nontoxicprint art & science

Reproduction Risks

Selected writings

A growing concern amongst printmakers,

painters, decorating enthusiasts,

and artists in general, is whether the materials

and methods they are using

can have an effect not just on their own health

but on that of an unborn child.

The following is a selection of information from key experts and agencies dealing with this particular issue in the arts environment.

1. UIC Online Health and Safety in the Arts Library
   "Reproductive Hazards in the Arts and Crafts"

2. Rachel's Environment & Health News
   "Solvents: All-Purpose Poisons"
   Peter Montague

3. Arts, Crafts & Theater Safety Inc (ACTS)
   "Reproductive Risks to Artists"
   Monona Rossol MS, MFA

1. Reproductive Hazards in the Arts and Crafts

Source: UIC University of Illinois Online Health and Safety in the Arts Library

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Miscarriages, birth defects, sterility, loss of sex drive - all of these, and more, have come to be associated in recent years with chemical exposures, and they have come to be of serious concern to artists, no matter what their gender. A few basic facts help explain why:

- Between 30 and 80 percent of all conceptions end in miscarriage, stillbirth, or early infant death
- At least 7 percent of all newborn children have birth defects, or will develop them
- Men's sperm counts have decreased by 30 to 40 percent during the last thirty years

What causes these reproductive problems?
Obviously no one single factor is responsible, but research has suggested that several environmental factors (such as radiation, viruses, drugs, and chemicals) cause between 5 and 11 percent of all birth defects. Further, the multitude of toxic chemicals in our environment has aroused concern that they may be partly responsible for the high rate of miscarriages.

Since you are likely to be one of the 78.5 million artists, craftspeople, or hobbyists in the U.S., chances are also that you work with just such toxic materials. Whether you are an amateur or professional, whether you paint, sculpt, work in glass, photography, wood, textiles, leather, ceramics, or jewelry, or if you teach art of any kind, the materials you use may be harmful to your health unless you take adequate precautions. What is more, these materials may affect you ability to conceive and give birth to healthy children.

This fact sheet will help you cope with this problem. It describes the effects on the reproductive systems caused by common toxic substances used by artists, and gives you practical tips about how to work safely.

What is a Toxic Substance?
A toxic substance is a poison that can damage your body's organ systems when you are overexposed to it. Some substances are so toxic that just one exposure to a tiny quantity can produce harmful effects. More often, the substance is less toxic and damages the body through repeated exposures over months or years.

Toxic substances come in many forms:

- Vapors from such things as turpentine, toluene, or other solvents in paint removers, lacquer thinners, silkscreen inks, etc., which evaporate from open containers
- Mists accumulated in the air from spraying paints or fixatives, airbrushing, using spray guns, etc.
- Gases from etching metals, working with photographic baths, welding, or firing kilns
- Metallic fumes from welding, soldering, or foundry casting
- Dusts from pottery making, mixing dry pigments or dyes, grinding, and woodworking

How Toxic Substances Enter the Body
Toxic substances enter the body in three principal ways.

1. Absorption through the skin
   Example: you can absorb a lacquer thinner or turpentine if it splashes your skin
2. Inhalation through nose and mouth
   Example: you can inhale dusts while you mix dyes or pottery glazes
3. Ingestion through eating, drinking, or smoking in your work area
   Example: dusts can mingle with food left in an open container while you mix a glaze

What Are the Reproductive Effects of Toxic Substances?
Toxic substances and some physical agents produce various effects on the reproductive systems of both men and women and on pregnant women and their fetuses. These are summarized below and listed in Table 1.

Effects on Reproductive System
Both men's and women's reproductive systems can be affected.
In men, some toxins such as manganese and antimony compounds interfere with sex drive and may cause impotence. Others, cadmium and lead, may cause testicular

damage. In women, toluene, xylene, and formaldehyde may cause menstrual disorders. Other toxins, such as lead or benzene, are called mutagens because they change the genetic structure of men's and women's chromosomes and cause mutations in the first and future generations of offspring.

Risks to the Fetus
Once a pregnant woman has absorbed, inhaled, or ingested a toxic substance, the toxin circulates through her bloodstream, and, in many instances, it can pass through the placenta. The type of damage it causes depends upon the stage of pregnancy, the amount of exposure, and the nature of the toxin. During the first trimester, when organ development occurs, chemicals such as pentachlorophenol, lithium, mercury and ethyl alcohol can interfere with normal organ development, causing birth defects. These chemicals are known as teratogens. Concentrations of them, which could not harm the mother, are capable of causing harmful birth defects. Toxic substances such as lead and carbon monoxide also can poison the fetus to cause miscarriages or spontaneous abortions. These usually occur when concentrations are high enough so they might also affect the mother.

Risks to the Mother during Pregnancy
An artist may be more vulnerable to toxic chemicals during pregnancy than at other times, due to some of the physiological changes that occur in the body during pregnancy. For example, higher concentrations of solvents can circulate through the bloodstream during pregnancy because a pregnant woman's blood volume increases by 30 to 40 percent. This increase means that the amount of iron in the blood decreases, so a pregnant artist may become more vulnerable to chemicals (such as lead, benzene, and carbon monoxide) that can cause anemia. There are also higher concentrations of inhaled substances in the lungs of a pregnant artist because she needs more oxygen and breathes more deeply, thus becoming more susceptible to respiratory problems. The increased strain upon the respiratory system might make it inadvisable for a pregnant woman to wear a respirator for extended periods, because a respirator itself increases breathing resistance.

Risks of Toxic Exposure after Birth
Infants and children also can be affected by their parents' exposure to toxins. For example, mercury poisoning in infants has been caused by mercury that was present in breast milk. Solvents have also been found in breast milk. Children can be exposed if they come in contact with their parents' work clothes, shoes, or unprotected hair, or if they are allowed to play in a studio or work area.

How can Reproductive Damage be Prevented?
If you are planning to have children and you know a substance you use has reproductive effects, do not use it. Unfortunately, no one knows what levels of exposure to a toxic substance are safe for sperm, egg, or fetus. Therefore, if you are using a material that can get into your body through inhalation or skin absorption, it is obviously advisable to stop using this material from conception until breast-feeding has ceased. (Why risk the unknown when the inconvenience is only temporary?) If the only hazard is ingestion, you usually can avoid it through careful personal hygiene.

This advice to artists is similar to the advice physicians routinely give their pregnant patients about medications: avoid using medications during pregnancy unless they are absolutely necessary. The reason is that most medications have not been studied properly, so no one knows if they are safe or at what levels they might be safe. (This does not mean that all medications can cause birth defects or other reproductive effects. It simply means that you should be better safe than sorry.)

Men who are planning a family should also avoid mutagens and chemicals affecting fertility well in advance of the planned pregnancy. If you have been exposed, a medical evaluation is suggested.

Tips for the Workplace
If you must continue to work with hazardous materials while preparing for a family or during a pregnancy, here are some additional tips to help you work more safely. They are good to follow any time, not just before and during pregnancy and while breast-feeding. And they are especially important if you are considering having children in the future.

- If you work at home, keep your work area separate from your living area. If you are not an artist but live with one, remember that you still risk potential exposure. Artists who work at home additionally risk twenty-four-hour-a-day exposure to toxins, unless proper precautions are taken.
- If you do not know what is in a substance you use, try to find out. The label sometimes will list the ingredients and suggest safety precautions but sometimes there is not enough information to help. You should contact the manufacturer or supplier and request a

Material Safety Data Sheet. Or you can contact the Center for Safety in the Arts for more information.

- Substitute safer materials for more toxic ones. For example, use acrylic paints or watercolors instead of oil paint. This eliminates the need to use turpentine and paint thinner. Make simple black and white photographs, and do not do toning, intensifying or color photographic processing. In general, working with waterbased materials is safer than working with solvent-based materials or powders.
- Inspect your work area for adequate ventilation, proper storage of materials, etc. The checklist below will help you.
- Wear work clothes or coveralls to protect you when you work. Wear gloves, goggles, and a respirator if necessary.
- Wash work clothes separately from the family's clothes.
- Do not eat or drink in a work area.
- Do not drink alcoholic beverages if you are pregnant. Besides being a known teratogen, ethyl alcohol can produce more severe effects.
- Do not smoke. Besides the known teratogenic effects of carbon monoxide, smoking can increase the amount of toxins that enter the lungs.
- If employed as an artist or craftsperson by someone else during a pregnancy, consider asking you employer to transfer you to a non-hazardous work area. Such a transfer should not entail a loss of benefits during your pregnancy.

Work Area Checklist
Here are some common things to consider when inspecting your work area.
A complete list is available from the Center for Safety in the Arts.

- General ventilation (a window exhaust fan) for small amounts of vapors and gases
- Additional local exhaust ventilation for certain processes, such as a canopy hood for kilns, a spray booth for spraying, etc.
- Removal of carpets and other fabrics that can collect dust from wall, floors, and ceilings
- Properly labeled containers
- Powdered materials stored in airtight jars
- Liquids stored in tightly capped containers
- Large containers on floor or low shelves to prevent falls or spills
- Dangerous materials stored away from work and living areas
- Flammable and combustible materials properly stored
- Fire extinguisher in work area
- Machines properly guarded
- Adequately stocked first aid kit in work area
- Emergency telephone numbers posted by a nearby telephone

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excerpt from 'BioNews', 6-2008
Dr Kirsty Horsley

"Painting and Decorating may be harmful to male fertility

...New research shows that the sperm of men who work as painters and decorators is likely to be of poorer quality. This is due to their exposure to chemical solvents known as glycol ethers in water-based paints and other substances used in their trade.

The scientists, from the universities of Sheffield and Manchester in the UK, published their findings in the BMJ (British Medical Journals)- journal of Occupational Environmental Medicine. The researchers examined the working lives of 2,118 men across the UK in an attempt to assess how environmental work factors, particularly exposure to chemical substances, affected male fertility. The research took place in 14 fertility clinics in 11 cities across the country.

The research showed that men working with glycol ethers have a 2.5-fold increased risk of having high numbers of sperm with low motility (swimming ability) compared to men who are not often exposed to the chemicals..."

link to the full text on BioNews http://www.bionews.org.uk/page_13404.asp

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TABLE 1: Reproductive Effects From Exposure to Toxic Chemicals

FEMALE Before Conception	FEMALE During Pregnancy	MALE Before Conception	FETUS Before Conception	NEWBORN After Birth
loss of sex drive	increased vulnerability of mother	loss of sex drive	conception prevented or made more difficult	toxic effects on newborn from chemicals transmitted in breast milk
lowered fertility (production of damaged eggs or decreased ability to ovulate)	complications from miscarriages, spontaneous abortions, etc.	impotence	mutations from damaged egg or sperm	toxic effects on infant from chemicals contaminating living area or parents' clothes, hair, etc.
sterility	exposure to teratogens: developmental damage resulting in fetal death, birth defects, growth retardation, premature birth, low birth weight, etc.	lowered fertility (production of damaged sperm or decreased ability to produce sperm)		toxic effects on child being exposed to chemicals in art studio
genetic damage to eggs (mutations)	exposure to toxic chemicals - miscarriages, organ damage, spontaneous abortions, etc.	sterility		exposure to some carcinogens - possible cancer during childhood or later

menstrual changes or disorders		genetic damage to sperm cells (mutations)		
cancer of reproductive organs		testicular changes or damage		
		cancer of reproductive organs		

Aided by Reproductive Hazards in the Workplace Grant No. 15-43 from the March of Dimes Birth Defect Foundation,
and by a grant from the C.S. Fund.

2. Solvents: All-Purpose Poisons

Source: Environmental Research Foundation (ERF) Rachel's *Environment & Health News*, Issue 647, April 21, 1999

Peter Montague

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In all industrialized societies, both men and women are often exposed to organic solvents at work and in the home. Gasoline contains a mixture of organic solvents, and solvents are major components of lighter fluid, spot removers, many aerosol sprays, paints, paint thinners, paint removers, fingernail polish and remover, glues, and floor and tile cleaners.

In the past year or so, half a dozen studies have implicated solvents in several serious health problems, including major birth defects, immune system disorders (such as rheumatoid arthritis, scleroderma, and lupus erythematosus), and several kinds of cancer, including breast cancer.

Chemicals in the "organic solvent" class include aliphatic hydrocarbons (mineral spirits, varnish, kerosene), aromatic hydrocarbons (benzene, toluene, xylene), chlorinated hydrocarbons (carbon tetrachloride, trichloroethylene, tetrachloroethylene [also known as perchloroethylene, or perc]), aliphatic alcohols (methanol), glycols (ethylene glycol), and glycol ethers (methoxyethanol). There are hundreds of different organic solvents on the market and it is rare to be exposed to only one at a time; mixtures are common.

Birth Defects

Several occupations dominated by women have potential exposure to organic solvents: health care professions, work in the clothing and textile industries, and the graphic arts, among others.

In 1998, an analysis of five previous studies showed that women exposed to organic solvents during pregnancy had a 64% increased chance of giving birth to a baby with a major birth defect. A major birth defect was defined as "potentially life-threatening or a major cosmetic effect." However, all five studies were retrospective in design - that is, women were asked after the birth of their child whether they had been exposed to solvents during pregnancy. All retrospective studies can suffer from "recall bias."

A "prospective" study of solvents and birth defects published in the *Journal of the American Medical Association* (JAMA) found that women occupationally exposed to solvents during pregnancy have a 13- fold increased chance of giving birth to a child with a major birth defect.

Defects that occurred in babies born to women in the solvent-exposed group included heart valve defects; soft cartilage in the larynx; micropenis [abnormally small penis];

deafness; clubfoot; neural tube defect [opening to the spinal cord at the base of the brain]; and hydronephrosis [a serious kidney defect].

The JAMA study examined 125 women who were occupationally exposed to organic solvents during pregnancy and an equal number of pregnant controls matched for age, number of previous pregnancies, smoking and drinking habits. In addition, the control group had been exposed to chemicals known not to produce birth defects.

All the exposed women worked with organic solvents for at least the first 13 weeks of pregnancy. The most common occupations were factory worker; laboratory technician; professional artist or graphic designer; and printing industry worker. Other solvent-exposed occupations included chemist, painter, office worker, veterinary technician, funeral home worker, carpenter, social worker, and car cleaner.

The two groups of pregnant women differed in several noteworthy respects. Both groups had had an equal number of pregnancies, but the solvent-exposed women had had significantly more miscarriages (and thus fewer children born). Babies born to solvent-exposed women weighed an average of 168 grams (5%) less than babies born to the control group. Eight babies born to solvent-exposed women fell in the category "low birth weight" (defined as less than 2500 grams [5.5 pounds].) Among non-exposed women, three babies had low birth weight. Among the solvent-exposed group, seventeen babies suffered "fetal distress" at birth vs. six with fetal distress among the unexposed group. Fetal distress was defined as fetal intestinal discharge during delivery and/or abnormal fetal heart rate during delivery, or the requirement of resuscitation or a neonatal intensive care unit.

Among the 125 women occupationally exposed to solvents, 75 reported symptoms temporarily associated with their exposure, 43 had no symptoms of exposure, and for 7 such information was missing. Twelve of the 13 major birth defects occurred among the group reporting symptoms of exposure. The exposed women were further divided into two groups - those exposed for 7 months or longer; and those exposed for 3 to 7 months. Sixteen women exposed more than 7 months had labor with fetal distress vs. only one among those with shorter exposure.

Organic solvents can readily pass from the mother to the fetus in the womb, by passing through the placenta. The authors conclude that pregnant women are endangered by occupational exposure to solvents, and so are their babies, particularly if the mother has symptoms of solvent exposure herself.

Peter Montague

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3. Reproductive Risks to Artists

Source: Arts, Crafts & Theater Safety, Inc (ACTS)

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