Flawed assumptions fuel autoimmune disease: The sorry state of vaccine safety science

Vinu Arumugham

Jun 2017

vinucubeacc@gmail.com

Infection, vaccination and autoimmune disease

Wraith et al.[1] observe that there is a high probability that microbial antigens can induce cross-reactive immune responses against self-antigens. They explain that we have evolved fail-safe mechanisms that usually protect us from developing autoimmune disease following infections.

They write:
"Here we analyse our understanding of how infections can lead to autoimmune disease and thus assess the relative risk of autoimmune disease arising as a consequence of vaccination." and "These fail-safe mechanisms apply equally to the host response to vaccination. "

Mojsilovic[2] writes:
"Moreover, one must not overlook the fact that vaccines only mimic natural infections, and infectious agents themselves can elicit the same immune phenomena. Indeed, the risk of develop- ing immune-mediated diseases by acquiring natural infection is even greater than the risk of the same diseases to develop by vaccine- associated reactions."

Unfortunately, neither Wraith et al. nor Mojsilovic, provide any explanation, evidence or reference to literature supporting this fundamental assumption that fail-safe mechanisms operative during infections are active during host response to vaccination.

This fundamental assumption is easily demonstrated to be false. Live attenuated influenza vaccine (LAIV, Flumist) and live oral rotavirus vaccines come closest to natural infection and have routes of administration that match natural infection. So the immune pathways triggered may be similar. Even so, considering that the vaccines do not cause disease, one cannot guarantee that all immune pathways triggered by natural infection are also triggered by the vaccine. So the autoimmune fail-safe mechanisms cannot be assumed to have been operational.

Many vaccines administered today are subunit vaccines. They are administered through intramuscular or subcutaneous routes. Neither matches the route of natural infection. So they trigger different immune pathways. Subunit vaccines primarily contain one or more antigens from the target organism. These antigens are poorly immunogenic and the host response is weak. This weak immune response is part of the autoimmune fail-safe mechanism at work. To make the vaccine work, adjuvants such as aluminum salts or toxoids are needed to boost the immune response. In other words, adjuvants, by definition, defeat the fail-safe mechanism.

Mojsilovic writes:
"The main role of adjuvants is to trick the immune system in perceiving vaccine antigen as a serious threat, and thus initiate innate and consecutively adaptive response mechanisms, including long-term immune memory to that antigen."

This artificial immune response was NOT engineered to mimic a natural infection. It was a serendipitous discovery (immunology's dirty secret), tuned empirically[3,4]. The mechanisms of action involved in an adjuvant induced response is still not understood and is an active area of research. So there is no scientific basis to make the claim that the natural autoimmune fail-safe mechanisms are operational in the case of adjuvanted subunit vaccines either.

Fever is common during natural infections[5]. Fever is rare with subunit vaccines[6]. Even the rare vaccine induced fever is suppressed with the (controversial and changing) recommendation of using acetaminophen following vaccination, to overcome injection site pain. Acetaminophen may affect inflammatory pathways.[7,8] Fever impacts immune system behavior including IL-6 and heat shock protein related pathways[5]. Clearly, natural infection and vaccines DO NOT produce the same immunological effect. Therefore autoimmune fail-safe mechanisms operational during natural infection, CANNOT be assumed to be operational during a vaccine-induced host response. So, the Wraith et al. observation that there is a high probability that microbial antigens can induce cross-reactive immune responses against self-antigens, needs serious consideration in the context of vaccines. And we see strong evidence of vaccines inducing numerous autoimmune diseases.[9–17]

In Biotechnology and Safety Assessment (2003)[18], immunotoxicology expert Dr. François Verdier with vaccine maker Aventis Pasteur (now Sanofi Pasteur), writes: “Helicobacter pylori catalase was excluded from the screening of vaccine antigens because first it showed sequence homology with human catalase and second human catalase is reported to be an autoantigen in inflammatory bowel disease”

If Wraith et al. were right about "These fail-safe mechanisms apply equally to the host response to vaccination. ", an H. pylori catalase vaccine should have the same risk of causing autoimmune disease as the H. pylori infection. But as Dr. Verdier points out, the H. pylori catalase vaccine was considered unsafe and was excluded. But unfortunately, numerous other vaccines contaminated with catalase, were inexplicably approved and are in widespread use.[19] This can explain the epidemic of inflammatory bowel disease.

Tricking the immune system gets tricky

We understand very little about the immune system but we have decided to trick it.
It is not a story you expect to end well.

Mojsilovic writes:
"The main role of adjuvants is to trick the immune system in perceiving vaccine antigen as a serious threat, and thus initiate innate and consecutively adaptive response mechanisms, including long-term immune memory to that antigen."

Vaccines are of course contaminated with non-target viral, bacterial antigens, numerous growth media proteins including casein, ovalbumin, yeast, bovine serum albumin etc.[20] Example: the Pandemrix

vaccine contained influenza hemaggluttinin proteins (target) and influenza nucleoproteins (contaminant).[16]

By tricking the immune system into perceiving ALL of the above proteins as a serious threat, adjuvants predictably produce numerous off-target immune responses such as food allergies[21], asthma[22] and disable the autoimmune fail-safe mechanism, producing autism[11,23] and other autoimmune disorders[19].

The fact that adjuvanted vaccines work is proof that they create allergy and autoimmune diseases as well.

This is a fundamental flaw in current vaccines.

Vaccine safety recommendations are ignored

Wraith et. al. call for autoimmune serology during vaccine trials.
Vaccine trials have ignored that recommendation. No autoimmune serology is performed during vaccine trials.[6,24–26].

Serology is used only to check titers of antibodies against the target antigen.
Checking for other antibodies such as IgE and IgG4 against self and contaminating antigens could easily identify vaccine-induced allergies, asthma, autism and autoimmunity.[10,27–30]

The fact that Pandemrix induced narcolepsy was only discovered after sickening numerous patients is proof that safety mechanisms required during vaccine design and testing, to avoid autoimmune diseases, are absent or dysfunctional.

Wraith et al. say autoimmune disease manifestation takes years. Yet vaccine trials last a few months. And post-marketing manifestation is easily dismissed with the statement: “Because these events were reported voluntarily from a population of uncertain size, it is not possible to reliably estimate their frequency or to establish a causal relationship to vaccine exposure.”[31]

Adjuvant and vaccine safety claims are premature

Vaccines and the adverse events they induce can be separated by decades.

In one mechanism, vaccine induced autoantibodies in women, attack the fetal brain and cause autism.[11]
With decades between vaccine induced autoantibodies and the adverse event affecting a different individual than the one vaccinated, there is no chance that vaccine surveillance mechanisms will ever find this type of adverse event or help in determining root cause.

This is the fundamental limitation of the "safety by testing" methodology.
We need "safety by design". Testing should be used to catch design errors. But current vaccines are empirically derived using trial and error. The result is fundamentally unsafe vaccines.

Mojsilovic:
"Some of the first adjuvants discovered back then, on empirical basis of trial and error, are still in widespread use today, but only recently some light on the molecular mechanisms of their action has been shed."

Immunological effects of current adjuvants were not designed. They are empirical, trial and error based. So no claim can be made that autoimmune fail-safe mechanism operative during natural infection are active during adjuvanted vaccine driven immune responses.

Diseases like cerebral infarction (CI), diabetes mellitus (DM), cardiovascular diseases (CVD) develop over the long-term due to inflammation[32]. There is evidence that they may have an autoimmune basis[12,33]. These diseases may been caused by aluminum adjuvanted vaccines decades ago. So the safety claims being made for aluminum adjuvants or vaccines are premature. The real cause and autoimmune basis of these adverse events is just surfacing now.

The autoimmune basis of many diseases are still being elucidated and researched.[9,34–39]. How can we rule out aluminum adjuvant and/or vaccines being the causative agent? It is therefore premature to make any claim about the safety of aluminum adjuvants or vaccines.

Tissue damage

Wraith et al.
"Based on first principles, one could argue that a killed vaccine would be less likely than a live-attenuated vaccine to activate the innate immune response or cause tissue disruption."

Not true. A live-attenuated influenza vaccine can at least be administered without tissue disruption. On the other hand, killed or subunit vaccine administration through intramuscular or subcutaneous routes involve tissue disruption. Vaccine antigens mimicking self antigens being present in the vicinity of tissue damage is therefore a very common occurrence with current vaccines.
So the risk of autoimmune disease induction is greater with killed or subunit vaccines.

Further, killed or subunit vaccines are poorly immunogenic. As Mojsilovic points outs,
“Adjuvants do that by triggering the same evolutionary conserved mechanisms that innate immunity utilizes to detect danger. By inducing innate immune reaction, adjuvants can concurrently provoke some undesirable immune response”.
Even if the killed or subunit vaccines by themselves were less likely to activate the innate immune response or cause tissue disruption as Wraith et al. claim, the adjuvant used to fix the problem of poor immunogenicity, works by activating the innate immune response and causing tissue damage.[40]

Intramuscular or subcutaneous vaccine administration results in tissue damage due to the injection itself and further tissue damage caused by adjuvants. This results in Danger Associated Molecular Pattern (DAMP) receptor signals being asserted. Next, vaccine antigens trigger Pathogen Associated Molecular Pattern (PAMP) receptor signals.
With natural infection, the signaling is reversed. The pathogen is detected before any tissue damage occurs. Any tissue damage due to infection and associated DAMP signaling follows.
This is another difference between vaccines and natural infection. What effect does this have on the immune response and the autoimmune fail-safe mechanism?

Atopy and autoimmune disease

Wraith et al. state that atopy is unrelated to autoimmunity. Again they provide no references. This is an incorrect notion. We know that IgE antibodies are created to just about every type of protein that is injected.[41,42] Once sensitized to IgE, we know that prolonged exposure to the antigen causes the synthesis of IgG4 to the same antigen.[43–46] We know that one cause of autism is folate receptor alpha autoantibodies (FRAA)[34,36]. A majority of FRAA are of the IgG4 isotype.[36] Many vaccines are contaminated with cow's milk that contains the folate receptor protein. So we have an example of atopy, where induction of IgE to folate receptor proteins in milk contaminated vaccines is the first step in an autoimmune disease. Continuing exposure to dietary milk results in the induction of IgG4 autoantibodies causing this type of autism which is an autoimmune disease.[47]
So there are no clear delineations between atopy and autoimmune diseases.

Similarly, injection of yeast (Saccharomyces cerevisiae) contaminated vaccines can be expected to cause IgE mediated sensitization. Atopic dermatitis patients react to S. cerevisiae.[48,49] Subsequent prolonged exposure to yeast will result in IgG4 induction.[50]
Many autoimmune diseases are associated with anti-saccharomyces cerevisiae autoantibodies (ASCA)[9,51–53].

Pertussis vaccine and autoimmune disease

The FDA made the flawed assumption that the acellular pertussis vaccine prevented transmission of disease, when they approved the vaccine. The acellular pertussis vaccine does not prevent transmission. The vaccine does not provide mucosal immunity.[54] Vaccinated individuals are colonized by B. pertussis and spread the disease to infants too young to be vaccinated.[55] This B. pertussis airway colonization has been linked to multiple sclerosis, an autoimmune disorder.[54]
To protect neonates against pertussis via passive immunity, the Advisory Committee on Immunization Practices (ACIP) has recommended the Tdap vaccine for every pregnant woman. However, this increases the risk of autoimmune responses against the fetus.[11,47]

Vaccines are assumed safe until proven otherwise

The Infanrix vaccine package insert says: “The role of the different components produced by B. pertussis in either the pathogenesis of, or the immunity to, pertussis is not well understood.”[6]

The Flumist flip-flop by the ACIP, is more evidence that vaccines are poorly understood.
So it makes no sense to assume that vaccines are safe until proven otherwise.
Instead, with vaccines being powerful immunomodulatory interventions, we MUST assume that vaccines are unsafe until proven otherwise. Here’s an example of the unintended consequences. The pertussis vaccine enables subclinical colonization by B. pertussis. The consequences of colonization include Alzheimer’s disease. [56]

In the WHO methodology described by Wraith et al. Vaccines are assumed safe until proven otherwise. This does not make any sense. With widespread molecular mimicry between vaccine antigens, contaminants and self antigens, vaccines can impact numerous functions in the human body. Therefore, if any disease occurs after vaccine administration, vaccines MUST be assumed to be the cause unless one can prove otherwise.

The only way to ensure that all the immune pathways required for natural autoimmune fail-safe mechanisms are triggered is to make the vaccine produce the disease. Therefore any useful vaccine cannot be guaranteed to trigger the autoimmune fail-safe mechanisms. Therefore, all vaccines must be considered autoimmune disease causal agents unless proven otherwise. The WHO approach of assuming vaccines are safe until proven otherwise is wrong and unsupported by scientific evidence.

The bar for vaccine safety has been set too low.

The scientific process has failed

Peer review has failed to identify these problems that have continued to persist for decades with devastating consequences.
In the case of the acellular pertussis vaccine, reality's rude awakening in the form of pertussis infections, at least led to the FDA/CDC acknowledging the problem.

Theory vs. Practice

Mojsilovic on an advantage of adjuvants:
"... including the possibility to restrict the number of antigens present in a vaccine, and thus further reduce any risk of undesired (cross-reactive) immune responses to self tissues."

Pandemrix was adjuvanted but the manufacturer failed to restrict the number of antigens thus triggering narcolepsy. So a theoretical advantage of adjuvants backfired in practice due to a sloppy vaccine design. Coupled with sloppy vaccine testing which was not designed to catch such problems, the consequences were devastating.

Regulatory failure

Mojsilovic:
"By carefully monitoring the rare adverse events and scrupulously studying their mechanism of development, regulatory agencies, vaccine manufacturers, and researchers are participating in a joint endeavor to identify the specific factors that contribute to these events and to develop even safer vaccines."
Mojsilovic:
"there are carefully elaborated regulatory mechanisms to ensure that risks of such adverse reactions are kept at minimum."

Unfortunately, Mojsilovic cites no references to support these claims.

How can one assume that adverse events are rare? It may be as common and widespread as obesity or atherosclerosis caused by vaccine-induced autoantibodies.[12,16,33,57]
If above claims by Mojsilovic are true, why did Pandemrix induce narcolepsy?
Why no autoimmune serology in clinical trials, as suggested by Wraith et al.?

Wraith et al.
"Criteria underpinning the assessment of adverse events of vaccines have been established by the WHO"

But WHO has no criteria for designing vaccines to avoid autoimmune diseases in the first place?

Vaccine risk vs. disease risk

Wraith et al.
"However, the degree of vaccine-related risk should always be compared with that associated with the corresponding natural infection, either for the whole population or for a specific subgroup."

The touted benefit of a vaccine is the avoidance of natural infection and its sequelae.
So it is unacceptable for a vaccine to have the same risk of autoimmune disease as the natural infection.
Depending on the disease, natural infection may be rare (say tetanus). But everyone is going to get a tetanus vaccine, multiple times. This increased exposure must be accounted in risk evaluation.

Wraith et al.
"potential molecular and immunological mimicry between vaccine antigens and host components should be extensively analysed through a combination of bioinformatics and immunological studies."

Never happens. Pandemrix induced narcolepsy could have been avoided if this homework was done.[17] Where are studies establishing safety of these cases of mimicry?[11–16]

Accounting for antigen exposure dependent autoimmune disease

Autoimmunity caused by molecular mimicry to food antigens could result in severe illness due to ongoing exposure to food antigens. An example of this is cow's milk contaminated vaccines inducing folate receptor autoantibodies that block folate receptors and cause autism spectrum disorders.[34,47]
A milk-free diet reduces autism symptoms.[34,58]
Similarly, vaccine induced autoimmunity caused by molecular mimicry to bacterial or viral antigens could be transient and only manifest itself upon re-exposure to that bacteria or virus.
Studies that don’t account for such details will come to the wrong conclusion.

Conclusion

Whitaker et al.[59] write:
“the promise of adversomics is to understand the mechanisms behind vaccine adverse events in order to improve vaccine safety”

200 years after Dr. Jenner’s vaccines, understanding the mechanisms behind vaccine adverse events remains a novel concept? Proof that root cause analysis is an alien concept in vaccine research and industry.

Whitaker et al. write:
“If vaccine adverse events are noted, then further studies will need to be conducted to determine whether the adverse event is related to the adjuvant, to the antigens in the vaccine, or to an adjuvant-antigen combination.”

Applying that statement to aircraft, accentuates the absurdity:
“If air crash occurrences are noted, then further studies will need to be conducted to determine whether the crash is related to the engine, to the airframe of the aircraft, or to an engine-airframe combination.”

Explains why Pandemrix caused narcolepsy. If “further studies” can be performed, you don’t wait for people to get hurt but you should perform them before the product hurts people.

With little root cause analysis, little design for safety, the vaccine industry has been stuck tinkering with trial and error for over 200 years. The devastating consequences are predictable. This is no way to build a product that has such an enormous impact on people’s lives. It is doubtful if any other safety critical industry can get away with such a callous disregard for human safety.

References

1. Wraith DC, Goldman M, Lambert P-H. Vaccination and autoimmune disease: what is the evidence? Lancet (London, England). England; 2003 Nov;362(9396):1659–66.
2. Mojsilovic SB. Immunological effects of adjuvants, their mechanisms, and relevance to vaccine safety. Cent Eur J Paediatr Vol 13, No 1 Cent Eur J Paediatr. 2017;
3. Garçon N, Di Pasquale A. From discovery to licensure, the Adjuvant System story. Hum Vaccin Immunother. Taylor & Francis; 2017 Jan 16;13(1):19–33.
4. Gayed PM. Toward a modern synthesis of immunity: Charles A. Janeway Jr. and the immunologist’s dirty little secret. Yale J Biol Med. United States; 2011 Jun;84(2):131–8.
5. Evans SS, Repasky EA, Fisher DT. Fever and the thermal regulation of immunity: the immune system feels the heat. Nat Rev Immunol. 2015 Jun 15;15(6):335–49.
6. Glaxo Smith Kline. Infanrix package insert [Internet]. Available from: https://www.fda.gov/downloads/biologicsbloodvaccines/vaccines/approvedproducts/ucm124514.pdf
7. Lewis K, Cherry JD, Sachs MH, Woo DB, Hamilton RC, Tarle JM, et al. The effect of prophylactic acetaminophen administration on reactions to DTP vaccination. Am J Dis Child. United States; 1988 Jan;142(1):62–5.
8. Prymula R, Siegrist C-A, Chlibek R, Zemlickova H, Vackova M, Smetana J, et al. Effect of prophylactic paracetamol administration at time of vaccination on febrile reactions and antibody responses in children: two open-label, randomised controlled trials. Lancet (London, England). England; 2009 Oct;374(9698):1339–50.
9. Rinaldi M, Perricone R, Blank M, Perricone C, Shoenfeld Y. Anti-saccharomyces cerevisiae autoantibodies in autoimmune diseases: From bread baking to autoimmunity. Clinical Reviews in Allergy and Immunology. 2013. p. 152–61.

10. Wang B, Shao X, Wang D, Xu D, Zhang J-A. Vaccinations and risk of systemic lupus erythematosus and rheumatoid arthritis: A systematic review and meta-analysis. Autoimmun Rev. Netherlands; 2017 Jul;16(7):756–65.

11. Arumugham V. Strong protein sequence alignment between autoantigens involved in maternal autoantibody related autism and vaccine antigens [Internet]. 2017. Available from: https://www.zenodo.org/record/1034571

12. Arumugham V. Strong protein sequence alignment between autoantigens involved in atherosclerosis-related coronary artery disease, cerebral infarction, diabetes mellitus and vaccine antigens [Internet]. 2017. Available from: https://www.zenodo.org/record/1034569

13. Arumugham V. Significant protein sequence alignment between Saccharomyces cerevisiae proteins (a vaccine contaminant) and Systemic Lupus Erythematosus associated autoepitopes [Internet]. 2017. Available from: https://www.zenodo.org/record/1034585

14. Arumugham V. Significant protein sequence alignment between vaccine antigens and Alopecia Areata associated autoantigen [Internet]. 2017. Available from: https://www.zenodo.org/record/1034591

15. Arumugham V. Strong protein sequence alignment between autoantigens involved in cardiac arrhythmias and vaccine antigens [Internet]. 2017. Available from: https://www.zenodo.org/record/1034758

16. Arumugham V. Strong protein sequence alignment between vaccine antigens and adiponectin: an autoantigen involved in atherosclerosis-related coronary artery disease, cerebral infarction, diabetes mellitus and obesity [Internet]. 2017. Available from: https://www.zenodo.org/record/1034756

17. Ahmed SS, Volkmuth W, Duca J, Corti L, Pallaoro M, Pezzicoli A, et al. Antibodies to influenza nucleoprotein cross-react with human hypocretin receptor 2 (ABSTRACT ONLY). Sci Transl Med. 2015;7(294):294ra105–294ra105.

18. Verdier F. Chapter 14 - Preclinical Safety Evaluation of Vaccines. In: Thomas JA, Fuchs RL, editors. Biotechnology and Safety Assessment (Third Edition). Third Edition. San Diego: Academic Press; 2003. p. 397–412.

19. Arumugham V. Vaccine induced autoimmunity: The price we pay for a flawed vaccine design and safety process [Internet]. 2017. Available from: https://www.zenodo.org/record/1034593

20. Vaccine Excipient & Media Summary [Internet]. 2015 [cited 2016 Jan 16]. Available from: http://www.cdc.gov/vaccines/pubs/pinkbook/downloads/appendices/B/excipient-table-2.pdf

21. Arumugham V. Evidence that Food Proteins in Vaccines Cause the Development of Food Allergies and Its Implications for Vaccine Policy. J Dev Drugs. 2015;4(137):2.

22. Arumugham V. Medical muddles that maim our children with allergies, asthma and autism [Internet]. Unpublished; 2017. Available from: https://www.zenodo.org/record/1034595

23. Fox-Edmiston E, de Water J Van. Maternal anti-fetal brain IgG autoantibodies and autism spectrum disorders: current knowledge and its implications for potential therapeutics. CNS Drugs. 2015 Sep;29(9):715–24.

24. Engerix B Package Insert [Internet]. [cited 2016 May 8]. Available from: http://www.fda.gov/downloads/BiologicsBloodVaccines/Vaccines/ApprovedProducts/UCM224503.pdf

25. Recombivax HB Package Insert [Internet]. [cited 2016 May 8]. Available from: http://www.fda.gov/downloads/BiologicsBloodVaccines/Vaccines/ApprovedProducts/UCM110114.pdf

26. MMR II Vaccine Package Insert [Internet]. [cited 2016 May 3]. Available from: http://www.fda.gov/downloads/BiologicsBloodVaccines/Vaccines/ApprovedProducts/UCM123789.pdf

27. Nakayama T, Kumagai T, Nishimura N, Ozaki T, Okafuji T, Suzuki E, et al. Seasonal split influenza vaccine induced IgE sensitization against influenza vaccine. Vaccine. 2015 Nov 9;33(45):6099–105.

28. Davidsson A, Eriksson JC, Rudblad S, Brokstad KA. Influenza specific serum IgE is present in non-allergic subjects. Scand J Immunol. 2005 Dec;62(6):560–1.

29. Smith-Norowitz T a, Wong D, Kusonruksa M, Norowitz KB, Joks R, Durkin HG, et al. Long term persistence of IgE anti-influenza virus antibodies in pediatric and adult serum post vaccination with influenza virus vaccine. Int J Med Sci. 2011;8(3):239–44.

30. Yamane H. N. U. Serological examination of IgE- and IgG-specific antibodies to egg protein during influenza virus immunization. Epidemiol Infect. 1988;100(2):291–9.

31. Gardasil Package Insert [Internet]. Available from: http://www.fda.gov/downloads/BiologicsBloodVaccines/Vaccines/ApprovedProducts/UCM111263.pdf

32. Balaji C, Kevinkumar V, Aravindhan V. Long term persistence of inflammation in children vaccinated with Salmonella conjugate vaccine is associated with augmented Th9-Th17 cytokine. Cytokine. 2017 Mar;91:128–31.

33. Hiwasa T, Zhang X-M, Kimura R, Ohno M, Chen P-M, Nishi E, et al. Elevated Adiponectin Antibody Levels in Sera of Patients with Atherosclerosis-Related Coronary Artery Disease, Cerebral Infarction and Diabetes Mellitus. J Circ Biomarkers. SAGE Publications Ltd STM; 2016 Jan 1;5:8.

34. Frye RE, Sequeira JM, Quadros E V, James SJ, Rossignol D a. Cerebral folate receptor autoantibodies in autism spectrum disorder. Mol Psychiatry. 2012;18(3):369–81.

35. Frye RE, Sequeira JM, Quadros E, Rossignol DA. Folate Receptor Alpha Autoantibodies Modulate Thyroid Function in Autism Spectrum Disorer. North Am J Med Sci. 2014;7(1):1–7.

36. Ramaekers VT, Blau N, Sequeira JM, Nassogne MC, Quadros E V. Folate receptor autoimmunity and cerebral folate deficiency in low-functioning autism with neurological deficits. Neuropediatrics. 2007;38:276–81.

37. Moretti P, Sahoo T, Hyland K, Bottiglieri T, Peters S, del Gaudio D, et al. Cerebral folate deficiency with developmental delay, autism, and response to folinic acid. Neurology. 2005;64(6):1088–90.

38. Braunschweig D, Krakowiak P, Duncanson P, Boyce R, Hansen RL, Ashwood P, et al. Autism-specific maternal autoantibodies recognize critical proteins in developing brain. Transl Psychiatry. Nature Publishing Group; 2013 Jul 9;3(7):e277.

39. Bresson D, Pugnière M, Roquet F, Rebuffat SA, N-Guyen B, Cerutti M, et al. Directed Mutagenesis in Region 713-720 of Human Thyroperoxidase Assigns 713KFPED717 Residues as Being Involved in the B Domain of the Discontinuous Immunodominant Region Recognized by Human Autoantibodies. J Biol Chem . 2004 Sep 10;279 (37):39058–67.

40. Awate S, Babiuk LA, Mutwiri G. Mechanisms of Action of Adjuvants. Front Immunol. Frontiers Media S.A.; 2013 May 16;4:114.

41. Stratton K, Ford A, Rusch E, Clayton EW. Adverse Effects of Vaccines : Evidence and Causality. Injury. 2011. 0-24 p.

42. Arumugham V. Professional Misconduct by NAM Committee on Food Allergy [Internet]. 2016. Available from: https://www.zenodo.org/record/1034559

43. Homburger HA, Mauer K, Sachs MI, O'Connell EJ, Jacob GL, Caron J. Serum IgG4 concentrations and allergen-specific IgG4 antibodies compared in adults and children with asthma and nonallergic subjects. J Allergy Clin Immunol. 1986;77.

44. Savilahti EM, Rantanen V, Lin JS, Karinen S, Saarinen KM, Goldis M, et al. Early recovery from cow's milk allergy is associated with decreasing IgE and increasing IgG4 binding to cow's milk epitopes. J Allergy Clin Immunol. 2010;125.

45. Vickery BP, Lin J, Kulis M, Fu Z, Steele PH, Jones SM, et al. Peanut oral immunotherapy modifies IgE and IgG4 responses to major peanut allergens. J Allergy Clin Immunol. 2013;131(1).

46. Du Toit G, Roberts G, Sayre PH, Bahnson HT, Radulovic S, Santos AF, et al. Randomized trial of peanut consumption in infants at risk for peanut allergy. N Engl J Med. 2015;372(9):803–13.

47. Arumugham V. Autism Spectrum Disorders: A special case of vaccine-induced cow's milk allergy? [Internet]. 2017. Available from: https://www.zenodo.org/deposit/1034557

48. Kortekangas-Savolainen O, Lammintausta K, Kalimo K. Skin prick test reactions to brewer's yeast (Saccharomyces cerevisiae) in adult atopic dermatitis patients. Allergy. Blackwell Publishing Ltd; 1993;48(3):147–50.

49. Arumugham V. Atopic dermatitis caused by vaccine-induced allergy to Saccharomyces cerevisiae? [Internet]. 2016. Available from: https://www.zenodo.org/record/1034567

50. Oshitani N, Hato F, Jinno Y, Sawa Y, Nakamura S, Matsumoto T, et al. IgG subclasses of anti Saccharomyces cerevisiae antibody in inflammatory bowel disease. Eur J Clin Invest. England; 2001 Mar;31(3):221–5.

51. Mokrowiecka A, Gasiorowska A, Malecka-Panas E. pANCA and ASCA in the diagnosis of different subtypes of inflammatory bowel disease. Hepatogastroenterology. Greece; 2007;54(77):1443–8.

52. Israeli E, Grotto I, Gilburd B, Balicer RD, Goldin E, Wiik A, et al. Anti-Saccharomyces cerevisiae and antineutrophil cytoplasmic antibodies as predictors of inflammatory bowel disease. Gut. 2005;54(9):1232–6.

53. Krause I, Blank M, Cervera R, Font J, Matthias T, Pfeiffer S, et al. Cross-Reactive Epitopes on beta2-Glycoprotein-I and Saccharomyces cerevisiae in Patients with the Antiphospholipid Syndrome. Ann N Y Acad Sci. 2007;1108(1):481–8.

54. Rubin K, Glazer S. The potential role of subclinical Bordetella Pertussis colonization in the etiology of multiple sclerosis. Immunobiology. 2015 Dec 18;

55. Zhang Q, Yin Z, Li Y, Luo H, Shao Z, Gao Y, et al. Prevalence of asymptomatic bordetella pertussis and bordetella parapertussis infections among school children in China as determined by pooled real-time PCR: A cross-sectional study. Scand J Infect Dis. 2014;46(4):280–7.

56. Rubin K, Glazer S. The pertussis hypothesis: Bordetella pertussis colonization in the pathogenesis of Alzheimer's disease. Immunobiology. 2017 Feb;222(2):228–40.

57. Machida T. Elevated Levels of Autoantibodies against ATP2B4 and BMP-1 in Sera of Patients with Atherosclerosis-related Diseases. Zhang X-M, editor. Immunome Research. OMICS International.,; 2015. p. 1–9.

58. Ramaekers VT, Sequeira JM, Blau N, Quadros E V. A milk-free diet downregulates folate receptor autoimmunity in cerebral folate deficiency syndrome. Dev Med Child Neurol. 2008;50(5):346–52.

59. Whitaker JA, Ovsyannikova IG, Poland GA. Adversomics: a new paradigm for vaccine safety and design. Expert Rev Vaccines. 2015 Jul 2;14(7):935–47.