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# Microbial Induced Autoimmune Inflammation as a Cause of Mental Illness in Adolescents: A Case Series

Nancy Brown

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## Abstract

The incidence of mental health disorders in adolescents continues to rise. The cause of the increase in mental illness is multifactorial, including both environmental and biological causes. To investigate the latter, ten adolescents at a psychiatric residential treatment center in Colorado with the DSM-5 diagnosis of major depressive disorder (MDD), of whom seven were additionally diagnosed with generalized anxiety disorder (GAD), were chosen at random for further serologic study. Testing revealed exposure to group A Streptococcus (GAS) in 3 of 10 (30

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***Index terms***— PANDAS, PANS, autoimmune, neuroinflammation, streptococcus, lyme, bartonella, cunningham panel, mental illness, adolescents.

# 1 Introduction

cited as a significant factor [5]. Common sources of Corresponding Author ?: e-mail: kinderlehrer@gmail.com stress in adolescence include social stress/peer pressure, academic pressure, isolation, dysfunctional home environment, physical or sexual abuse, bullying, low self-esteem and substance abuse. Compounding these issues, adolescents who spend more time on social media and electronic devices such as smartphones are more likely to report mental health issues, and an increase in screen time is associated with a decrease in in-person social interaction and an increase in depressive episodes [1].

It is clear that biological issues also have a significant role in mental health disorders. Neuropsychiatric symptoms can be caused by multiple organic issues including heavy metal toxicity [6], allergy to gluten [7], thyroid disorders [8], and autoimmune illness [9]. In addition, the medical literature is replete with the identification of neuropsychiatric disorders caused by infection [9,10].

Autoimmune mechanisms may underly the linkage between infection and neuropsychiatric disorders. In 1994, Swedo et.al. described mental health issues associated with group A Streptococcus (GAS) infections [38]. Based on the first fifty children who met the clinical description of neuropsychiatric disorders following streptococcal infections, Swedo outlined five diagnostic criteria for this diagnosis and coined the term pediatric autoimmune neuropsychiatric disorders ental health problems among adolescents are increasing [1]. The most common mental health disorder in this age group is anxiety. Anxiety disorders occur in approximately 32% of adolescents 13 to 18 years of age, and 8.3% had severe impairment [2]. The number of adolescents who experienced major depressive disorder (MDD) was 21.48% in 2015 and increased by nearly a third from 2009/2010 to 2015 [1]; 13.3% of youth aged 12 to 17 report suffering from at least one major depressive episode in 2017 **??**3]. The suicide rate among persons aged 10 to 24 has increased 56% between 2007 and 2017; since 2014 suicide has replaced homicide as the second most common cause of death for teenagers ages 10 to 19 in the United States [4].

The cause of mental health disorders in adolescents is multifactorial, including both biological and environmental causes. Stress issues have been

# 2 M

Other tick-borne infections can also cause neuropsychiatric illness. Infections with Bartonella spp. have been associated with anxiety, panic disorder, depression, obsessive compulsive disorder (OCD), phobias, eating disorders, alcohol and drug abuse, psychosis and personality disorders [18][19][20][21][22].

Bartonella henselae (B. henselae) is also associated with a wide spectrum of autoimmune conditions [23][24][25][26][27][28][29][30][31][32][33][34][35][36][37], including pediatric acute-onset neuropsychiatric syndrome (PANS) [22].

Infections transmitted by ticks have been linked to a spectrum of mood and behavioral disorders. Borrelia burgdorferi sensu lato (Bbsl), the pathogen that causes Lyme disease, is responsible for a wide range of mental health disorders, including anxiety disorders, depression, schizoaffective disorders, bipolar disorder, eating disorders, addiction, suicide, violence, anhedonia, depersonalization and dissociative episodes [11][12][13][14][15] **??**16][17].

Abstract-The incidence of mental health disorders in adolescents continues to rise. The cause of the increase in mental illness is multifactorial, including both environmental and biological causes. To investigate the latter, ten adolescents at a psychiatric residential treatment center in Colorado with the DSM-5 diagnosis of major depressive disorder (MDD), of whom seven were additionally diagnosed with generalized anxiety disorder (GAD), were chosen at random for further serologic study. Testing revealed exposure to group A Streptococcus (GAS) in 3 of 10 (30%); Borrelia burgdorferi sensu lato (Bbsl) in 2 of 10 (20%); and spp. in 3 of 10 (30%). In addition, 9 of 10 (90%) subjects had abnormal Cunningham Panels, which measures levels of antineuronal antibodies that have been associated with psychiatric disturbances. Given the degree of psychological dysfunction in these adolescents requiring intensive residential treatment, this case series lends support to the hypothesis that exposure to infectious agents may play a role, perhaps by autoimmune mechanisms, in the significant and ongoing rise in the rate of neuropsychiatric illness in adolescents. This preliminary report adds to this premise and requires further investigation.

Bartonella associated with streptococcal infections (PANDAS) [39]. These criteria include OCD or tic disorder (as defined by DSM IV, American Psychiatric Association, 2000), prepubertal age of onset, an abrupt onset with relapsing or remitting course, neurological abnormalities during exacerbations (such as involuntary, choreiform movements or motor hyperactivity), and a temporal association between streptococcal infections and neuropsychiatric symptom exacerbations.

In recognition of the finding that multiple microbes in addition to GAS can trigger autoimmune encephalitis and autoimmune encephalopathies or PANDAS-like syndromes, this condition is now referred to as pediatric acute-onset neuropsychiatric syndrome (PANS), and criteria have been developed for this diagnosis. Children must have the abrupt onset of OCD or severely restricted food intake; there must be no known neurologic or medical disorder that would account for the symptoms; and include at least two of the following seven conditions: anxiety, emotional lability and/or depression; irritability, aggression, and/or severe oppositional behaviors; behavioral (developmental) regression; sudden deterioration in school performance; motor or sensory abnormalities; somatic signs and symptoms, including sleep disturbances, enuresis, or urinary frequency [40]. Multiple microbes have been documented as triggering PANS including herpes simplex virus, influenza A virus, varicella zoster virus, Epstein-Barr virus, HIV, recurrent sinusitis, the common Immune cross-reactivity between microbes and host tissues has been well documented and is attributed to molecular mimicry [43,44]. Children with PANS-like conditions exhibit elevated levels of antineuronal antibodies against dopamine receptors [45][46][47], lysoganglioside [48], and tubulin [49]. Antineuronal antibodies crossing the blood-brain barrier can activate calcium calmodulin-dependent protein kinase II (CaMKII), a multifunctional enzyme highly concentrated in the brain, which mediates many different learning, memory, and developmental cell pathways. CaMKII alters dopamine neurotransmission, leading to neuropsychiatric symptoms of OCD as well as tics, and youths with OCD and tics have elevations in CaMKII activity [50].The Cunningham Panel was developed to assess patients with PANS-like syndromes, and includes levels of these antibodies as well as CaMKII activity.

autoimmune induced neuroinflammation as a possible cause of their disorders.

# 3 II.

# 4 Methods

Subjects were randomly selected patients at a residential adolescent treatment center. The severity of their mental health issues prevented them from living at home and attending school. All were suffering from depression, and some also suffered from anxiety. Informed consent was reviewed and approved by the Western Institutional Review Board (WIRB). Consent was obtained from all subjects and their guardians.

# 5 III.

# 6 Results

The subjects ranged from fourteen to seventeen years of age. There were six females and four males. All ten satisfied DSM-5 criteria for MDD, and seven additionally satisfied DSM-5 criteria for GAD. Three of the subjects were diagnosed with Attention Deficit Disorder (ADD), three subjects had made serious suicide attempts, four subjects had behavior associated with non-suicidal self-injury disorder (NSSID) in the form of cutting, and one had tics. One subject had previously been diagnosed with celiac disease, but the remaining nine had no known medical disorder. See Table 1. cold, Mycoplasma pneumonia and B. henselae [22,41,42].

Serum testing included Lyme ImmunoBlot IgM and IgG for evidence of exposure to Bbsl; Bartonella Multi-species Western Blot IgM and IgG for evidence of exposure to Bartonella spp.; Anti-DNase B (ADB) for evidence of exposure to GAS; and the Cunningham Panel for evidence of autoimmune neuroinflammation. The Cunningham Panel includes five assays performed on serum that measure human IgG levels by enzymelinked immunosorbent assay (ELISA) directed against the Dopamine D1 Receptor, Dopamine D2L Receptor, Lysoganglioside-GM1, and Tubulin, as well as a cell stimulation assay which measures the ability of a person's serum IgG to stimulate CaMKII activity in human neuronal cells.

This exploratory study has two aims. First, to examine whether adolescents with serious mental health disorders have a higher rate of exposure to GAS, Bbsl, and Bartonella spp. than the general population. Secondly, to evaluate whether adolescents with significant mental health disorders have elevations in antineuronal antibody levels, consistent with Nine of ten subjects (90%) had abnormalities in the Cunningham Panel with elevations in anti-neuronal antibodies and five of ten (50%) subjects with elevations in CaMKII activity. See Table 5.

# 7 Discussion

In this case series, three of ten subjects (30%) had positive titers to ADB consistent with exposure to GAS. ADB titers become positive one week to one month after streptococcal infection and usually stay positive for months. However, in some individuals ADB titers stay positive longer than one year, including in some with streptococcal carrier states [51,52]. ADB titers are positive in the majority of patients with streptococcal induced autoimmune illnesses including rheumatic fever and post-streptococcal glomerulonephritis, as well as in patients with PANDAS [51][52][53]. Fujikawa et. al. found that only 8% of a noncarrier control population had elevations in ADB titers [52]. The finding that 30% of the subjects in this study had elevations in ADB levels suggests the possibility that GAS may have played a role in their mental health issues.

In this case series, 2 of 10 (20%) subjects showed evidence of exposure to or current infection with Bbsl. The Lyme immunoblot assay, which utilizes pure While neuroinflammation has been documented in both acute and persistent infection with Bbsl [63][64][65], this pathogen has not as yet been documented as a singular cause of PANS. Cross et.al. described the case of a pre-pubescent female who developed PANS with a positive Cunningham Panel, was serologically positive for Streptococcus but also for several tick-borne infections including Bbsl, B. henselae, and Babesia recombinant proteins as test antigens, is more sensitive and specific than the Lyme ELISA and the Lyme Western Blot [54][55][56]. While cross-reactivity of some Borrelia proteins with antigens from other bacteria and viruses is well known [40], the presence of IgG antibodies at 23-kdA (outer surface protein [Osp]C), 34-kdA (OspB) and at 39-kdA are considered specific and therefore diagnostic for B. burgdorferi [57][58][59][60]. Subjects 3 and 6 demonstrated IgG reactivity at Bands 23, 34 and/or 39. While these results do not meet the Centers for Disease Control and Prevention (CDC) criteria for reporting Lyme disease, the CDC criteria were established for surveillance purposes only, not for clinical diagnosis ??61,62].

# 8 Bbsl ImmunoBlot positive

# 9 Medical Research

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Microbial Induced Autoimmune Inflammation as a Cause of Mental Illness in Adolescents: A Case Series duncani, and responded to broad spectrum antimicrobial therapy [66]. Many of the neuropsychiatric symptoms of neuroborreliosis parallel or overlap with those of PANS, including anxiety disorders, depression, OCD and tics [11][12][13][14][15] ??16][17]67].

illness in humans, including autoimmune and psychiatric illness as noted above. There is an abundance of data on infections in animals with B. vinsonii and B. elizabethae, but in humans it is limited. There are reports that both species can cause infective endocarditis [82][83][84], and B. vinsonii has additionally been reported to cause neurological abnormalities [85,86]. There are no reports of neuropsychiatric complications with these two Bartonella species. However, these infections need to be considered emerging illnesses at this time; few laboratories are equipped to identify these potential pathogens and correlate them with clinical syndromes.

There is also the possibility of cross-reactivity among different species of Bartonella [87]. The relevance of positive Bartonella spp. IgG in three adolescents in this study is unclear.

In this case series, 9 of 10 (90%) subjects demonstrated the presence of anti-neuronal antibodies and 5 of 10 (50%) had CaMKII activation. The utility of the Cunningham Panel has been demonstrated in the assessment of PANDAS/PANS by Shimasaki et. al. They evaluated 58 patients meeting the diagnostic criteria for PANDAS/PANS who were tested pre-and posttreatment. Patients were categorized as "Improved/ Resolved" (n=34) or "Not-Improved/Worsened" (n=24). The changes in assays of the Cunningham Panel paralleled changes in patient symptoms following treatment with an accuracy of 90%, a sensitivity of 88% and a specificity of 92% [88]. Chain et.al. compared 35 acute onset PANDAS patients with 28 healthy controls and found that 32 sera (91.4%) in the PANDAS group were positive for one or more of the antineuronal autoantibodies compared with 9 of 28 healthy controls (32.1%) [89]. Likewise, Connery et.al. found that the Cunningham Panel accurately predicted significant responses in aberrant behavior and social responsiveness in children with autism [90]. Multiple other studies have found an association between autoimmune neuropsychiatric disorders such as PANDAS/PANS and the biomarkers included in the Cunningham Panel [45][46][47][48][49][50][91][92][93][94][95][96]. Antineuronal antibodies crossing the blood brain barrier and activating CaMKII may underlie the serious mental health issues in the subjects in this case series.

Hesselmark and Bejerot have challenged the utility of using the Cunningham panel to diagnose PANS [97].Their study found both low sensitivity and specificity of the Cunningham panel, and did not find a statistical difference between patients with PANS and healthy controls. But their findings have been challenged because, among other issues, they used invalid serum collection tubes-they used gold top tubes that contain both a clot activator and a serum gel separator rather than glass red top tubes that have no additives [98].

The rates of infections with GAS [99,100] and tick-borne pathogens [101] are increasing, and perhaps molecular mimicry resulting in immune cross-reactivity underlies the rise in autoimmune illnesses [102]. Nonmicrobial factors that underlie the development of autoimmunity are also increasing, including occupational exposures such as pesticides [103,104], dietary changes and their impact on the microbiome B. henselae causes a wide spectrum of clinical Some of the chronic symptoms in patients with post-treatment Lyme disease syndrome (PTLDS) are attributed to autoimmunity [68,69], and Chandra et. al. found anti-neuronal antibody levels 41 of 83 (49.4%) PTLDS patients who continued to suffer from chronic symptoms of pain, fatigue, and impaired cognition; antibodies against Bbsl cross-reacted with several neural proteins [63]. Likewise, Fallon et.al. found higher levels of antibodies against Lysoganglioside-GM1, Tubulin, and Dopamine D1-Receptor as well as well as elevated activity of CaMKII in patients with a prior history of Lyme borreliosis but not in those without that history [70]. Osp A has a protein sequence similar to GAS [71], and OspA is associated with autoimmune reactivity [69]. It is not unlikely that Bbsl is yet another microbe that can trigger PANS-like syndromes. The finding that 20% of subjects in this case series had evidence of exposure to Bbsl raises the possibility that this microbe is playing a role in their mental health issues.

In this case series, 3 of 10 (30%) subjects showed evidence of exposure to or current infection with Bartonella spp. B. henselae, an intracellular gramnegative pleomorphic bacillus, is the causative agent of cat scratch disease (CSD) transmitted via the cat flea. In addition to transmission via fleas, sandflies and lice, B. henselae can be transmitted via the Ixodes tick [72,73]. Co-occurrence of Bartonella spp. with known tick-borne pathogens such as Bbsl is not uncommon. A survey by Adelson et. al. of Ixodes ticks in northern New Jersey found B. burgdorferi present in 35% while 34% harbored Bartonella spp. [74]. Additional surveys have confirmed the high incidence of Bartonella spp. in Ixodes ticks [75,76]. The Bartonella bacillus is difficult to grow; therefore, culture is not recommended [77]. While polymerase chain reaction (PCR) in serum or tissue specimens is the most definitive way to diagnose infection with Bartonella, PCR detection lacks sensitivity (43-76%) [78]. ELISA and Indirect immunoflourescence assays (IFA) are the standard tools to diagnose bartonellosis, however increased sensitivity is associated with decreased specificity with both these antibody assays [79,80]. There is preliminary evidence that Western blot testing for Bartonella as performed in this case series is both more sensitive and specific than either IFA or ELISA testing [81]. Microbial Induced Autoimmune Inflammation as a Cause of Mental Illness in Adolescents: A Case Series [105,106], and stress-related disorders such as posttraumatic stress disorder (PTSD) [107,108]. Indeed, all these factors can alter epigenetics [109][110][111][112][113] **??**114], and epigenetics is crucial to the development of autoimmunity **??**115]. Therefore, it is possible that multiple factors are contributing to autoimmunity and are cumulative in succeeding generations.

V.

# 10 Conclusion

The increasing incidence of mental health disorders in adolescents is multifactorial. Stress issues and an increase in screen time on electronic devices has appropriately received attention, but less attention has been given to the role of organic disorders. This case series documented exposure to GAS, Bbsl and Bartonella spp. in 5 of 10 (50%) subjects, raising the possibility that these microbes may be playing a causative role in the subjects' mental illness. In addition, 9 of 10 (90%) subjects had evidence of autoimmune neuroinflammation as evidenced by their positive Cunningham Panels. The high percentage incidence of antineuronal antibodies and CaMKII activation in this group of ten subjects may not necessarily be indicative of all patients in this facility due to the small sample size, but it is possible that neuroinflammation is an important contributor to the increasingly high incidence of mental health disorders in the adolescent population.

Given the serious and increasing morbidity and mortality of mental illness in the adolescent population, the implications are significant for promoting future research. Further studies in a larger cohort of patients compared with a healthy control population that would help elucidate the roles of GAS, Bbsl and Bartonella along with autoimmune neuroinflammation in the etiology of mental health issues in the adolescent population is warranted.

**1**

| Subject | Age | Gender | MDD | GAD | Suicide attempt | Eating Disorder | NSSID (Cutting) | Tics | Medical Disorder |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 16 | M | + | + | + | | | | Celiac |
| 2 | 16 | F | + | | + | | + | | |
| 3 | 14 | M | + | + | | | | | |
| 4 | 15 | F | + | + | | + | + | + | |
| 5 | 15 | F | + | + | | | | | |
| 6 | 16 | F | + | + | | | | | |
| 7 | 15 | M | + | + | | | | | |
| 8 | 17 | F | + | + | + | | + | | |
| 9 | 17 | M | + | | | | | | |
| 10 | 15 | F | + | | | | + | | |

MDD, Major depressive disorder
GAD, Generalized anxiety disorder
NSSID, Non-suicidal self-injury disorder
Three of ten subjects (30%) had elevated levels of ADB. See Table 2.

Figure 1: Table 1 :

**2**

Subject 1 2 3 4 5 6 7 8 9 Anti-DNase B (RR:0-170) 286 125 <78 <78 324 113 <78 238 163
10 Elevated levels are highlighted and in bold <78

Table 3 summarizes the results of the Lyme ImmunoBlot IgM and IgG testing. Two of ten subject (20%) ha

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1 2 | IgM | + | | + | + | | + | NEG |
| | IgG | | | - | | | | NEG |
| | IgM | | | + | | | | NEG |
| | IgG | | | | | | | POS |
| 3 | | | | | | | | |
| | IgM | | | | | | | NEG |
| 4 | IgG | + | + | + | | | | NEG |
| | IgM | | | + | | | | NEG |
| | IgG | | | + | ++ | | + | NEG |
| 5 | | | | | | | | |
| | IgM | | | + | | | | NEG |



Figure 2: Table 2 :


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**4**



| Subject | Bartonella Western blots IgG | IgM |
|---|---|---|
| 1 | NEG | NEG |
| 2 | NEG | NEG |
| 3 4 5 6 7 8 9 | POS B. elizabethae NEG NEG POS B. vinsonii NEG NEG POS B. henselae | NEG NEG NEG NEG NEG NEG NEG |
| 10 | NEG | NEG |

IgG, Immunoglobulin G
IgM, Immunoglobulin M



*[Note: B. elizabethiae, Bartonella elizabethiae B. vinsonii, Bartonella vinsonii B. heneslae, Bartonella henselae Three of ten subjects (30%) had antibodies to either B. henselae, Bartonella elizabethae (B. elizabethae) or Bartonella vinsonii (B. vinsonii). See Table 4.]*

Figure 3: Table 4 :

**5**

| Subject | Anti-Dopamine D1 RR:500-2000 | Anti-Dopamine D2L RR:2000-8000 | Anti-Lysoganglioside RR:80-320 | Anti-Tubulin RR:250-1000 | CaMKII Activity RR:53-130 |
|---|---|---|---|---|---|
| 1 | 1:8000 | 1:8000 | 1:80 | 1:2000 | 125 |
| 2 | 1:4000 | 1:8000 | 1:160 | 1:4000 | 137 |
| 3 | 1:4000 | 1:8000 | 1:160 | 1:4000 | 133 |
| 4 | 1:4000 | 1:8000 | 1:160 | 1:8000 | 159 |
| 5 | 1:4000 | 1:8000 | 1:160 | 1:4000 | 130 |
| 6 | 1:2000 | 1:4000 | 1:80 | 1:2000 | 121 |
| 7 | 1:4000 | 1:2000 | 1:40 | 1:2000 | 123 |
| 8 | 1:16000 | 1:16000 | 1:320 | 1:4000 | 134 |
| 9 | 1:2000 | 1:4000 | 1:80 | 1:1000 | 113 |
| 10 | 1:4000 | 1:8000 | 1:80 | 1:4000 | 118 |

Abnormal results are highlighted and in bold
CaMKII, Calcium calmodulin-dependent protein kinase II

Figure 4: Table 5 :

**6**

Figure 5: Table 6

**6**

| | | | | | |
|---|---|---|---|---|---|
| | | | | | Year 2021<br>5 |
| Subject 1 2 3 4 5 6 7 8 | Anti-DNase B positive + + + | + + | Bartonella spp. Western Blot positive + + | Cunningham Panel positive + + + + + + + + | Volume XXI Issue I Version I D D D D ) |
| 9 | | | + | | ( |
| 10 Bbsl, Borrelia burgdorferi sensuolato | | | | + | Medical Research Global Journal of |

*[Note: A © 2021 Global Journals Microbial Induced Autoimmune Inflammation as a Cause of Mental Illness in Adolescents: A Case Series IV.]*

Figure 6: Table 6 :

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## .3 Author contributions

D.A.K. conceived the premise of this research and secured IRB approval. N.B. secured approval from subjects and their guardians and implemented the collection of data. N.B. performed the analysis of the data. D.A.K. authored the manuscript.

## .4 Conflicts of interest

The authors cite no conflict of interest.

[] , 10.3390/healthcare6030104. 6 p. .

[] , 10.1176/ajp.151.11.1571. 151 p. .

[] , 10.1001/archpedi.156.4.356. 156 p. .

[] , 10.2174/1874205x01206010088. 6 p. .

[] , 10.1186/1756-3305-3-29. 20377863. PMC2859367. 3 p. 29.

[] , 10.1086/656214. 20795820. 202 p. .

[] , 10.1371/journal.pone.0073516. 24073196. PMC3779221. 8 p. e73516.

[] , 10.1016/j.autrev.2007.11.007. 7 p. .

[Van Der Plaat et al.] , D A Van Der Plaat , K De Jong , M De Vries , C C Van Diemen , N Nedeljkovi ? I, Amin , H Kromhout .

[Dis ()] , Dis . 10.1371/journal.pntd.0001186. 2011. 5 p. e1186.

[ Horm Res Paediatr ()] , 10.1159/000346903. *Horm Res Paediatr* 2013. 79 (3) p. .

[ (2018)] , 10.1136/oemed-2017-104787. 29459480. PMC5969365. 2018 Feb 19. 75 p. .

[ (2019)] , 10.3201/eid2503.181518. 30602121. PMC6390732. 2019 Mar 17. 25 p. .

[Shimasaki et al. (2019)] , C Shimasaki , R E Frye , R Trifiletti , M Cooperstock , G Kaplan , I Melamed , R Greenberg , A Katz , E Fier , D Kem , D Traver , T Dempsey , M E Latimer , A Cross , J P Dunn , R Bentley , K Alvarez , S Reim , J Appleman , Neuroimmunol . 10.1016/j.jneuroim.2019.577138. 31884258. 2020 Feb 15. 2019 Dec 15. 339 p. 577138.

[ (2013)] , 10.4049/jimmunol.1102592. 24184556. Dec 1. 2013 Nov 1. 191 p. .

[ (Mar 1)] , 10.1001/jamapsychiatry.2018.3428. 30516814. PMC6439826. Mar 1. 76 p. .

[ (Sep)] , 10.1128/JCM.34.9.2270-2274.1996. 8862597. PMC229230. Sep. 34 p. .

[Köhler-Forsberg et al. ()] 'A Nationwide Study in Denmark of the Association between Treated Infections and the Subsequent Risk of Treated Mental Disorders in Children and Adolescents'. O Köhler-Forsberg , L Petersen , C Gasse , P B Mortensen , S Dalsgaard , R H Yolken , O Mors , M E Benros . *JAMA Psychiatry* 2019.

[Fallon et al.] 'Anti-lysoganglioside and other anti-neuronal autoantibodies in post-treatment Lyme Disease and Erythema Migrans after repeat infection'. B A Fallon , B Strobino , S Reim , J Stoner , M W Cunningham . *Brain BehavImmun Health* 202 p. 100015.

[Chandra et al. ()] 'Anti-neural antibody reactivity in patients with a history of Lyme borreliosis and persistent symptoms'. A Chandra , G P Wormser , M S Klempner , R P Trevino , M K Crow , N Latov . DOI: 10.1016/ j.bbi.2010.03.002. *Brain Behav Immun* 2010. 24 (6) p. .

[Cox et al. ()] 'Antineuronal Antibodies Microbial Induced Autoimmune Inflammation as a Cause of Mental Illness in Adolescents: A Case Series in a Heterogeneous Group of Youth and Young Adults with Tics and Obsessive-Compulsive Disorder'. C J Cox , A J Zuccolo , E V Edwards , A Mascaro-Blanco , K Alvarez , J Stoner . 10.1089/cap.2014.0048. *J Child AdolescPsychopharmacol* 2015Feb. 25 (1) p. .

[Mattingley and Koola ()] 'Association of Lyme Disease and Schizoaffective Disorder, Bipolar Type: Is it Inflammation Mediated?'. D Mattingley , M Koola . 10.4103/0253-7176.155660. *Indian J Psychol Med* 2015. 37 (2) p. .

[Song et al. (2018)] ‘Association of Stress-Related Disorders with Subsequent Autoimmune Disease’. H Song , F Fang , G Tomasson , F K Arnberg , D Mataix-Cols , Fernández De La Cruz , L Almqvist , C Fall , K Valdimarsdóttir , UA . 10.1001/jama.2018.7028. 29922828. PMC6583688. *JAMA* 2018 Jun 19. 319 (23) p. .

[Chain et al. ()] *Autoantibody Biomarkers for Basal Ganglia Encephalitis in Sydenham Chorea and Pediatric Autoimmune Neuropsychiatric Disorder Associated with Streptococcal Infections. Front Psychiatry*, J L Chain , K Alvarez , A Mascaro-Blanco . 10.3389/fpsyt.2020.00564. 2020. 11 p. 564.

[Benros et al. (2013)] ‘Autoimmune diseases and severe infections as risk factors for mood disorders: a nationwide study’. M E Benros , B L Waltoft , M Nordentoft , S D Ostergaard , W W Eaton , J Krogh , P B Mortensen . 10.1001/jamapsychiatry.2013.1111. 23760347. *JAMA Psychiatry* 2013 Aug. 70 (8) p. .

[Van Audenhove et al. ()] ‘Autoimmune haemolyticanaemia triggered by Bartonella henselae infection: a case report’. A Van Audenhove , G Verhoef , W E Peetermans , M Boogaerts , P Vandenberghe . 10.1046/j.1365-2141.2001.03165.x. *Brit J Haematol* 2001. 115 (4) p. .

[Cunningham and Cox ()] ‘Autoimmunity against dopamine receptors in neuropsychiatric and movement disorders: a review of Sydenham chorea and beyond’. M W Cunningham , C J Cox . 10.1111/apha.12614. *Acta Physiol* 2016Jan. 216 (1) p. .

[Cunningham ()] *Autoimmunity: an infectionrelated risk? CurrOpinRheumatol*, M W Cunningham . 2013. 25 p. .

[Maggi et al. ()] ‘Bacteremia and Rheumatic Symptoms in Patients from Lyme Disease-endemic Region’. R G Maggi , B R Mozayeni , E L Pultorak , B C Hegarty , J M Bradley , M Correa . DOI: 10.3201/ eid1805.111366. *Emerg Infect Dis* 2012. 18 (11) p. .

[Chiuri et al.] *Bartonella heneslae Infection Associated with Autoimmune Thyroiditis in a Child*, R M Chiuri , M F Matronola , C D Giulio , L Comegna , F Chiarelli , A Blasetti .

[Breitschwerdt et al. (2019Mar18)] ‘Bartonella henselae Bloodstream Infection in a Boy With Pediatric Acute-Onset Neuropsychiatric Syndrome’. E B Breitschwerdt , R Greenberg , R G Maggi , B R Mozayeni , A Lewis , J M Bradley . 10.1177/1179573519832014. *J Cent Nerv Syst Dis* 2019Mar18. 11.

[Massei et al. ()] ‘Bartonella Henselae Infection Associated With Guillain-Barré Syndrome’. F Massei , L Gori , G Taddeucci , P Macchia , G Maggiore . 10.1097/01.inf.0000195642.28901.98. *Pediatr Infect Dis J* 2006. 25 (1) p. .

[Durey et al. ()] ‘Bartonella henselae infection presenting with a picture of adult-onset Stills disease’. A Durey , H Y Kwon , J-H Im , S M Lee , J Baek , S B Han . 10.1016/j.ijid.2016.03.014. *Int J Infect Dis* 2016. 46 p. .

[Tsukahara et al. ()] ‘Bartonella Infection Associated with Systemic Juvenile Rheumatoid Arthritis’. M Tsukahara , H Tsuneoka , H Tateishi , K Fujita , M Uchida . 10.1086/317532. *Clin Infect Dis* 2001. 32 (1) p. .

[Robinson et al. (2005Apr5)] ‘Bartonella seropositivity in children with Henoch-Schonlein purpura’. J L Robinson , D W Spady , E Prasad , D Mccoll , H Artsob . 10.1186/1471-2334-5-21. *BMC Infect Dis* 2005Apr5. 5 (21) .

[Breitschwerdt et al. ()] ‘Bartonella sp. bacteremia in patients with neurological and neurocognitive dysfunction’. E B Breitschwerdt , R G Maggi , W L Nicholson , N A Cherry , C W Woods . 10.1128/JCM.00832-08. *J Clin Microbiol* 2008. 46 (9) p. .

[Fenollar et al. ()] ‘Bartonella vinsonii subsp. arupensis as an agent of blood culturenegative endocarditis in a human’. F Fenollar , S Sire , D Raoult . 10.1128/JCM.43.2.945-947. *J Clin Microbiol* 2005. 2005. 43 p. .

[Breitschwerdt et al. (2010)] *Bartonella vinsonii subsp. berkhoffii and Bartonella henselae bacteremia in a father and daughter with neurological disease. Parasit Vectors*, E B Breitschwerdt , R G Maggi , P M Lantos , C W Woods , B C Hegarty , J M Bradley . 2010 Apr 8.

[Roux et al. ()] ‘Bartonella vinsonii subsp. berkhoffii as an agent of afebrile blood culture-negative endocarditis in a human’. V Roux , S J Eykyn , S Wyllie , D Raoult . *J Clin Microbiol* 2000. 38 p. .

[Lotan et al. (2014)] ‘Behavioral and neural effects of intra-striatal infusion of anti-streptococcal antibodies in rats’. D Lotan , I Benhar , K Alvarez , A Mascaro-Blanco , L Brimberg , D Frenkel , M W Cunningham , JoelD . 24561489. PMC4000697. *Brain Behav Immun* 2014 May. 2014 Feb 20. 38 p. .

[Brimberg et al. (2012)] *Behavioral, pharmacological, and immunological abnormalities after streptococcal exposure: a novel rat model of Sydenham chorea and related neuropsychiatric disorders. Neuropsychopharmacology*, L Brimberg , I Benhar , A Mascaro-Blanco , K Alvarez , D Lotan , C Winter , J Klein , A E Moses , F E Somnier , J F Leckman , S E Swedo , M W Cunningham , JoelD . 10.1038/npp.2012.56. 22534626. PMC3398718. 2012 Aug. 2012 Apr 25. 37 p. .

[Cox et al. ()] ‘Brain human monoclonal autoantibody from sydenham chorea targets dopaminergic neurons in transgenic mice and signals dopamine D2 receptor: implications in human disease’. C J Cox , M Sharma , J F Leckman , J Zuccolo , A Zuccolo , A Kovoor , S E Swedo , M W Cunningham . *J Immunol* 2013.

[Fallon et al. ()] 'Bransfield RC. Aggressiveness, violence, homicidality, homicide, and Lyme disease'. B A Fallon , J M Kochevar , A Gaito , J A Nields . 10.1016/s0193-953x(05)70032-0.16. DOI: 10.2147/ndt.s155143. *Neuropsychiatric Dis Treat* 1998. 2018. 21 (3) p. . (Psychiatr Clin N Am)

[Case Definitions for Infectious Conditions Under Public Health Surveillance MMWR ()] 'Case Definitions for Infectious Conditions Under Public Health Surveillance'. *MMWR* 1997. 46 (10) .

[Cross et al. ()] *Case Report: PANDAS and Persistent Lyme Disease With Neuropsychiatric Symptoms: Treatment, Resolution, and Recovery. Front Paychiatry*, A Cross , D Bouboulis , C Shimasaki , C R Jones . 10.3389/fpsyt.2021.505941. 2021. 12 p. .

[Giladi et al. ()] 'Cat-scratch disease-associated arthropathy'. M Giladi , E Maman , D Paran , J Bickels , D Comaneshter , B Avidor . 10.1002/art.21411. *Arthritis Rheum* 2005. 52 (11) p. .

[Sheth and Mcglade ()] *Chronic Stress in Adolescents and Its Neurobiological and Psychopathological Consequences: An RDoC Perspective. Chronic Stress*, C Sheth , E Mcglade , Yurgelun-Todd , D . DOI: 10.1177/ 2470547017715645. 2017. 1.

[Stockmeyer et al. ()] 'Chronic Vasculitis and Polyneuropathy due to Infection with Bartonella henselae'. B Stockmeyer , C Schoerner , P Frangou , T Moriabadi , D Heuss , T Harrer . 10.1007/s15010-007-6021-3. *Infection* 2007. 35 (2) p. .

[Chang et al. ()] 'Clinical Evaluation of Youth with Pediatric Acute-Onset Neuropsychiatric Syndrome (PANS): Recommendations from the 2013 PANS Consensus Conference'. K Chang , J Frankovich , M Cooperstock , M W Cunningham , M E Latimer , T K Murphy , M Pasternack , M Thienemann , K Williams , J Walter , S E Swedo . 10.1089/cap.2014.0084. *J Child Adolesc Psychopharmacol* 2015. 25 (1) p. .

[Swedo et al. (2015)] 'Clinical presentation of pediatric autoimmune neuropsychiatric disorders associated with streptococcal infections in research and community settings'. S E Swedo , J Seidlitz , M Kovacevic , M E Latimer , R Hommer , L Lougee , P Grant . 10.1089/cap.2014.0073. 25695941. PMC4340334. *J Child Adolesc Psychopharmacol* 2015 Feb. 25 (1) p. .

[Holden et al. ()] *Codetection of Bartonella henselae, Borrelia burgdorferi, and Anaplasmaphagocytophilum in Ixodes pacificus Ticks from California, USA. Vector-Borne Zoonotic Dis*, K Holden , J Boothby , R Kasten , B Chomel . 2006. 6 p. .

[Fawcett et al. ()] 'Comparison of Immunodot and Western Blot Assays for Diagnosing Lyme Borreliosis'. P T Fawcett , D Rose?carlos , K M Gibney , R A Doughty . DOI: 10.1128/ cdli.5.4. *Clin Diagn Lab Immunol* 1998. 1998. 5 (4) p. .

[Bruckbauer et al. ()] 'Cross-reactive proteins of Borrelia burgdorferi'. H R Bruckbauer , V Preac-Mursic , R Fuchs , B Wilske . 10.1007/BF02098084. *Eur J Clin Microbiol Infect Dis* 1992. 11 p. .

[Qin and Wade ()] 'Crosstalk between the microbiome and epigenome: messages from bugs'. Y Qin , P A Wade . 10.1093/jb/mvx080. *J Biochem* 2018Feb. 163 (2) p. .

[Scola and Raoult ()] 'Culture of Bartonella quintana and Bartonella henselae from Human Samples: a 5-Year Experience (1993 to 1998)'. La Scola , B Raoult , D . *J Clin Microbiol* 1999. 37 p. .

[Curtin and Heron ()] 'Death rates due to suicide and homicide among persons aged 10-24: United States'. S C Curtin , M Heron . *NCHS Data Brief* 2000-2017. 2019Oct. 352.

[Flegr et al. (2018Jul13)] *Depressiveness and Neuroticism in Bartonella Seropositive and Seronegative Subjects-Preregistered Case-Controls Study. Front Psychiatry*, J Flegr , M Preiss , P Balátová . 10.3389/fpsyt.2018.00314. 2018Jul13. 9 p. 314.

[Sander et al. ()] 'Detection of Bartonella henselae DNA by Two Different PCR Assays and Determination of the Genotypes of Strains Involved in Histologically Defined Cat Scratch Disease'. A Sander , M Posselt , N Böhm , M Ruess , M Altwegg . *J Clin Microbiol* 1999. 37 p. .

[Hopp and Eppes ()] 'Development of IgA nephritis following cat scratch disease in a 13-year-old boy'. L Hopp , S C Eppes . DOI: 10.1007/ s00467-004-1432-1. *Ped Nephrol* 2004. 19 (6) p. .

[Hauser et al. ()] 'Diagnostic Value of Proteins of Three Borrelia Species (Borrelia burgdorferi SensuLato) and Implications for Development and Use of Recombinant Antigens for Serodiagnosis of Lyme Borreliosis in Europe'. U Hauser , G Lehnert , B Wilske . 10.1128/cdli.5.4.456-462.1998. *Clin Diagn Lab Immunol* 1998. 5 (4) p. .

[Vieira et al. ()] 'Diet, microbiota and autoimmune diseases'. S M Vieira , O E Pagovich , M A Kriegel . 10.1177/0961203313501401. *Lupus* 2014. 23 (6) p. .

[Schaller et al. ()] 'Do bartonella infections cause agitation, panic disorder, and treatment-resistant depression?'. J Schaller , G A Burkland , P J Langhoff . *MedGenMed* 2007. 9 (3) p. 54.

[Ben-Pazi et al. (2013)] *Dopamine receptor autoantibodies correlate with symptoms in Sydenham's chorea. PLoS One*, H Ben-Pazi , J A Stoner , M W Cunningham . 2013 Sep 20.

[Giladi et al. ()] 'Enzyme Immunoassay for the Diagnosis of Cat-Scratch Disease Defined by Polymerase Chain Reaction'. M Giladi , Y Kletter , B Avidor , E Metzkor-Cotter , M Varon , Y Golan , M Weinberg , I Riklis , M Ephros , S Leonard . 10.1086/324162. `https://doi.org/10.1086/324162` *Clin Infect Dis* 2001. 33 (11) p. .

[Collotta et al. ()] 'Epigenetics and pesticides'. M Collotta , P A Bertazzi , V Bollati . 10.1016/j.tox.2013.01.017. *Toxicology* 2013. 307 p. .

[Halos et al. (2005)] 'Evidence of Bartonella sp. in questing adult and nymphal Ixodes ricinus ticks from France and co-infection with Borrelia burgdorferi sensulato and Babesia sp'. L Halos , T Jamal , R Maillard , F Beugnet , Le Menach , A Boulouis , H J Vayssier-Taussat , M . 10.1051/vetres:2004052. 15610725. *Vet Res* 2005 Jan-Feb. 36 (1) p. .

[Raveche et al. ()] 'Evidence of Borrelia Autoimmunity-Induced Component of Lyme Carditis and Arthritis'. E S Raveche , S E Schutzer , H Fernandes , H Bateman , B A Mccarthy , S P Nickell , M W Cunningham . DOI: 10.1128/ jcm.43.2.850-856. *J Clin Microbiol* 2005. 2005. 43 (2) p. .

[Frankovich et al. ()] 'Five Youth with Pediatric Acute-Onset Neuropsychiatric Syndrome of Differing Etiologies'. J Frankovich , M Thienemann , Rana S Chang , K . 10.1089/cap.2014.0056. *J Child Adolesc Psychopharmacol* 2015. 25 (1) p. .

[Coughlin et al. ()] 'Imaging glial activation in patients with posttreatment Lyme disease symptoms: a pilot study using [11C]DPA-713 PET'. J M Coughlin , T Yang , A W Rebman , K T Bechtold , Y Du , W B Mathews , W G Lesniak , E A Mihm , S M Frey , E S Marxhall , H B Rosenthal , T A Reekie , M Kassiou , R F Dannals , M J Soloski , J N Aucott , M G Pomper . 10.1186/s12974-018-1381-4. `https://doi.org/10.1186/s12974-018-1381-4` *J Neuroinflammation* 2018. 15 p. 346.

[Palumbo et al. ()] 'Immune thrombocytopenic purpura as a complication of Bartonella henselae infection'. E Palumbo , F Sodini , G Boscarelli , G Nasca , M Branchi , G Pellegrini . *Le Infezioni in Medicina* 2008. 16 (2) p. .

[Engstrom et al. ()] 'Immunoblot interpretation criteria for serodiagnosis of early Lyme disease'. S M Engstrom , E Shoop , R C Johnson . 10.1128/jcm.33.2.419-427.1995. *J Clin Microbiol* 1995. 33 (2) p. .

[Watts et al. ()] 'Increased Risk for Invasive Group A Streptococcus Disease for Household Contacts of Scarlet Fever Cases'. V Watts , S Balasegaram , C S Brown , S Mathew , R Mearkle , D Ready , V Saliba , T Lamagni . *Emerg Infect Dis* 2011-2016. 2019 Mar.

[Twenge et al. ()] 'Increases in Depressive Symptoms, Suicide-Related Outcomes, and Suicide Rates among U.S. Adolescents after 2010 and Links to Increased New Media Screen Time'. J M Twenge , T E Joiner , M L Rogers , G N Martin . 10.1177/2167702617723376. *Clinical Psychological Science* 2018. 6 (1) p. .

[Tyrrell et al. ()] 'Increasing Rates of Invasive Group A Streptococcal Disease'. G J Tyrrell , S Fathima , J Kakulphimp , C Bell . DOI: 10.1093/ ofid/ofy177. *Open Forum Infect Dis* 2003-2017. 2018. 5 (8) p. .

[Quinn et al. ()] 'Induction of Autoimmune Valvular Heart Disease by Recombinant Streptococcal M Protein'. A Quinn , S Kosanke , V A Fischetti , S M Factor , M W Cunningham . 10.1128/iai.69.6.4072-4078.2001. *Infect Immun* 2001. 69 (6) p. .

[Fallon et al. ()] 'Inflammation and central nervous system Lyme disease'. B A Fallon , E S Levin , P J Schweitzer , D Hardesty . 10.1016/j.nbd.2009.11.016. *Neurobiol Dis* 2010. 37 (3) p. .

[Paul et al. ()] 'Influences of diet and the gut microbiome on epigenetic modulation in cancer and other diseases'. B Paul , S Barnes , W Demark-Wahnefried , C Morrow , C Salvador , C Skibola , T A Tollefsbol . 10.1186/s13148-015-0144-7. *Clin Epigenet* 2015. 7 (1) .

[Hauser et al. ()] 'Interpretation criteria for standardized Western blots for three European species of Borrelia burgdorferi sensulato'. U Hauser , G Lehnert , R Lobentanzer , B Wilske . 10.1128/jcm.35.6.1433-1444.1997. *J Clin Microbiol* 1997. 35 (6) p. .

[Connery et al. (2018)] 'Intravenous immunoglobulin for the treatment of autoimmune encephalopathy in children with autism'. K Connery , M Tippett , L M Delhey , S Rose , J C Slattery , S G Kahler , J Hahn , U Kruger , M W Cunningham , C Shimasaki , R E Frye . 10.1038/s41398-018-0214-7. 30097568. PMC6086890. *Transl Psychiatry* 2018 Aug 10. 8 (1) p. 148.

[Kinderlehrer] 'Is Bartonella a Cause of Primary Sclerosing Cholangitis? A Case Study'. D A Kinderlehrer . *Gastrointest. Disord* 2020 p. .

[Merikangas et al. ()] 'Lifetime Prevalence of Mental Disorders in US Adolescents: Results from the National Comorbidity Study-Adolescent Supplement (NCS-A)'. K R Merikangas , J-Ping He , M Burstein , S A Swanson , S Avenevoli , L Cui . DOI: 10.1016/ j.jaac.2010.05.017. *J Am Acad Child Adolesc Psychiatry* 2010Oct. 49 (10) p. .

[Rhee and Cameron ()] 'Lyme disease and pediatric autoimmune neuropsychiatric disorders associated with streptococcal infections (PANDAS): an overview'. H Rhee , D Cameron . 10.2147/ijgm.s24212. *Int J Gen Med* 2012. 5 p. .

[Bransfield (2007Dec1)] 'Lyme Disease, comorbid tick-borne diseases, and neuropsychiatric disorders'. R C Bransfield . *Psychiatr Times* 2007Dec1. 24 (14) p. .

[Fallon and Nields ()] 'Lyme disease: a neuropsychiatric illness'. B A Fallon , J A Nields . *Am J Psychiatry* 1994.

[Kirvan et al. ()] 'Mimicry and autoantibody-mediated neuronal cell signaling in Sydenham chorea'. C A Kirvan , S E Swedo , J S Heuser , M W Cunningham . 10.1038/nm892. *Nat Med* 2003. 9 (7) p. .

[Cusick et al. ()] 'Molecular Mimicry as a Mechanism of Autoimmune Disease'. M F Cusick , J E Libbey , R S Fujinami . 10.1007/s12016-011-8294-7. *Clin Rev Allergy Immunol* 2012Feb. 42 (1) p. .

[Jackson et al. ()] 'Neurologic and Psychiatric Manifestations of Celiac Disease and Gluten Sensitivity'. J R Jackson , W W Eaton , N G Cascella , A Fasano , D L Kelly . 10.1007/s11126-011-9186-y. *Psychiatr Q* 2012Mar. 83 (1) p. .

[Breitschwerdt et al. ()] 'Neurological Manifestations of Bartonellosis in Immunocompetent Patients: A Composite of Reports from 2005-2012'. E B Breitschwerdt , S Sontakke , S Hopkins . 10.4303/jnp/235640. *J Neuroparasitol* 2012. 3 p. .

[Singer et al. (2015)] 'Neuronal antibody biomarkers for Sydenham's chorea identify a new group of children with chronic recurrent episodic acute exacerbations of tic and obsessive compulsive symptoms following a streptococcal infection'. H S Singer , A Mascaro-Blanco , K Alvarez , C Morris-Berry , I Kawikova , H Ben-Pazi , C B Thompson , S F Ali , E L Kaplan , M W Cunningham . 10.1371/journal.pone.0120499. 25793. PMC4368605. *PLoS One* 2015 Mar 20. 10 (3) p. 715.

[Bransfield ()] 'Neuropsychiatric Lyme Borreliosis: An Overview with a Focus on a Specialty Psychiatrist's Clinical Practice'. R C Bransfield . *Healthcare* 2018.

[Lundberg et al. ()] 'Occupation, Occupational Exposure to Chemicals and Rheumatological Disease: A register based cohort study'. I Lundberg , L Alfredsson , N Plato , B Sverdrup , L Klareskog , S Kleinau . DOI: 10.3109/ 03009749409099278. *Scand J Rheumatol* 1994. 23 (6) p. .

[Vermeulen et al. (2018)] 'Occupational exposure to pesticides is associated with differential DNA methylation'. R Vermeulen , D S Postma , C M Van Duijn , H M Boezen , J M Vonk . *Biobank-based Integrative Omics Study Consortium*, 2018 Jun.

[Cozzani et al. ()] 'Onset of cutaneous vasculitis and exacerbation of IgA nephropathy after Bartonella henselae infection'. E Cozzani , E Cinotti , P Ameri , A Sofia , G Murialdo , A Parodi . 10.1111/j.1365-2230.2011.04177.x. *Clin Exp Dermatol* 2011. 37 (3) p. .

[Chan et al. ()] 'Parental Advisory: Maternal and Paternal Stress Can Impact Offspring Neurodevelopment'. J C Chan , B M Nugent , T L Bale . 10.1016/j.biopsych.2017.10.005. *Biol Psychiatry* 2018. 83 (10) p. .

[Tisi et al. ()] 'Pediatric acute onset neuropsychiatric syndrome associated with Epstein-Barr infection in child with Noonan syndrome'. G Tisi , M Marzolini , G Biffi . 10.1016/j.eurpsy.2017.01.492. *Europ Psychiatry* 2017. 41 p. S456. (Supplement)

[Liu et al. ()] 'Pilot Study of Immunoblots with Recombinant Borrelia burgdorferi Antigens for Laboratory Diagnosis of Lyme Disease'. S Liu , I Cruz , C Ramos , P Taleon , R Ramasamy , J Shah . 10.3390/healthcare6030099. *Healthcare* 2018. 6 (3) p. 99.

[Adelson et al. (2004)] 'Prevalence of Borrelia burgdorferi, Bartonella spp., Babesia microti, and Anaplasmaphagocytophila in Ixodes scapularis ticks collected in Northern New Jersey'. M E Adelson , R V Rao , R C Tilton , K Cabets , E Eskow , L Fein , J L Occi , E Mordechai . 15184475. *J Clin Microbiol* 2004 Jun. 42 (6) p. .

[Placidi et al. ()] 'Prevalence of Psychiatric Disorders in Thyroid Diseased Patients'. G Placidi , M Boldrini , A Patronelli , E Fiore , L Chiovato , G Perugi . 10.1159/000026545. *Neuropsychobiology* 1998. 38 (4) p. .

[Ellis et al. (2010)] 'Priming the immune system for heart disease: a perspective on group A streptococci'. N M Ellis , D K Kurahara , H Vohra , A Mascaro-Blanco , G Erdem , E E Adderson , L G Veasy , J A Stoner , E Tam , H R Hill , K Yamaga , M W Cunningham . *J Infect Dis* 2010 Oct 1.

[Murphy and Pichichero ()] 'Prospective Identification and Treatment of Children with Pediatric Autoimmune Neuropsychiatric Disorder Associated With Group A Streptococcal Infection (PANDAS)'. M L Murphy , M E Pichichero . *Arch PediatrAdolesc Med* 2002.

[Fagala and Wigg ()] 'Psychiatric Manifestations of Mercury Poisoning'. G E Fagala , C L Wigg . DOI: 10.1097/ 00004583-199203000-00019. *J Am Acad Child Adolesc Psychiatry* 1992. 31 (2) p. .

[Steere et al. ()] 'Relationship between Immunity to Borrelia burgdorferi Outersurface Protein A (OspA) and Lyme Arthritis'. A C Steere , E E Drouin , L J Glickstein . 10.1093/cid/ciq117. *Clin Infect Dis* 2011. 52 (suppl_3) p. .

[Frye and Shimasaki (2019)] 'Reliability of the Cunningham Panel'. R E Frye , C Shimasaki . 10.1038/s41398-019-0462-1. *Transl Psychiatry* 2019. 2019 Apr 8. 9 (1) p. 129. (Published)

[Daly et al. ()] 'Rochalimaeaelizabethae sp. nov. isolated from a patient with endocarditis'. J S Daly , M G Worthington , D J Brenner , C W Moss , D G Hollis , R S Weyant , A G Steigerwalt , R E Weaver , M I Daneshvar , O'connor Sp . *J Clin Microbiol* 1993. 31 p. .

[Manzel et al. ()] 'Role of "Western Diet" in Inflammatory Autoimmune Diseases'. A Manzel , D N Muller , D A Hafler , S E Erdman , R A Linker , M Kleinewietfeld . DOI: 10.1007/ s11882-013-0404-6. *Curr Allergy Asthma Rep* 2014. 14 (1) p. 404.

[Ayoub et al. ()] 'Role of Bartonella henselae in the etiology of Henoch-Schönlein purpura'. E M Ayoub , J Mcbride , M Schmiederer , B Anderson . 10.1097/00006454-200201000-00006. *Pediatr Infect Dis J* 2002. 21 (1) p. .

[Scola and Raoult ()] 'Serological cross-reactions between Bartonella quintana, Bartonella henselae, and Coxiella burnetii'. La Scola , B Raoult , D . *J Clin Microbiol* 1996.

[Vermeulen et al. (2007)] 'Serological testing for Bartonella henselae infections in The Netherlands: clinical evaluation of immunofluorescence assay and ELISA'. M J Vermeulen , M Herremans , H Verbakel , A M Bergmans , J J Roord , P J Van Dijken , M F Peeters . 10.1111/j.1469-0691.2007.01700.x.Epub. 17378931. *Clin Microbiol Infect* 2007 Jun. 2007 Mar 22. 13 (6) p. .

[Fujikawa et al. (1982)] 'Significance of anti-deoxyribonuclease-B (ADN-B) determination in clinical practice'. S Fujikawa , S Kawakita , N Kosakai , T Oda , M Ohkuni , Y Shiokawa , N Watanabe , T Yamada . 10.1253/jcj.46.1180. 6752453. *Jpn Circ J* 1982 Nov. 46 (11) p. .

[Swedo et al. (1994Feb1)] 'Speculations on Antineuronal Antibody-Mediated Neuropsychiatric Disorders of Childhood'. S E Swedo , H L Leonard , L S Kiessling . *Pediatrics* 1994Feb1. 93 (2) p. .

[Kirvan et al. ()] 'Streptococcal mimicry and antibody-mediated cell signaling in the pathogenesis of Sydenham's chorea'. C A Kirvan , S E Swedo , D Kurahara , M W Cunningham . *Autoimmunity* 2006. 39 (1) p. .

[Stojanovich and Marisavljevich ()] 'Stress as a trigger of autoimmune disease'. L Stojanovich , D Marisavljevich . *Autoimmun Rev* 2008.

[Gold et al. ()] 'Systemic Autoimmune Disease Mortality and Occupational Exposures'. L S Gold , M H Ward , M Dosemeci , Ajd Roos . 10.1002/art.22880. *Arthritis Rheum* 2007. 56 (10) p. .

[Bejerot and Hesselmark ()] 'The Cunningham Panel is an unreliable biological measure'. S Bejerot , E Hesselmark . 10.1038/s41398-019-0413-x. *Transl Psychiatry* 2019. 9 p. 49.

[Johnson et al. ()] 'The Human Immune Response to Streptococcal Extracellular Antigens: Clinical, Diagnostic, and Potential Pathogenetic Implications'. D R Johnson , R Kurlan , J Leckman , E L Kaplan . *Clin Infect Dis* 2010. 50 (4) p. .

[Fallon et al. ()] 'The neuropsychiatric manifestations of Lyme borreliosis'. B A Fallon , J A Nields , J J Burrascano , K Liegner , D Delbene , M R Liebowitz . 10.1007/bf01064684. *Psychiatr Q* 1992. 63 (1) p. .

[Bransfield ()] 'The Psychoimmunology of Lyme/Tick-Borne Diseases and its Association with Neuropsychiatric Symptoms'. R C Bransfield . *Open Neurol J* 2012.

[Greenberg ()] *The Role of Infection and Immune Responsiveness in a Case of Treatment-Resistant Pediatric Bipolar Disorder. Front Psychiatry*, R Greenberg . 10.3389/fpsyt.2017.00078. 2017May. 8.

[Lerner et al. ()] 'The World Incidence and Prevalence of Autoimmune Diseases is Increasing'. A Lerner , P Jeremias , T Matthias . 10.12691/ijcd-3-4-8. *Int J Celiac Dis* 2015Dec. 3 (4) p. .

[Kuehn ()] 'Tickborne Diseases Increasing'. B Kuehn . 10.1001/jama.2018.20464. *JAMA* 2019. 321 (2) p. 138.

[Kirvan et al. ()] 'Tubulin Is a Neuronal Target of Autoantibodies in Sydenham's Chorea'. C A Kirvan , C J Cox , S E Swedo , M W Cunningham . 10.4049/jimmunol.178.11.7412. *J Immunol* 2007. 178 (11) p. .

[Otsuyama et al. (2017)] 'Utility of Bartonella henselae IgM Western Blot Bands for Serodiagnosis of Cat Scratch Disease'. K I Otsuyama , H Tsuneoka , H Yoshidomi , M Haraguchi , M Yanagihara , N Tokuda , J Nojima , K Ichihara . 10.1128/JCM.01322-17. 29093103. PMC5744212. *J Clin Microbiol* 2017 Dec 26. 56 (1) p. .

[Hauser et al. (1999)] 'Validity of Interpretation Criteria for Standardized Western Blots (Immunoblots) for Serodiagnosis of Lyme Borreliosis Based on Sera Collected throughout Europe'. U Hauser , G Lehnert , B Wilske . 10.1128/jcm.37.7.2241-2247.1999.61. `https://wwwn.cdc.gov/nndss/case-definitions.html` *J Clin Microbiol* 1999. Accessed February 1, 2021. 37 (7) p. .

[Balakrishnan et al. ()] 'Vasculitis, cerebral infarction and persistent Bartonella henselae infection in a child'. N Balakrishnan , M Ericson , R Maggi , E B Breitschwerdt . 10.1186/s13071-016-1547-9. *Parasit Vectors* 2016. 9 (1) p. 254.

[Cotté et al. ()] 'Vayssier-Taussat, M. Transmission of Bartonella henselae by Ixodes ricinus'. V Cotté , S Bonnet , D Le Rhun , E Le Naour , A Chauvin , H.-J Boulouis , B Lecuelle , T Lilin . *Emerg. Infect. Dis* 2008. 14 p. .

[Reis et al.] *Vector Competence of the Tick Ixodes ricinus for Transmission of Bartonella birtlesii*, C Reis , M Cote , D Le Rhun , B Lecuelle , M Levin , M Vayssier-Taussat , S I Bonnet . PLoSNegl. Trop.