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Conventional farming is dependent on synthetic biocides (pesticides, fungicides and herbicides). These poisons are used in food production to kill pests, diseases and weeds.

More than 7200 registered biocide products are used in Australian agriculture. [1] This is similar in the USA and Europe. Regulatory authorities assure us that these poisons have been rigorously tested and are used safely on our foods and in our environment.

1. The Residue Myth

A major myth is that most modern agricultural chemicals leave few residues. We are mislead into believing that they breakdown and do not persist in our food.

A typical claim states:**"… Organophosphorous pesticides, carbamate pesticides are mostly biodegradable, and therefore do not concentrate in the food chain. Synthetic pyrethroids … are generally biodegradable and therefore tend not to persist in the environment." [2]**

These types of statements give a false impression.

1. **Most agricultural and veterinary chemicals leave residues in food.** That is why residue tolerances called the Average Daily Intake (ADI) are set for these poisons.

   The following are some of the poisons found in Australian foods in 2003:
   Acephate, Azinphos-methyl, Bifenthrin, Bioresmethrin, Captan, Carbaryl, Chlorfenvinphos, Chlorothalonil, Chlorpyrifos, Chlorpyrifos-methyl, DDT, DDE, Dimethoate, Diphenylamine, Endosulfan, Fenitrothion, Fenoxycarb, Fenthion, Iprodione, Maldison, Metalaxyl, Methamidophos, Methidathion, Methoprene, o-phenylphenol, Parathion-methyl, Permethrin, Piperonyl butoxide, Pirimicarb, Pirimiphos-methyl, Procymidone, Propargite, Propiconazole, Pyrimethanil, Tebufenpyrad, Tetradifon, Vinclozolin [2]

   Testing in Australia only looks at a small sample of the large number of chemicals used. The majority of agricultural chemicals are not included in residue testing. Some of the most widely used chemicals, including herbicides such as Atrazine, Glyphosate, 2,4-D, Diuron and Paraquat

were not included in the testing.

2. Many of the current chemicals, including some of the Synthetic Pyrethroids, Organophosphates, Carbamates and Herbicides are as residual as banned Organochlorines such as Dieldrin, DDT, Chlordane, Heptachlor, Lindane and Aldrin.

2. The Breakdown Myth

One of the biggest myths is that once a chemical degrades, it disappears and is harmless. **Most agricultural poisons leave residues of breakdown chemicals when they degrade.**[3,4]

1. A substantial number of agricultural pesticides such as organophosphates like Diazinon become even more toxic when they break down.
2. Where research exists, it shows that many of the breakdown chemicals from agricultural poisons cause health and reproductive problems.
3. There is virtually no testing to detect the residues of the breakdown chemicals of agricultural poisons in our food.
4. Very little research has been done to determine safe intake levels for the breakdown chemicals of agricultural poisons. Consequently, there are virtually no safety levels to determine the Average Daily Intake (ADI) for the toxic breakdown chemicals that contaminate our food.

3. The Rigorously Tested Myth

One of the greatest myths is that all agricultural poisons are scientifically tested to ensure their safe use.

A: registered agricultural and veterinary products

Most agricultural poisons are mixtures of one or more chemicals called the active ingredient(s) mixed with other mostly toxic products, such as solvents or surfactants that are defined as "inerts".

Only the active ingredient is individually tested to determine a safety level for the Average Daily Intake (ADI). The actual registered product, which is the mixture of chemicals used by farmers, is not tested for long term effects such as cancers, hormone disruption, birth defects, nervous system damage and immune system damage.

Testing of Roundup, a mixture of the active ingredient Glyphosate, solvents and surfactants shows that this compound-is more toxic than the active ingredient Glyphosate. In fact Glyphosate barely works as a herbicide without the addition of these 'inert' chemicals. [20]

Most of the 7200 registered agricultural and veterinary products used in Australian food production are not tested for health and reproductive effects. This applies in most other countries, meaning there is no scientific data to determine safety levels for the actual products used on our food.

B: Chemical Cocktails in food and water

Another important issue is that several different toxic chemical products are applied in the production of most foods. These can be a combination of herbicides, pesticides, fungicides and some of the synthetic fertilizer compounds.

Most foods contain a cocktail of small amounts of these toxic chemicals, which are absorbed when eaten. A study by the U.S. Center for Disease Control found a cocktail of many toxic chemicals in the blood and urine of most Americans tested.[3,4, 5]

Regulatory authorities assume that because each of the active ingredients is below the ADI that the cocktail is also safe. They do not test for the safety of these combinations of chemicals – the chemical cocktails that we ingest everyday. Recent studies raise serious concerns. The emerging body of science demonstrates that many chemical cocktails act synergistically. This means that instead of 1+1= 2, the extra effect of the mixtures can mean 1+1= 60 or even 1000 in toxicity.

A study in the journal Toxicology and Industrial Health showed that combinations of low doses of commonly used agricultural chemicals can significantly affect health.

In experiments conducted by Warren Porter et al at the University of Wisconsin-Madison, mice were given drinking water with combinations of pesticide, herbicide and nitrate, at concentrations currently found in groundwater in the USA. They exhibited altered immune, endocrine (hormone) and nervous system functions. The effects were most noticeable when a single ~~a~~ herbicide (Atrazine) was combined with nitrate fertilizer. [6]

Atrazine is widely used in many agricultural industries including sugar cane and grain production. Atrazine is also one of the most persistent herbicides polluting much of the drinking water in the Midwestern USA, and in parts of Europe and Australia. It is measurable in corn, milk, beef and other foods in the USA and Europe.

Porter showed that the influence of pesticide, herbicide and fertilizer mixtures on the endocrine system may also cause changes in the immune system and affect fetal brain development. Of particular concern was thyroid disruption in humans. This has multiple consequences including effects on brain

development, level of irritability, sensitivity to stimuli, ability or motivation to learn and an altered immune function.

A later experiment by Porter and colleagues found that very low levels of a mixture of the common herbicides 2,4-D, Mecoprop, Dicamba and inert ingredients caused a decrease in the number of embryos and lives births in mice at all doses tested. Very significantly the data showed that low and very low doses caused these problems. [7]

4: The Very Small Amount Myth - 'The residues are too low to cause any problems'

The current model of toxicology (science of poisons) works on the notion that the lower the dose the less the effect of the poison. When animal testing shows that a certain dose level of poison causes no observable ill effects, this dose becomes the basis for determining the Average Daily Intake (ADI). Authorities then claim that any residue levels below the ADI are too low to cause health problems.

Research shows that the toxicology used by our authorities is inadequate in determining the safety of chemical compounds. [3,4]

A significant numbers of studies show that compounds considered to have very little toxicity in parts per million (ppm) have a range of adverse effects in parts per billion (ppb). These compounds disrupt our hormone systems at levels 1000 times lower than previous research stated was safe. Agricultural chemicals have been shown to mimic hormones such as estrogen, blocking hormone receptors or stopping hormone activity. These chemicals have been implicated in lower sperm counts, increases in breast, uterine, testicular and prostate cancers and deformities in the genital-urinary tracts.[4]

An example of this is Atrazine – one of the worlds most commonly used herbicides. Two peer reviewed studies conducted by Tyrone Hayes showed that levels 1000 times lower than currently permitted in our food causes severe reproductive deformities in frogs. [8,9]

Sara Storrs and Joseph Kiesecker of Pennsylvania State University recently confirmed Hayes' research. They exposed tadpoles of four frog species to Atrazine. **'Survival was significantly lower for all animals exposed to 3 ppb compared with either 30 or 100 ppb… These survival patterns highlight the importance of investigating the impacts of contaminants with realistic exposures and at various developmental stages.'** [10]

5. The Regulatory Authorities Myth

The greatest myth is that government regulatory authorities ensure agricultural

poisons are used safely and cause no adverse health or environmental problems.

History shows a consistent failure of regulatory authorities to prevent the contamination of the environment and human health by products previously said to be safe such as Asbestos, Lead, Mercury, Dioxins, PCBs, DDT, Dieldrin and other Persistent Organic Pollutants. These products were not (and are still not in many cases) withdrawn until decades after good scientific evidence was presented to demonstrate their damage.

Regulatory authorities around the world seem to be ignoring a large body of published science showing that the current methods of determining the safety of the agricultural poisons are grossly inadequate.

A: Environmental Fate

Pesticides do not just pollute our food; they poison our drinking water and air.

In 1999, Swiss research demonstrated that some of the rain falling on Europe contains such high levels of pesticides that it would be illegal to supply it as drinking water.[11] Rain over Europe is laced with atrazine, alochlor, 2,4-D and other common agricultural chemicals sprayed onto crops. A 1999 study of rainfall in Greece found one or more pesticides in 90% of 205 samples taken. Atrazine was measurable in 30% of the samples.[12]

Atrazine interferes with the endocrine system.[8] It causes tumors of the mammary glands, uterus, and ovaries in animals.[13] Studies suggest that it is one of a number of agricultural chemicals that cause cancer in humans.[14, 15]

European regulatory authorities have decided to ban Atrazine in 2006 because of the recent evidence showing widespread contamination at levels that cause serious health problems. Authorities around the world, including the USA and Australia have decided to ignore the overwhelming body of science about the adverse effects of this chemical.

B: Epidemiology and Scientific Testing

Most of the biocides used in farming are synthetic chemicals that have never existed before. Scientists are continuing to find serious unintended consequences on the environment and human health. An abundance of published scientific research links commonly used pesticides such as Malathion, Diazinon, Chlorpyrifos and other organophosphates as well as the carbamates, synthetic pyrethroids and herbicides to disruptions the hormone, nervous and immune systems. They are also linked to cancers such as pancreatic, colon, lymphoma, leukemia, breast, uterine and prostate. Autoimmune diseases linked include asthma, arthritis and chronic fatigue syndrome. [3,4,16,17,18, 19, 20, 21, 22, 23.24]

This article cannot detail them all, however, a few examples of the most common 'safe' herbicides follow:

A case-controlled study published in March 1999 by Swedish scientists Lennart Hardell and Mikael Eriksson showed that non-Hodgkin's lymphoma (NHL) is linked to exposure to a range of pesticides and herbicides.[17] Hardell and Eriksson published an earlier study linking phenoxy herbicides to non-Hodgkin's lymphoma (NHL) in 1981. These herbicides are widely used 2,4-D – part of the infamous Agent Orange.

Before the 1940's, non-Hodgkin's lymphoma was one of the world's rarest cancers. Now it is one of the most common. Between 1973 and 1991, the incidence of non-Hodgkin's lymphoma in the U.S. increased at a rate of 3.3% per year, to become the third fastest-growing cancer.[18] In Sweden, the incidence of NHL has increased at the rate of 3.6% per year in men and 2.9% per year in women since 1958.

One of the biocides linked to NHL by the Hardell study is Glyphosate. A previous study in 1998 had implicated Glyphosate to hairy cell leukemia.[19] Several animal studies have shown that Glyphosate can cause gene mutations and chromosomal aberrations.[20] Denmark banned Glyphosate in September 2003 because it was so persistent that it polluted most of the water table.

The response of many regulatory authorities is to ensure that use of Glyphosate is increased substantially around the world with the approval of "Roundup Ready" genetically modified crops.

C: Children and the Unborn

The greatest concern about these pesticides in our food and water is for the unborn and children. The 20th Australian Total Diet Survey found pesticide residues in infant food. The regulatory authorities ignored the data by stating "**These results confirm that although infant foods contain pesticide residues, these are at very low levels."**

Children have the greatest biocide exposure in proportion to their size. According to the 20th Australian Total Diet Survey. **"In general, the dietary exposure to pesticide residues was highest for the toddler age group. This is due to the high food consumption relative to body weight."**[2]

However because this dietary exposure is below the ADI, many regulatory authorities continue to state that this exposure does not cause problems.

The research by Porter et al at the University of Wisconsin-Madison showed that children and developing fetus' are at risk from common agricultural chemical mixtures found at levels below those that authorities regard as safe.

The influence of these low dose mixtures on developing neurological, endocrine and immune systems can cause diminished learning ability and increased aggression. [6,7]

Research conducted independently by Hayes et al and Storrs et al showed that exposure to amounts more than 1000 times lower than previously regarded as safe caused serious health and developmental problems to the fetus and juveniles. [8,9,10]

Dan Qiao et al of the Department of Pharmacology and Cancer Biology, Duke University Medical Center found that the developing fetus and the newborn are particularly vulnerable to amounts of pesticide far lower than currently permitted by most regulatory authorities around the world. Their studies showed that the fetus and the newborn possess lower concentrations of the protective serum proteins than adults. [25] A major consequence is developmental neurotoxicity, where the poison damages the developing nervous. [16,21, 25]

The Scientists stated: **"These results indicate that chlorpyrifos and other organophosphates such as diazinon have immediate, direct effects on neural cell replication... In light of the protective effect of serum proteins, the fact that the fetus and newborn possess lower concentrations of these proteins suggests that greater neurotoxic effects may occur at blood levels of chlorpyrifos that are nontoxic to adults."** [25]

Apart from Europe's ban of Atrazine and Denmark's ban of Glyphosate, regulatory authorities have made no effort to remove toxic chemicals from food. They continue to perpetuate the myths of safety.

Avoiding Pesticides and other Biocides

It is time to dispense with the myths that food from conventional farming is safe to eat. The lack of rigorous testing and blatant disregard of current scientific evidence confirm there is a lack of credible science to back claims that the poison residues in food are safe to consume.

The only way to avoid these poisons is to eat certified organically grown food - produced without these toxic compounds.

A detailed scientific analysis of organic fruits and vegetables in the USA, published in the peer-reviewed journal Food Additives and Contaminants, showed that organic foods have significantly less pesticide residues than conventionally grown foods. [26]

A similar study in Australia by Ruth McGowan for the Victorian Department of Primary Industries conducted 14000 tests on 300 hundred samples of certified organic produce. The study concluded that: **"The results demonstrate that**

Victorian organic produce is virtually 'chemical free'." [27]

Both of these studies showed that the vast majority of organic foods have no residues. Where residues were found, these were due to widespread contamination by several pesticides used in conventional farming. Even then, these residues were substantially lower in organic foods than in conventionally produced food.

Most importantly scientific studies are beginning to show that eating organic food results in lower levels of these pervasive chemicals in humans, particularly children.

A study published in the peer reviewed journal, Environmental Health Perspectives, found that children who eat organic foods have lower levels of one class of agricultural pesticides in their bodies. The University of Washington researchers who conducted the study concluded **'The dose estimates suggest that consumption of organic fruits, vegetables, and juice can reduce children's exposure levels from above to below the U.S. Environmental Protection Agency's current guidelines, thereby shifting exposures from a range of uncertain risk to a range of negligible risk. Consumption of organic produce appears to provide a relatively simple way for parents to reduce their children's exposure to OP [organophosphate] pesticides.' [28]**

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A case-controlled study published in March 1999 by Swedish scientists Lennart Hardell and Mikael Eriksson showed that non-Hodgkin's lymphoma (NHL) is linked to exposure to a range of pesticides and herbicides.[17] Hardell and Eriksson published an earlier study linking phenoxy herbicides to non-Hodgkin's lymphoma (NHL) in 1981. These herbicides are widely used 2,4-D – part of the infamous Agent Orange.

Before the 1940's, non-Hodgkin's lymphoma was one of the world's rarest cancers. Now it is one of the most common. Between 1973 and 1991, the incidence of non-Hodgkin's lymphoma in the U.S. increased at a rate of 3.3% per year, to become the third fastest-growing cancer.[18] In Sweden, the incidence of NHL has increased at the rate of 3.6% per year in men and 2.9% per year in women since 1958.

One of the biocides linked to NHL by the Hardell study is Glyphosate. A previous study in 1998 had implicated Glyphosate to hairy cell leukemia.[19] Several animal studies have shown that Glyphosate can cause gene mutations and chromosomal aberrations.[20] Denmark banned Glyphosate in September

2003 because it was so persistent that it polluted most of the water table.

The response of many regulatory authorities is to ensure that use of Glyphosate is increased substantially around the world with the approval of "Roundup Ready" genetically modified crops.

C: Children and the Unborn

The greatest concern about these pesticides in our food and water is for the unborn and children. The 20th Australian Total Diet Survey found pesticide residues in infant food. The regulatory authorities ignored the data by stating "**These results confirm that although infant foods contain pesticide residues, these are at very low levels.**"

Children have the greatest biocide exposure in proportion to their size. According to the 20th Australian Total Diet Survey. "**In general, the dietary exposure to pesticide residues was highest for the toddler age group. This is due to the high food consumption relative to body weight.**"[2]

However because this dietary exposure is below the ADI, many regulatory authorities continue to state that this exposure does not cause problems.

The research by Porter et al at the University of Wisconsin-Madison showed that children and developing fetus' are at risk from common agricultural chemical mixtures found at levels below those that authorities regard as safe. The influence of these low dose mixtures on developing neurological, endocrine and immune systems can cause diminished learning ability and increased aggression. [6,7]

Research conducted independently by Hayes et al and Storrs et al showed that exposure to amounts more than 1000 times lower than previously regarded as safe caused serious health and developmental problems to the fetus and juveniles. [8,9,10]

Dan Qiao et al of the Department of Pharmacology and Cancer Biology, Duke University Medical Center found that the developing fetus and the newborn are particularly vulnerable to amounts of pesticide far lower than currently permitted by most regulatory authorities around the world. Their studies showed that the fetus and the newborn possess lower concentrations of the protective serum proteins than adults. [25] A major consequence is developmental neurotoxicity, where the poison damages the developing nervous. [16,21, 25]

The Scientists stated: "**These results indicate that chlorpyrifos and other organophosphates such as diazinon have immediate, direct effects on neural cell replication... In light of the protective effect of serum proteins, the fact that the fetus and newborn possess lower concentrations of these proteins**

suggests that greater neurotoxic effects may occur at blood levels of chlorpyrifos that are nontoxic to adults." [25]

Apart from Europe's ban of Atrazine and Denmark's ban of Glyphosate, regulatory authorities have made no effort to remove toxic chemicals from food. They continue to perpetuate the myths of safety.

Avoiding Pesticides and other Biocides

It is time to dispense with the myths that food from conventional farming is safe to eat. The lack of rigorous testing and blatant disregard of current scientific evidence confirm there is a lack of credible science to back claims that the poison residues in food are safe to consume.

The only way to avoid these poisons is to eat certified organically grown food - produced without these toxic compounds.

A detailed scientific analysis of organic fruits and vegetables in the USA, published in the peer-reviewed journal Food Additives and Contaminants, showed that organic foods have significantly less pesticide residues than conventionally grown foods. [26]

A similar study in Australia by Ruth McGowan for the Victorian Department of Primary Industries conducted 14000 tests on 300 hundred samples of certified organic produce. The study concluded that: **"The results demonstrate that Victorian organic produce is virtually 'chemical free'."** [27]

Both of these studies showed that the vast majority of organic foods have no residues. Where residues were found, these were due to widespread contamination by several pesticides used in conventional farming. Even then, these residues were substantially lower in organic foods than in conventionally produced food.

Most importantly scientific studies are beginning to show that eating organic food results in lower levels of these pervasive chemicals in humans, particularly children.

A study published in the peer reviewed journal, Environmental Health Perspectives, found that children who eat organic foods have lower levels of one class of agricultural pesticides in their bodies. The University of Washington researchers who conducted the study concluded **'The dose estimates suggest that consumption of organic fruits, vegetables, and juice can reduce children's exposure levels from above to below the U.S. Environmental Protection Agency's current guidelines, thereby shifting exposures from a range of uncertain risk to a range of negligible risk. Consumption of organic produce appears to provide a relatively simple way for parents to**

reduce their children's exposure to OP [organophosphate] pesticides.' [28]

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