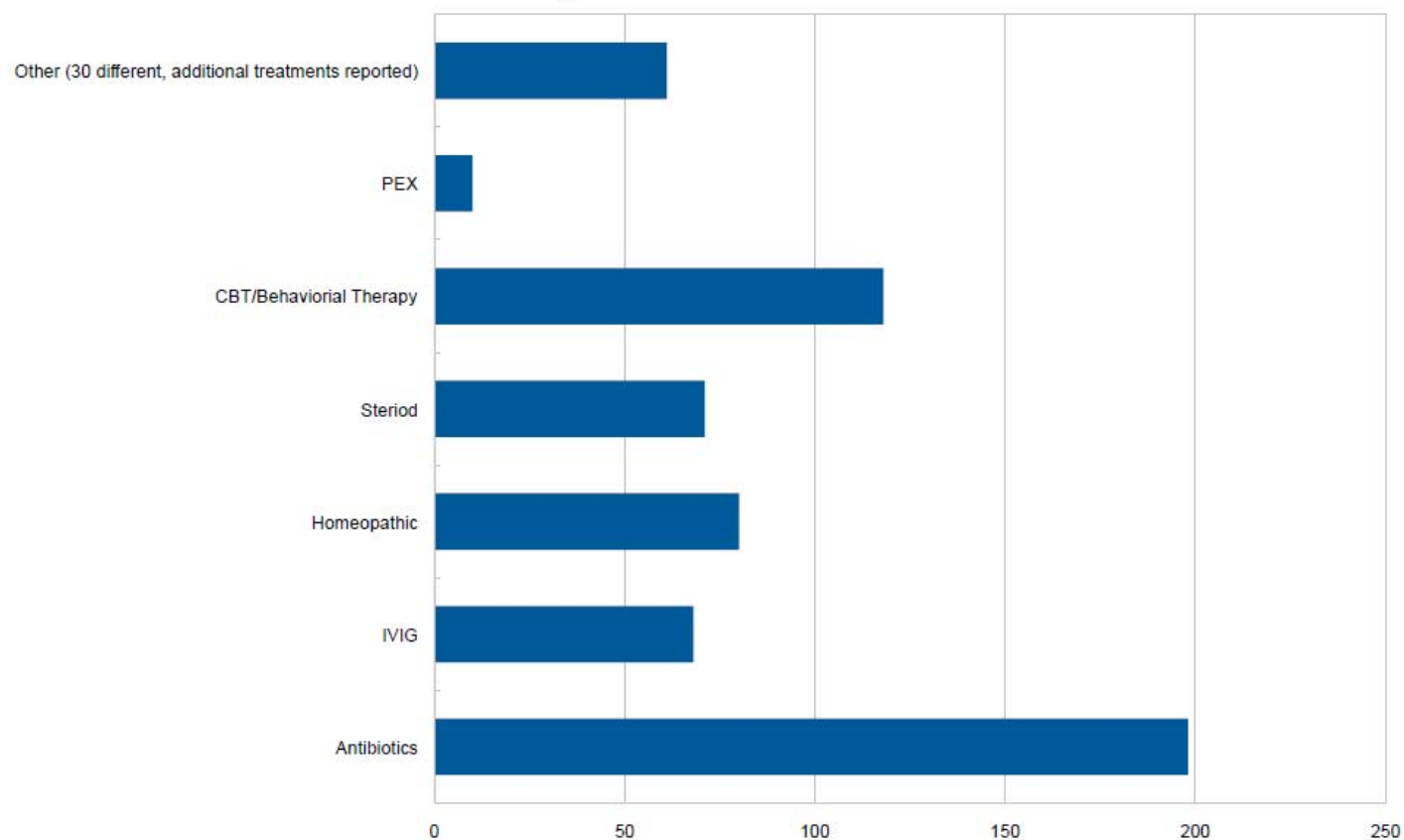
# PANDAS Parent Survey 2013

## Additional Types of Specialists Seen



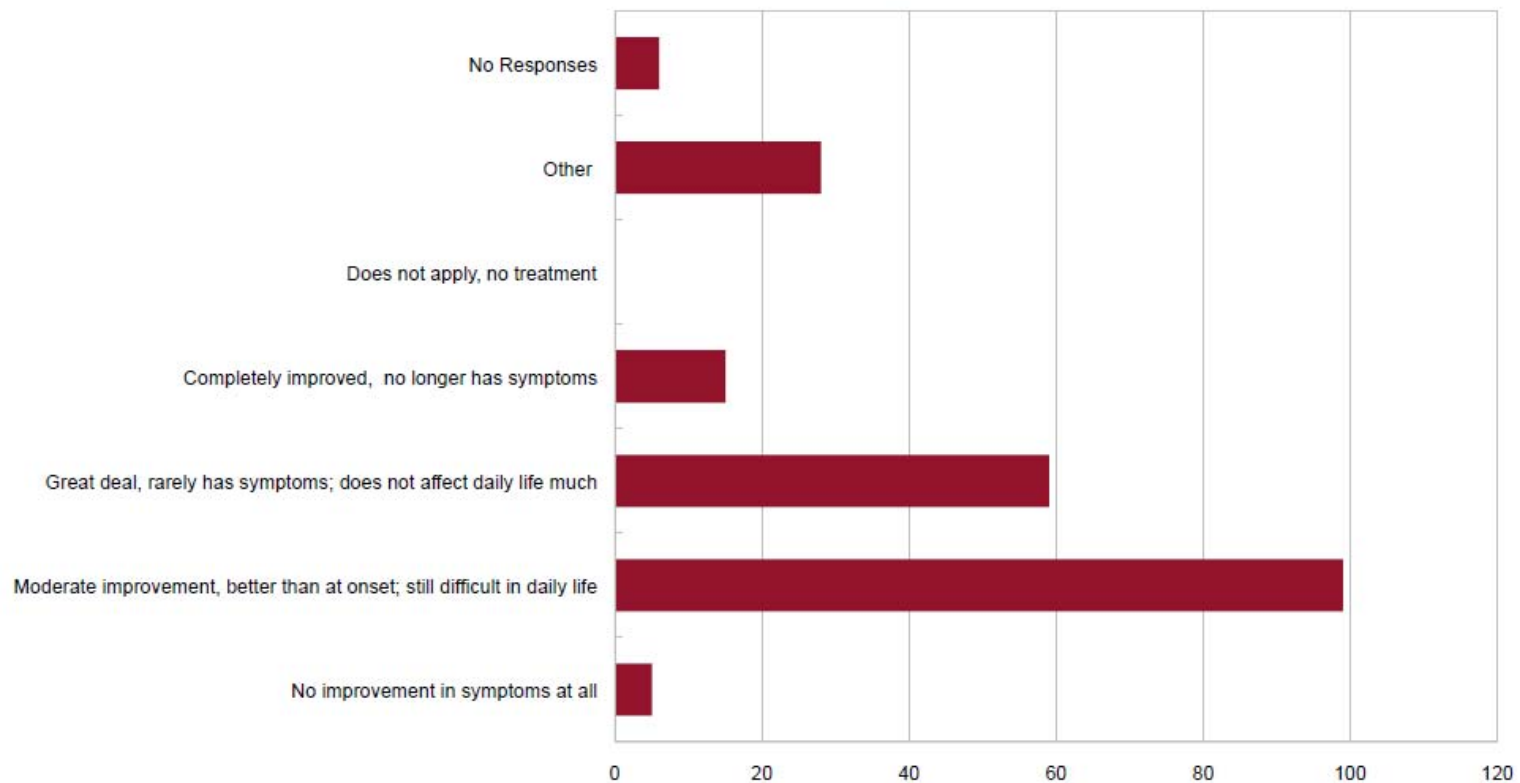
# PANDAS Parent Survey 2013

## What treatments have you tried with your child?

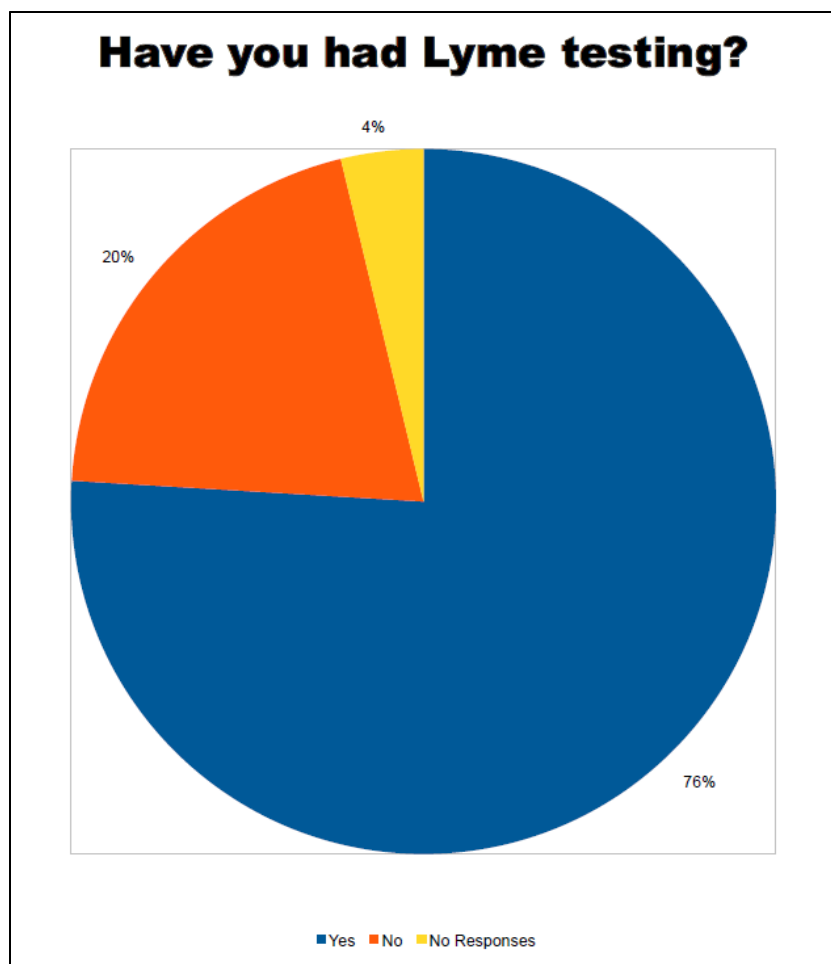


# PANDAS Parent Survey 2013

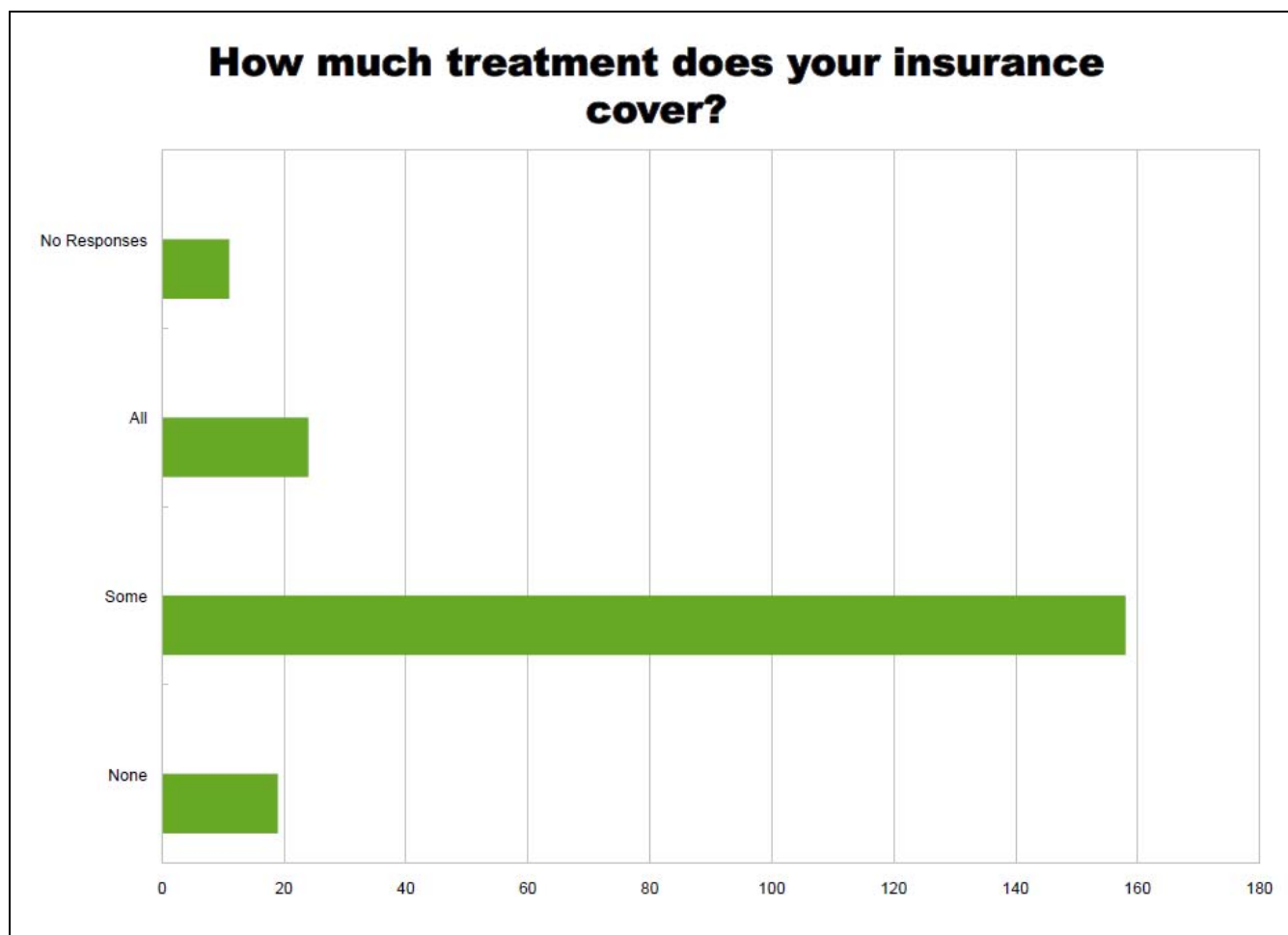
**With treatment, how would you say your child is doing today?**



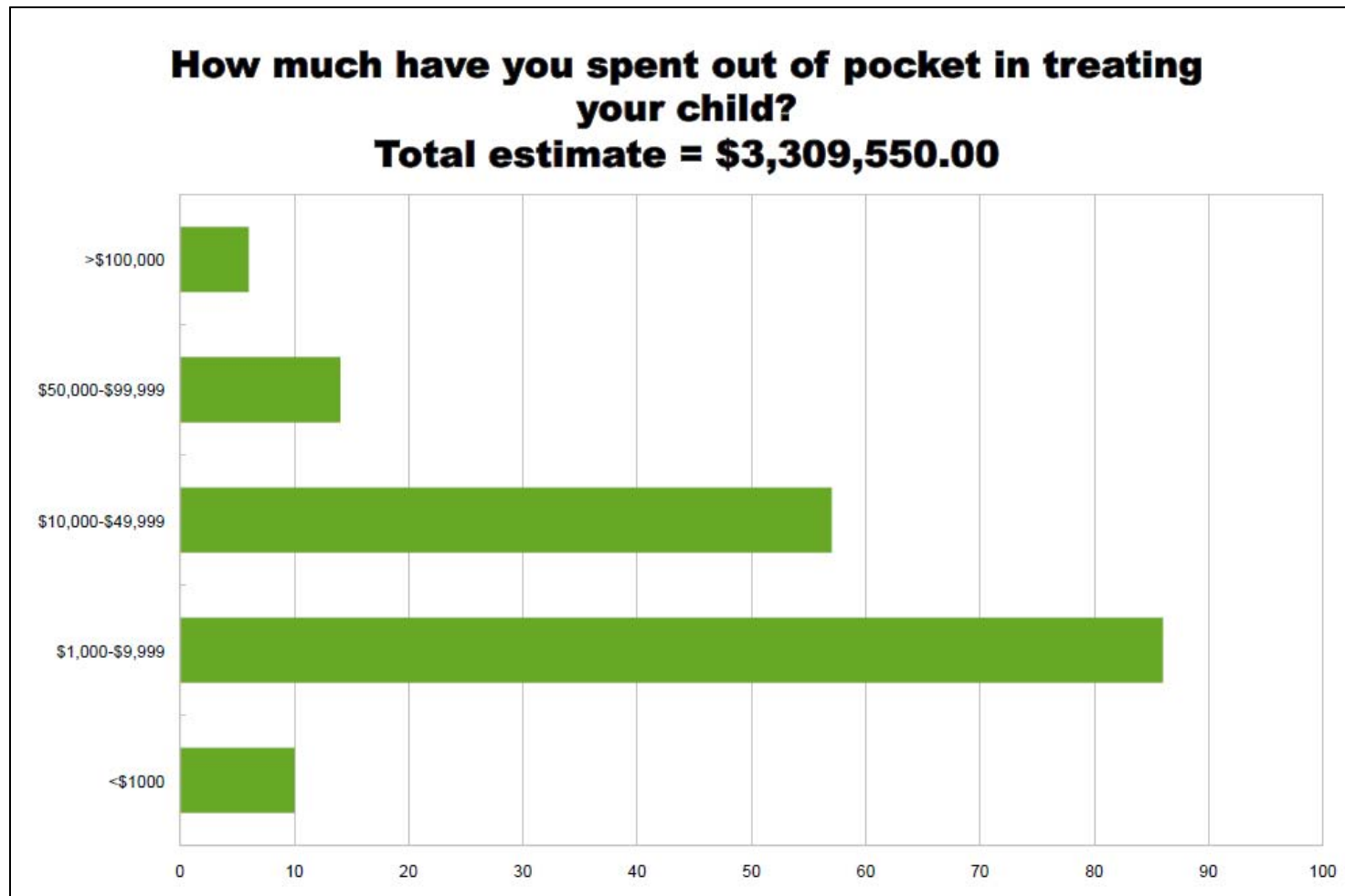
# PANDAS Parent Survey 2013



# PANDAS Parent Survey 2013

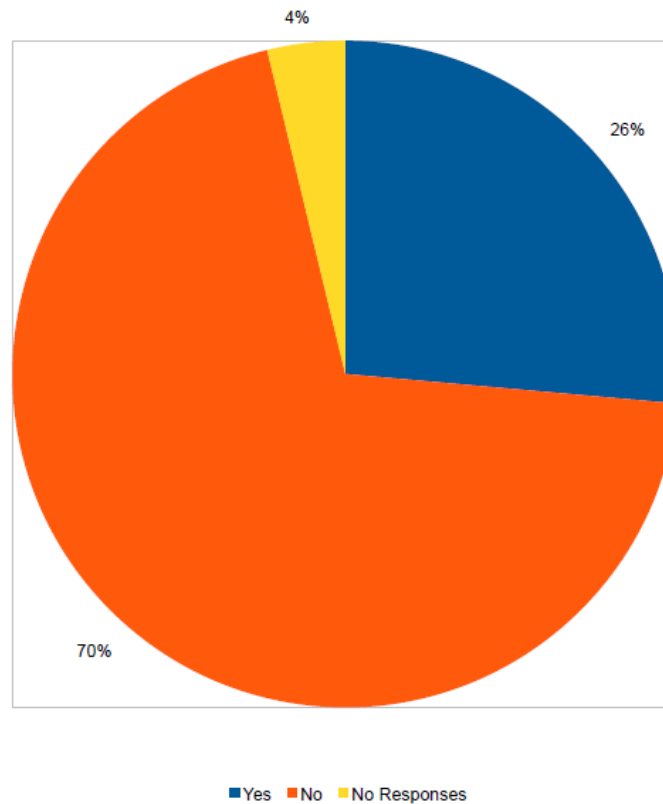


# PANDAS Parent Survey 2013



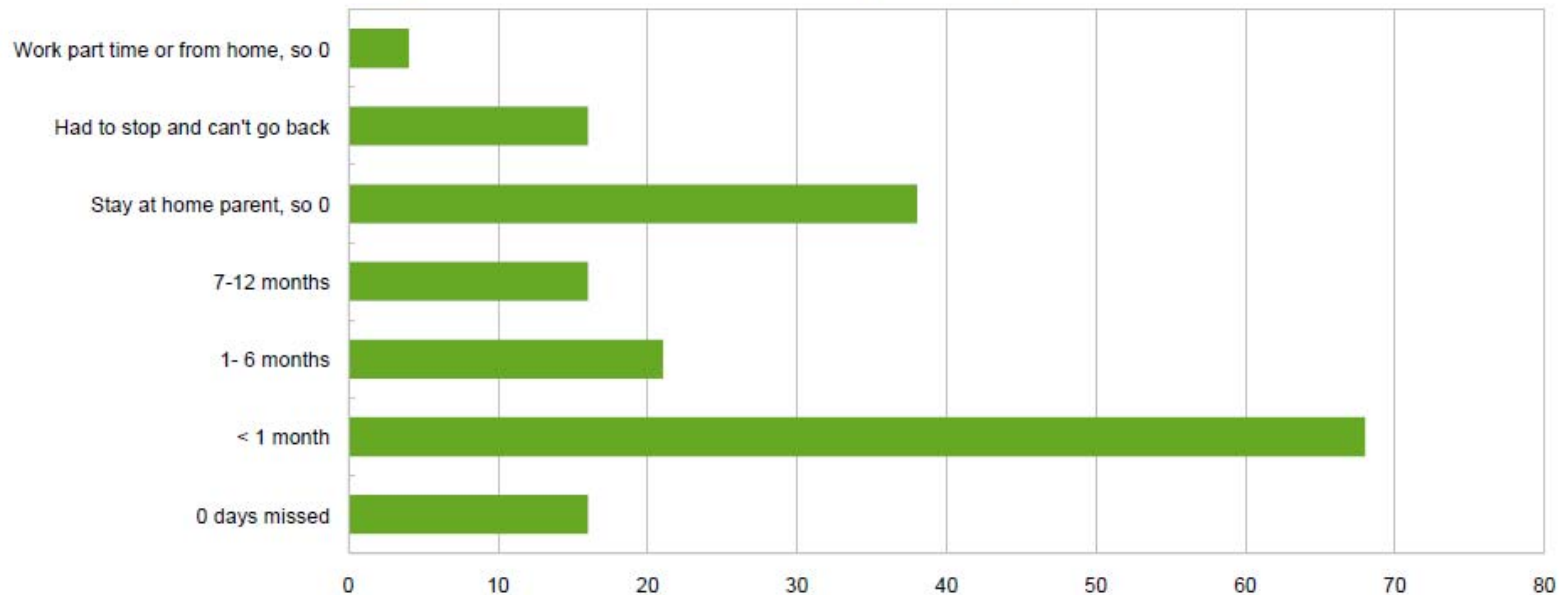
# PANDAS Parent Survey 2013

**Did you have to leave a job  
to care for your child with PANDAS/  
PANS?**



# PANDAS Parent Survey 2013

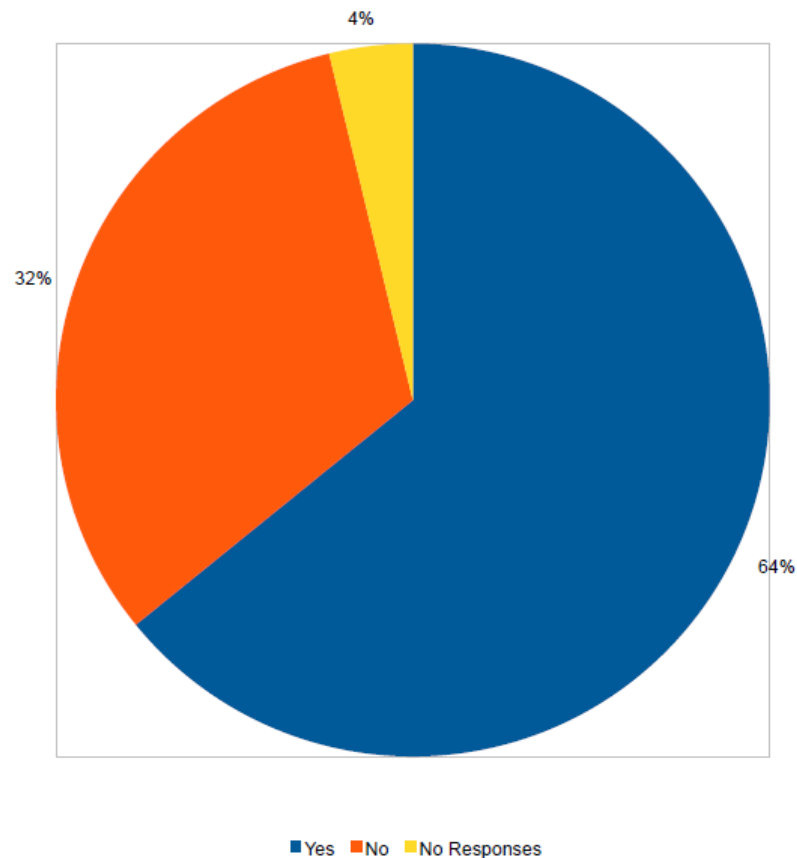
## How many days of work would you guess you missed last year due to caring for your child?





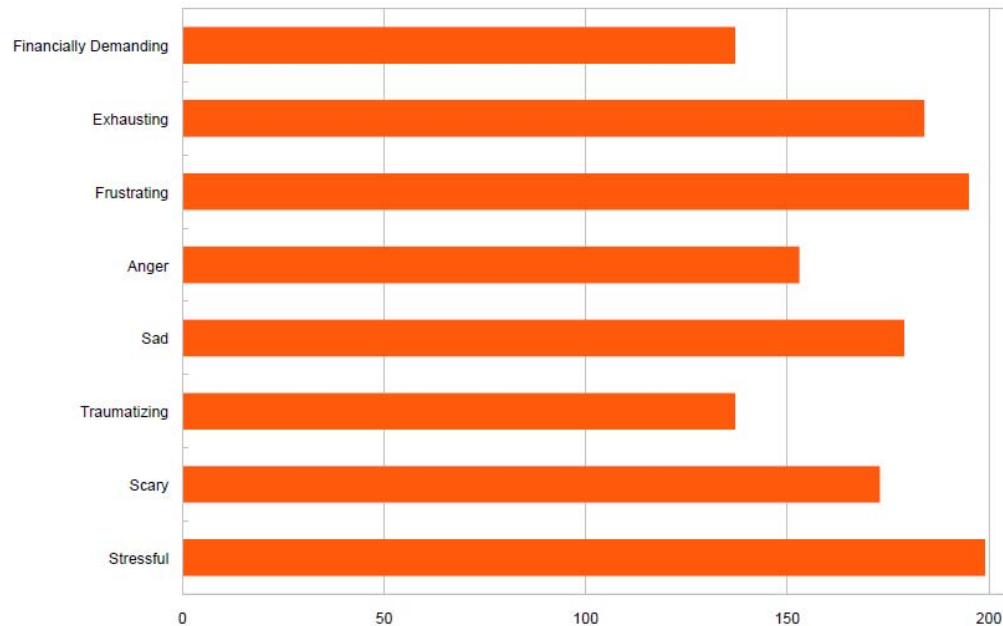
# PANDAS Parent Survey 2013

**Does your child have special school accommodations?  
(IEP, 504, home school, etc.)**

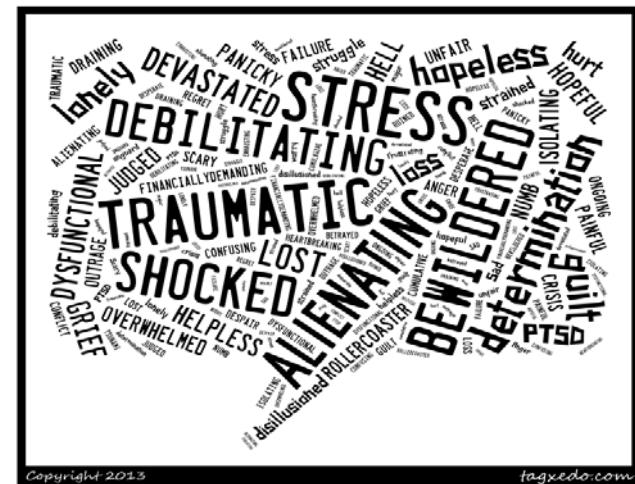


# PANDAS Parent Survey 2013

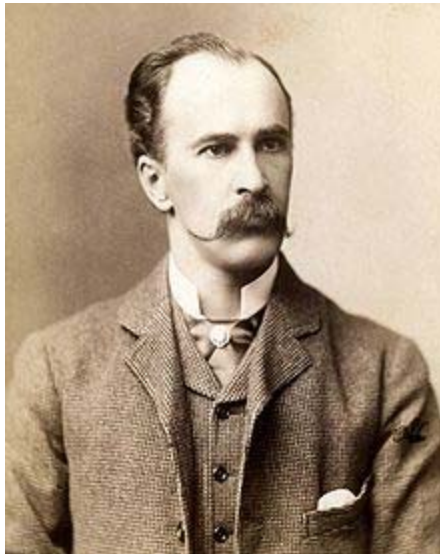
## Describe Your Emotions as a Parent



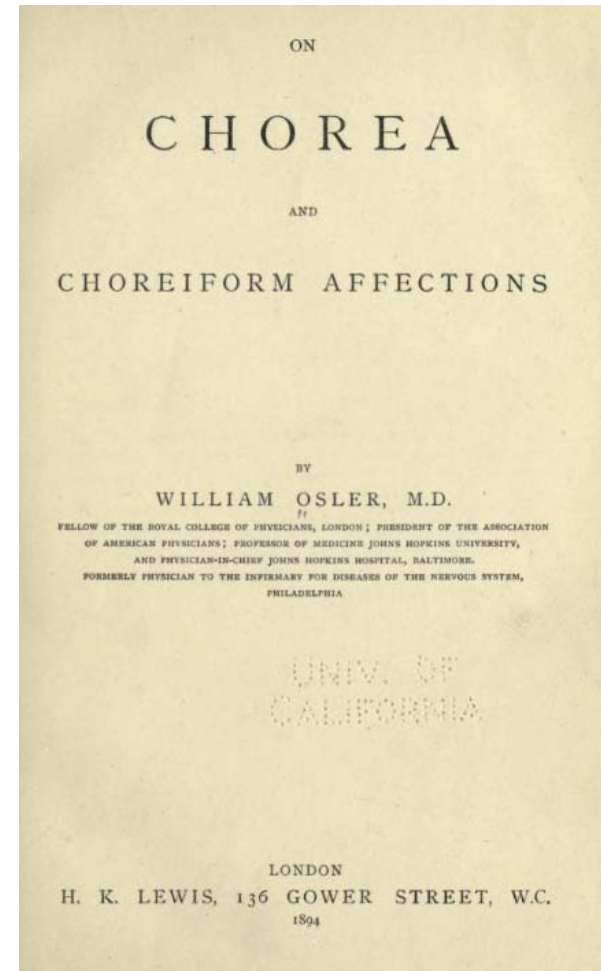
## Describe Your Emotions as a Parent



# What is PANDAS? Sydenham Chorea is the Model



In 1894, Sir William Osler described “bizarre” and “perseverative behaviors” of children with “chorea minor,” and first made the relationship between obsessive-compulsive OCD symptoms and Sydenham’s chorea (SC)



# Sydenham Chorea is the Medical Model for PANS/PANDAS

- Chorea: “Dance-like” abnormal movements.
  - Loss of fine-motor control
  - Loss of emotional control
- Sydenham Chorea is the neurological manifestation of Acute Rheumatic Fever
- Group A Streptococcus-triggered autoimmune reaction involving the brain

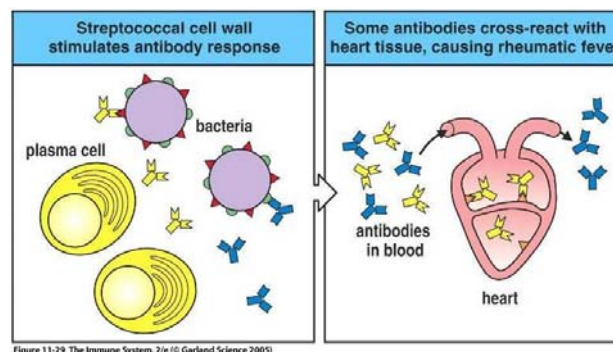
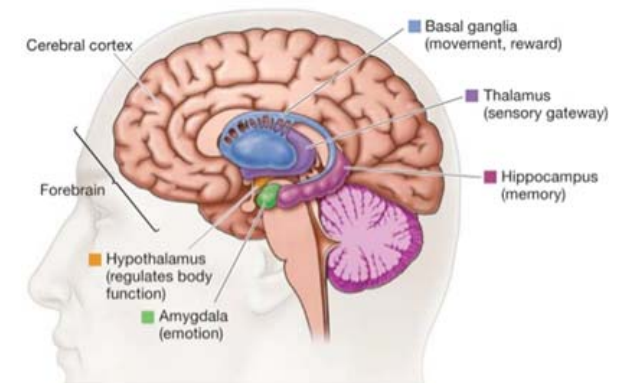


Figure 11-29 The Immune System, 2/e (© Garland Science 2005)



# What is PANDAS?

## Pediatric Autoimmune Neuropsychiatric Disorder Associated with Streptococcal infection



Pediatric Autoimmune Neuropsychiatric Disorders  
Associated With Streptococcal Infections:  
Clinical Description of the First 50 Cases

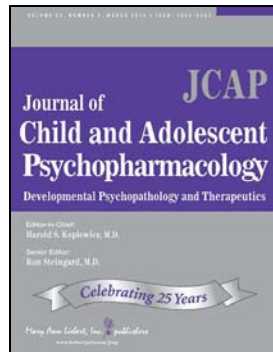
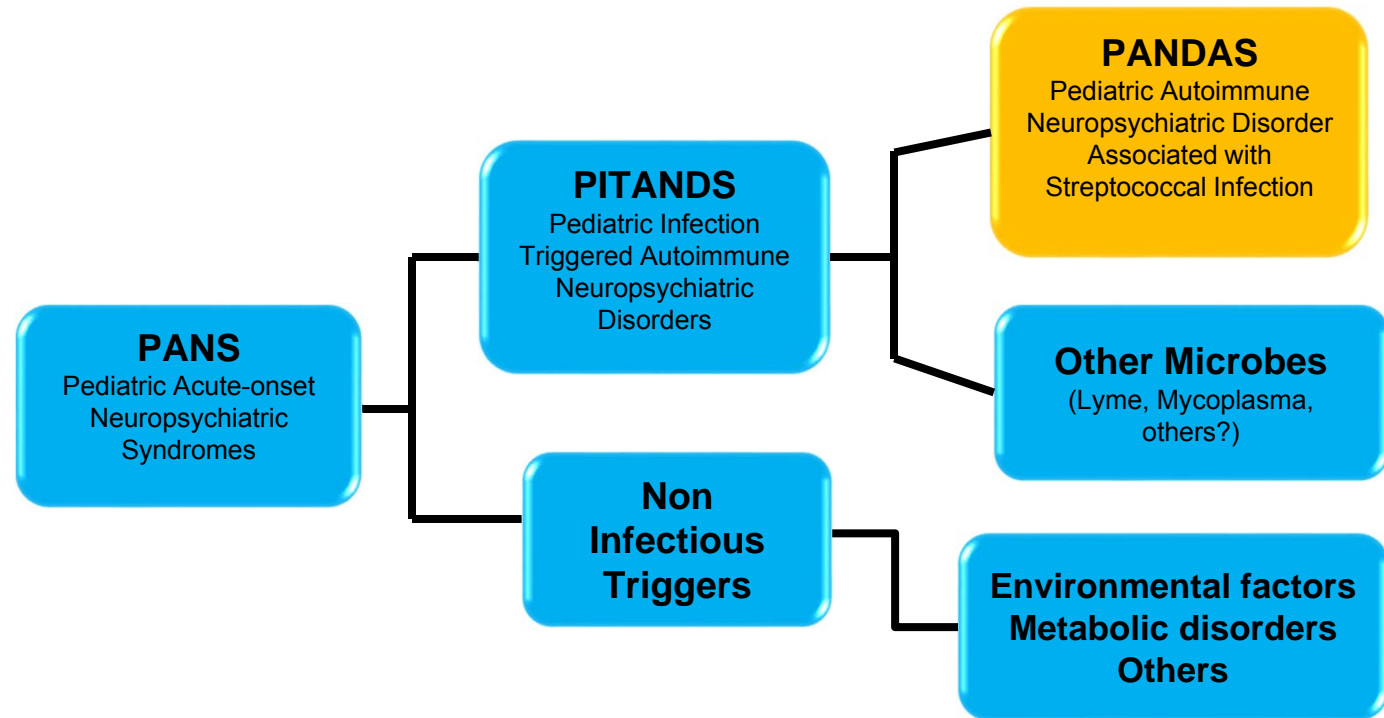
Susan E. Swedo, M.D., Henrietta L. Leonard, M.D., Marjorie Garvey, M.D.,  
Barbara Mittleman, M.D., Albert J. Allen, M.D., Ph.D., Susan Perlmutter, M.D.,  
Lorraine Lougee, L.C.S.W., Sara Dow, B.A., Jason Zamkoff, B.A., and Billinda K. Dubbert, M.S.N.

(1998) *Am J Psychiatry* 155(2): 264-271.

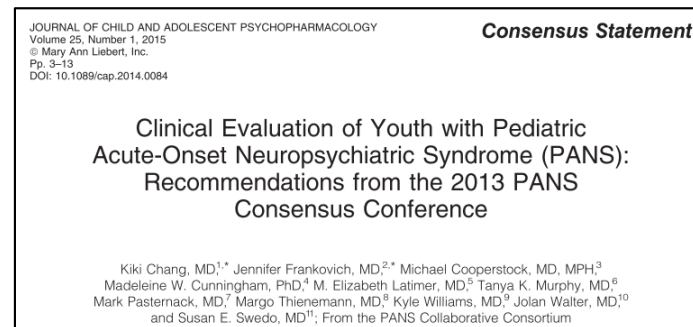
THE AMERICAN JOURNAL OF  
**PSYCHIATRY**



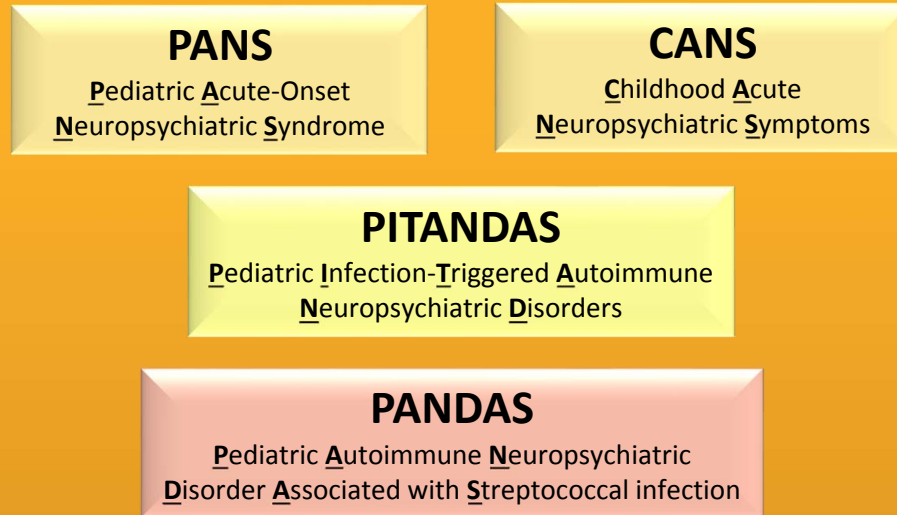
# Nomenclature and Hierarchy



Chang, K. et al. *J Child Adolesc Psychopharmacol* **25**(1): 3-13.



# What are the Common Denominators in these Names?



**Infectious Autoimmune Encephalopathy**  
**Infectious Autoimmune Encephalitis**

**“Post-”Infectious Autoimmune  
Disorder of the Brain (Basal Ganglia)**

*“Post-” after the infection, not necessarily after an infection is gone*

## 1. Infection-Triggered

- Bacterial, Viral, Parasitic, Fungal or possibly environmental?

## 2. Autoimmune

- Immune dysfunction or Immune-mediated

## 3. Neuropsychiatric Syndrome or Symptoms

- Multisymptom

## 4. Directed against portions of the brain

- Basal ganglia

## 5. Acute-Onset?

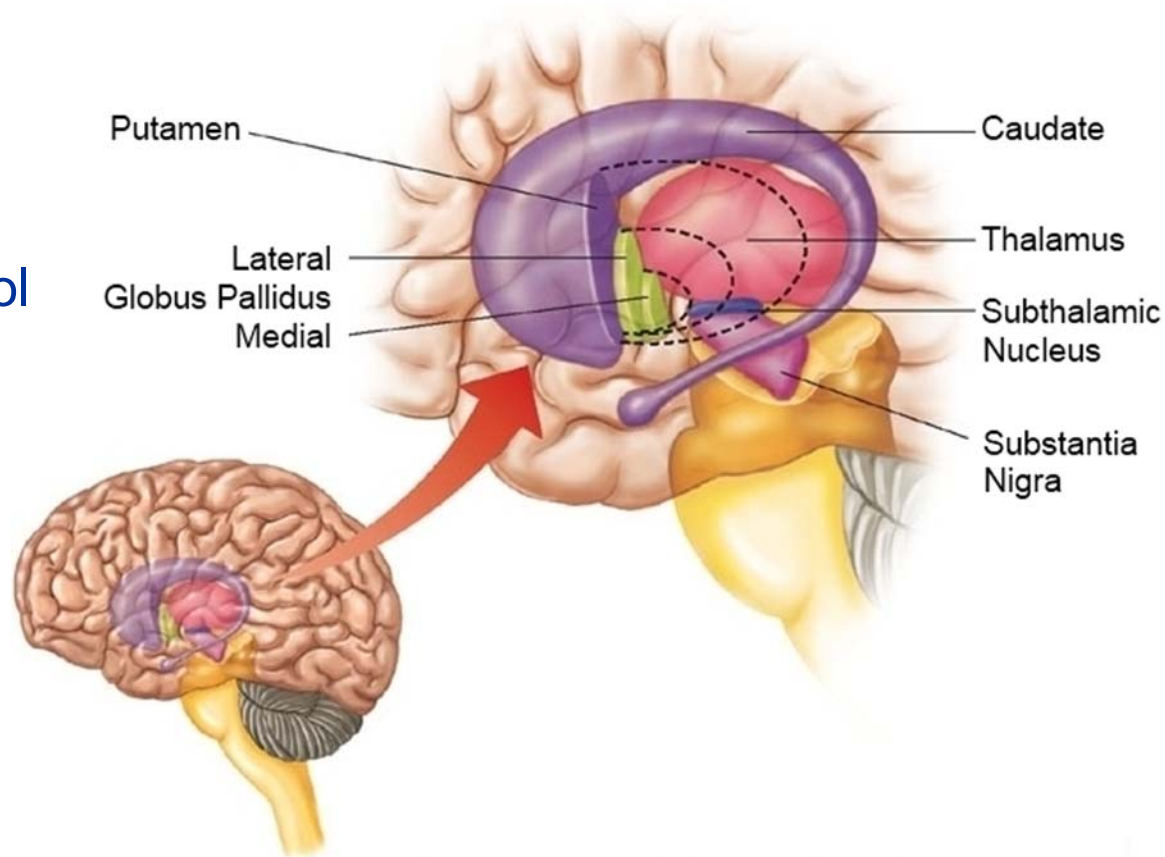
- (Criteria for PANDAS/PANS but not observed in all conditions)

# Infection-Triggered Autoimmune Disorders of the Basal Ganglia

## Basal Ganglia is Responsible for:

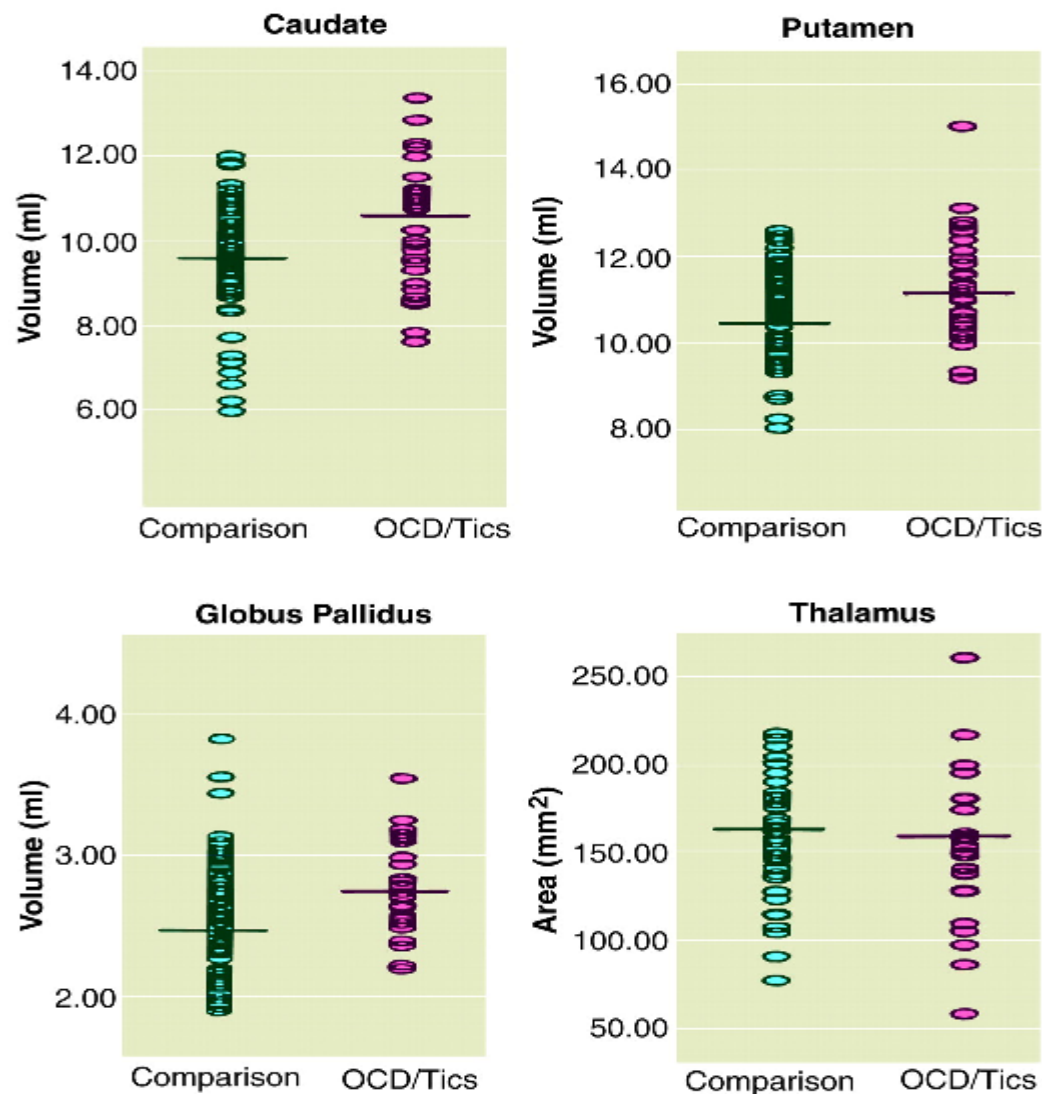
- Voluntary motor control
- Procedural learning
- Cognitive functions
- Emotional functions
- Eye movement

Two disorders of the Basal Ganglia are Parkinson's' Disease and Huntington's Disease





# MRI Inflammation in Strep-Associated Children with OCD/Tics compared to Healthy Children



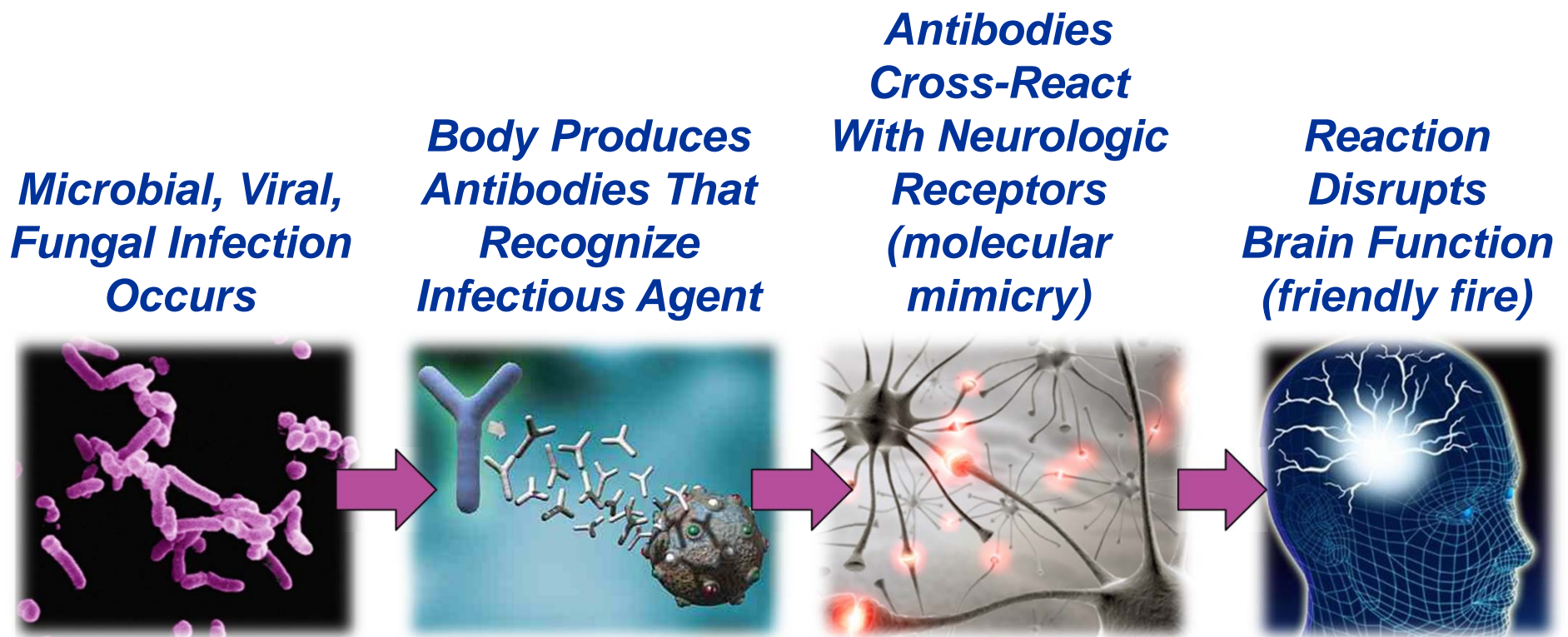
***The average size of the Caudate, Putamen, Globus Pallidus was enlarged, but not the Thalamus or total Cerebrum in Strep Associated OCD/Tics children compared to health children***

Am J Psychiatry 2000, Giedd et al. 157:281-283

## Components of the Basal Ganglia

- Caudate (OCD)
  - Putamen (Tics)
  - Globus Pallidus
  - Substantia Nigra
  - Subthalamic Nucleus
- } OCD/Tics/ADHD

# One Mechanism of Infection-Triggered Autoimmune Neuropsychiatric Disorders



# Molecular Mimicry

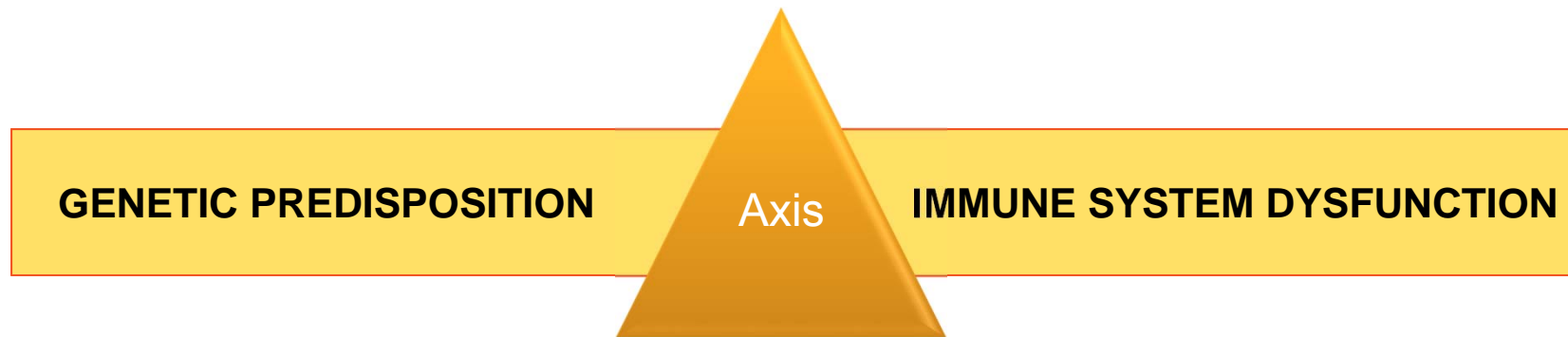
- “Friendly Fire”
- Mechanism of action that is implicated in many chronic debilitating diseases
- Infections that lead to autoimmune responses with debilitating symptoms including neuropsychiatric



# Infection, Immune, Brain Connection to Neuropsychiatric Disorders

## Brain Function

(Neurological and Neuropsychiatric symptoms)



## Infectious/Non-Infectious Triggers

(Environmental, bacteria, microbiome, viruses, parasites)

## Immune System

(inflammation, microglia activation, cytokines, mast cell activation, autoimmune antibodies)

# What is the Controversy?

## Defining, Diagnosing and Treating a Cross-disciplinary Multi-symptom Neuropsychiatric Disorder

### 1. **PANDAS**

- Association with Group A Streptococcus (GAS)  
but most all children get Strep

### 2. **Heterogeneous symptoms**

- Patients present with multiple, and often  
different neurological and psychiatric symptoms

### 3. **Crosses multiple medical specialties**

- Infectious Disease, Immunology/Rheumatology,  
Neurology, Psychiatry

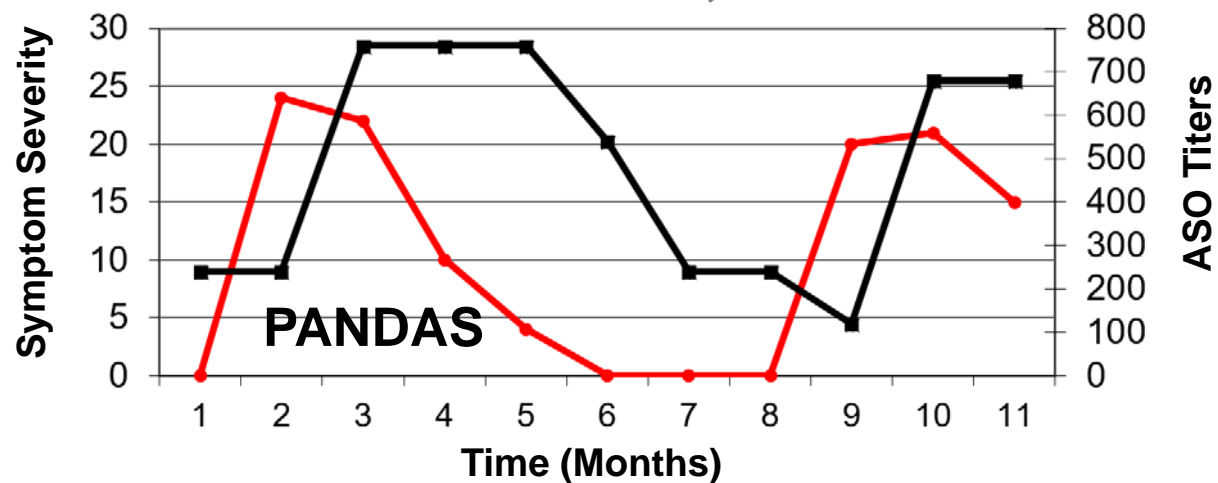
### 4. **A clinically-defined disorder without identifying biological markers**

- based upon symptoms and often a diagnosis of  
exclusion

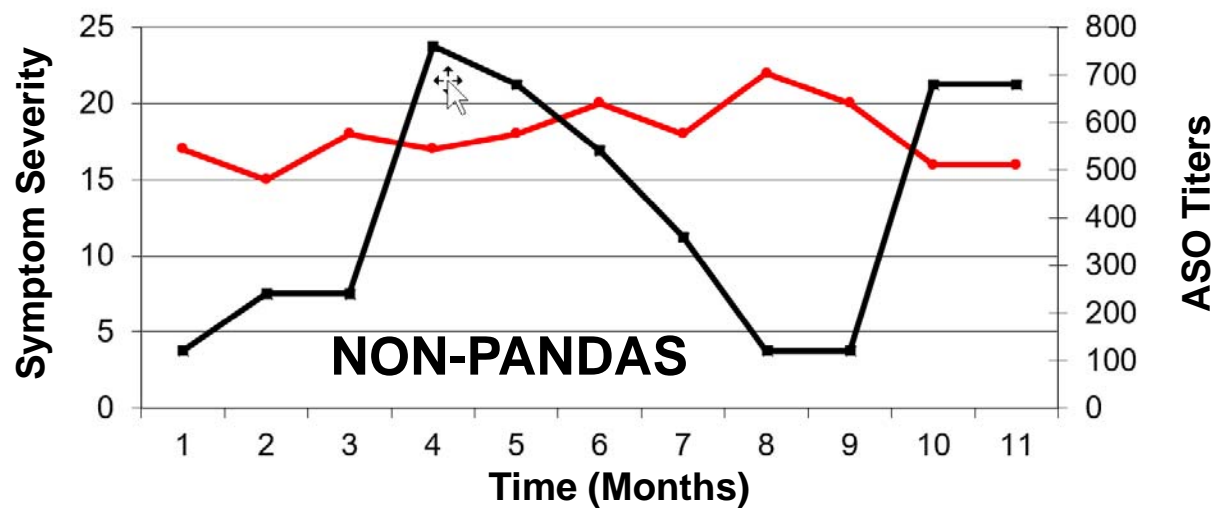
???

**CONTROVERSY**

# Anti-Streptolysin O Titers and OCD Symptom Severity (Y-BOCS)



ASO TITER ---  
Y-BOCS ---

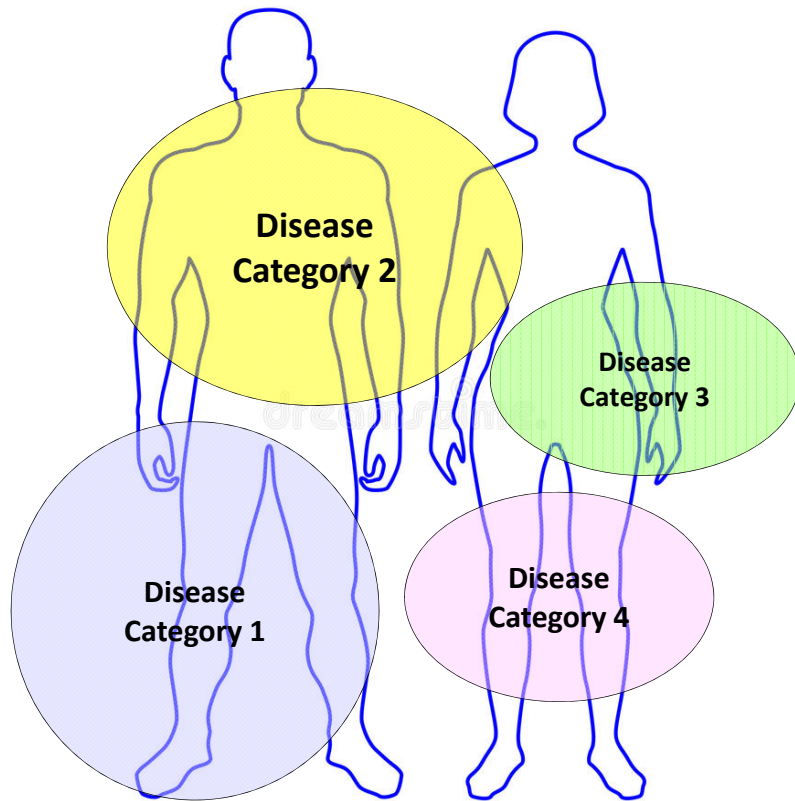


ASO TITER ---  
Y-BOCS ---

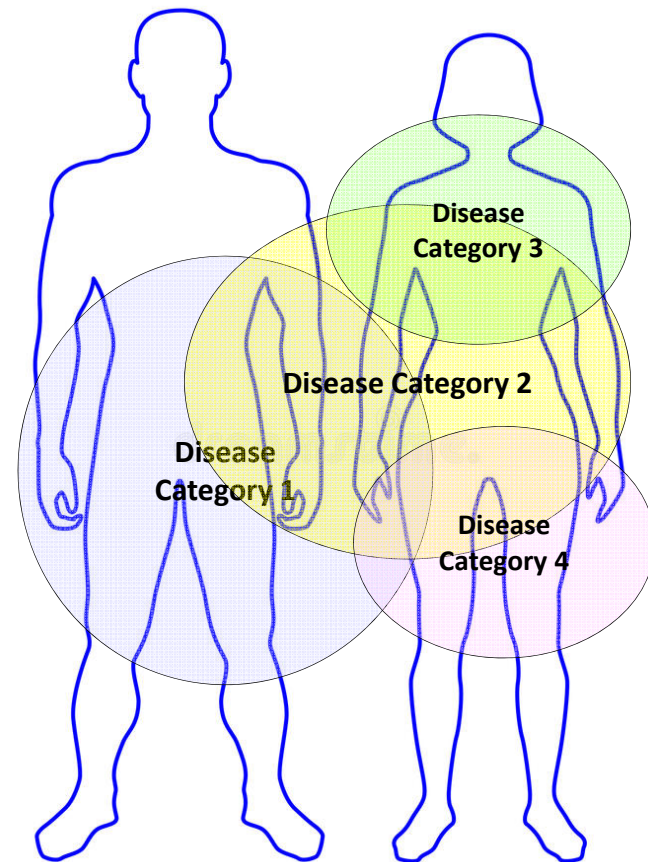
*Credits: Dr. Susan Swedo*

# Challenges when Diagnosing Human Disease and the Impact of Organ System Specialization in Medicine

Artificial View of Disease



More Practical View of Disease

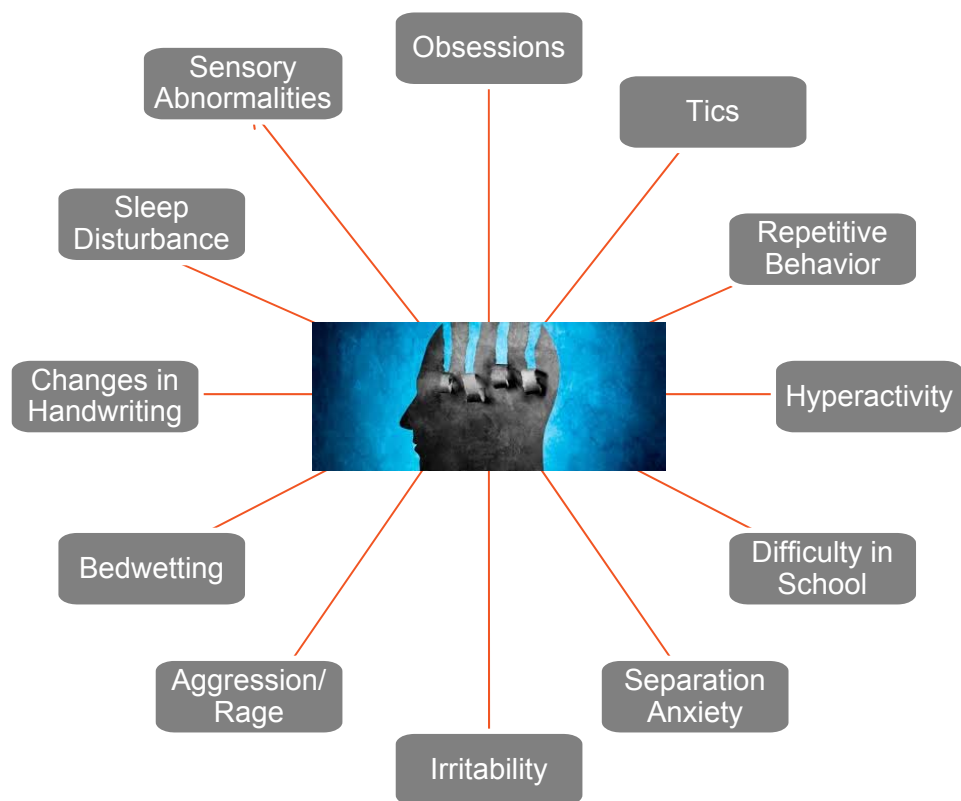


Different etiologies of disease can manifest identical symptoms  
but resolution is only possible with an understanding of the etiology



# Problem: Patients Become Labeled into Symptom-Based Categories

## Common Symptoms



## Diagnostic Labels

*Pediatric  
Acute-Onset  
Neuropsychiatric  
Syndrome (PANS)*

*Autism Spectrum  
Disorders*

*Developmental  
& Behavioral  
Disorders*

*Neuropsychiatric  
Disorders*

*Asperger's  
Syndrome*

*Tourette's  
Syndrome*

*Attention Deficit  
Hyperactivity  
Disorder  
(ADD/ADHD)*

*Chronic  
Depression*

*Pervasive  
Developmental  
Delay (PDD)*



# Tack Laws #1 and #2 (Dr. Sydney Baker)



## Tack Law #1



- If you are sitting on a tack, the treatment is not two Advil every 3-4 hours
- The treatment for “**tack sitting**” is “**tack removal**”
- Search for the root and treat the *cause* rather than the symptoms

## Tack Law #2



- If you are sitting on two tacks, removing one tack does not eliminate 50% of the symptoms
- Complex conditions are “complex”
- To be effective, address all the underlying *causes* for resolution

Correctly diagnosing the root cause for patients with neuropsychiatric symptoms  
is critical to prescribing the correct treatment

# Topics We will Cover

## **1. Definition of PANDAS/PANS**

- PANDAS Parent Survey
- Nomenclature and alternative nomenclature
- Proposed mechanism
- What is the controversy?

## **2. Brief clinical presentation and symptoms associated with PANDAS/PANS**

- Some common infectious triggers

## **3. Anti-neuronal antibodies in the Cunningham Panel**

- Biomarker selection
- Patient population study
- Swedish study conclusions and issues

## **4. Closing Thoughts for Parents with Children with Infection-triggered Autoimmune Encephalopathies**

# Estimated that 1 out of 150 to 250 children in the US have PANS/PANDAS

## **PANDAS DIAGNOSIS CRITERIA**

- Presence of OCD and/or tics, particularly multiple, complex or unusual tics
- Age requirement (Symptoms of the disorder first become evident between 3 years of age and puberty)
- Acute onset and episodic (relapsing-remitting) course
- Association with Group A Streptococcal (GAS) infection
- Association with neurological abnormalities



- Young age at onset
  - 6.5 +/- 3.0 years for tics
  - 7.4 +/- 2.7 years for OCD
- Boys outnumber girls 2.6 to 1

# Symptoms found in National Institute of Mental Health Samples (NIMH)

## Symptoms During Exacerbations

- ▶ Choreiform movements 95%
- ▶ Emotional lability 66%
- ▶ School changes 60%
- ▶ Personality changes 54%
- ▶ Bedtime fears 50%
- ▶ Fidgetiness 50%
- ▶ Separation fears 40%
- ▶ Sensory defensiveness 40%
- ▶ Irritability 40%
- ▶ Impulsivity and distraction 38%



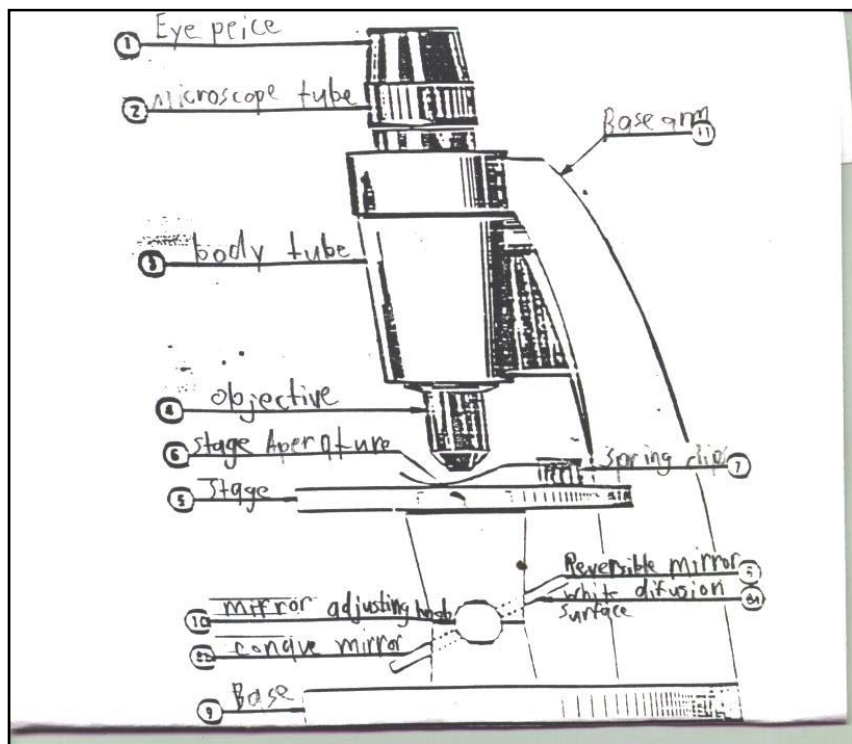
## Comorbid Diagnoses



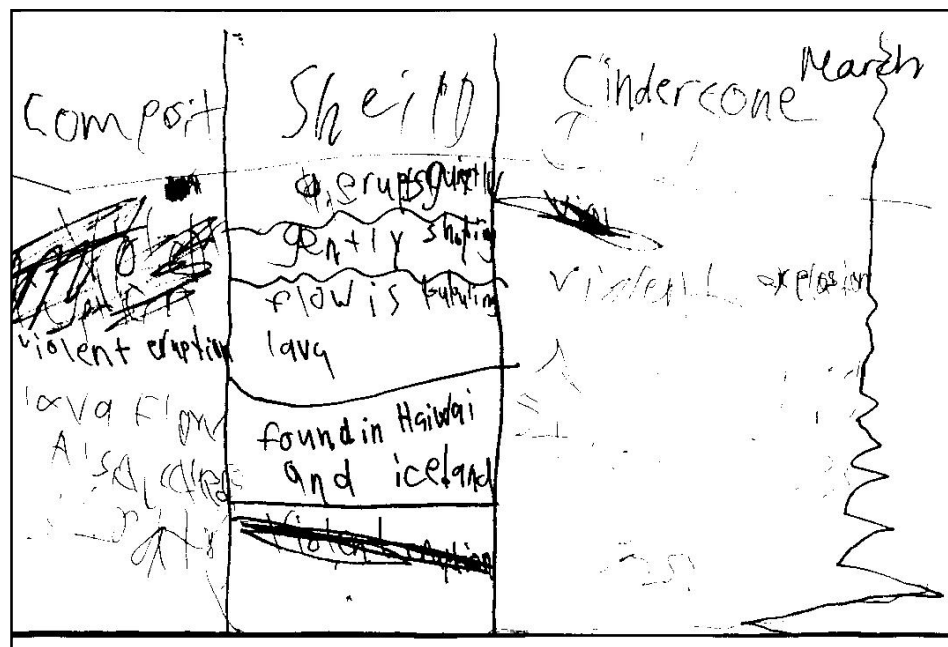
- ▶ ADHD 40%
- ▶ ADD 40%
- ▶ Depression 36%
- ▶ Separation anxiety 20%
- ▶ Overanxious 28%
- ▶ Enuresis 20%
- ▶ Anorexia 17%

# Dysgraphia is Frequently Observed in Children with These Conditions

Subject 1: Before Observed Motor Tics



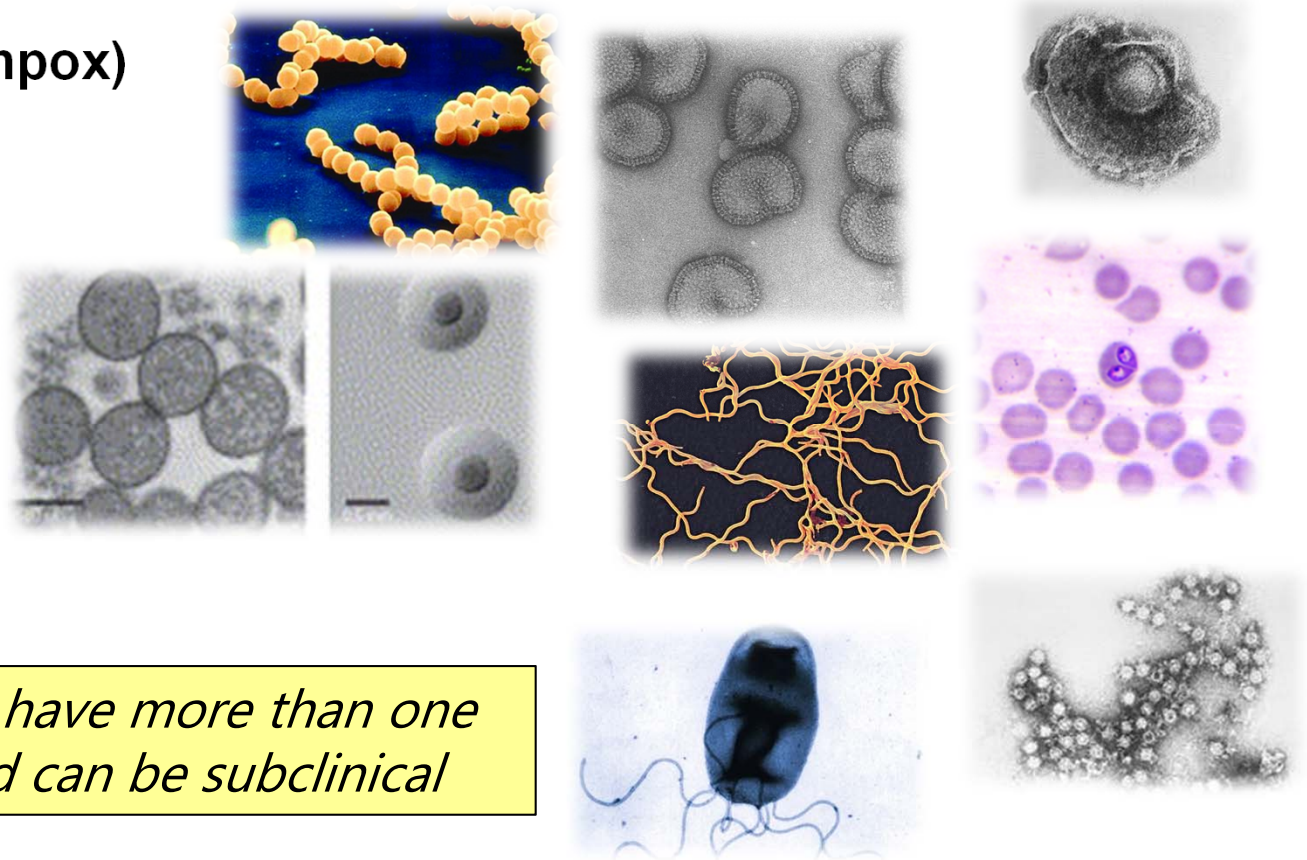
Subject 1: After Observed Motor Tics



Before and after pictures illustrate how a child with tics is profoundly impacted

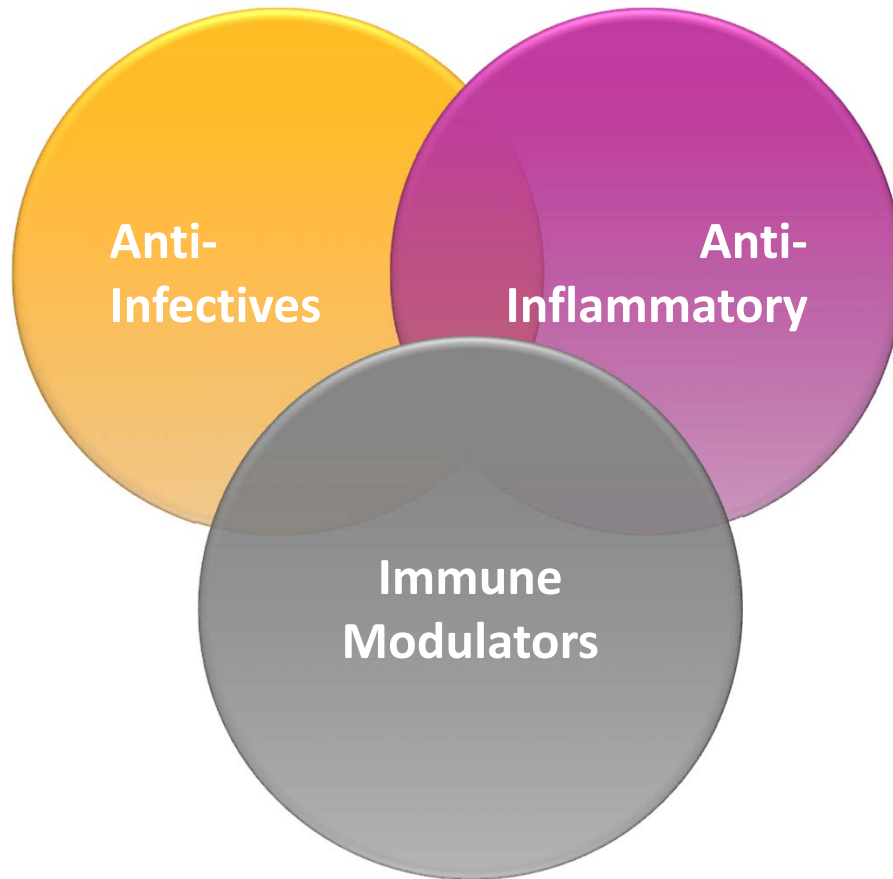
# Some Infectious Triggers that are Associated with PANDAS or PANS

- **Group A streptococci**
- **Influenza A**
- **Varicella (chickenpox)**
- **Mycoplasma**
- **Lyme disease**
- **Babesia**
- **Bartonella**
- **Coxsackie virus**



*Patients often have more than one infection, and can be subclinical*

# Treatment Categories for Infection-triggered Autoimmune Neuropsychiatric Disorders of the Brain



- **Anti-microbials**
- **Steroids and NSAIDs**
- **Plasmapheresis (Plasma exchange)**
- **Intravenous Immunoglobulins (IVIG)**
- **Immune modulating medications**
- **Symptomatic Treatment**
  - **Cognitive Behavioral Therapy**
  - **Low dose SSRIs**

Effective allopathic, integrative or natural treatments tend to fall into these categories



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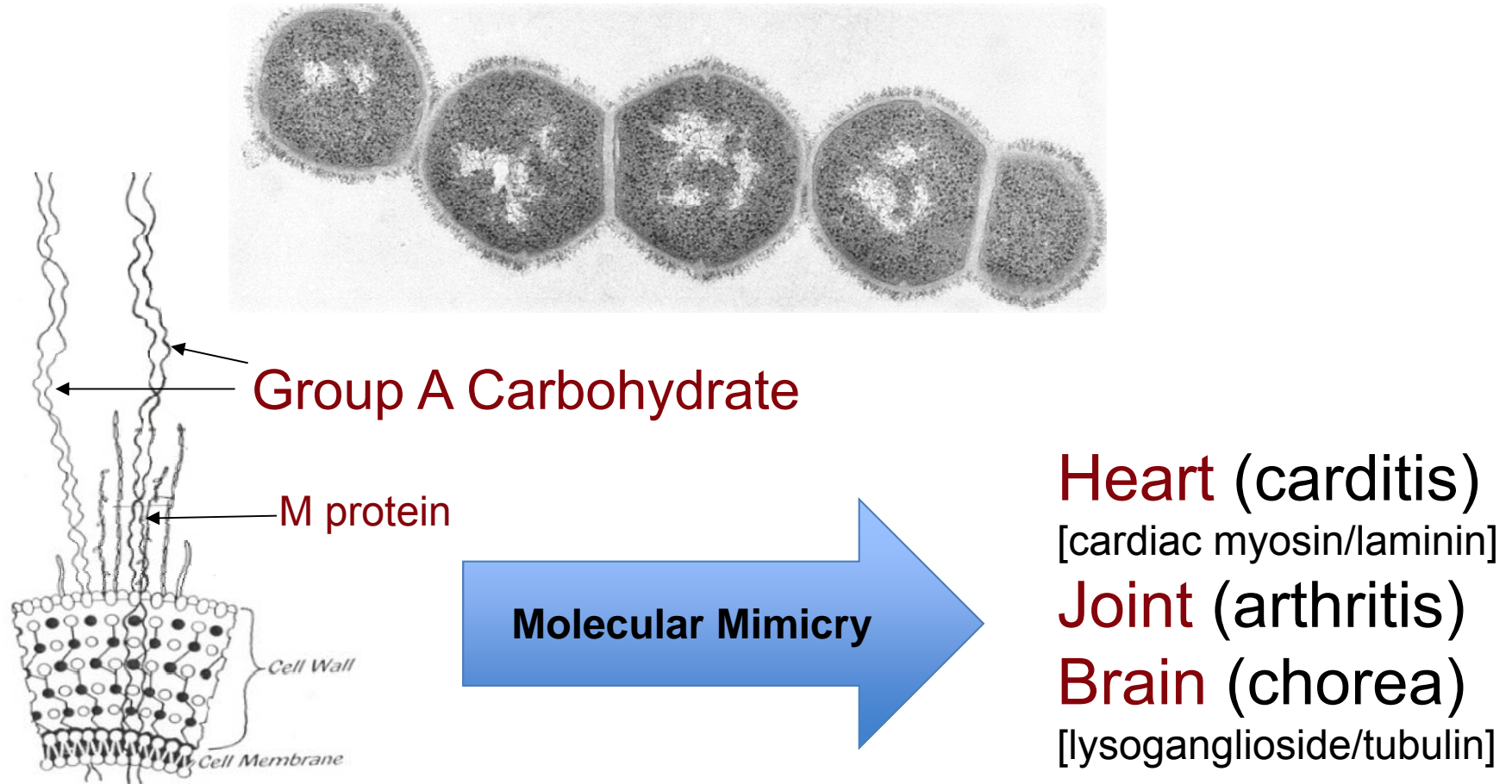
- Biomarker selection
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# Molecular Mimicry Between Strep and Self-Antigens

Similar antigenic determinants between host and infecting microorganisms



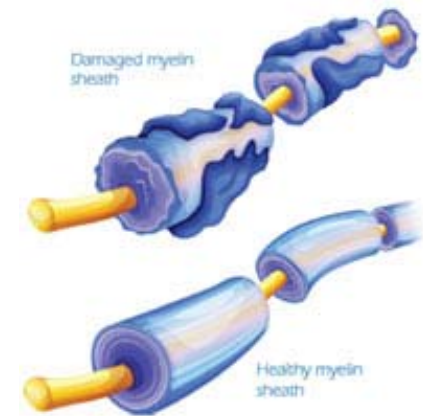
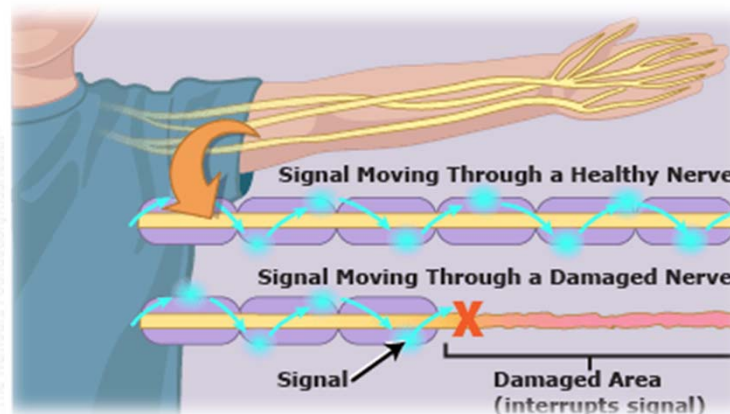
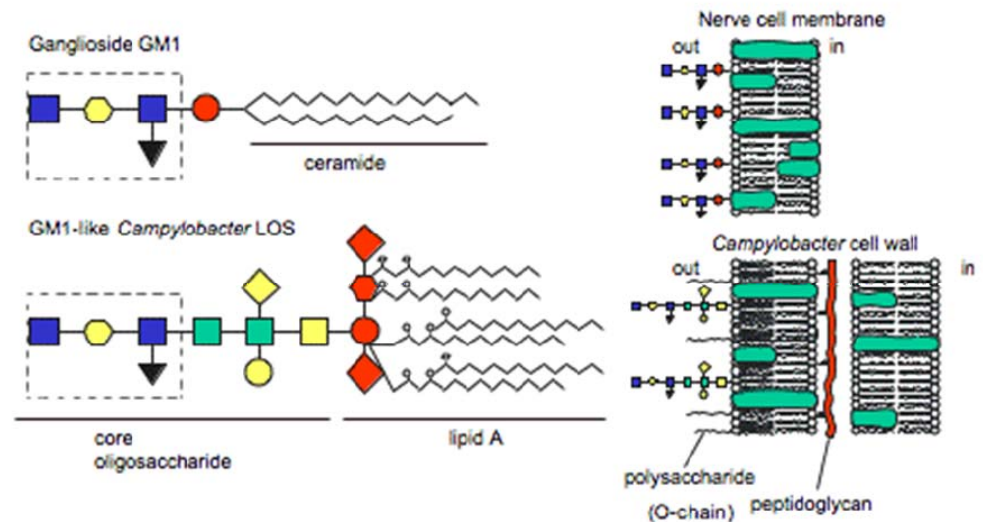
**Streptococcal Cell Wall**

# Molecular Mimicry in Guillain-Barré Syndrome

Robert K. Yu et al. Infect. Immun. 2006;74:6517-6527

Most often preceded by gastrointestinal or respiratory infections:

- ***Campylobacter jejuni***
- *Mycoplasma*
- *Cytomegalovirus (CMV)*
- *Epstein-Barr virus (EBV)*
- *Varicella-zoster virus*
- *Influenza*



Infection-triggered autoimmune reaction against the peripheral nervous system (the myelin sheath)


# Infection-Triggered Autoimmune Response through Molecular Mimicry\*

## ***Infection-Triggers that affect the CNS and other Systems***

- **Guillain-Barré Syndrome**
  - Campylobacter jejuni
- **Sydenham Chorea**
  - Group A Streptococcus
- **Systemic Lupus Erythematosus (Lupus)**
  - Epstein-Barr virus (EBV nuclear antigen -1)
- **Multiple Sclerosis**
  - EBV, measles and HHV-6
- **Myasthenia Gravis**
  - Herpes Simplex Virus Type 1 (gpD)
- **Cardiomyopathy (myocarditis)**
  - Coxsackie virus, Group A Streptococcus
- **Crohn's Disease**
  - Gram-positive bacterial peptidoglycans
- **Diabetes Type 1**
  - Coxsackie B virus, rubella, herpesvirus, rotavirus
- **Psoriasis**
  - Streptococcus pyogenes (Streptococcal M Protein)

\*M.F. Cusick, et. al., Clin Rev Allergy Immunol. 2012 February, 42(1): 102-111

# Molecular Mimicry as a Basis for Chronic Disorders of the Brain and other Diseases

 **NIH Public Access**  
**Author Manuscript**  
*Clin Rev Allergy Immunol*. Author manuscript; available in PMC 2013 February 01.  
 Published in final edited form as:  
*Clin Rev Allergy Immunol*. 2012 February ; 42(1): 102–111. doi:10.1007/s12016-011-8294-7.

**Molecular Mimicry as a Mechanism of Autoimmune Disease**

Matthew F. Cusick, PhD, Jane E. Libbey, MS, and Robert S. Fujinami, PhD<sup>§</sup>  
 Department of Pathology University of Utah 30 North 1900 East, 3R330 SOM Salt Lake City, UT 84132

**Immunological Reviews**

Emily M. L. Chastain  
 Stephen D. Miller

Molecular mimicry as an inducing trigger for CNS autoimmune demyelinating disease

INFECTION AND IMMUNITY, Dec. 2006, p. 6517–6527  
 0019-9567/06/\$08.00+0 doi:10.1128/IAI.00967-06  
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Vol. 74, No. 12

**MINIREVIEW**

**Ganglioside Molecular Mimicry and Its Pathological Roles in Guillain-Barré Syndrome and Related Diseases<sup>7</sup>**

Robert K. Yu,<sup>\*</sup> Seigo Usuki, and Toshio Ariga

*Institute of Molecular Medicine and Genetics and Institute of Neuroscience, Medical College of Georgia, Augusta, Georgia 30912*


**nature medicine** **ARTICLES**

**Autoimmunity due to molecular mimicry as a cause of neurological disease**

MICHAEL C. LEVIN<sup>1,2,3</sup>, SANG MIN LEE<sup>2,3</sup>, FRANCK KALUME<sup>2,4</sup>, YVETTE MORCOR<sup>2,5</sup>, F. CURTIS DOHAN JR<sup>6</sup>, KAREN A. HASTY<sup>1,4,6</sup>, JOSEPH C. CALLAWAY<sup>2,4</sup>, JOSEPH ZUNZ<sup>6</sup>, DOMINIC M. DESIDERIO<sup>1,7</sup> & JOHN M. STUART<sup>1,8</sup>

<sup>1</sup>Research Service, Veterans Affairs Medical Center, Memphis, Tennessee, USA  
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<sup>10</sup>Department of Neurology, University of Washington, Seattle, Washington, USA  
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Rev Endocr Metab Disord (2016) 17:485–498  
 DOI 10.1007/s11154-016-9363-2



**Molecular mimicry and autoimmune thyroid disease**

Salvatore Benvenia<sup>1,2,3</sup> · Fabrizio Guarneri<sup>4</sup>

Diabetologia (1998) 41: 40–46

**Diabetologia**  
 © Springer-Verlag 1998

**Molecular mimicry in diabetes mellitus: the homologous domain in coxsackie B virus protein 2C and islet autoantigen GAD<sub>65</sub> is highly conserved in the coxsackie B-like enteroviruses and binds to the diabetes associated HLA-DR3 molecule**

G. R. Vreugdenhil<sup>1</sup>, A. Geluk<sup>2</sup>, T. H. M. Ottenhoff<sup>2</sup>, W. J. G. Melchers<sup>1</sup>, B. O. Roep<sup>2</sup>, J. M. D. Galama<sup>1</sup>

<sup>1</sup> University of Nijmegen, Department of Medical Microbiology, Nijmegen, The Netherlands  
<sup>2</sup> University of Leiden, Department of Immunohematology and Blood Bank, Leiden, The Netherlands

CLINICAL MICROBIOLOGY REVIEWS, Jan. 2006, p. 80–94  
 0893-8512/06/\$08.00+0 doi:10.1128/CMR.19.1.80-94.2006  
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Vol. 19, No. 1

**Molecular Mimicry, Bystander Activation, or Viral Persistence: Infections and Autoimmune Disease**

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# Topics We will Cover

## **1. Definition of PANDAS/PANS**

- PANDAS Parent Survey
- Nomenclature and alternative nomenclature
- Proposed mechanism
- What is the controversy?

## **2. Brief clinical presentation and symptoms associated with PANDAS/PANS**

- Some common infectious triggers

## **3. Anti-neuronal antibodies in the Cunningham Panel**

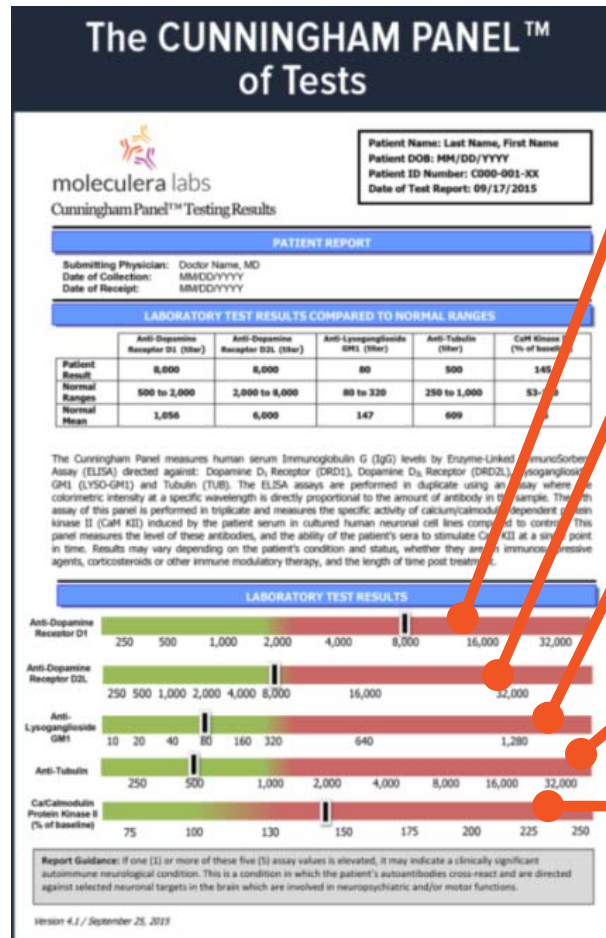
- Biomarker selection
- Patient population study
- Swedish study conclusions and issues

## **4. Closing Thoughts for Parents with Children with Infection-triggered Autoimmune Encephalopathies**



# The Cunningham Panel™ Biomarker Components

***The 5 biomarkers were originally identified from patients with Sydenham Chorea and PANDAS/PANS children***



## 1) Anti-Dopamine D1

Often positive with psychiatric symptoms including psychosis<sup>(1)</sup>

## 2) Anti-Dopamine D2L

Often positive with movement disorders and impulsivity<sup>(1)</sup>

## 3) Anti-Lysoganglioside GM1

Often positive with neuropathic symptoms including tics<sup>(1)</sup>

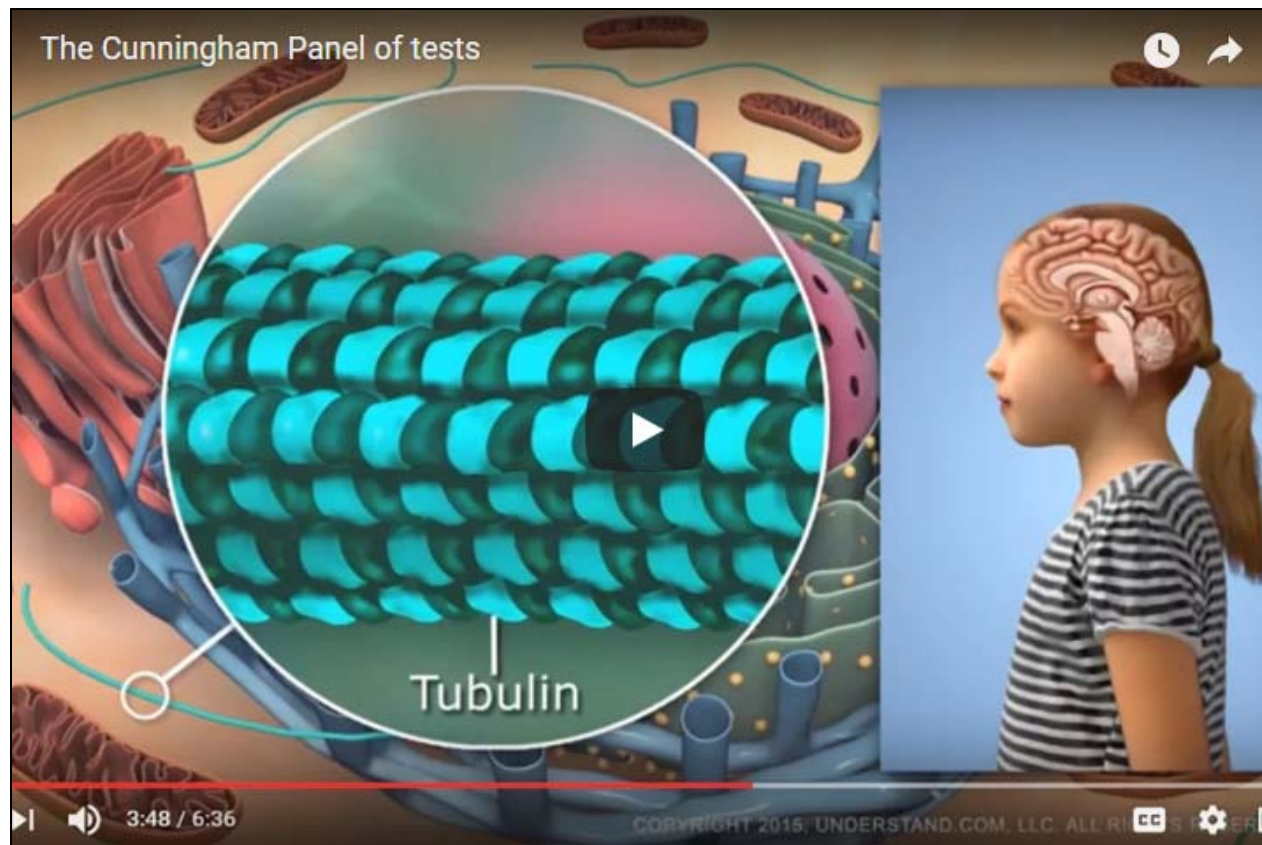
## 4) Anti-Tubulin

Often positive with cognitive complaints, OCD and brain fog<sup>(1)</sup>

## 5) CaM KII Activity

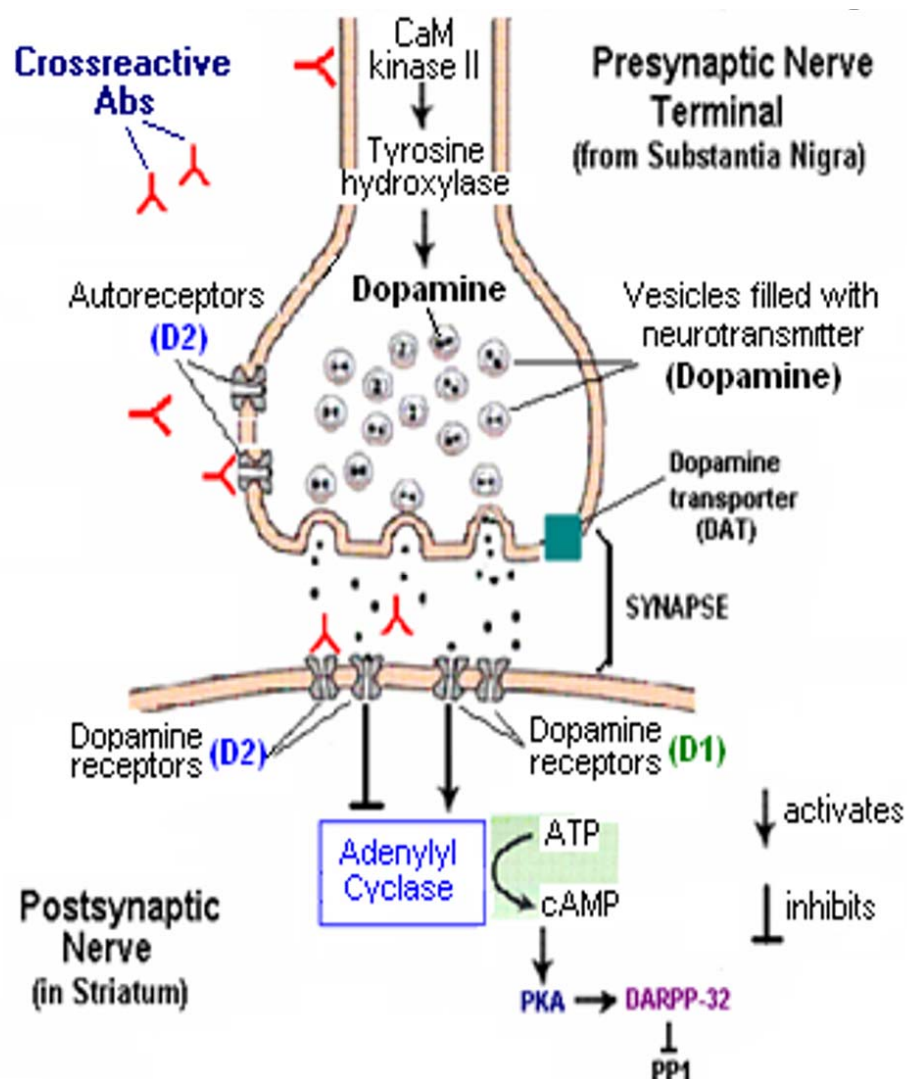
Often positive with involuntary movements and any symptom of adrenergic activation<sup>(1)</sup>

Ref: (1) Reported by Dr. Amirm Katz base upon his 112 patients studied and our patient responses



<https://www.moleculeralabs.com/cunningham-panel-pandas-pans-testing/>

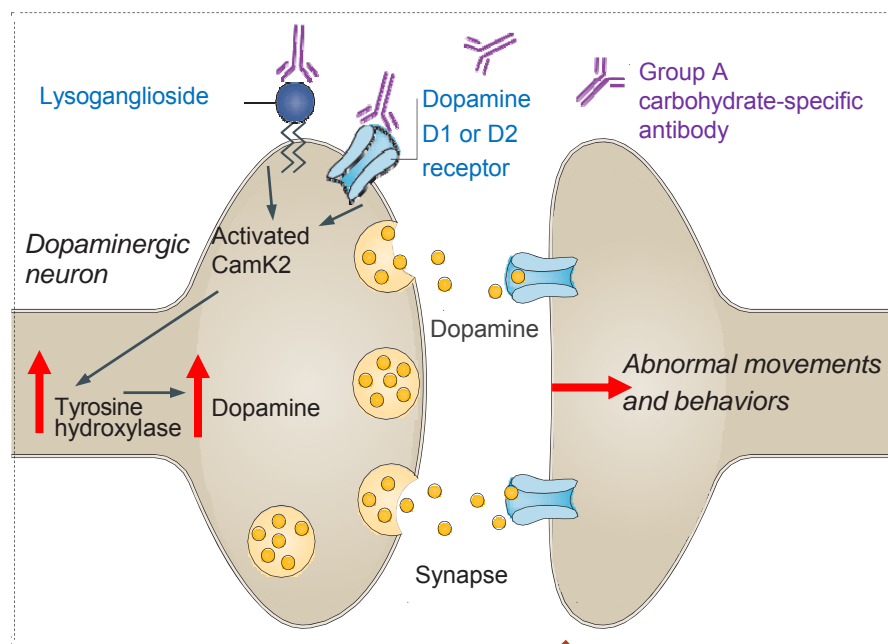
# Autoantibodies that stimulate CAMKII in Children with neuropsychiatric syndromes



Children who demonstrate CaMKII neuronal cell stimulation positive tests, respond to immunotherapy and their neuropsychiatric symptoms resolve



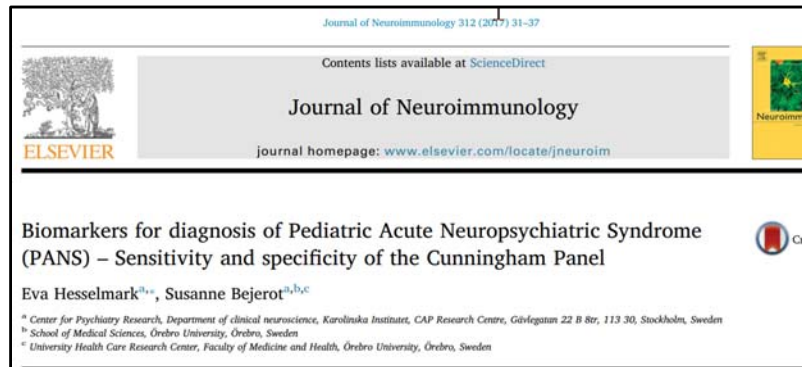
# Connecting Autoimmune Neurologic Antibodies and Neuropsychiatric Symptoms



Neuropsychiatric Symptoms Including Anxiety, Aggression, Rage, OCD, Tics, Depression, Hyperactivity, Insomnia, Phobias



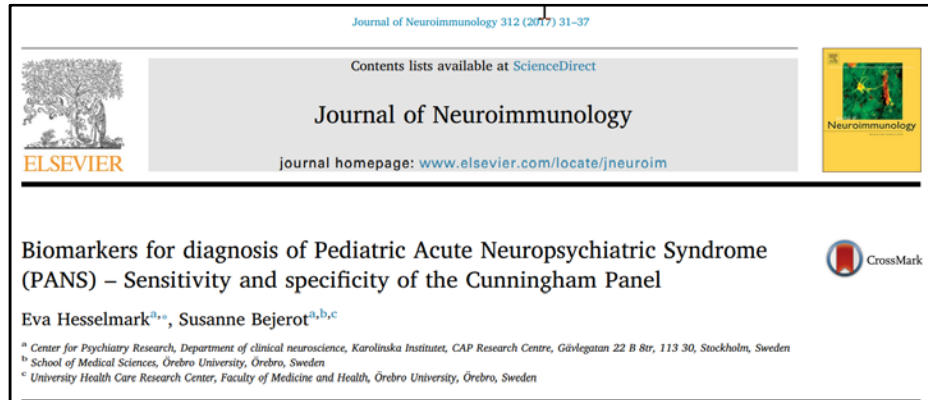
# Swedish Study of Cunningham Panel



Although our findings identified a moderate correlation between change in CaMKII and change in symptom severity in individuals with PANS or PANDAS, there was no indication that the Cunningham Panel can be used to diagnose PANS or PANDAS. Our results also suggest that **test-retest reliability of CaMKII may be insufficient, and that Cunningham Panel results are commonly elevated in healthy controls.**

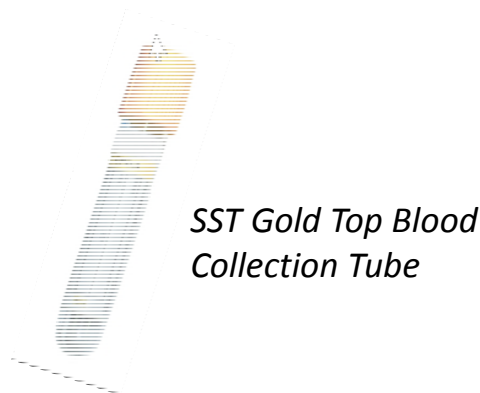


# Swedish Study of Cunningham Panel



## Swedish Study Conclusions of Cunningham Panel

1. “...test-retest reliability of CaMKII may be insufficient”
2. “...results are commonly elevated in healthy controls”



*SST Gold Top Blood Collection Tube*

### Invalid Blood Collection Tube

- Polymer Gel for serum separation
- Interferes with assay results



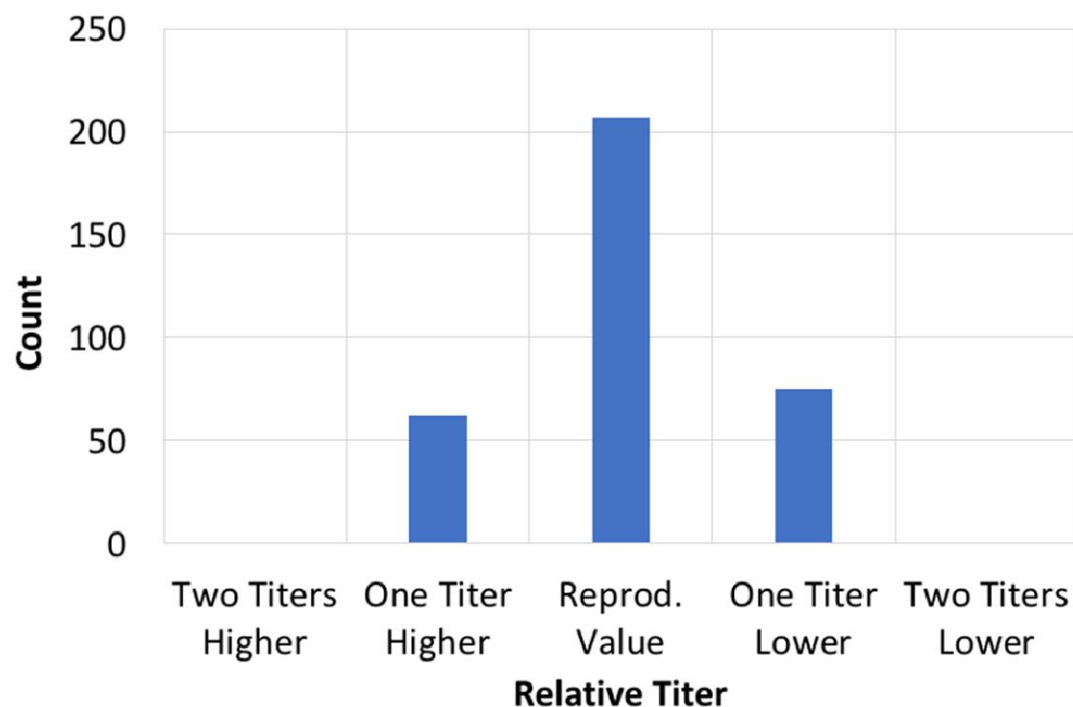
*Red Top Glass Blood Collection Tube*

### Only validated Blood Collection Tube

- No Polymer Gel

# Anti-Dopamine D1R Test-Retest Reproducibility in Tubes w/o Additives

Figure 8. D1R ELISA Assay Reproducibility

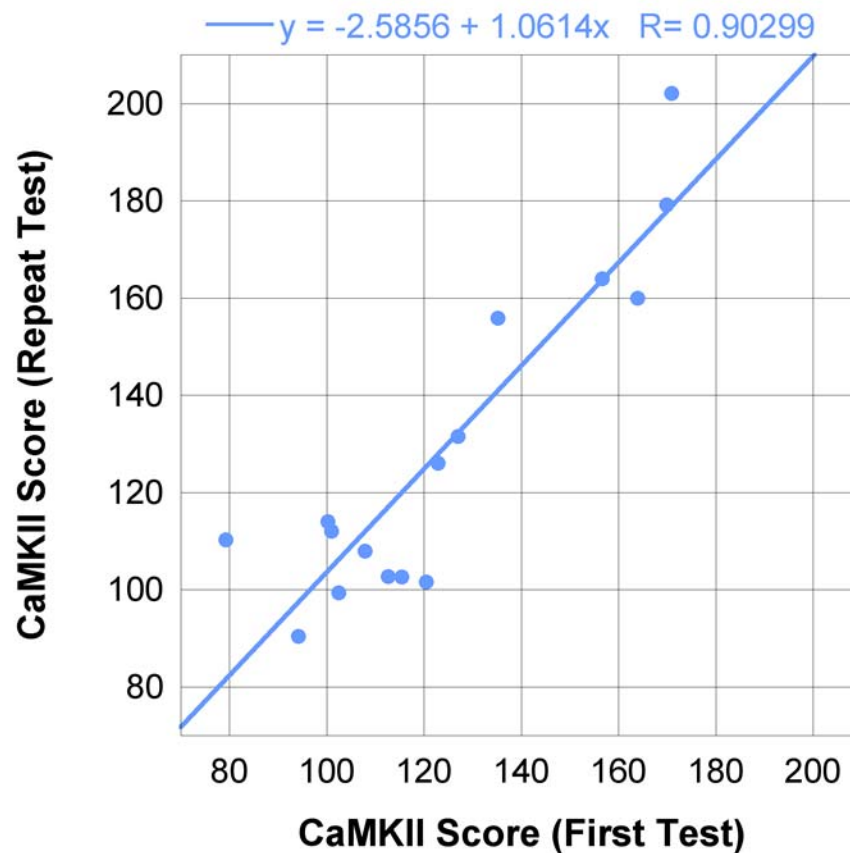


*Results of 344 individual repeated tests on 7 individual patients over several months*

Seven patient samples collected in validated glass tubes with no additives (Red Top glass tubes) tested at random intervals over a period of several months for 344 individual tests. We observed 62 readings at one dilution higher, 207 readings at the most commonly observed dilution, and 75 readings at one dilution lower

# CaMKII Test-Retest Reproducibility in Tubes w/o Additives

Figure 9. CaMKII Assay Reproducibility



**Multiple Test-retesting of samples collected in Red Top Glass Tubes (No additives)**

- First test on the X axis
- Repeat test on the Y axis
- $R=0.90299$

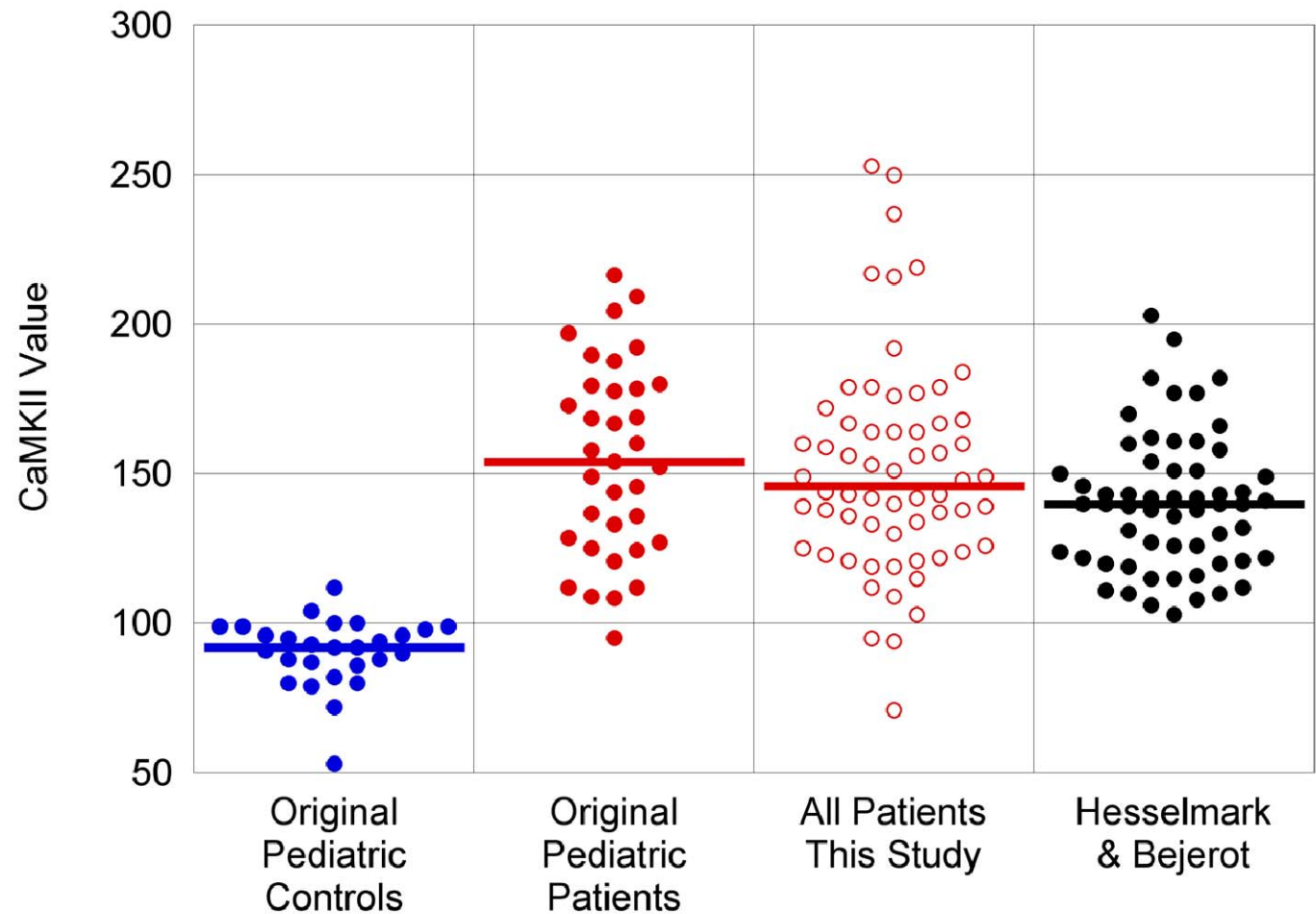
# Impact of Control Population Selection

## CaMKII Results in Study Populations of Diseased Children

### Normal ranges based upon 50 pediatric patients

- No Lifetime history of neuropsychiatric disorders
- No first degree relative with neuropsychiatric disorders
- No patient history of autoimmune diseases
- No active infections or symptoms

Figure 10. Results of CaMKII assays in Various Populations



# Cunningham Panel Performance Conclusions

1. **Results are variable and uncertain when blood is collected in non-valid tubes**, working on finding if other collection tubes can be validated
2. **Assay test-retest reproducibility is robust and highly reproducible**, especially considering this is a biological assay
3. **Selection of control population for these patients and in this Panel is critical** to understanding the differences in diseased and “healthy patients”
4. **More studies are needed** to better understand the biology and other potential biomarkers in PANS/PANDAS patients





# Autoantibody Etiology for Multiple Neuropsychiatric Disorders Detected by These 5 Biomarkers

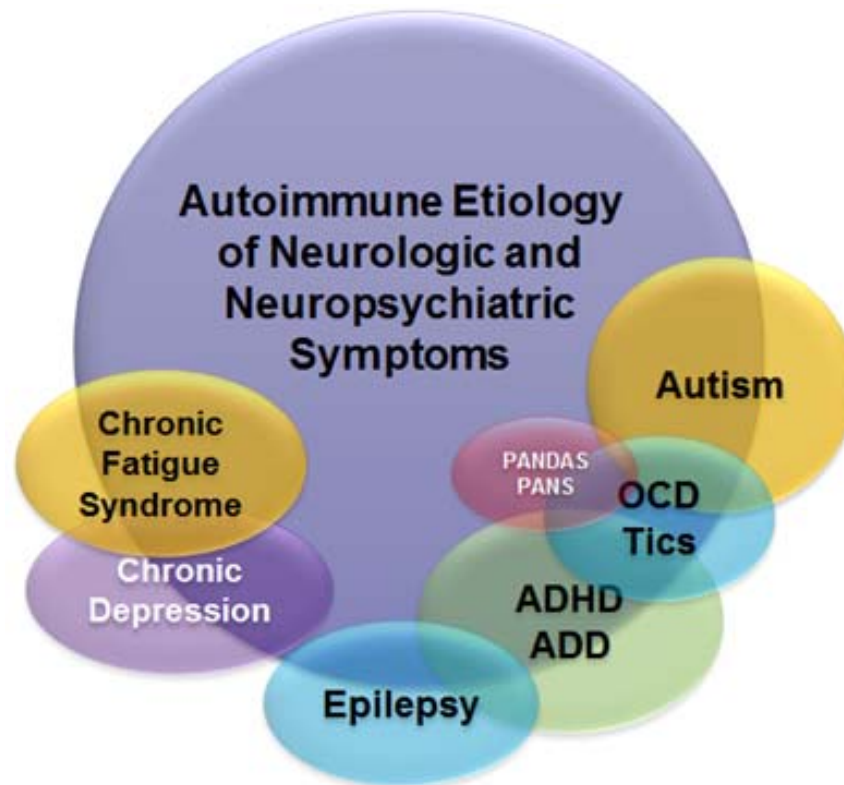
- **PANDAS/PANS**
- **Autism Spectrum Disorder (ASD)**
- **ADHD**
- **Tourette's**
- **Anxiety**
- **Obsessive Compulsive Disorder**
- **Chronic Depression**
- **Bipolar Disorder**
- **Epilepsy**
- **Eating Disorders**



Physicians have been utilizing the panel for many of these disorders with positive results when using similar therapy. Case studies are being generated and working manuscripts.



# Many Chronic Disorders can have a Patient Segment whose Cause is an Autoimmune Etiology



Distinctly different etiologies of disease can manifest identical symptoms  
but resolution is only possible with an understanding of the etiology

# Topics We will Cover

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## Additional Information Sources



[www.panspandasuk.org](http://www.panspandasuk.org)



[www.pandasnetwork.org](http://www.pandasnetwork.org)



[www.pandasppn.org](http://www.pandasppn.org)

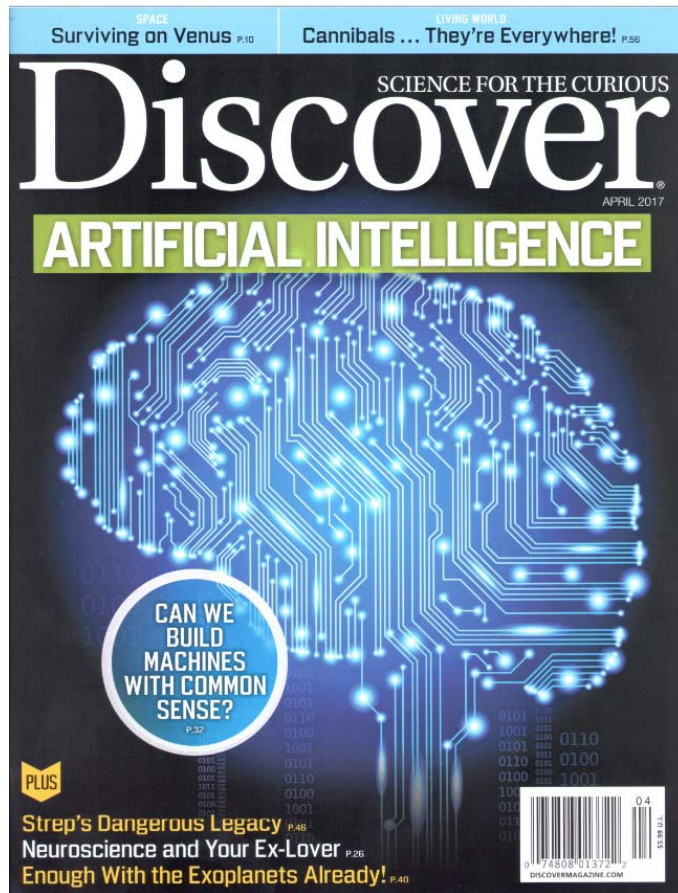


moleculera labs  
[www.moleculeralabs.com](http://www.moleculeralabs.com)



[www.nimh.nih.gov](http://www.nimh.nih.gov)

# Additional Resources: Discover Magazine April 2017 Issue



## PINNING DOWN PANS

While medical experts have established criteria for diagnosing pediatric acute-onset neuropsychiatric syndrome, coming to that conclusion is still tough. Tests like the Cunningham Panel help, but researchers are still learning how PANS affects the brain. For now, here's where things stand.

### How the Body Turns on Itself

Bacteria, virus or other trigger causes immune response

Plasma cell

Cells release antibodies to fight infection

Antibodies

Infectious agent

In autoimmune disorders, these antibodies also attack the body's own healthy tissue, making them autoantibodies

### Testing for PANS

The Cunningham Panel tests for specific autoantibodies and other features associated with the neuropsychiatric symptoms PANS patients display. If antibody levels are high, that suggests the autoimmune response was triggered by an infection.

**The panel focuses on:**

- 1) Anti-dopamine receptor D1
- 2) Anti-dopamine receptor D2L
- 3) Anti-lysoganglioside
- 4) Anti-tubulin
- 5) CaM Kinase II activity levels

### Basal ganglia

Contains many dopamine D2L receptors. This part of the brain is crucial for motor control and plays a role in movement disorders like OCD.

### Dopamine

Neurotransmitter that, among other things, helps with motor control and cognition.

### Lysogangliosides

Molecules in neuron membranes that help with signal transmission between neurons.

### Tubulin

A protein molecule involved in helping cells maintain structures.

Tubulin forms microtubules

### CaM Kinase II

High activity levels of this enzyme cause the brain to become overstimulated.

SYNAPSE

Dopamine

Dopamine receptors

CAM KII

Neurons communicate by sending signals across gaps called synapses

CELL BODY

AXON

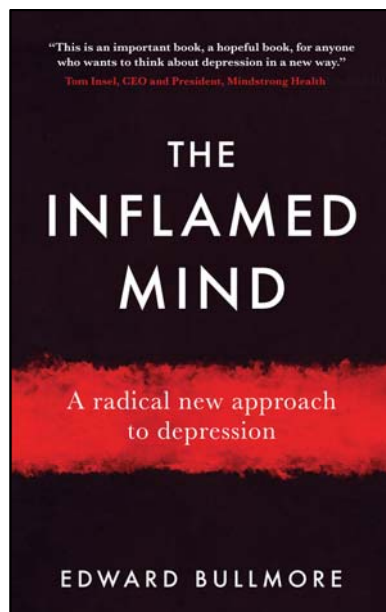
Microtubules

Microtubule

April 2017 DISCOVER 53

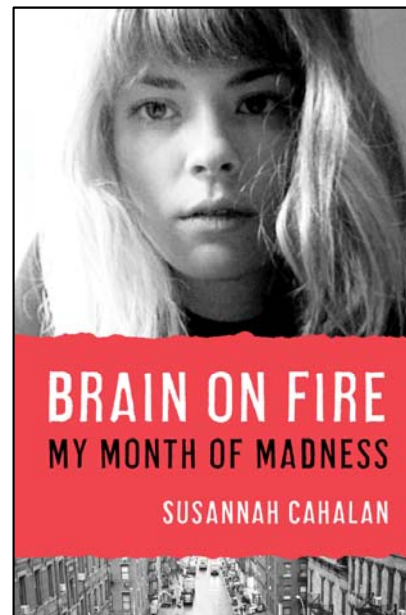
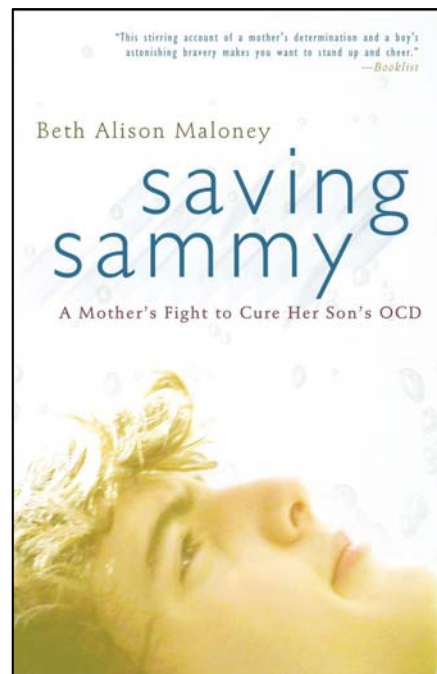


# Infection-Triggered Autoimmune Neuropsychiatric Disorders of the Brain



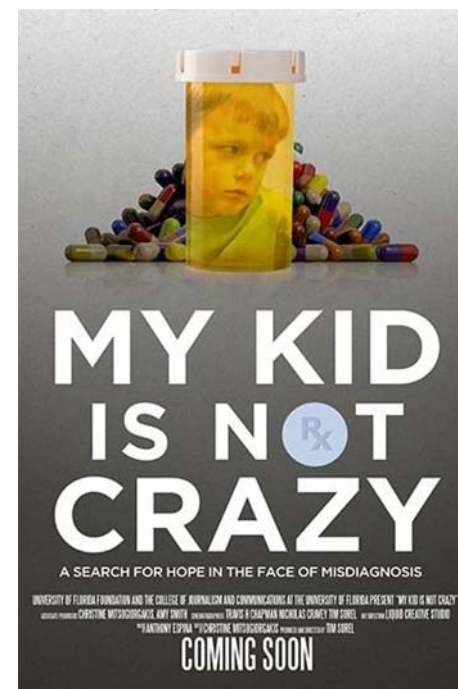
Released April 2018  
Dr. Bullmore is Co-Chair of Cambridge Neuroscience, Scientific Director of the Wolfson Brain Imaging Centre, and Head of the Department of Psychiatry at Cambridge University

Linking infection to "mental" illness, as strep antibodies are linked to the neurological Tourette's syndrome, has been rejected by many doctors since the rise of psychoanalysis, but Maloney insisted Sammy be tested for strep titers when he became unable to attend school and to walk. He was diagnosed with PANDAS. Antibiotics ended two torturous years for the family, and Sammy's regains came as rapidly as the symptoms had overtaken him



Susannah Cahalan is a news reporter at the *New York Post* who succumbed to an infection then began a painful journey to be diagnosed with an autoimmune disorder attacking her brain, and then the path to recovery after receiving the right treatment.

DVD: Documentary chronicling several families and their children suffering from PANDAS and what they went through to reach a diagnosis and begin recovery



# Closing Thoughts

1. **Seek out resources on**
  - PANDAS/PANS
  - Autoimmune Neuropsychiatric Disorders
  - Autoimmune Encephalopathies/ Encephalitis
2. **Find a PANDAS/PANS support group and other parents who have experienced what you are going through, or start one**
  - See PANDAS Network website for locations
3. **Find doctors that have some experience in treating these disorders no matter where they are, or find someone who is willing to listen and work with you**
4. **Be persistent, Don't loose hope, Don't Give Up because there are answers and your child depends on it**



## Grace's Story – One of Thousands we Have Tested



<https://www.molecularabs.com/pans-pandas-grace-story/>





*Our Mission is to Help Change How Medicine is  
Practiced for Neuropsychiatric Disorders*

***We are hear to help provide some answers!***

For More Information Contact:

Craig Shimasaki, PhD, MBA

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[www.MoleculeraLabs.com](http://www.MoleculeraLabs.com)

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