

# Historical Perspectives on the Antaeon Animadversion of Vaccine Science in the 21<sup>st</sup> Century

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## Abstract

Anti-vaccine sentiment has been present since the concept of immunization was first introduced by Edward Jenner in the fin de siècle decade of the 18<sup>th</sup> century in England. This paper considers historical perspectives surrounding contravening and injurious views toward vaccinations. Clinicians and scientists are often perplexed by how seemingly intelligent and caring parents can conclude that scientifically-validated vaccines are dangerous to their children, prompting such parents to refuse to provide some or even all of the vaccines recommended by major organizations in medicine around the world. The pungent philippic of the anti-vaccine community can seem disingenuous and desipient to the science community; unfortunately, this antipodal diatribe is often positively perceived by some members of the public and has been for countless eons. Anti-vaccine animus is not a fugacious movement of lilliputian dimensions but an antaeon, amaranthine straw man fallacy with deep roots buried in the zeitgeist of *Homo sapiens* that has and will cause tragic harm to helpless children from what are vaccine preventable diseases. Appreciation of such concepts can be useful in constructing strategies to improve this 21<sup>st</sup> century vaccine animadversion. One can accurately adumbrate that failing to effectively address such issues will only lead to more vaccine refusals despite the persistent and impressive progress that is being made in vaccinology. Modern science does not have a nepenthe for the parents who have needlessly lost children because these precious little ones were not vaccinated for a vaccine preventable disease. The silence of the anti-vaccine mantics and maudits in such cases is deafening and pantagruelian.

**Keywords:** History; Anti-vaccine movement; Media effects; Autism

## Introduction

It was over 80 millennia ago that *Homo sapiens* first emerged from over 300,000 years of hominoid evolution. Born into an unforgiving and mysterious world, humans struggled to deal with sickness and disability [1,2]. They learned to mourn their dead as noted by evidence that Neanderthals of 70,000 years ago carefully buried their loved ones, even those with deformities from rickets [3]. They learned to deal with disease and death in their lives and that there was little one could do to prevent what was felt to be “inevitable”. Humans developed various theories to help them cope which included the emergence of a wide variety of religions, exotic euhemerism, concepts of mysticism, and magisterial mantics. Early healers and ancient thaumaturges were often based in religion or magic and early humans learned to not trust these individuals, for their work did not seem to heal the ill or deformed. Humans developed a mistrust of “healers” from the earliest time since their advice rarely helped, except with serendipity. Thus, mistrust of advice from medical professionals is a time-honored human tradition. Some cultures even punished so-called “healers” if their recommendations proven ineffective or harmful.

There has also been considerable apotropaic prejudice against the ill and deformed that arose thousands of years ago. Food was scarce and was too precious to be shared with the non-contributing and fainéant disabled humans. Agriculture was not discovered until 10,000 years ago and food was reserved for the healthy and not the sick. One writer in ancient China during the Zhou Dynasty (841BC to 221BC) called mentally retarded children “stupid---born stupid and fearful” [4]. People in Western cultures were fearful and distrustful of those with mental retardation and etiology of epilepsy was given sacerdotal explanations such as being due to demon-possession [5].

If one were unhealthy very negative consequences could be expected. For example, those with unexplained skin disease were ostracized in ancient Israel. Leviticus (written around 1400 BC) in the Old Testament provides a graphic account of the separation that occurred with those diagnosed by the priests in the line of Aaron

with what was called *tzaraath* or “leprosy.” It did not matter who you were—royalty or average person—such skin disease meant you lived your life away from your family and friends. The misery of those with these miscellaneous skin diseases, which may have included but was not restricted to leprosy, was reflected in 2 Kings 7:3 (860BC) by one “leper” who noted” : *why are we sitting here until we die?*”

Babies who were examined and declared defective in ancient Sparta (700 BC to 300 BC) were simply thrown into a chasm (*Ceadas*) at a cliff on Mount Taygetus in Peloponnese, Greece [6]. Why should the defective interfere with the lives of normal individuals? Better to kill them before they become a burden to society. Why help rehabilitate them? It became a common notion that the weak should die without help and not be allowed to interfere with the normal population. The classic Greek philosopher, Plato (424 BC-347 BC), was concerned that the disabled would interfere with a world of potential perfection—noting: “*The offspring of the inferior, or of the better when they chance to be deformed, will be put away in some mysterious, unknown place, as they should* [6].”

Some religions weighed in on this concept and felt that birth defects and disabilities, which may not be curable anyway, was simply the punishment of God because of the sins of their parents [6]. This, if disability has such a theological cause and is untreatable, why try to

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**Received** November 28, 2012; **Accepted** December 19, 2012; **Published** December 21, 2012

**Citation:** Greydanus DE (2013) Historical Perspectives on the Antaeon Animadversion of Vaccine Science in the 21<sup>st</sup> Century. J Clin Trials 3: 140. doi:10.4172/2167-0870.1000140

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help the weak and lamb? The Old Testament states that the blind and lame were forbidden from *entering the house of the Lord* while the New Testament noted that demon possession was the cause of at least some mental illness.

William Shakespeare (1564-1616) referred to those with mental retardation as “court fools” because they could get away with saying anything they wanted in the royal courts [7]. Those with mental retardation were called “village idiots” in 19<sup>th</sup> century Western Europe and they lived their lives as court jesters, church dependents and beggars [1]. The hamartia of misguided, mythopoeic persons later in the 20<sup>th</sup> century would tragically seek to establish a viperine vinculum between vaccine science and mental retardation as well (*vida infra*).

### The initiation of vaccinology

Indeed, humans have spent tens of thousands of years concerned that the weak and handicapped are ill and vapid because of sacerdotal underpinnings and not worth the effort in helping them. However, there were some, including physicians, who did not agree with such ideas and felt that everyone should be helped to a life of optimal salubriousness. The general practitioner, Edward Jenner MD (1749-1823) was one who wanted to help his fellow human beings and in this wish, he eventually has helped prevent disease in more people than anyone else in human history. He became a successful family physician and set up his practice in 1773 in his native Berkeley, England.

Dr. Jenner found a land devastated by one of the greatest killers of humans, smallpox, that lead to death in over one third of those infected for thousands of years. After astute observations he inoculated (using what was called the Turkish method) an 8 year old local farmer’s son, James Phipps, with cowpox in 1796; later this boy was exposed to smallpox but did not get infected-- launching in the era of vaccinology in Western civilization. One hundred and eighty one years later, the world was declared free of this deadly killer except for stockpiles in some countries [8]. The government of Spain became the first country to vaticinate the importance of smallpox vaccination by launching the world’s first immense immunization campaign from 1803 to 1813 saving untold thousands of lives [9].

### The initiation of vaccine agon

Unfortunately serious concerns with vaccinations began as soon as the era of vaccines started and has remained with us to this very day [1,10,11]. A number of people began a tromperly against immunizations as soon as progress with vaccinations was observed much as occurs today despite the clear success immunizations have had in removing smallpox from the world, nearly removing polio, and greatly reducing mortality and morbidity from many other vaccine preventable diseases, including measles, rubella, congenital rubella syndrome, Haemophilus influenza, hepatitis B, tetanus, pertussis, and so many more deadly infections [10,12].

Complexities of this new science along with stinging criticism from anti-vaccine persons crippled the development of new post-smallpox vaccines in the 19<sup>th</sup> century. The next vaccine to arrive was the rabies vaccine in 1885 followed by cholera vaccine in 1886, typhoid vaccine in 1896, and plague vaccine in 1897. One of the key factors in threatening the progress of vaccinology and limiting the number of people willing to be vaccinated was the emergence of highly intelligent persons who successfully argued against using this new science. One of the stimulants for this objection was the 1853 Vaccination Act in England that mandated the public must get the smallpox vaccination

[13]. Telling people what they must do can sometimes back-fire and this occur with vaccines both then and now.

Arguably the first charismatic leader of this movement was Alfred Russel Wallace (1823-1913) who was born in Monmouthshire, Great Britain the year Edward Jenner died. Wallace was a brilliant, mullish scholar who became a well-known biologist, explorer, geographer, naturalist, and anthropologist. He is cited by history as the co-discoverer of natural selection. He also became one of the leaders of the anti-vaccine campaign in England in the 1880s. Wallace argued that no one should be forced to get a vaccine because of violation of natural laws of ethics but also then joined forces with those arguing that the smallpox vaccine was not safe, a claim not without merit at the time. He also argued that such a treatment would upset the balance of nature and that principles of natural selection should rule. If one is weak and cannot live unless given artificial, unnatural aid, then one should meet the fate that was intended by nature. This was in line with thousands of years of intuitive reasoning by humans that the weak should perish and wake way for the strong.

This was consistent with the jeremiad by Plato about the inferior and deformed (*vida supra*). This concept was also coterminous with the Old Testament isolating those called lepers so as not to contaminate or defile the healthy. This is synergistic with thinking that illness is due to the sins or peccadilloes of the parents and it is up to God, not man, to save these children. Many humans concluded that one must not rely on science but on irrefragable religious creeds and principles of prestidigitation to live.

Wallace challenged the medical establishment in regards to vaccinations and encouraged all to avoid such a dangerous treatment method that was unnatural or against the laws of nature and which was more important than any rule established by untrustworthy scientists. Wallace was joined by some prominent scientists of the Victorian age to remove the compulsory vaccination act and discredit the vaccine paradigm. He argued with the Journal, *Lancet*—a medical journal that would come to prominence in the vaccine world in the 20<sup>th</sup> century. The *Lancet* diaskeuasts noted that Wallace and his colleagues ignored large amounts of scientific data in arriving at their anti-vaccine conclusions—a stance noted in the 21<sup>st</sup> century with those arguing against vaccines [14]. Little wonder that more progress in vaccinology was slowed and the next vaccine was developed in France and certainly not in England. Unfortunately such events would repeat themselves in the 20<sup>th</sup> century with severe consequences for the public health. The criticism that vaccines are dangerous and un-natural remains with the public consciousness and domain even in the 21<sup>st</sup> century [15].

### The impact of Autism on the 20<sup>th</sup> Century Anti-vaccine Movement

As smallpox was the catalyst for anti-vaccine sentiment in the 19<sup>th</sup> century, autism (autistic spectrum disorders) has been the catalyst for antipodal positions against vaccines in the 20<sup>th</sup> and now 21<sup>st</sup> century. The first description of autism was probably that of a 12 year old boy that was commented on by the proclaimed founder of the Reformation, Martin Luther (1483-1546), in the works of Luther’s notetaker, Mathesius [16]. The courts of 18<sup>th</sup> century Scotland provides one of the earliest well-documented cases of autism with the legal recordings of Hugh Blair (Borgue, Scotland) who was due to gain an inheritance and his brother was arguing in court why he was not fit for such a beneficence [17]. A feral child was caught in 1798 in Aveyron, France who was treated by Jean Itard, a medical student, and called the “Wild Boy of Aveyron” [18].

Autism was not named as such until the 20<sup>th</sup> century based first on the work of Leo Kanner (1894-1981), whose illustrious career at Johns Hopkins University (Baltimore, Maryland) led to the development of child psychiatry in the United States [19]. Kanner published a classic article in 1943 called *Autistic Disturbances of Affective Contact*, based on his astute observations of 11 children with features we now associate with autism [20]. His work centered on what was called early infantile autism or Kanner's autism and this became part of the spectrum now identified as autistic spectrum disorders [21,22]. It was unknown what caused autism and that allowed various so-called experts to pontificate their own theories. Kanner's original theory was that autism was caused by mothers who were unable to relate in a healthy social manner to their babies.

Again, the scientists had it wrong in a long line of false and even dangerous theories on health and disease. This concept of blaming mothers for the poor social skills and untreatable psychiatric problems of infants and children was an unfortunate event in the development of understanding as well as misunderstanding about autism. Humans have blamed patients and families for various unmanageable problems for thousands of years. Unfortunately healers and religious experts, for example, blamed many medical and psychological problems of adolescents on the fact that teenagers were sexually active.

For example, Claudius Galen (130-210AD), the great Greek physician to the emperor and gladiators of Rome, linked countless incurable teenage diseases (i.e., acne, epilepsy, depression, others) to teenage masturbation. Galen pontificated: "watch carefully over this young man, leave him alone neither night nor day; at least sleep in his chamber. When he [the masturbator] has contracted this fatal habit (i.e., masturbation), the most fatal to which a young man can be subject, he will carry its painful effects to the tomb—his mind and body will always be enervated" [23].

Thus, placing the blame of a condition on someone fit in with earlier ways of blaming the patient or the parents that had been occurring for eons of time. Bruno Bettelheim, PhD (1903-1990) was a well-known expert in children with autism who taught at the University of Chicago from 1944 to 1973. He agreed with the Kanner concept that autism is caused by what became popularized as "refrigerator mothers" [24]. Mothers of children with autism knew this was not the case and a considerable mistrust of medical authorities was thus worsening. Challenges to such a position were mounting as mothers publically stated and even wrote that their children did not develop autism from "cold" mothers [25]. Such a bloviation by medical experts was refuted by the public and the public was eventually proven correct!

As the American public became concerned with such ideas, they were vulnerable to false theories, as humans for eons have been. There was a one-hour television presentation in 1982 that appeared in the Washington, DC area called "DTP: Vaccine Roulette" in which the whole cell pertussis vaccine was blamed for causing severe vaccine reactions in infants leading to encephalopathy and irreversible brain damage [26]. The influence of such media-driven anti-vaccine nescience cannot be underestimated in stimulating and continuing the hysterical anti-vaccine rhetoric seen in the 21<sup>st</sup> century [27]. The pertussis vaccine was changed adding to the public's education that it was not safe in the first place.

In the penultimate and *fin de siècle* decades of the 20<sup>th</sup> century, the public was seeking, as in the days of Wallace, champions to encourage anti-vaccines, identify the cause of autism, and stop blaming parents for their children's problems. Adding fuel to this fire is the public

perception that unknown numbers of doctors and pharmaceutical companies value money over the health of people [1]. Starting in 2000 the U.S. Institute of Medicine has published comprehensive reports on medical errors revealing the thousands of patients who die at the hands of unprofessional and/or error-prone doctors [28,29]. Why should the public trust doctors and pharmaceutical companies? Healers have been proven wrong for thousands of years---wrong with their theories of illness and wrong to push toxic treatments on the unwary public.

Mothers upset with doctors blaming them for their autistic children and an untrusting public was in need of prophets to lead them out of confusion. Enter Bernard Rimland, PhD (1928 to 2006) who was an American psychologist credited for impressive scientific work in the field of childhood mental retardation, autism, learning disorders, attention deficit hyperactivity disorder, and other maladies of children [1]. His view was that mothers were not to blame for their autistic children which was a major breakthrough in the eons of human existence blaming parents their children's diseases. He founded the Autism Society of America in 1965 and in 1967 became the director of the Autism Research Institute in San Diego, California. He was viewed by these relieved and adoring mothers as a modern Ptolemy's pharos providing lucid and salient concepts of children with disabilities.

As Dr. Rimland looked at various researches he felt that vaccines (thiomersal) were behind the "epidemic" of autism in America and elsewhere. Though organized medicine did not agree with this opinion, the public had its champion. Mothers were vindicated and as they watched their beautiful children slip into the horrible bonds of autism while receiving childhood vaccines, people became convinced of this cause and effect relationship. Indeed, "healers" were at it again with treatments that were dangerous yet profitable for countless unprofessional scientists and clinicians.

As in the days of Wallace, other anti-vaccine champions emerged. Andrew Wakefield (born: 1957) is a trained surgeon and researcher from England who published a now infamous paper in *Lancet* in 1998 that described his research findings seeking to demonstrate a link between the MMR vaccine and he called "autistic enterocolitis" [30]. This research was eventually discredited and *Lancet*, the journal that did battle with Wallace in the 19<sup>th</sup> century, eventually withdrew the Wakefield paper [31-34]. However, there was now another scholar for the suspicious public to believe, along with movie stars and various media goliaths who either believed the autism-MMR link or raised the possibility of such a link. This continues to the present day even though the scientific literature is thorough and lucid that vaccines do not cause autism or other disorders [35-39].

### Anti-vaccine animus in the 21<sup>st</sup> century

Parents have various and complex reasons for rejection of some or all vaccines and the results of such historical perspectives is part of this complexity. The public remains skeptical and the media is ready to pursue this apodictic story [40-43]. Parents and the public remain confused and sometimes go along their individual thought patterns which can conflict with other parent's decisions. Some feel that too many vaccines overload the child's immune system, that low disease severity does not warrant use of potential "risky" (toxic) vaccines, and some feel that sympathy still exists for Wakefield and other "prophets" who are against vaccines [44]. Parents simply may not rely on evidence of science and medicine to determine their decisions about vaccines for their children; some are concerned over the impartiality of their physicians and do not trust neither them nor the pharmaceutical companies in regards to vaccine information [45,46]. Vaccine refusal

has spread beyond MMR vaccines to other immunizations as well involving influenza, pertussis, hepatitis B, and others—even those whose chronic illness puts them at increased risk from vaccine preventable diseases [47].

Parents are truly perplexed about potential adverse effects of vaccines and the actual need for vaccines [11]. On the basis of the Allais paradox and fuzzy-trace theory, some parents choose to ignore vaccines and not risk feeling bad about potential risks or negative aspects of “toxic” vaccination [48]. This is also part of a generalized movement in the public in which power has shifted from scientists and physicians to the patient while anti-vaccine material is consistent with a message some wish to hear. The fact that research that is consistent with their anti-vaccine message is unscientific remains immaterial because such conclusions fit with a message they wish to hear [15]. The obdurate message, some say, is not “anti-vaccine” but one of a “pro-safe vaccine” [15]. Information on the internet can be inaccurate and part of the anti-vaccine movement includes material even written by nescient physicians and non-physician healthcare professionals [49]. Also, complicating this issue is that some physicians are not knowledgeable about *au courant* vaccine recommendations that often change and offer limited effective rebuttal to anti-vaccine information [50]. Healthcare workers may refuse vaccinations for them and may be susceptible to the complex, minacious, mesmerizing anti-vaccine sentiment that has been present since the science of immunizations began [51-57].

This is not to deny the potential positive influence of pro-vaccine physicians in selective arenas [58]. However, epidemics of vaccine preventable illness (i.e., measles, mumps, pertussis, others) are being recorded around the globe in the 21<sup>st</sup> century because of parent’s reluctance to vaccinate their children [58-68]. Parents are rushing to the American court system to get payment for the damage allegedly caused by vaccines [69]. Vaccine companies may cut back on their efforts to manufacture and even produce new vaccines if this movement augments ever more [70].

Why should scientists and clinicians be concerned about such agons in the 21<sup>st</sup> centuries? Many scientists continue to develop amazing new vaccines and clinicians continue to treat patients. It is important to understand that some of the population is not being given the full benefits of vaccine science. It is important to understand that the reasons for such animadversion and anti-vaccine ballyragging are complex and deeply rooted in many historical factors. Simply going about our business as usual in a lethean manner is not helpful to the public and to the defenseless children who have and will suffer preventable morbidity and mortality because of well-meaning but misinformed parents. Effective strategies to blunt the gains of the professional anti-vaccine basilisk can and should be developed based upon a perspicacious understanding of the history of such a movement.

The reasons for low vaccination rates among children in various countries are complex and multi-varied. Part of this complexity is the various reasons underlying anti-vaccine attitudes and knowledge found in many countries [71]. The rise in use of complementary and alternative medicine leads to a natural rise in anti-vaccine sentiment [72]. We must not be discouraged by the seemingly irrefragable nature of the parents and their benighted advisors who persistently and jauntily resist vaccine science. Direct and sustained counter-marketing programs aimed at the internet-anti-vaccine messages is recommended [73]. Some suggest that focusing more on individual parents may be more productive than focusing on anti-vaccine groups [74]. Public reluctance to accept vaccines complicates other disease-stimulating

factors such as vaccine failures, falling antibody levels from previous vaccinations, and others [63,75,76].

## Summary

*Homo sapiens* have been debating the merit of preventing and managing illness and deformity for over 80 millennia. Humans have been distrustful of healers whether they were ancient medical priests or modern opulent physicians. The idea of medications being toxic and/or un-natural has been applied to immunizations over the past two centuries by a variety of anti-vaccine groups that have included scientists, physicians, and an assortment of the general public. Strategies to offset the gains of anti-vaccine pecksniff-ianism are possible if scientists and clinicians wish to do so and utilize a multi-tiered, carefully developed strategic movement of their own based on understanding of the historical underpinnings of the current antaeon animadversion of vaccine science in the 21<sup>st</sup> century.

It is important that the pro-vaccine community not dismiss and ignore the anti-vaccine group as maundering maudits. Parents are not careless myrmidons blindly listening to maniacal mantics but are people who love their children and are sincerely as well as historically afraid of potentially unnatural, toxic, and unneeded vaccines. In addition to the development of new vaccines, we must seek to carefully confront the *au courant* vaccine animus to help the defenseless children who will otherwise be harmed. There is no available nepenthe to ease or ameliorate the aeonian sorrows of a parent who has lost a beloved child from a vaccine preventable disease because of failure to provide their lost one with a vaccine that is easily available and has been produced by the post-Jenner science of vaccinology. We must remain trustworthy, tigrine, tinnient tutelaries of these precious children and be worthy of our tellurian existence.

## References

1. Greydanus DE, Toledo-Pereyra LH (2012) Historical perspectives on Autism: Historical Perspectives on Autism: Its Past Record of Discovery and its Present State of Solipsism, Skepticism, and Sorrowful Suspicion. *Pediatr Clin North Am* 59: 1-11.
2. Greydanus DE, Pratt HD (2005) Syndromes and disorders associated with mental retardation: Selected Comments. *Indian J Pediatrics* 72: 27-32.
3. Beck S. Prehistoric cultures. In: *Mideast and Africa to 1700*. Santa Barbara, CA: World Peace Communications.
4. Su H, Van Dyke DC (2005) Breaking the silence and overcoming the invisibility: Down Syndrome in China. *Internat Pediatr* 20: 25-33.
5. Greydanus DE, Van Dyke D (2005) Epilepsy in the adolescent: The Sacred Disease and the Clinician’s Sacred Duty. *International Pediatrics* 20: 6-8.
6. Mackelprang RW, Salsgiver RO (1998) *Disability: A Diversity Model Approach in Human Service Practice*. Florence, KY: Cengage Learning.
7. Sulkes SB (2006) MR in Children and adolescent. In: Greydanus DE, Pratt HD, Patel DR, (eds). *Behavioral Pediatrics*.
8. Huygelen C (1996) Jenner’s cowpox vaccine in light of current vaccinology. *Verh K Acad Geneeskld Belg* 58: 479-536
9. Mark C, Rigau-Pérez JG (2009) The world’s first immunization campaign: the Spanish smallpox vaccine expedition, 1803-1813. *Bull Hist Med* 83: 63-94.
10. Greydanus DE, Olipra D, De Leon J, Neupaney A (2012) Perspectives on immunizations. In: *Tropical Pediatrics. A Public Health Concern of International Proportions*. NY: Nova Biomedical Publications, 15-37.
11. Meyer C, Reiter S (2004) Vaccine opponents and sceptics. History, background, arguments, interaction. *Bundesgesundheitsblatt Gesundheitsforschung Gesundheitsschutz* 47: 1182-8
12. Greydanus DE, Patel DR (2010) Vaccines for adolescents leaving for higher studies in the USA. In: Bhav S, Parthasarathy A, Yadav S, (eds). *A ready*

- manual for vaccinations: Adult, adolescents, and pediatric. New Delhi, India: Jaypee Brothers Medical Publishers 154-172.
13. Tafuri S, Martinelli D, Prato R, Germinario C (2011) From the struggle for freedom to the denial of evidence: history of the anti-vaccination movements in Europe. *Ann Ig* 23: 93-99.
  14. Sloten RA (2004) *The Heretic in Darwin's Court: The Life of Alfred Russel Wallace*. NY: Columbia University Press.
  15. Kata A (2012) Anti-vaccine activists, Web 2.0, and the postmodern paradigm--an overview of tactics and tropes used online by the anti-vaccination movement. *Vaccine* 30: 3778-89.
  16. Wing L (1997) The history of ideas on autism: legends, myths, and reality. *Autism* 1:13-27.
  17. Houston R, Frith U (2000) Autism in history: The case of Hugh Blair of Borgue. Blackwell.
  18. Wolff S (2004) The history of autism. *Eur Child Adolesc Psychiatry* 13: 201-8.
  19. [http://en.wikipedia.org/wiki/Leo\\_Kanner](http://en.wikipedia.org/wiki/Leo_Kanner)
  20. Kanner L (1943) Autistic disturbances of affective contact. *Nervous Child* 2: 217-250.
  21. Kanner L (1946) Irrelevant and metaphorical language in early infantile autism. *Am J Psychiatry* 103:242-6.
  22. Kanner L, Eisenberg L (1956) Early infantile autism 1943-1955. *Am J Orthopsychiatry* 26: 55-66.
  23. Greydanus DE, Merrick J, Dodich C (2012) Adolescence and sexual health. *Int J Child and Adolescent Health* 5: 1-3.
  24. Pollack R (1997) *The Creation of Dr. B: A biography of Bruno Bettelheim*. NY: Simon & Schuster.
  25. Park CC (1967) *The Siege: The First Eight Years of an Autistic Child*. Boston, MA: Little, Brown, and Company.
  26. Adashi EY, Offit PA (2011) Paul Offit on the dangers of the anti-vaccine movement.
  27. [http://en.wikipedia.org/wiki/Paul\\_Offit\\_Assessed\\_September\\_1](http://en.wikipedia.org/wiki/Paul_Offit_Assessed_September_1)
  28. Kohn LT, Corrigan JM, Donaldson MS (2000) *To err is human: building a safer health system*. Washington, DC.
  29. Aspden P, Wolcott JA, Bootman JL, Cronenwett (2007) *Preventing Medication Errors: Quality Chasm Series*. Washington DC: The National Academies Press.
  30. Wakefield AJ, Murch SH, Anthony A, Linnell J, Casson DM, et al. (1998) Ileal-lymphoid-nodular hyperplasia, non-specific colitis, and pervasive developmental disorder in children. *The Lancet* 351: 637-41.
  31. Offit PA (2008) *Autism's false prophets: bad science, risky medicine, and the search for a cure*. NY: Columbia University Press.
  32. Eggertson L (2010) Lancet retracts 12-year-old article linking autism to MMR vaccines. *CMAJ* 182: E199-E200
  33. Godlee F, Smith J, Marcovitch H (2011) Wakefield's article linking MMR vaccine and autism was fraudulent. *BMJ* 342: c7452.
  34. Black C, Kaye JA, Jick H (2002) Relation of childhood gastrointestinal disorders to autism: nested case-control study using data from the UK General Practice Research Database. *BMJ* 325: 419-21.
  35. DeStefano F, Chen RT (2000) Autism and measles, mumps, and rubella vaccine: no epidemiological evidence for a causal association. *J Pediatr* 136: 125-126.
  36. [http://www.nap.edu/catalog.php?record\\_id=10997](http://www.nap.edu/catalog.php?record_id=10997)
  37. Mrozek-Budzyn D, Kiełtyka A, Majewska R (2010) Lack of association between measles-Mumps-rubella vaccination and autism in children: a case-control study. *Pediatr Infect Dis J* 29: 397-400.
  38. Institute of Medicine. Adverse effects of vaccines: Evidence and causality. Released August 25, 2011. Accessed November 21, 2012.
  39. Demicheli V, Rivetti A, Debalini MG, Di Pietrantonio C (2012) Vaccines for measles, mumps and rubella in children. *Cochrane Database Syst Rev* 2: CD004407.
  40. Speers T, Lewis J (2004) Journalists and jabs: media coverage of the MMR vaccine. *Commun Med* 1: 17181.
  41. Freed GL, Clark SJ, Butchart AT, Singer DC, Davis MD (2010) Parental vaccine safety concerns in 2009. *Pediatrics*.
  42. Hackett AJ (2009) Risk, its perception and the media: the MMR controversy. *Community Pract* 81: 22-5.
  43. Goodman NW (2007) MMR scare stories: some things are just too attractive to the media. *BMJ* 335:222.
  44. Brown KF, Long SJ, Ramsay M, Hudson MJ, Green J, et al. (2012) U.K. parents' decision-making about measles-mumps-rubella (MMR) vaccine 10 years after the MMR-autism controversy: a qualitative analysis. *Vaccine* 30: 1855-64.
  45. McMurray R, Cheater FM, Weighall A, Nelson C, Schweiger M, et al. (2004) Managing controversy through consultation: a qualitative study of communication and trust around MMR vaccination decisions. *Br J Gen Pract* 54: 520-5.
  46. Brown KF, Kroll JS, Hudson MJ, Ramsay M, Green J, et al. (2010) Factors underlying parental decisions about combination childhood vaccinations including MMR: a systematic review. *Vaccine* 28: 4235-48.
  47. Costa Tadeo X, Navarro Aznárez G, Campos Abellana C, Esporriñ Bosque C, Romero Ruiz AL (1991) The evaluation of noncompliance in an anti-influenza vaccination program. *Aten Primaria* 8: 544-546,548.
  48. Reyna VF (2012) Risk perception and communication in vaccination decisions: a fuzzy-trace theory approach. *Vaccine* 30: 3790-7.
  49. Poscia A, Santoro A, Collamati A, Giannetti G, de Belvis AG, et al. (2012) Availability and quality of vaccine information on the Web: a systematic review and implication in public health. *Ann Ig* 24: 113-21.
  50. Zimmerman RK, Wolfe RM, Fox DE, Fox JR, Nowalk MP, et al. (2005) Vaccine criticism on the world wide web. *J Med Internet Res* 7: e17.
  51. Davies P, Chapman S, Leask J (2002) Antivaccination activists on the World Wide Web. *Arch Dis Child* 87: 22-25.
  52. Anastasi D, Di Giuseppe G, Marinelli P, Angelillo IF (2009) Paediatricians knowledge, attitudes, and practices regarding immunizations for infants in Italy. *BMC Public Health* 9: 463.
  53. Roehr B (2012) Media induced anti-vaccination sentiment can even affect health workers vaccine researcher says. *BMJ* 344: e1563.
  54. Siriwardena AN (2007) Healthcare workers and influenza vaccination. Commentary on Canning HS, Phillips UJ & Allsup S (2005). Healthcare workers beliefs about influenza vaccine and the reasons for non-vaccination-a cross-sectional survey. *J Clin Nursing* 14: 922-925. *J Clin Nurs* 16: 1186-1188.
  55. Sukriti A, Pati NT, Sethi A, Agrawal K, Agrawal K, et al. (2008) Low levels of awareness, vaccine coverage, and the need for boosters among healthcare workers in tertiary care hospitals in India. *J Gastroenterol Hepatol* 23: 1710-1715.
  56. Busse JW, Wilson K, Campbell JB (2008) Attitudes towards vaccination among chiropractic and naturopathic students. *Vaccine* 26: 6237-6243.
  57. Russell ML, Injeyan HS, Verhoef MJ, Eliasziw M (2004) Beliefs and behaviours: understanding chiropractors and immunization. *Vaccine* 23: 372-379.
  58. Coniglio MA, Platania M, Privitera D, Giammanco G, Pignato S (2011) Parents' attitudes and behaviours towards recommended vaccinations in Sicily, Italy. *BMC Public Health* 11: 305.
  59. Serpell L, Green J (2006) Parental decision-making in childhood vaccination. *Vaccine* 24: 4041-4046.
  60. Mortamet G, Dina J, Freymuth F, Guillois B, Vabret A (2012) Measles in France. *Arch Pediatr* 19: 1269-1272.
  61. Leloup P, Barbarot S, Biron A, Peuvrel L, Briand-Godet V, et al. (2012) Measles resurgence: a retrospective analysis of 55 cases. *J Eur Acad Dermatol Venereol* 26: 1585-1587.
  62. Oliveira MI, Figueiredo CA, Afonso AM, Santos FC, Lemos XR, et al. (2012) Resurgence of measles virus in São Paulo, Brazil. *Rev Inst Med Trop Sao Paulo* 54: 113-114.
  63. Barskey AE, Glasser JW, LeBaron CW (2009) Mumps resurgences in the United States: A historical perspective on unexpected elements. *Vaccine* 27: 6185-6195.

64. Centers for Disease Control and Prevention (CDC) (2009) Progress toward measles elimination--European Region, 2005--2008. *MMWR Morb Mortal Wkly Rep* 58: 142-145.
65. Celentano LP, Massari M, Paramatti D, Salmaso S, Tozzi AE, et al. (2005) Resurgence of pertussis in Europe. *Pediatr Infect Dis J* 24: 761-765.
66. Cherry JD (2012) Epidemic pertussis in 2012--the resurgence of a vaccine-preventable disease. *N Engl J Med* 367: 785-787.
67. Centers for Disease Control and Prevention (CDC) (2012) Pertussis epidemic--Washington, 2012. *MMWR Morb Mortal Wkly Rep* 61: 517-522.
68. Vivancos R, Keenan A, Farmer S, Atkinson J, Coffey E, et al. (2012) An ongoing large outbreak of measles in Merseyside, England, January to June, 2012. *Euro Surveill* 17: pii:20226.
69. Sugarman SD (2007) Cases in vaccine court--legal battles over vaccines and autism. *N Engl J Med* 357: 1275-1277.
70. Bragesiö F, Haliberg M (2011) Dilemmas of a vitalizing vaccine market: lesions from the MMR vaccine/autism debate. *Sci Context* 24: 107-125.
71. Rainey JJ, Watkins M, Ryman TK, Sandhu P, Bo A, et al. (2011) Reasons related to non-vaccination and under-vaccination of children in low and middle income countries: findings from a systematic review of the published literature, 1999-2009. *Vaccine* 29: 8215-8221.
72. Ernst E (2001) Rise in popularity of complementary and alternative medicine: reasons and consequences for vaccination. *Vaccine* 1: S90-S93.
73. Seeman N, Ing A, Rizo C (2010) Assessing and responding in real time to online anti-vaccine sentiment during a flu pandemic. *Healthc Q* 13: 8-15.
74. Blume S (2006) Anti-vaccination movements and their interpretations. *Soc Sci Med* 62: 628-642.
75. Jan CF, Huang KC, Chien YC, Greydanus DE, Davies HD, et al. (2010) Determination of immune memory to hepatitis vaccination through early booster response in college students. *Hepatology* 51: 1547-1554.
76. Sakou II, Tsitsika AK, Papaevangelou V, Tzavela ED, Greydanus DE, et al. (2011) Vaccination coverage among adolescents and risk factors associated with Incomplete Immunization. *Eur J Pediatr* Nov 170: 1419-1426.

This article was originally published in a special issue, **Clinical Trials Cellular Immunology** handled by Editor(s). Dr. Vladia Monsurr'o, University of Verona Medical School, Italy