

Expert Commentary Series

Another Antivaccinationist Wrong About Genetic Research and Autism: A Review of Teresa Conrick's "Dear America, You Are Being Bamboozled Again About Autism and Genes" (*Age of Autism*, July 23, 2014)

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Executive Summary

A number of organizations as well as bloggers have arisen over the past several decades claiming that vaccines and/or their ingredients cause a number of disorders, foremost among these is autism. The results of their efforts have been a decline in vaccine coverage and a rise in previously rare childhood diseases, resulting in unnecessary suffering, hospitalizations, long term disabilities, and even death. The following paper will demonstrate, using one article by Teresa Conrick, a contributing editor to *Age of Autism*, the poor scholarship and science displayed by many antivaccinationists. If people are to decide on whether to vaccinate their children or not, it should be based on scholarly, well-grounded science, and reflect basic common sense, not claims made by people who are deficient in these.

Conrick's recent post on *Age of Autism*, "Dear America, You Are Being Bamboozled Again About Autism and Genes," should raise a number of red flags regarding her scholarship, basic understanding of science, common sense, and, perhaps, even her ethics. Conrick's article claims that a recent study, looking at genetics and autism, published in the journal *Nature Genetics* by Gaugler *et al.*, "Most Genetic Risk for Autism Resides Within Common Variation," reflects an "onslaught of studies and articles to try and persuade [people] that AUTISM is a genetic ONLY disorder," that the Gaugler *et al.* study "is completely denying ANY ENVIRONMENTAL OR TOXIC EXPOSURE."

The conclusions of this paper are:

1. The Gaugler *et al.* study, "Most Genetic Risk for Autism Resides Within Common Variation" (August 2014), based on Swedish data, looked at the contribution of various types of genes to the genetic component of autism, which was estimated to be around 52%. No mention was made of environmental or toxic exposure, so, obviously, it couldn't be denying either.
2. Conrick contradicts herself by following her claim that "studies . . . try[ing] to persuade that AUTISM is a genetic ONLY disorder" with a follow up statement that the Gaugler *et al.* study estimates the genetic contribution to be 52%. The math I learned doesn't equate 52% with 100%.

3. Conrick partly bases her article on an online article by Paul Hamaker, “Largest Study to Date Shows Majority of Autism is Genetic,” found on the blog “Birmingham Science News Examiner,” which stated the Gaugler *et al.* “study included the contribution of environmental causes of autism and found that genetics trumps any environmental cause for autism.”
4. It appears that Conrick is using Hamaker’s paper together with the Gaugler study as straw men, given her belief that autism is all or mainly environmentally determined, to persuade the reader that there is too much research emphasis on genetics, something I refuted in this paper. However, the Gaugler study did not address environmental factors at all, while Hamaker simply claimed it “found that genetics trumps any environmental cause.”
5. Conrick’s claim that the study “is completely denying ANY ENVIRONMENTAL OR TOXIC EXPOSURE,” is just plain WRONG! If Conrick wants to express her belief that too much research is being devoted to genetics, then she should do so; but not by such hyperbole and misrepresenting the research that has been conducted. What in Conrick’s opinion would be an acceptable division of research funding and what percentage of genetic contributions to autism would she agree with? And is she capable of supporting her position with good science?
6. Remarkably, in his article, Hamaker also implies that, by focusing on genetics, Gaugler *et al.* advocated a discredited eugenics approach. I find it despicable that Conrick would draw attention to anyone advocating eugenics, which was used to justify racism and discrimination against various groups, leading to untold suffering from forced sterilizations to Nazi death camps.
7. Conrick, apparently, doesn’t understand the role that genetics, environment, and their interaction play in just about all aspects of human life nor the extensive research on these and the advances being made in diagnostics, prevention, and treatment.
8. Though the Gaugler *et al.* study did not discuss nor discount the environment’s role in ASD, Conrick uses her claim that they did as a straw man to attack genetic studies. She posits the role of pesticides, vitamin D, sunlight and other factors to discount the relevance of the study’s findings. Conrick refers to one exploratory study looking at pesticides and ASD by Shelton *et al.* published in the journal *Environmental Health Perspectives*, “Neurodevelopmental Disorders and Prenatal Residential Proximity to Agricultural Pesticides: The CHARGE Study,” citing the study’s findings. She speculates regarding the role of vitamin D’s affect on the incidence of ASD without any foundation nor evidence that she has even bothered to research the subject. In fact, if further research were to implicate pesticides and/or vitamin D, it would weaken the main claim by Conrick and *Age of Autism* contributors of the role of vaccines in ASD, given that any effect from either of the above would occur *in utero*.
9. Conrick bases her article on a press release of the Gaugler *et al.* study and a blog post discussing it. She based her mention of the pesticide study on a *PubMed Health* post about the actual study, giving only the “conclusions” of the study, while failing to acknowledge any inconvenient facts or suggested weaknesses. With regard to either actual study, Conrick gives no indication she attempted to read either of them and/or understood them, though both were available. In addition, she bases her outrage on an obscure blogger, unethically implying he was reflecting sentiments contained in the Gaugler study.

As stated on the website, *Age of Autism*: “We are published to give voice to those who **believe** [my emphasis] autism is an environmentally induced illness.” In my opinion, Conrick's mind is made up. They are absolutely certain they are right, despite gross deficiencies in scholarship, science, and common sense. My review of Conrick’s article as well as my previous review of an article by Lynn Redwood of *SafeMinds* (Harrison, 2014) clearly indicates the desperate lengths they will go to in order to promote their ideologically rigid beliefs. Given that both are major advocates among antivaccinationists, and *SafeMinds*, Redwood’s organization, is even listed as a sponsor of *Age of Autism*, why would anyone accord either *Age of Autism* or *SafeMinds* any credibility?

The only conclusion for Conrick’s and Redwood’s papers, is “don’t be bamboozled” by people who literally don’t know what they are talking about.

Introduction

A number of organizations as well as bloggers have arisen over the past several decades claiming that vaccines and/or their ingredients cause a number of disorders, foremost among these is autism. The results of their efforts have been a decline in vaccine coverage and a rise in previously rare childhood diseases, resulting in unnecessary suffering, hospitalizations, long term disabilities, and even death. In assessing whether to believe claims made by antivaccinationists, the first question that comes to mind is whether their claims display acceptable standards of scholarship, science, and, in some cases, even basic common sense. In other words, do they know what they are talking about? This paper examines this question in relation to one specific blog post by Teresa Conrick, a contributing editor to *Age of Autism*, where she criticizes an article examining genetic factors contributing to autism.

Age of Autism is one of the more “popular” anti-vaccination websites. If people are to decide on whether or not to vaccinate their children, it should be based on scholarly, well-grounded science, and reflect basic common sense, not claims made by people who are deficient in these. Hopefully, by reading this article, people will learn to apply critical thinking to what they read.

Background

According to *Age of Autism*:

We are published to give voice to those who **believe** [my emphasis] autism is an environmentally induced illness, that it is treatable, and that children can recover. For the most part, the major media in the United States aren't interested in that point of view, they won't investigate the causes and possible biomedical treatments of autism independently, and they don't listen to the most important people – the parents, many of whom have witnessed autistic regression and medical illness after vaccinations. We do all those things, and more.

We *believe* [my emphasis] that autism is the defining disorder of our age, man-made and therefore preventable, and that it points to the truth about other problems that beset us, from ADD to asthma to Alzheimer's. We address those issues as well, along with exposing the special interests, bureaucratic inertia, and medical malfeasance that perpetuate denial and suffering. (Olmsted, A Letter from the Editor, Age of Autism, <http://www.ageofautism.com/a-welcome-from-dan-olmste.html>)

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Teresa Conrick's "Dear America, You Are Being Bamboozled Again About Autism and Genes" (July 23, 2014)

A recent article by Conrick should raise a number of red flags regarding her scholarship, basic understanding of science, common sense, and, perhaps, even her ethics, and, given her position as a contributing editor to *Age of Autism*, the overall credibility of the website.

According to Conrick:

It's happening again. The onslaught of studies and articles to try and persuade you, dear citizen of the USA, that AUTISM is a genetic ONLY disorder . . . The article I want to share about a new gene study has these bizarre quotes: [hyperlinks to: Hamaker, July 21, 2014]

The source of autism in children is in majority the result of the desire of parents with defective genes to have children. The study included the contribution of environmental causes of autism and found that genetics trumps any environmental cause of autism. The study was based on the genetic analysis of over 1.6 million Swedish families and compared 3,000 people with autism with a group that did not have autism that was the same size. . . This discovery that included the National Institutes of Health in the United States and several experts from U.S. universities brings into serious doubt previous claims that vaccinations or any environment source caused autism. [hyperlink to: Hamaker, July 21, 2014]

There are many, many studies showing that TOXINS are involved in autism. . . "Pesticides linked to autistic disorders". [hyperlinks to PubMed Health, June 23, 2014]

The fact that this study, *Population-Based Autism Genetics and Environment Study* [press release thus far] is completely denying ANY ENVIRONMENTAL OR TOXIC EXPOSURE is very odd and suspect.

Published in the July 20 issue of the journal 'Nature Genetics,' the study found that about 52 percent of autism was traced to common genes and rarely inherited variations . . . the team also showed that inheritability outweighs environmental risk.

Plus, it should be noted that this study was done in SWEDEN. There are many differences between Sweden and the USA, as far as both genetics and the environmental factors of each country, like food, Vit D [Vitamin D], sun exposure, vaccinations, heavy metal exposures and pesticides. In the 1990's, where a big chunk of the birth cohorts in this study

were used, “Sweden mandated a fifty percent reduction in the use of agricultural pesticides”. . . , the results of a comparison of genes in differing countries and cultures seems obtuse.

And, what about the other 46% or so of autism that this study does not address? (Conrick, 2014)

Is there an “onslaught of studies and articles . . . that AUTISM Is a genetic ONLY disorder”?

Conrick’s own post just a few sentences later contradicts this when she writes: “the study found that about 52 percent of autism was traced to common genes and rarely inherited variation.” The math I was taught did not equate 52% genetic with 100% genetic. And Conrick further contradicts herself when she writes: “The fact that this study, *Population-Based Autism Genetics and Environment Study* [press release thus far] is completely denying ANY ENVIRONMENTAL OR TOXIC EXPOSURE” “And, what about the other 46% or so of autism that this study does not address?” If they did not address the other 46%, how can they be “completely denying ANY ENVIRONMENTAL OR TOXIC EXPOSURE”? The CDC website, under “Facts About ASD” [Autism Spectrum Disorders] section “Causes and Risk Factors” states: “We do not know all of the causes of ASD. However, we have learned that there are likely many causes for multiple types of ASD. There may be many different factors that make a child more likely to have an ASD, including *environmental* [my emphasis], biologic and genetic factors. . . Most scientists agree that genes are one of the risk factors that can make a person more likely to develop ASD. (CDC, Facts About ASD)

The recent “Strategic Plan for Autism Spectrum Disorder Research 2013 Update” lists both current findings as well as research areas which include “Progress in Field of Genetic Risk Factors”, “Progress in the Field of Environmental Risk Factors”, and “Progress in the Field of Gene-Environment Interaction.” (The Interagency Autism Coordinating Committee, April 2014, pp. 31-34) The entire report is well-worth reading, including the breakdown in amounts spent by category, as well as other information available on the website!

So, who or what is the Interagency Autism Coordinating Committee? According to the GAO:

From fiscal year 2008 through fiscal year 2012, 12 federal agencies funded autism research . . . these agencies spent at least \$1.4 billion.

To address growing concern about the increasing prevalence of autism and to stimulate research into possible autism causes and interventions, the Combating Autism Act of 2006 (CAA) was enacted in December of that year. The CAA reauthorized the Interagency Autism Coordinating Committee (IACC), which is a federal advisory committee that was initially established under the Children’s Health Act of 2000. The CAA directs the IACC to coordinate all autism activities within HHS and to monitor federal activities related to autism. The IACC includes members representing 10 federal agencies—8 agencies within HHS, the Department of Defense (DOD), and the Department of Education (Education). In addition, there are 14 nonfederal members who represent individuals with autism and parents of children with autism; as well as members of the autism advocacy, research, and service-provider communities. (GAO, 2013, p. 2)

Thus, the above mentioned report, representing the lion's share of ASD research funding in the U.S., is an authoritative account/review of previous studies and currently planned ones, with environmental studies a major focus.

What Were the Findings of the “*Population-Based Autism Genetics and Environment Study*”?

As I demonstrate below, there is no indication that Conrick read the actual study, or, if she did, that she understood it. She refers to the press release. However, from the press release, it is quite clear that the actual study's title is “Most genetic risk for autism resides with common variation.” The press release makes it clear “the research team [were] from the Population-Based Autism Genetics and Environment Study Consortium.” (Carnegie Mellon University Press Release, July 20, 2014) Just one of many “mis-reads” by Conrick. The importance of the title will become clear below.

The study abstract reads:

A key component of genetic architecture is the allelic spectrum [an allele is a variation of one gene] influencing trait variability. For autism spectrum disorder (herein termed autism), the nature of the allelic spectrum is uncertain. Individual risk-associated genes have been identified from rare variation, especially de novo mutations. From this evidence, one might conclude that rare variation dominates the allelic spectrum in autism, yet recent studies show that common variation, individually of small effect, has substantial impact en masse. At issue is how much of an impact relative to rare variation this common variation has . . . we reach several conclusions about autism's genetic architecture: its narrow-sense heritability is ~52.4%, with most due to common variation, and rare de novo mutations contribute substantially to individual liability, yet their contribution to variance in liability, 2.6%, is modest compared to that for heritable variation. (Gaugler, 2014a, p. 881)

We conclude that inherited rare variation explains a smaller fraction of total heritability than common variation. Although uncertainty is inherent in all of these estimates, the results converge on a total heritability in the range of 50-60%, with common variants explaining the bulk of it. (Gaugler, 2014a, p. 883)

Nonetheless, the finding that all Swedish studies, regardless of design, converge on similar estimates of heritability lends strong support for our conclusion that the bulk of risk for autism arises from genetic variation. (Gaugler, 2014a, p. 884)

The only mention of environment as part of the study in the article reads: “By analyzing these recurrence risk rates for additive and non-additive genetic effects and shared and non-shared environmental effects, the best model consists of only additive genetic and non-shared environmental effects, and yields quite precise estimates of the narrow-sense heritability of autism ($h^2 = 54%$, s.e.m. = 5%).” (Gaugler, 2014a, p. 882) If nothing else, the title of the article “Most Genetic Risk for Autism Resides Within Common Variation,” makes it clear that the article is looking at aspects of the genetic risk con-

tribution to ASD, nothing more, nothing less. While the research team was part of a consortium conducting research into genetic and environmental contributions to ASD, the particular study referred to in the press release focused on the genetic contributions.

From the press release which Conrick refers to:

Using new statistical tools, Carnegie Mellon University's Kathryn Roeder has led an international team of researchers to discover that most of the genetic risk for autism comes from versions of genes that are common in the population rather than from rare variants or spontaneous glitches. . . "From this study, we can see that genetics plays a major role in the development of autism compared to environmental risk factors, making autism more like height than we thought -- many small risk factors add up, each pushing a person further out on the spectrum," said Roeder, professor of statistics and computational biology at Carnegie Mellon . . . Although autism is thought to be caused by an interplay of genetic and other factors, *including environmental forces* [my emphasis], consensus on their relative contributions and the outlines of its genetic architecture has remained elusive, until now. With this new study, the researchers believe that autism genetics is beginning to catch up. (Carnegie Mellon, July 20, 2014)

The actual study made absolutely NO claims about the importance of environmental factors. And the press release repeated this, stating that while autism “is thought to be caused by an interplay of genetic and other factors, including environmental forces, consensus on their relative contributions and the outlines of its genetic architecture has remained elusive, until now. With this new study, the researchers believe that autism genetics is beginning to catch up.” In other words, the press release contradicts Conrick’s claim that genetics is claimed to be the “ONLY” cause by stating that “autism genetics is beginning to catch up,” obviously implying that environmental factors had been prominent in much of the previous research, and still specifically states “including environmental forces.”

Genetics vs Environment or Genetics and Environment?

Age of Autism is “published to give voice to those who *believe* [my emphasis] autism is an environmentally induced illness.” It is one thing to emphasize/focus on the importance of environmental factors in ASD, and quite another to fantasize research claims of genetics “ONLY”; but *beliefs* are often not subject to logic or empirical verification.

As Susser writes: “thus current genetics, in common with epidemiology, uses models of multiple causality. Even where the heritable component of a particular characteristic appears to be large, the models are compatible with dramatic changes in the frequency of the characteristic produced by change in the environment.” (Susser, 1973, p. 31)

Rothman provides an excellent example of why both genetics and environment are almost always contributory factors, despite individual study estimates of the import of each:

Much publicity attended the pronouncement in 1960 that as much as 90% of cancer is environmentally caused. Since “environment” can be thought of as an all-embracing category that represents non-genetic causes, which must be present to some extent in every

sufficient causes, it is clear on *a priori* grounds that 100% of any disease is environmentally caused.

Similarly, one can show that 100% of any disease is inherited. . . The example given by Hogben of yellow shanks, a trait occurring in certain genetic strains of fowl fed on yellow corn. Both the right set of genes and the yellow corn diet are necessary to produce yellow shanks. A farmer with several strains of fowl who feeds them all only yellow corn would consider yellow shanks to be a genetic condition, since only one strain would get yellow shanks, despite all strains getting the same diet. A different farmer who owned only the strain liable to get yellow shanks but who fed some of the birds yellow corn and others white corn would consider yellow shanks to be an environmentally determined condition because it depends on diet. In reality, yellow shanks is determined by both genes and environment; there is no reasonable way to allocate a portion of the causation to genes or environment. Similarly, every case of every disease has some environmental and some genetic component causes, and therefore every case can be attributed both to genes and to environment. No paradox exists as long as it is understood that the fractions of disease attributable to genes and to environment overlap with one another.

Many researchers have spent considerable effort in developing heritability indices that are supposed to measure the fraction of disease that is inherited. Unfortunately, *these indices only assess the relative role of environmental and genetic causes of disease in a particular setting*. For example, *some genetic causes may be necessary components of every causal mechanism* [my emphasis]. If everyone in a population has an identical set of the genes that cause disease, however, their effect is not included in heritability indices, despite the fact that having these genes is a cause of the disease. The two farmers in the earlier example would offer very different values for the heritability of yellow shanks, despite the fact that the condition is always 100% dependent on having certain genes.

If all genetic factors that determine disease are taken into account, whether or not they vary within populations, then 100% of disease can be said to be inherited. Analogously, 100% of any disease is environmentally caused, even those diseases that we often consider purely genetic . . . the point that every case of disease has both genetic and environmental causes is theoretically defensible and has important implications for research. (Rothman, 1998, pp.13-14)

Down Syndrome perfectly illustrates the above. When I was much younger, the life expectancy of children with Down Syndrome was in their teens. Today, with modern open-heart surgery and other medical developments, they can often live reasonably long lives. Advances in cognitive psychology have led to new approaches to educating those with Down Syndrome. Where once they were considered hopelessly “retarded,” now many can reach the lower range of “normal” intelligence and be taught to lead independent lives. Thus, changes in environment can lead to dramatic changes, although the changes are specifically targeted to the phenotype resulting from their genes. As my examples in Part 1 show, genetic research has contributed to diagnostics, prevention, and treatment, that is, knowing which genes are involved leads to targeted interventions (Harrison, 2014).

The main point is that by contrasting a “genetic only” explanation with an environmental one, Conrick, and many others among the antivaccinationists, either fail to understand the above or choose not to. Their “beliefs” frame their every argument.

Poor Scholarship, Confirmation Bias: Trawling the Internet

Confirmation bias . . . is the tendency to search for or interpret information in a way that confirms one's beliefs or hypotheses. People display this bias when they gather or remember information selectively, or when they interpret it in a biased way. The effect is stronger for emotionally charged issues and for deeply entrenched beliefs. People also tend to interpret ambiguous evidence as supporting their existing position. (Wikipedia, "Confirmation Bias") (For additional information on Confirmation Bias and other fallacies of reasoning, see: Carroll, 2013; Gilovich, 1991; Shermer, 1997, especially Chapter 3)

Conrick writes: "The fact that this study, *Population-Based Autism Genetics and Environment Study* [press release thus far] is completely denying ANY ENVIRONMENTAL OR TOXIC EXPOSURE is very odd and suspect." This, as already explained, is a complete misrepresentation of what the press release states and the easily accessed Abstract (see above). But that's not the only problem with the claim.

Conrick partly bases her article on an online article by Paul Hamaker, "Largest Study to Date Shows Majority of Autism is Genetic," found on the blog "Birmingham Science News Examiner," which states: "At least 60 percent of autism is genetically inherited through gene mutations. Fifty-two percent of the mutations that cause autism are directly inherited from parents and family. . . The study included the contribution of environmental causes of autism and found that genetics trumps any environmental cause for autism."

It appears that Conrick is using Hamaker's paper together with the Gaugler paper as straw men, given her belief that autism is all or mainly environmentally determined, to persuade the reader that there is too much research emphasis on genetics, something I refuted above. However, the Gaugler study did not address environmental factors at all, while Hamaker simply claimed it "found that genetics trumps any environmental cause." Hamaker is also wrong about the study claiming "at least 60 percent of autism is genetically inherited."

Conrick's claim that the study "is completely denying ANY ENVIRONMENTAL OR TOXIC EXPOSURE," is just plain WRONG! If Conrick wants to express her belief that too much research is being devoted to genetics, then she should do so; but not by such hyperbole and misrepresenting the research that has been conducted. Unfortunately, from her article there is NO indication she really understands the essential and interacting roles of genetics and environment, apparently basing her position on her beliefs devoid of good science or scholarship. What in Conrick's opinion would be an acceptable division of research funding and what percentage of genetic contributions to autism would she agree with? And is she capable of supporting her position with science"?

The Examiner's blog administrators claim that the "examiner.com is fully powered by Examiners, thousands of writers who are self-motivated independent contributors." (examiner.com "About Us") However, it is readily apparent that there is a serious lack of critical thinking and scientific rigor applied to the posts on the site.

Conrick then quotes Haymaker: "The source of autism in children is in majority the result of the desire of parents with defective genes to have children. The study included the contribution of environmental

causes of autism and found that genetics trumps any environmental cause of autism. This discovery that included the National Institutes of Health in the United States and several experts from U.S. universities brings into serious doubt previous claims that vaccinations or any environment source caused autism.”

Again, absolutely nowhere in the actual study nor the press release is any statement made that “brings into serious doubt previous claims that vaccinations or any environment source caused autism.” The estimated range of genetic contribution to ASD of 50-60% does NOT dismiss the importance of the remaining 40-50%.

As for Hamaker’s: “the source of autism in children is in majority the result of the desire of parents with defective genes to have children, at least Conrick didn’t repeat Hamaker’s additional eugenics remark: “An obvious preventative would be genetic testing prior to conception. Those people that have a high rate of mutation of the genes that cause autism might consider adoption.” (Hamaker, 2014)

Hamaker’s statements take extreme license in “interpreting” or better “misrepresenting” the Gaugler's research. Personally, I find Hamaker’s eugenics statements repulsive, and I feel the same about any re-posting of them! Though Conrick’s quote is designed to discredit Hamaker’s view and genetic research more broadly, it also increases the quote’s audience in much the same way that repeating a rumor regardless of one’s intent can lead to its spread and accords Hamaker some legitimacy. In addition, I find it highly unethical that Conrick’s article implies that the actual researchers presented such a despicable and discredited eugenics point of view! For those not aware of the discredited history of the eugenics movement, during the first part of the 20th Century, eugenics arguments were used, among others, as justification for racism, against Eastern and Southern Europeans, Italian and Jewish immigrants, and Afro-Americans. Tens of thousands of individuals were forcefully sterilized in the United States and the atrocities of Nazi Germany represented its culmination. Much of Nazi Germany’s racial hygiene laws were modeled after those promulgated in the United States (e.g. Black, 2003; Gould, 1996; Kevles, 1985)

The press release was posted online on July 20, 2014. The actual article, though its official publication date was August, 2014, was also posted online on July 20, 2014. The Abstract could be found posted on *Nature Genetic’s* website on July 20th and in the National Library of Medicine’s PubMed database on July 21st (Gaugler, 2014b). Conrick’s article was posted three days later. Conrick refers to the press release; however, if Conrick did not have access to electronic databases that include *Nature Genetics*, a quick trip to most university and many other libraries would have allowed Conrick to access the article through electronic databases available on their in-house computers. So, why didn’t she? Confirmation Bias!

There is no indication that Conrick read the actual article nor even the abstract, or, if she did, that she understood either. More than likely she read the press release and then searched the Internet to find anything that supported her rigid, preconceived ideology, and found Hamaker’s article, which misrepresented the actual study. Not surprising given that *Age of Autism’s* stated goal is “We are published to give voice to those who *believe* [my emphasis] autism is an environmentally induced illness.” So Conrick found one blog post as “proof” of “the onslaught of studies and articles to try and persuade you, dear citizen of the USA, that AUTISM is a genetic ONLY disorder . . . The article I want to share about a new gene study has these bizarre quotes.” And, indeed, she is absolutely right when she uses “bizarre quotes” to describe the blog post; but not the actual research.

One can always find articles/posts that misrepresent other articles, either through lack of understanding of basic science, poor scholarship and lack of critical thinking skills, or, in some cases, intentionally, simply Confirmation Bias at its absolute worst. Based on Conrick's article, *Age of Autism* is a good starting place to find misrepresented research and, in general, poor scholarship and science.

Pesticides and Autism?

According to Conrick: "There are many, many studies showing that TOXINS are involved in autism. . . 'Pesticides linked to autistics disorders.'" [hyperlinks to PubMed Health, June 23, 2014]

The PubMed Health post that Conrick refers to was actually written to counter press releases that did not accurately portray a specific study. According to the PubMed post:

This was a type of *exploratory research* [my emphasis] . . .

Despite these seemingly alarming findings, it is important to note that causation cannot be established.

It is also worth noting that this study analyzed data in California — a region with a high pesticide usage, so the finding may be considered 'extreme'.

From what is known about ASD, it is unlikely that a single environmental factor, such as exposure to pesticides, can cause the condition. It is currently thought that the condition arises through a complex mix of genetic and environmental factors . . .

Previous studies suggest that any type of exposure to a particular substance that occurs during the first trimester of pregnancy can have the biggest influence on subsequent development.

There is also the possibility that there is no association at all between ASDs and pesticide use, and that these were chance findings.

Though the original sample size was fairly large, the study included only 144 children with ASDs whose mothers were exposed to pesticides at any time during pregnancy or pre-conception. When further dividing this sample of 144 children into the specific pesticide they were exposed to, and the trimester of pregnancy at which they were exposed, the numbers become smaller still. When conducting statistical analyses using small sample numbers, this increases the possibility of chance findings.

. . . information on the hours the mother spent in the home or elsewhere was not available, which may also contribute to errors in estimating pesticide exposure. (PubMed Health, June 23, 2014)

An advanced publication of the actual article as well as Supplemental Materials were posted on the Internet on June 23, 2013, available to download free as a pdf (Shelton, 2014ab). According to the article:

Because pesticide exposure is correlated in space and time, differences in time-windows of vulnerability, if they exist, may be difficult to detect, and variation in associations according to time window of exposure may not represent causal variation. Several limitations to this study were unavoidable in the exposure assessment, potentially producing misclassification. Primarily, our exposure estimation approach does not encompass all potential sources of exposure to each of these compounds: Other sources of potential error include errors in reporting to the Pesticide Use Report database . . . information on hours spent in the home or elsewhere was not available.

Children of mothers who live near agricultural areas, or who are otherwise exposed to organophosphate, pyrethroid, or carbamate pesticides during gestation may be at increased risk for neurodevelopmental disorders. ***Further research on gene-by-environment interactions may reveal vulnerable sub-populations.*** [my emphasis] (Shelton, 2014, pp.18 - 20)

Conclusions

Far be it from me to discount the possibility that pesticides could contribute to the development of ASD (e.g. Dufault, 2012). Personally I try to buy foods that are pesticide-free. Pesticides could either contribute directly to gene mutations, to epigenetics, and/or later neurodevelopment. “The term *epigenetic* refers to long-term alterations of DNA that don’t involve changes in the DNA sequence itself . . . The naked gene consists of DNA in the form of the famous double helix. The genes in our cells are rarely naked, however. They are, rather, clothed in a variety of other organic molecules that are chemically attached. What makes these chemical attachments important is that they can alter the behavior of the genes to which they are attached . . . What makes these attachments even more important is that they can stay attached for long periods of time, sometimes a lifetime.” (Francis, 2011, pp. x-xi) Pesticides could be responsible for gene mutations (e.g. Huguet, 2013; Lewis, 2005, Chapter 12, pp. 215 - 238)

However, the study was an “exploratory” one. Exploratory studies look for associations in order to generate hypotheses for further investigation. Often associations found in exploratory studies are not confirmed when more rigorous scientific methods are employed. As discussed above, and from the authors’ own conclusion, if the study findings are replicated/confirmed with more accurate measures of actual exposure and more rigorous methodology, genes will still play a role. What’s more, given that the epigenetic effects, mutations, and/or neurodevelopment problems occur *in utero*, most likely during the first trimester, the overwhelming emphasis of *Age of Autism’s* website on vaccines would, at least be weakened in that some proportion of the increase in ASD would then be ascribed to *in utero* exposure to pesticides, at least in areas where pesticide use is prevalent.

Even when randomized clinical studies are well-designed and implemented, the findings could still be subject to random error. Randomization only “guarantees” that all other variables that could affect the outcome are distributed evenly between the two groups over many “replications”. In any single study,

uncontrolled/unknown variables could be responsible for the outcomes. The larger the study and the more rigorous the methodology, the closer randomization comes to evenly distributing the groups on variables that could influence the outcome other than the ones being studied. As mentioned, the number of cases of ASD was small. Observational studies are even more subject to influences from uncontrolled/unknown variables. As Susser discusses under the “*Consistency and Replication*” section of his book: “In epidemiology, variation in the conditions of study is for all practical purposes a constant. An alternative to exact replication is consistency of a finding on repeated tests. The criterion of consistency depends on the replications of results in many studies or analyses. The strength of the argument rests on the fact that diverse approaches produce similar results. (Susser, 1973, p. 148)

Conrick found one study, an exploratory one, and writes uncritically as if its findings were definitive. In contrast to this uncritical acceptance of an early stage study whose results fit her preconceptions, Conrick is hypercritical towards any study, regardless of the level of methodological sophistication and design if it does not support her ideologically rigid point of view.

Though a large well-done randomized clinical trial still has the possibility of random error from uncontrolled/unknown variables, the probability is low enough that decisions follow; but with the caveat of not claiming absolute certainty and, thus, open to the possibility that later research findings could change things. Obviously randomized clinical trials could not be conducted on children, e.g. half given shots with thimerosal and half not, so epidemiological observational studies are what we have. Flaws can be found in each study; but given the number of studies, the methodological variety of approaches, the different countries and cultures, the different study populations, and the different researchers involved, the results have consistently found no association between either vaccines or thimerosal and ASD (e.g. CDC, “Concerns about Autism”)

It is disconcerting how Conrick and others look for every flaw in every study they disagree with; but often accept single studies such as the one above linking pesticides with ASD, ignoring methodological weaknesses and, in this case, even the fact that it was an exploratory study.

Conrick’s Critique of the Gaugler Study’s Use of Swedish Data

According to Conrick:

Plus, it should be noted that this study was done in SWEDEN. There are many differences between Sweden and the USA, as far as both genetics and the environmental factors of each country, like food, Vit D, sun exposure, vaccinations, heavy metal exposures and pesticides. In the 1990’s, where a big chunk of the birth cohorts in this study were used, “Sweden mandated a fifty percent reduction in the use of agricultural pesticides”. . . , the results of a comparison of genes in differing countries and cultures seems obtuse. (Conrick, 2014)

Besides the fact that she is attacking a straw man, that is, the Swedish study did not discount the contributions of environmental factors but looked at the contributions of various types of genes to the genetic contribution to ASD, if she had bothered to use a scholarly scientific approach, she would have found that the Supplementary Text and Figures to the article contains a Table that gives a list of “Reported

Heritability Estimates” from eight other studies from 1977 - 2011, only some Swedish. (Gaugler, 2014c) Numerous other studies in different countries and reviews have found different percentages of how much genetics contributes to ASD; but as Susser and Rothman, quoted above, make clear, both genetics and environment are important, regardless of the relative percentages varying according to specific situations. Among these is one using data from California (Risch, 2014) and another one from Sweden using twins (Sandin, 2014). And, of course, as Steven Pinker writes: ““more than half the genome is put to work primarily or exclusively in the brain.” (Pinker, 2012, p. 91) If over half of our genes contribute to the brain, certainly genetics must play a role in ASD. Regardless of the different estimates of the relative contributions of genetics and environment from various studies and, of course, their interactions both are ABSOLUTELY necessary. Doesn't Conrick understand this?

Though it should be obvious by now that Conrick is attacking a straw man, that is, she is trying to discredit the Swedish data because she believes it discounted the role of environmental contributions to ASD, which it absolutely did not, I think it is instructive to show with one more example that her understanding of environmental factors is quite deficient in both scholarship and science.

Vitamin D and Autism Spectrum Disorders

As Conrick writes: “There are many differences between Sweden and the USA, as far as both genetics and the environmental factors of each country, like food, Vit D [Vitamin D], sun exposure, vaccinations, heavy metal exposures and pesticides.”

According to a recent paper, published online February 20, 2014, [though not available for free downloads, many libraries subscribe to the journal or, as I did, Conrick could get it through inter-library loans]:

Four observations are consistently associated with ASD: [one of which is] low plasma concentrations of the vitamin D hormone precursor 25-hydroxyvitamin D. (Patrick, 2014, p. 1)

The National Health and Nutrition Examination Survey (NHANES) reported . . . vitamin D sufficiency (30-80 ng/ml) [in] 2004 [of] 30% in Caucasians, . . . 5% in African Americans, and . . . 6% in Latinos, indicating that more than half of the U.S. population may have insufficient levels of this critical vitamin D hormone. . . According to a 2006 NHANES report, 96% of Americans not taking vitamin and mineral supplements have insufficient vitamin D levels, whereas only 25% using supplements containing vitamin D have insufficient levels.

Evidence of increased autism prevalence in regions with lower sun exposure in the general population has been available for some time. In the United States, there is an inverse correlation between autism incidence and exposure to UVB, as measured by the level of ultraviolet (UV) radiation in the child's state of birth. Children born in overcast and rainy counties of Oregon, Washington, and California are twice as likely to be diagnosed with autism as children born in sunnier parts of these states. Accordingly, there is an inverse correlation between the rapid rise in autism incidence and the percentage of the U.S. popu-

lation with plasma concentrations of 25(OH)D₃ considered sufficient by current guidelines. (ibid, p. 3)

A common denominator between Minneapolis and Stockholm with respect to the increased incidence of autism in Somali immigrants is that both of these regions are at much higher northern latitudes relative to Somalia and thus have lower levels of sun exposure. Since Somalis have high levels of melanin, [upon] migration to northern latitudes, such as Sweden and Minnesota, they would require 5-10 times more UVB exposure than light-skinned individuals or an alternative vitamin D source, such as from the diet or supplementation. (ibid, p. 4)

Some foods have been fortified with vitamin D, including milk (100 IU/8 ounces) . . . dairy products are a suboptimal choice for fortification for the ~50 million Americans who are lactose intolerant, including 75% of African Americans. (ibid, p. 9)

So, though only one paper (regardless of how well-written, rarely definitive), the findings of this review are that:

1. ASD is associated with low levels of vitamin D, below a certain threshold.
2. Vitamin D levels are associated with both exposure to sunlight and diet/supplements.
3. Levels of melanin, genetically determined, affect levels of vitamin D from exposure to sunlight.
4. Lactose tolerance, again genetically determined, affects the ability of individuals to get vitamin D from fortified dairy products.
5. Over half of Americans may be vitamin D deficient, a combination of lactose intolerance, diet and supplement usage, melanin levels, and availability of sunlight.

Conrick, in her desperation to discredit the Swedish data, lists several possible causes for differences in percentage of genetic/environmental contributions to ASD, including vitamin D levels and availability of sunshine. She does this with no foundation, no evidence she has devoted any effort to researching this and no references to studies; a clear example of poor scholarship and science. Let's take a closer look to review the evidence, keeping in mind that this is just one more problematic argument in addition to those discussed above. Several questions come to mind:

1. If there is a difference, does it contribute to ASD and studies of the relative contributions to ASD of genetics and environment?
2. Is there a difference in the percentage of the population that is deficient in vitamin D levels between Swedes and Americans?
3. If we assume the above two are true, does it really matter since the relative contributions may vary from study to study; but, in actuality, both almost always make an important contribution (see Rothman above)?

We know that Swedes are usually light-skinned, reflecting low levels of melanin, so whatever sunlight is available to them, they are genetically programmed to absorb it. As for lactose intolerance, "the frequency of lactose intolerance ranges from 5% in Northern European countries (England, Scotland, Ireland, Scandinavia, and Iceland) to 71% in Italy (Sicily) to more than 90% in

some African and Asian countries.” (Wikipedia, Lactose Intolerance) So, based on the above article, 5% of Swedes are lactose intolerant compared with approximately 17% of Americans.

According to data from 2007, the “Milk Consumption per Capita (kg)” found Sweden in 2nd place with 355.86 kg, whereas the U.S. placed 16th with 253.8 kg. (Wikipedia, List of Countries by Milk Consumption per Capita) Thus, Swedes consume approximately 40% more milk than Americans. Just as the U.S. fortifies milk and various milk products with vitamin D, Sweden has fortified milk and various other dairy products with Vitamin D since 1983. (Livsmedelsverket, Swedish National Food Agency, May 14, 2013) Vitamin D can also be obtained from “Fish, especially fat fish such as salmon, herring, and makrill, all milks are fortified as well as yoghurts, margarines are fortified, and vitamin D is contained in eggs and meat . . . If one eats fish regularly, drinks milk and uses margarine . . . this will supply enough vitamin D even during the Winter months.” . . . Swedish studies found “fewer than 5 percent of 8-year olds had too little vitamin D.” (Livsmedelverket, Swedish National Food Agency, May 12, 2014, my translation) Thus, Swedes consume more dairy products fortified with vitamin D and have a much lower percentage of lactose intolerance.

The titles of two recent Swedish papers are: [Vitamin D status in healthy children in Sweden still satisfactory] and [Risk of vitamin D deficiency among certain groups in Sweden] [PubMed title translations], reflecting the levels of vitamin D in general and among groups such as Somali immigrants with high levels of melanin and lactose intolerance. I won’t bother translating key points from these papers. However, if I were claiming differences in vitamin D between Sweden and the U.S., I would have started by looking at what the data says about them. Those papers can be easily found online, first by searching PubMed, then by going to the journal *Läkartidningen* online and most large cities, such as Chicago where Conrick teaches in a nearby suburb, have Swedish associations and colleges/universities where Swedish is taught. I would have arranged to get translations. At any rate, I would not make the claim without actually looking at the data. The Gaugler study did not claim environment played no important role in ASD despite Conrick’s claim. Without any basis, except her rigid bias and poor scholarship, Conrick then tries to undermine the results of the study; but a cursory review of the evidence finds that, if anything, indications are that a higher percentage of the Swedish population have adequate levels of vitamin D than Americans. So, the answer to question 1 is that there probably is a difference in vitamin D levels between Swedes and Americans. Question 2’s answer from the above paper is that ASD is associated with deficiencies of vitamin D, in other words, not a dose response; but levels below a certain threshold. And, question 3 has already been answered.

What’s more, vitamin D deficiencies associated with ASD would occur prenatally. In other words, Conrick’s referring to pesticides and vitamin D undermines or weakens any claims that vaccines contribute to ASD.

Is there an “onslaught of studies and articles to try and persuade you . . . that AUTISM is a genetic ONLY disorder”?

I already discussed above that ASD research funding is for genetics research, environmental research, and their interaction. A recent statement by Thomas Insel, Director of the National Institute of Mental Health, states:

Increasing prevalence suggests environmental factors like chemicals and microbes changing over the past decade, whereas genes change over generations. Why is anyone looking for genetic causes when there is such a rapid increase in prevalence? Shouldn't every research dollar be invested in finding the environmental culprit rather than searching for rare gene variants?

While individual genes appear to confer limited risk, the aggregate effect of spontaneous coding mutations across the genome is now estimated to increase the risk of autism by 5–20-fold.

It is important to understand that de novo mutations may represent environmental effects. In other words, environmental factors can cause changes in our DNA that can raise the risk for autism and other disorders.

Is autism genetic or environmental? These new studies suggest it can be both. Genetics will not identify the environmental factors, but it may reveal some of the many syndromes within the autism spectrum (as in other neurodevelopmental disorders), it can define risk (as in other medical disorders), and it should yield clues to the biology of autism (revealing potential targets for new treatments)

Finally, an unavoidable insight from these new papers is that autism, even when genetic may be spontaneous and not inherited in the sense that one or both parents carry some reduced form of the syndrome. (Insel, 2012)

Just one more clear statement that leading scientists consider both genetics and environment to be important, clearly not trying to persuade anyone that “AUTISM is a genetic ONLY disorder.”

And what about our mass media? The following with both autism and environment in their headlines were found in a quick Google search:

Reuters (July 4, 2011) - “Environment, not just genetics, at play in autism.” Available at: <http://www.reuters.com/article/2011/07/04/us-autism-environment-idUSTRE7634Y220110704>

New York Times (July 4, 2011) - “New Study Implicates Environmental Factors in Autism.” Available at: http://www.nytimes.com/2011/07/05/health/research/05autism.html?_r=0&pagewanted=print

Medical News Today (April 16, 2012) - “Autism Linked to Industrial Food Or Environment.” Available at: <http://www.medicalnewstoday.com/articles/244154.php>

The Wall Street Journal (May 4, 2013) - “Autism Linked to Environmental Factors - - - New Studies of Air Pollution, Pesticides and Iron Bolster Evidence Tying Developmental Disorder to Influences in Womb,” p. A.3.

National Institute of Environmental Health Sciences - NIEHS webcast transcript (April 22, 2014) - "Virtual Forum: Autism and the Environment." Available at: http://www.niehs.nih.gov/about/assets/docs/transcript_508.pdf

Fox News (May 5, 2014) - "Environment as influential as genes in autism, study says." Available at: <http://www.foxnews.com/health/2014/05/05/environment-as-influential-as-genes-in-autism-study-says/>

While my Google search certainly cannot be considered definitive (I only scrolled down a few pages), as far as I can tell, our mass media reports on the "study *du jour*". They often oversimplify research; but if a study emphasizes genetics, they report it, if another study emphasizes environment, they report it. Perhaps a systematic study using the Lexus Nexus database would find otherwise; but I certainly found NO evidence, either from PubMed, the U.S. National Library of Medicine's online database of peer-reviewed journal articles, official government websites, nor my quick Google search that there exists any attempt to convince the public or anyone else that "AUTISM is a genetic ONLY disorder."

The press release of the study that Conrick's article attacks actually states: "With this new study, the researchers believe that autism genetics is beginning to catch up." (Carnegie Mellon, July 20, 2014) This implies that the research emphasis had been mainly on environmental factors and that only recently progress is being made to determine genetic risk factors, the opposite of Conrick's claim. One would presume that a group who so passionately claims to be seeking to reduce the cases of ASD and support the families dealing with ASD would rejoice in the fact that experts are following every possible scientific avenue to find the causes and potential treatments for ASD.

Summary

1. The Gaugler *et al.* study, "Most Genetic Risk for Autism Resides Within Common Variation" (August 2014), based on Swedish data, looked at the contribution of various types of genes to the genetic component of autism, which was estimated to be around 52%. No mention was made of environmental or toxic exposure, so, obviously, it couldn't be denying either.
2. Conrick contradicts herself by following her claim that "studies . . . try[ing] to persuade that AUTISM is a genetic ONLY disorder" with a follow up statement that the Gaugler *et al.* study estimates the genetic contribution to be 52%. The math I learned doesn't equate 52% with 100%.
3. Conrick partly bases her article on an online article by Paul Hamaker, "Largest Study to Date Shows Majority of Autism is Genetic," found on the blog "Birmingham Science News Examiner," which stated the Gaugler *et al.* "study included the contribution of environmental causes of autism and found that genetics trumps any environmental cause for autism."
4. It appears that Conrick is using Hamaker's paper together with the Gaugler study as straw men, given her belief that autism is all or mainly environmentally determined, to persuade the reader that there is too much research emphasis on genetics, something I refuted in this paper. However, the Gaugler study did not address environmental factors

at all, while Hamaker simply claimed it “found that genetics trumps any environmental cause.”

5. Conrick's claim that the study “is completely denying ANY ENVIRONMENTAL OR TOXIC EXPOSURE,” is just plain WRONG! If Conrick wants to express her belief that too much research is being devoted to genetics, then she should do so; but not by such hyperbole and misrepresenting the research that has been conducted. What in Conrick's opinion would be an acceptable division of research funding and what percentage of genetic contributions to autism would she agree with? And is she capable of supporting her position with good science?
6. Remarkably, in his article, Hamaker also implies that, by focusing on genetics, Gaugler *et al.* advocated a discredited eugenics approach. I find it despicable that Conrick would draw attention to anyone advocating eugenics, which was used to justify racism and discrimination against various groups, leading to untold suffering from forced sterilizations to Nazi death camps.
7. Conrick, apparently, doesn't understand the role that genetics, environment, and their interaction play in just about all aspects of human life nor the extensive research on these and the advances being made in diagnostics, prevention, and treatment.
8. Though the Gaugler *et al.* study did not discuss nor discount the environment's role in ASD, Conrick uses her claim that they did as a straw man to attack genetic studies. She posits the role of pesticides, vitamin D, sunlight and other factors to discount the relevance of the study's findings. Conrick refers to one exploratory study looking at pesticides and ASD by Shelton *et al.* published in the journal *Environmental Health Perspectives*, “Neurodevelopmental Disorders and Prenatal Residential Proximity to Agricultural Pesticides: The CHARGE Study,” citing the study's findings. She speculates regarding the role of vitamin D's affect on the incidence of ASD without any foundation nor evidence that she has even bothered to research the subject. In fact, if further research were to implicate pesticides and/or vitamin D, it would weaken the main claim by Conrick and *Age of Autism* contributors of the role of vaccines in ASD, given that any effect from either of the above would occur *in utero*.
9. Conrick bases her article on a press release of the Gaugler *et al.* study and a blog post discussing it. She based her mention of the pesticide study on a *PubMed Health* post about the actual study, giving only the “conclusions” of the study, while failing to acknowledge any inconvenient facts or suggested weaknesses. With regard to either actual study, Conrick gives no indication she attempted to read either of them and/or understood them, though both were available. In addition, she bases her outrage on an obscure blogger, unethically implying he was reflecting sentiments contained in the Gaugler study.

Conclusion

As stated on their website, *Age of Autism*: “We are published to give voice to those who **believe** [my emphasis] autism is an environmentally induced illness, that it is treatable, and that children can recover.” The research record is clear that ASD is considered an array of related disorders with complex causes that include genetics, environment, and their interactions. From the above as well as my previous article for *Every Child By Two* (Harrison, 2014), it should be obvious that Redwood and Conrick

display poor scholarship, poor science, and a lack of common sense. The two papers clearly indicate the desperate lengths they will go in order to promote their ideologically rigid beliefs. Given that all three are major advocates among antivaccinationists, and *SafeMinds*, Redwood's organization, is even listed as a sponsor of *Age of Autism*, why would anyone accord what they write any credibility?

The only conclusion for Conrick's and Redwood's papers, is "don't be bamboozled" by people who literally don't know what they are talking about.

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