Daryl Garfinkel
Infant Development
Final Paper

Are Pesticides in Pregnancy a Problem?
A Search for the Significance of Eating an Organic Diet During Pregnancy

Specific Aims, Background, and Significance: This research grant proposal seeks funding for a study that investigates the effects of eating an organic diet versus a conventional diet during pregnancy. It seeks to fill a hole in the research, because no studies to this date have looked specifically at the ways in which eating an organic diet during pregnancy may affect the fetus, and subsequently the child. This study seeks to measure organic diet versus a conventional diet during pregnancy to understand whether there are lasting effects from the pesticides present in a conventional diet. Furthermore, the study seeks to understand if these effects are pervasive enough to last past pregnancy even when these pesticides are theoretically removed from the diet. These results should lend insight into whether or not there is a protective effect of an organic diet.

Organic foods prohibit the use of pesticides, hormones, or antibiotics in their production. The USDA definition of organic produce precludes the use of pesticides and genetically modified foods (United States Department of Agriculture, 2012). The USDA definition of organic livestock precludes the use of antibiotics or growth hormones (USDA, 2012). Many of these materials have been shown to have negative effects on health, especially in the case of developing children or fetuses. Pesticides seem to be of particular issue in these cases. Pesticide levels at birth, whether consumed through diet, or through home/industrial use, have been shown to correlate with developmental disabilities, cognitive decrements, differences in brain structure, and low birth weight

(Schafer & Marquez, 2012). Similar effects have been shown with consumption of pesticides in children.

These effects have been studied in relation to the development of ADHD. A study by Bouchard et al. in 2010, looked at concentrations of dialkylphosphate (DAP) metabolites in children's urine as it correlated to ADHD (Bouchard et al., 2010). Dialkylphosphate metabolites are markers of organophosphate pesticides, which are found in food and water supplies in addition to their home-use (Bouchard et al., 2010). The Diagnostic Interview Schedule determined a diagnostic criterion for Children IV (DISC-IV), which was assessed through interviews over the phone with the mothers (Bouchard et al., 2010). The results of this cross-sectional study showed that a higher level of DAP metabolites correlated positively with greater chances of meeting criteria for ADHD (Bouchard et al., 2010).

In 2005, Lu et al. studied an organic diet in children and their pesticide levels. This study looked at organophosphorus levels in urine of elementary school-aged children who ate conventional diets (Lu et al., 2005). These are also metabolites of pesticides found in a conventional diet (Lu et al., 2005). The study then implemented an organic diet for five days and looked at the same metabolites in the children's urine twice daily (Lu et al., 2005). The results of this study found that the signs of two of these organophosphorus metabolites in urine fell to undetectable levels as soon as the organic diet was implemented. Three other metabolites fell significantly below the levels that existed during the conventional diet and they did not detect any significant difference in three other organophosphate metabolites (Lu et al., 2005). These results show that there may be a protective effect of an organic diet against these potentially harmful pesticides.

The present study attempts to expand on this research to see if similar effects can be seen through implementing an organic diet after pregnancy. It calls into question whether or not the consumption of certain pesticides during pregnancy can have permanent effects. Rather than looking at levels in urine, the present study attempts to look for effects of these pesticides in infancy and then again in childhood when there is no longer any exposure to pesticides through the diet.

One effect that many studies have attempted to pesticides is the disruption of puberty. This has been attributed to the fact that 91 pesticides have been indentified as possible endocrine disruptors (McKinlay et al. 2008). Endocrine disruptors are exogenous factors that, through endocrine disturbance, have a negative impact on health of an organism or its offspring (McKinlay et al., 2008). While some of these pesticides have been banned, many are still used in agricultural practices and can be found on fruits and vegetables (McKinlay et al., 2008). A study by Vasiliu et al. in 2004 looked at exposure to polychlorinated byphenyls (PCBs) and dichlorodiphenyldichloroethylene (DDE), which are identified endocrine disruptors, in utero and the subsequent age of menarche (Vasiliu et al., 2004). The results demonstrated a negative correlation between the amount of DDE exposure in utero and the age of menarche in young females. DDE is a metabolite of the insecticide dichloro-diphenyl-trichloroethane (DDT), which is now banned for use in the United States. However, DDE has a much longer half-life, making it prevalent in foods today (Vasiliu et al., 2004).

Biro et al. (2012) argues that endocrine disruptors can have effects on the onset of puberty because they possibly contribute to obesity. This increase in weight gain may contribute to an earlier onset of puberty in females (Biro et al., 2012). For example, a study conducted by Rosenfield et al. in 2009 looked at the age of thelarche: the appearance of breast tissue, menarche: the first menstrual period, and pubarche: the appearance of sexual pubic hair in females as they related to Body Mass Index. Their results showed that adiposity correlated to earlier pubertal development (Rosenfield et al., 2009). There has been less research on the effects of obesity in boys, most likely due to the lack of a clear pubertal event (Kaplowitz, 2008). Most studies to date have shown that obesity can actually lead to later onset of puberty in boys (Wang, 2008 as cited in Kaplowitz, 2008). Research shows that much of the effects of these chemicals can have greatest effects during gametogenesis and early fetal development, which makes them particularly important to the present study (Hardell et al., 2006, Sharpe, 2006, Skarkkebaek, 2002, Sultan, 2001, as cited in McKinlay et al. 2008).

The effects of pesticides have been shown at the time of birth, with a negative correlation between pesticide exposure and birth weight and length (Whyatt et al., 2004). In 2004, Whyatt and colleagues found that chlorpyrifos (CPF) levels in umbilical cord plasma were negatively correlated with birth weight and length (Whyatt et al., 2004). CPF is an organophosphate insecticide used widely in agriculture (Rauh et al., 2012). They found that after Environmental Protection Agency standards increased in 2001, the levels of exposure when down in their participants and less of an effect was detected (Whyatt et al., 2004). However, many pesticides are still permitted in agriculture and studies have shown that there remain to be detectable levels of banned pesticides in foods (Whyatt et al., 2004).

A study by Roberts et al. in 2007 looked residential proximity to organochlorine pesticide applications during pregnancy in relation to child Autism Spectrum Disorder risk (Roberts et al., 2007). Organochlorine pesticides are insecticides and are also found on cotton, fruits, vegetables, beans, and nuts (Roberts et al., 2007). The results from this study showed an increased risk for Autism Spectrum Disorders with residential proximity to organochlorine pesticide applications (Roberts et al., 2007). A more resent study by Engel et al. found neurodevelopmental detriments in children of mothers with detectable prenatal urinary dialkylphosphate levels at 12 months, 24 months, 6 years, and 9 years of age in urban, inner city environments (2011). Specifically, the study reported lower scores on Bayley Scales of Infant Development-II (BSID-II) in Hispanics and blacks at 12 months old (Engel et al., 2011). Prenatal diethylphosphate metabolites were also correlated with small decreases in Full-Scale IQ scores (FSIQ), Perceptual Reasoning, and Working Memory in children ages 6-9 (Engel et al., 2011).

A study by Rauh et al. in 2012 looked at the association between chlorpyrifos (CPF) exposure prenatally and neurobehavioral deficits (Rauh et al., 2012). In comparing two groups with either high or low CPF exposure, Rauh et al. found structural differences in the brain (2012). Higher CPF exposure was associated with enlargement of many brain structures, including the superior temporal, posterior middle temporal and inferior postcentral gyri bilaterally and the superior frontal gyrus, gyrus rectus, cuneus, and precuneus (Rauh et al., 2012). This is significant because these areas are associated with attention and receptive language, social cognition, reward, emotion, and inhibitory control (2012). The results also showed detriments in IQ scores among the high-CPF group (2012).

These studies lay the foundation for greater research in the effects of pesticides directly from the diet. Because there is a great amount of research demonstrating the effects of prenatal exposure to pesticides on the fetus that last through childhood, it is important to look at diet during pregnancy. While these studies show great amounts of information about how pesticide levels at birth can correlate to damaging effects later in life, none of these studies are able to attribute these differences to these levels at birth alone. This is because it is possible that whatever caused the prenatal exposure, whether it was diet or home-use, could have continued into childhood affecting the outcomes for these children. For this reason, it would be extremely informative to try to better isolate exposure during pregnancy from exposure during childhood. The present study aims to do this through the study of diet during pregnancy and after pregnancy. This leads another focus of this study: a greater understanding of the effects of organic diet versus conventional diet during pregnancy. This study aims to compare mothers who have eaten an organic diet during their pregnancy to mothers who have eaten a conventional diet during pregnancy. Then, by encouraging all mothers to continue an organic diet with their children throughout the process of this study, we can aim to eliminate the pesticides from the diets of the conventional eaters. Overall, this study can inform us about the possible protective effects of an organic diet against many of the issues that previous studies have linked to pesticide consumption.

The present study looks specifically at the differences between mothers who ate conventionally or organically as it relates to their child's birth weight, their child's likelihood of being diagnosed with Autism Spectrum Disorder or ADHD, cognitive development in infancy and toddlerhood, childhood intelligence, and onset of puberty. The specific attributes of cognitive development will be measured through the Bayley Scales of Infant and Toddler Development and then using Wechsler Intelligence Scales.

This study seeks to connect this research in a way that may be meaningful for the understanding of issues during pregnancy as well as expand our understanding about how these products affect the body in general. The design of this study allows for the isolation of the effects of this type of diet on pregnancy as well as its effects into early adolescence.

Research Design and Methods:

Methods and Rationale: Research until this date does not provide any information about the possible protective effects of organic diet in exposure to pesticides during pregnancy. The present study seeks to fill this hole in the research by looking specifically at organic diet versus conventional diet during pregnancy. Presumably, the way a woman eats is the way she will feed her child. Therefore, although we have information about the effects of exposure to pesticides prenatally, we do not have any data on the isolation of diet during pregnancy. This study seeks to understand the effects of the pesticides primarily from conventional foods in pregnancy alone. The Lu et al. study (2005) showed that pesticide metabolites can disappear from a child's urine as soon as an organic diet is implemented (Lu et al., 2005). However, is this change enough to prevent the effects of pesticides? Specifically, could a change in diet after pregnancy prevent the effects of prenatal exposure to pesticides throughout diet? Or are these effects more permanent? Through the comparison of two groups of mothers longitudinally in the present study, we attempt answer some of these questions. The study will begin with assessments at birth and will continue until the subjects, the children, reach puberty.

Participants: Participants will be chosen using similar procedures to that of Engel et al. 2011. We plan to recruit 500 pregnant women in their third trimester of pregnancy.

We chose this large number on the assumption that many mothers will not follow through with the entire longitudinal aspect of the study. Two groups of pregnant women will be utilized to compare the two diets within pregnancy. One group of women will eat organic food during their pregnancy and feed their children organic food throughout the study. These women will be recruited with the criteria they have made an attempt to eat an organic diet throughout their pregnancy and plan to feed their child an organic diet once they begin to eat foods. The second group of women will eat conventionally throughout their pregnancy and then feed their children an organic diet for the duration of the study. These women will be recruited if they have chosen to eat conventionally throughout their pregnancy, but express the desire to feed their child an organic diet. To inspire this desire, we will present the mothers with information about the possible benefits of an organic diet. This design will allow for the isolation of effects of pesticides during pregnancy and possibly lactation alone. On the same note, this will allow us to view the potential protective effects of the organic diet during pregnancy. All pregnancies will be primiparous and singletons. The nature of this study requires that the mothers be of a relatively high socioeconomic status, because an organic diet can be expensive. Therefore, we will have to keep the participants limited to those who can afford such a diet. The mothers must have received prenatal care throughout their pregnancies. Mothers will be excluded if they have any severe underlying health conditions or have otherwise high-risk pregnancies.

Materials: Block surveys will be used to determine general nutrition of both the organic and the conventional mothers. We will specifically use the Food Frequency Questionnaire developed in 2008 in order to get a full picture of the foods and nutrients that the mothers consumed during pregnancy (Nutrition Quest, 2009). We will also develop an organic diet survey with Nutrition Quest to assess the amount of organic versus nonorganic foods that the mothers consumed throughout their pregnancy. The Block Questionnaire for Ages 2-7 will be used to assess nutrition at these ages (Nutrition Quest, 2009). Then, the Block Questionnaire for ages 8-17 will be used until the completion of the study (Nutrition Quest, 2009). We will also create a screener with Nutrition Quest for organic diet in children to be used in conjunction with these other childhood questionnaires.

The Bayley Scale of Infant and Toddler Development III (BSID-III) will be used to assess the infants' development throughout the study. This test focuses on development in Adaptive Behavior, Cognition, Language, Fine and Gross Motor Skills, and Socio-Emotional skills (Pearson, 2012)

The Wechsler Preschool and Preliminary Scale of Intelligence-II (WPPSI-II) will be used between the ages of 2 and 5 to assess intelligence. From age 6-onset of puberty, the children will be assessed using the Wechsler Intelligence Scale for Children-IV (WISC-IV).

Criteria for ADHD will be set by the Diagnostic Manual of Mental Disorders-IV (DSM-IV). Similar to the assessments in the study by Bouchard et al. (2010), The Diagnostic Schedule Interview for Children- IV (DSIC-IV) will be used based on the criteria set by the DSM-IV for ADHD. Some of these criteria are symptoms similar to inattention, hyperactivity, and impulsivity (Bouchard et al., 2010). Also, these symptoms must occur in two or more settings (Bouchard et al., 2010). Criteria for ASD will also be determined by using the DSIC-IV based on the DSM-IV.

Procedure: All research would be conducted in New York City at Mount Sinai Hospital, as modeled by Engel et al. (2011). However, the mothers would not be taken from the Environmental Health Cohort, but instead will be recruited through their doctors. If mothers meet the criteria, they will be asked about their diets when they come into their first doctor's appointment in their third trimester. At this point, we will determine which group they would be placed in (organic or conventional) and inform them of the details of the study. Each participant will provide informed consent. They will then be given the Block survey and the survey about organic diet. Both groups of mothers will receive the same surveys in order to confirm that they have been eating healthfully and are in the proper group. No measures will be taken in the rest of pregnancy. Again, the conventional mothers will be chosen only if they express desire to implement an organic diet for their children once they stop breastfeeding or formula-only diets.

Once the mothers give birth, we will measure their pesticide levels in the umbilical cord blood. We will use these measures to see if these pesticide levels mediate any effects that may arise from the different diets. At birth, we will measure birth weight. Then, we will measure cognitive development through toddlerhood. This will be tested with the BSID-III beginning when the child reaches 1 month old. They will then undergo this assessment again at 3 months, 6 months, 9 months and 12 months. After the first year, the BSID-III testing will occur once a year until month 36 (Pearson, 2012). Then, we will focus on intelligence measures as one operationalization of cognitive development. When the children are old enough, they will provide informed assent for these tests in addition to their mothers' informed consent. The children will be administered the WPPSI-II. Starting at age 6, the children will be given WISC-IV assessments yearly. The mothers will continue to fill out surveys about their child's diet and how often they eat organic throughout the study. The mothers will be encouraged to fill out these surveys with their children once they are old enough to be making some of their own food decisions.

Assessments will be done for ASD beginning at age 2 and continuing annually, with the other assessments. Assessments for ADHD will also be done annually, beginning at age 2.

Finally, we will look at onset of puberty. For females, this will be age of menarche. For males, we will use genital stages, looking for testicular or genital enlargement (Vignolo et al., 1998 as cited in Kaplowitz, 2008). Weight will be taken annually in conjunction with the other measures.

Statistics: All assessments will be evaluated using SPSS. We will assess the data using t-tests to compare the means of the two groups of infants/children. We will do this for levels of pesticide metabolites in umbilical cord blood, birth weight, incidence of ASD, incidence of ADHD, age of puberty onset, and scores on BSID-III and Wechsler scores. We will then use the pesticide metabolite levels identified in the umbilical cord blood to test for mediation effects. We will do this using multiple regressions to test if the diet is correlated with the effects on the independent variables, if the diet is correlated with the level of pesticides, and if the level of pesticides is correlated with the effects on the independent variables (Holmbeck, 2006). Finally, we will test to see if the effect of the diet is less when controlling for the effect of the pesticides (Holmbeck, 2006).

Predicted Results and Conclusions: Overall, we expect to see a pervasive effect of pesticide exposure during pregnancy, and therefore significant differences between the mothers who ate conventionally in pregnancy and mothers who ate organically in pregnancy. We expect to see significantly less pesticide metabolites in the umbilical cord blood of mothers who ate organically throughout pregnancy. We expect this difference to mediate the effects of child outcome. First, we expect that we will see lower birth weight in infants with mothers who have eaten a conventional diet, even when controlling for mother's weight. This is reflective of the effects of Whyatt et al., 2004. This is because we expect pervasive effects of pesticides from prenatal consumption of conventional food, even after the pesticide exposure has been theoretically decreased through the implementation of an organic diet.

It is also predicted that there will be slower cognitive development on the part of the infants and toddlers whose mothers ate a conventional diet. Specifically, we expect to see a significantly more detriments in the scores of the BSID-III among children whose mothers ate conventionally. We expect to see a slower development of these skills in children whose mothers ate a conventional diet during pregnancy. These results would expand on the results of Engel et al. 2011, showing that the organic diet during pregnancy has a protective effect against these detriments. Similarly, we expect lower scores of intelligence on both the WPPSI-II and the WISC-IV in those children whose mothers ate a conventional diet.

It is expected that the female children whose mothers ate a conventional diet will have an earlier onset of puberty than those whose mothers ate an organic diet during pregnancy. These results would be similar to the results seen in Vasiliu et al. (2004). We expect that this will be mediated by weight. Meaning, the children of mothers who ate conventional diets will have an earlier onset of puberty, as seen through menarche, to the extent at which their weight is greater than those whose mothers ate an organic diet during pregnancy. This is based in the idea that pesticides are endocrine disruptors and can cause weight gain (McKinlay et al., 2008 and Biro et al., 2012).

It is predicted that there will be significantly less incidence of ASD and ADHD in children whose mothers ate organically during pregnancy. This would extend the results of the studies by Bouchard et al. (2010) and Roberts et al. (2007). This is because the effects of prenatal exposure to pesticides may be enough to see an impact, regardless of diet after pregnancy. Similarly, pesticide exposure from food consumption in particular during pregnancy may be significant enough that an organic diet may be protective of such effects.

Again, it is expected that lower pesticide levels in umbilical cord blood of the organic mothers will mediate all of these results. We will use the Block surveys to determine that these effects are not caused by great differences in nutritional intake. Similarly, we will use the Nutrition Quest surveys about organic diet to determine that the organic mothers truly did eat organically during pregnancy and that all of the mothers are feeding their children primarily organic diets for the duration of the study.

If we do not find these specific results, the alternative results could be equally informative. If there are no significant differences in these measures between the mothers who ate organically and the mothers who ate conventionally, one could infer that a change to an organic diet after pregnancy could reverse any effects of pesticide exposure from prenatal diet. These results could also show that an organic diet is not protective against these effects. Results showing no significant differences in pesticide levels in umbilical cord blood would provide evidence for this hypothesis. In any of these cases, the results from this study would lead to greater information about pesticide effects during pregnancy and about organic diet. These results could help a lot of mothers, whether it is telling them that an organic diet may increase the quality of their child health outcome, or telling them that there may not be any worth to spending money on a strict organic diet during pregnancy.

There would be many opportunities to expand on this research even further. For example, there are many other variables that could be studied in this format. Some of these variables could be risk for asthma, obesity, diabetes, birth defects, childhood cancers, and other learning disabilities (Schafer & Marquez, 2012). It would also be informative for future studies to check child urine samples for pesticide metabolites in order to confirm that the organic diets are enough to protect from pesticide exposure. These metabolite levels could also be assessed for their mediating powers in the results. Similarly, the present study looked at the effects of diet alone, so future studies should evaluate other how sources of pesticide exposure may affect the data. The present study looked for the possible overarching effects of diet, so it particularly salient if the present study can find differences in the groups even without controlling for other sources of exposure, but it would be important to see what effects this other exposure may have. It may also be informative to look for changes in brain structures to better explain these behavioral and cognitive differences, similar to Rauh et al. (2012). Cognitive development could also be operationalized in different ways. Here we used the BSID-III and then looked at Wechsler Intelligence Scales, but there are many other possible operationalizations. Future studies should try to expand this research to women of varied socioeconomic status. The present study would not be able to do this because of the limits of food price, but it would be informative to know how far these results could generalize.

Overall, the present study is a great starting point for the study of organic diet during pregnancy. It opens up many opportunities to study more about diet during pregnancy and to understand more about the effects of current agricultural practices. Many pesticides have been banned for use in the United States and other countries because of their detrimental effects on health. However, many pesticides are still being used in conventional foods because they are cost and labor-efficient. Studies such as this force society to take a step back and look at the effects of such practices on human health. It is especially important to consider these effects because they may be contributing negatively to the health of future generations. This type of study forces the public to think about what is acceptable for our health. Likewise, this study could lead people to make informed decisions about how they spend their money. The results of this study have help individuals decide whether or not the expense of an organic diet is worth the price.

The unique factor of this study, the isolation of the effects of diet during pregnancy, would also add to our general understanding of the importance of consumption during pregnancy. It would reinforce just how important it is to avoid the consumption of certain substances during pregnancy and help us to better understand what chemicals may be problematic for pregnant women. If this study were carried out, the results would benefit the field of developmental psychology by supplementing current understandings of both fetal health and chemical effects on the brain.

References

Biro, F. M., Greenspan, L. C., & Galvez, M. P. (2012). Puberty in girls of the 21st century. *Journal of pediatric and adolescent gynecology*, *25*(5), 289–94. doi:10.1016/j.jpag.2012.05.009

Bouchard, M. F., Bellinger, D. C., Wright, R. O., & Weisskopf, M. G. (2010). Attention-deficit/hyperactivity disorder and urinary metabolites of organophosphate pesticides. *Pediatrics*, *125*(6), e1270–7. doi:10.1542/peds.2009-3058

Engel, S. M., Wetmur, J., Chen, J., Zhu, C., Barr, D. B., Canfield, R. L., & Wolff, M. S. (2011). Prenatal exposure to organophosphates, paraoxonase 1, and cognitive development in childhood. *Environmental health perspectives*, *119*(8), 1182–8. doi:10.1289/ehp.1003183

Holmbeck, G.N., (2006, October 4). Testing for mediation and moderation. Message posted to http://www.4researchers.org/articles/370

Kaplowitz, P. B. (2008). Link between body fat and the timing of puberty. *Pediatrics*, *121 Suppl 3*, S208–17. doi:10.1542/peds.2007-1813F

Lu, C., Toepel, K., Irish, R., Fenske, R. a., Barr, D. B., & Bravo, R. (2006). Organic Diets Significantly Lower Children's Dietary Exposure to Organophosphorus Pesticides. *Environmental Health Perspectives*, *114*(2), 260–263. doi:10.1289/ehp.8418

McKinlay, R., Plant, J. a, Bell, J. N. B., & Voulvoulis, N. (2008). Endocrine disrupting pesticides: implications for risk assessment. *Environment international*, *34*(2), 168–83. doi:10.1016/j.envint.2007.07.013

Nutrition Quest (2009). *Assessment and Analysis Services.* Retrieved from:

http://www.nutritionquest.com/assessment/list-of-questionnaires-and-screeners/

Pearson (2012). *Assessment and Information: Bayley Scales of Infant and Toddler Development, Third Edition.* Retrieved from http://www.pearsonassessments.com/HAIWEB/Cultures/en-us/Productdetail.htm?Pid=015-8027-23X

Rauh, V. a, Perera, F. P., Horton, M. K., Whyatt, R. M., Bansal, R., Hao, X., Liu, J., et al. (2012). Brain anomalies in children exposed prenatally to a common organophosphate pesticide. *Proceedings of the National Academy of Sciences of the United States of America*, *109*(20), 7871–6. doi:10.1073/pnas.1203396109

Roberts, E. M., English, P. B., Grether, J. K., Windham, G. C., Somberg, L., & Wolff, C. (2007). Maternal residence near agricultural pesticide applications and autism spectrum disorders among children in the California Central Valley. *Environmental health perspectives*, *115*(10), 1482–9. doi:10.1289/ehp.10168

Rosenfield, R. L., Lipton, R. B., & Drum, M. L. (2009). Thelarche, pubarche, and menarche attainment in children with normal and elevated body mass index. *Pediatrics*, *123*(1), 84–8. doi:10.1542/peds.2008-0146

Shafer, K.S., &Marques, E.C. (2012). *A Generation in Jeopardy: How pesticides are undermining our children's health and intelligence.* Oakland, California: Pesticide Action Network North America.

United States Department of Agriculture (2012). *National Organic Program.* Retrieved from:http://www.ams.usda.gov/AMSv1.0/ams.fetchTemplateData.do?template=TemplateN&navID=OrganicStandardsLinkNOPFactSheets&rightNav1=OrganicStand

ardsLinkNOPFactSheets&topNav=&leftNav=&page=NOPOrganicStandards&resultType=&acct=nopgeninfo

Vasiliu, O., Muttineni, J., & Karmaus, W. (2004). In utero exposure to organochlorines and age at menarche. *Human reproduction (Oxford, England)*, *19*(7), 1506–12. doi:10.1093/humrep/deh292

Whyatt, R. M., Rauh, V., Barr, D. B., Camann, D. E., Andrews, H. F., Garfinkel, R., Hoepner, L. a., et al. (2004). Prenatal Insecticide Exposures and Birth Weight and Length among an Urban Minority Cohort. *Environmental Health Perspectives*, *112*(10), 1125–1132. doi:10.1289/ehp.6641