

# **The Second Annual International Symposium on Man & His Environment in Health and Disease**

**Wadley Institutes of Molecular Medicine/Dallas, Texas**

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**DIMENSIONS OF ENVIRONMENTAL POLLUTION**

The health of the chemically sensitive patient is ecologically entwined with his or her environment. This introductory paper will explore the general state of the patient's environment. This will range from natural mutagens to antibiotics and animal feed. General areas to be covered are air pollution, water pollution, wildlife, soils, forests, living space and energy. Particular attention will be devoted to the transport of airborne pesticides and indoor air pollution including building types, air handling systems and personal exposure to individual chemicals such as formaldehyde.

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## **HOW TO INTERPRET THE POLLUTANT STANDARDS INDEX**

The pollutant standards index (PSI) is a method of reporting ambient air quality across the United States on a uniform basis. The index is based on five pollutants for which National Ambient Air Quality Standards have been established. These pollutants are: Total suspended particulates (TSP), sulfur dioxide (SO<sub>2</sub>), carbon monoxide (CO), ozone (O<sub>3</sub>) and nitrogen dioxide (NO<sub>2</sub>). For each pollutant, a subindex is calculated from a segmented linear function that transforms ambient concentrations onto a scale extending from 0 through 500. One hundred corresponds to the primary National Ambient Air Quality Standards and 500 corresponds to the level which is expected to cause significant harm to the general population. The PSI is chosen as the maximum of the calculated subindexes.

The main purpose of the PSI is to present urban air quality data from across the nation on a consistent basis. However, the PSI for a particular day does not indicate the level of air contaminants to which an individual is exposed. The PSI can be interpreted as an indicator of meteorological conditions with which either high or low levels of air contaminants can occur.

An individual's exposure to outdoor ambient air pollutants depends primarily upon his proximity to air contaminant sources and the prevailing meteorological conditions. The gasoline motor vehicle is the major source of carbon monoxide and nitrogen oxides in the United States. Coal combustion is the major source of particulates and sulfur dioxide. Ozone is a photochemical oxidant produced in the atmosphere by a mixture of nitrogen oxides, hydrocarbons, and particulates along with sunlight. Therefore, the closer an individual lives or works near a heavily traveled highway, the higher his exposure will be to carbon monoxide and nitrogen oxides. Depending on wind speeds, the highest concentration of ozone can occur many miles downwind from the urban center.

Meteorological conditions such as wind speed and atmospheric stability determine air contaminant concentrations downwind from a source. Inversions, usually radiational and subsidence types, act as a lid on air contaminants released into the air. Wind disperses pollutants with levels decreasing exponentially from the source. Precipitation, such as rain and snow, can remove some types of air contaminants from the atmosphere.

Since the PSI is based upon a small number of air quality monitors in an urban area, a high PSI level indicates that source levels along with meteorological conditions are favorable for the exposure of the population to high levels of air contaminants. However, since PSI levels are announced after the fact, their value as a warning to protect people from high levels of air contaminants can be questioned.

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## **TRACE LEVELS OF ORGANIC CHEMICALS IN BODY TISSUES AND FLUIDS**

At present there are a multitude of organic molecular species that result from anthropogenic activities. These chemicals frequently become pollutants of the work place and the environment. Some are biodegradable whereas others appear as biorefractories. Humans, therefore, can receive a toxic insult from either ingestion of contaminated food materials or absorption from contaminated atmospheres.

Technology is now available that can quantitatively and qualitatively measure trace levels of toxic organics in body tissues and fluids. A number of examples of bioaccumulation in patients of these environmentally derived chemicals will be discussed. Specifically, chlorinated pesticides, chlorinated phenols, low molecular volatile organics, herbicides, and related chemicals will be presented along with their possible environmental origin.

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## **A PERSPECTIVE ON EMPIRICAL HUMAN BIOMETEOROLOGY**

The atmospheric environment impinges upon man both directly and indirectly. His health and well-being may be related to microorganisms and vectors whose viability depends on the proper conditions of light, heat, and moisture. Or, the interaction may be as direct as erythema produced by the absorption of solar radiation.

Another perspective on the broad range of man-atmosphere interaction is afforded by noting that cause and effect may be established or only suspected. Quantitative Human Biometeorology deals with measurable changes in man caused by measured environmental elements in a way that is understandable from the physical, chemical, and biological viewpoints. That is, there is an established physical transfer mechanism. Examples are solar radiation effects, anoxia, and thermal stress leading to impairment of the cardiovascular system. When possible, the effects have been reproduced in laboratories.

Qualitative Human Biometeorology describes those situations in which there is little or no doubt about cause and effect, but the physical transfer mechanism is not well established, and there are often mitigating circumstances. Examples are allergies and the effects of air pollution and of air ionization. In some cases their effects are reproducible in the laboratory.

Relationships which are only suspected - the third level of inquiry into man-atmosphere interactions - are those deduced by association. There is only circumstantial evidence that the atmosphere is causative; thus the term Empirical Human Biometeorology. The evidence has accumulated from a great number of studies which, largely on the basis of statistical or graphical correlations, link weather to human response in general, and to mortality and morbidity in particular. The weather features which have been implicated as causative include fronts, especially cold fronts, certain winds (Foehn, Sharov, Santa Ana), and rapidly changing weather. The conceptual framework for most of this research has been weather types, certain associations of weather elements which are geographically fixed with respect to an idealized wave cyclone model.

It is particularly noteworthy that these findings are almost exclusively European, and have been used there as the basis of medical-meteorological forecasts. These are issued to doctors, clinics, and hospitals, and some kinds of surgery are scheduled only when certain weather types are forecast. There the focus is on biotropic weather factors and processes and the meteorotropic diseases and their pathophysiology. This contrast sharply with the conduct of human biometeorology in North America, the Commonwealth countries, the Scandinavian countries, and Japan, where the focus has been on human environmental physiology or climatic physiology. In these areas the main research topics are thermoregulation, the physiology of acclimatization to heat, cold, and mountain environments, comfort, working efficiency, and limits of tolerance. Studies of weather emphasize meteorological extremes rather than fronts, air masses, or special winds. Or, to express this contrast in terms of the perspective cited above, European research is largely in Empirical Human Biometeorology, while the remaining technologically advanced nations emphasize Qualitative and Quantitative Human Biometeorology.

Even though weather factors have accounted for a small proportion of the daily, seasonal, or regional variance of physiological functions, mortality and morbidity, the associations have for the most part been shown to be statistically significant, and have been replicated many times. They imply that there is something about everyday weather - weather exclusive of events known to be harmful such as floods, hurricanes, tornadoes, blizzards, acute air pollution episodes, and excesses of temperature - that predisposes, precipitates, or exacerbates pathological manifestations.

Why? What is the linking - the physical transfer - mechanism? The medical-meteorological community, from Hippocrates to Petersen, Huntington, and Mills; to the European investigators; to the contemporary researcher, armed as he is with data hungry computers and the most sophisticated statistical techniques; has amassed an enormous amount of empirical evidence

suggesting cause and effect. The fact that there is nothing in medical science to explain these associations - to provide the linking mechanism - makes them both puzzling and provocative.

The implications of findings in Empirical Human Biometeorology should be pursued to some conclusion, and not left unresolved. Are these relationships real or spurious? Are they not meteorological at all, but due to other factors which are coincident in time with weather? It is time to redirect attention for purely statistical studies - of which there is now a surfeit - to those which attempt to provide a firmer etiological basis for these weather-human response links. Empirical Human Biometeorology must be advanced from this very rudimentary stage of research to a higher level - to qualitative or even quantitative human biometeorology.

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## **EXPOSURE AND HEALTH EFFECTS OF INDOOR AIR POLLUTANTS**

There have been many reports of serious impacts on human health due to indoor exposure to formaldehyde, to carbon monoxide and other products of unvented combustion, to a variety of organic chemicals from consumer products, and to radioactive pollutants namely, radon and daughters. The as yet inadequately evaluated chronic exposures to imprecisely determined concentrations of the pollutants known to be released indoors is a matter of considerable public health concern. Consequently, the WHO Regional Office for Europe has undertaken to follow-up this subject through a series of working groups, each concentrating on a different aspect.

The second Group, meeting in 1982, reviewed current knowledge about the sources of a number of the more important indoor pollutants and considered the concentrations at which they have been reported. A summary of the current levels of knowledge about population exposure, sources, distribution, effectiveness of presently used measurement techniques, and the adequacy of available monitoring data for estimating population exposure are presented in Table 1.

Also considered were the concentrations at which the pollutants have been reported, and the respective adverse health effects to be expected were identified. In general, it was found that the instrumentation available for measuring exposure was usually of acceptable quality, but that the monitoring data and knowledge about the distribution of sources and concentrations were inadequate or marginal. It was noted that the types of adverse health effect to be expected were largely known, but that in many cases knowledge of exposure-effect relationships were

inadequate, especially with regard to delayed effects of chronic exposures.

It was concluded that current knowledge did not yet allow quantitative assessments of public health impact. With this understanding, and subject to modification in the light of improved knowledge, estimates were prepared for most of the pollutants, of concentrations below which it was felt no unacceptable adverse health effects would occur and above which serious concern about adverse health effects was to be expected in an indoor environment.

**Table 1. Current levels of knowledge about population exposure**

Pollutant	People with low exposure	People with high exposure	Sources	Distribution	Instrumentation	Indoor/personal monitoring
Tobacco smoke (passive smoking)	most	some	+	±	±*	±
NO <sub>2</sub>	some	some	±	0	+	±
CO	most	few	±	0	+	±
Radon and daughters	most	few	±	0	+	0
Formaldehyde	most	few	±	±	+	±
SO <sub>2</sub>	few	few	±	±	+	0
CO <sub>2</sub>	most	few	+	±	+	+
CO <sub>3</sub>	few	few	±	+	+	±
Asbestos	few	few	0	0	±	0
Mineral fibres	few	few	0	0	±	0
Organics	most	some	±	0	±	0
Allergens	most	some	0	0	±	+

\*For respirable particulates 0=inadequate ± = marginal + = adequate

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## **TOBACCO SMOKE AND NONSMOKERS**

Objective: To explore the factors affecting the concentration of tobacco smoke in occupied spaces; determine their implications for the health of exposed nonsmokers.

Method or Approach: An indoor air pollution model has been developed, verified experimentally, which can be used to accurately predict levels of RSP and carbon monoxide from cigarette smoke in occupied spaces given the smoker density and the effective ventilation rate. This model was found to accurately predict the experimental chamber measurements of Leaderer, from 4 to 16 cigarettes per hour over effective ventilation rates ranging from 2.2 to 13.6 air changes per hour.

Results to Date: Experimental observations on levels of respirable particles in public buildings where tobacco is smoked conclusively demonstrate that tobacco smoke inflicts substantial air pollution burdens on nonsmokers, far in excess of those encountered in smoke-free indoor environments, outdoors, and in vehicles on busy commuter highways. Some nonsmokers could absorb quantities of tobacco smoke comparable to those of low-tar cigarette smokers and these effects might very well be observable epidemiologically, since the doses absorbed by low-tar cigarette smokers appear to be similar to the doses absorbed by high-tar cigarette smokers who do not inhale. High-tar smokers who do not inhale appear to suffer from fourfold to eightfold the lung cancer risk of nonsmokers. Thus, based on modeled dose, there is reason to believe that some nonsmokers are at risk of the diseases of smoking from breathing ambient concentrations of smoke. After a series of experiments involving cigarettes, a pipe, and cigars, it is concluded that indoor air pollution from tobacco smoke cannot be adequately controlled by standard ventilation rates set by the American Society of Heating, Refrigerating, and Air-Conditioning Engineers under ASH-RAE Standards 62-73, 90-75, or 62-1981. These standards are based upon design occupancy and their inadequacy appears to be due to the large source strengths of smoking materials, indicating that the appropriate control measures lie not in uneconomical increases in ventilation rates, but rather strategies designed to separate smokers from nonsmokers physically, by regulating side stream emissions from smoking materials, or by encouraging smokers to quit. Further experiments have shown that so-called low-tar cigarettes (less than 1 mg) have side stream emissions which are 80 percent of those of 1977 cigarettes (about 17 mg) and 40 percent of those of 1959 cigarettes (about 29 mg). This model, based on 1977 cigarette emissions, should continue to be useful as the tar level of U.S. cigarettes declines, and with appropriate scaling, can be used to estimate exposures of populations in the past.

Project Dates: April 1977 - continuing.

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## **THE PRINCIPLES OF BIO-ARCHITECTURE**

Bio-architecture (in German Baubiologie) deals with the construction and the remodeling of dwelling places in order for them to be most conducive to human health. Since we dwell in buildings for maybe 90% of our time this is a most important aspect of environmental health.

Our emphasis is on the whollistic overall view of the many different aspects to be considered in this respect.

Following we give a list of 25 main principles:

- Building sites geobiologically undisturbed.
- Keep living quarters in a distance from centers of industry and main traffic routes.
- Have living quarters decentralized in loose settlements amidst green areas.
- Individual house planning taking the human aspect and family life into consideration.
- Use nature produced unadulterated building materials.
- Use wall and ceiling materials which allow gas diffusion.
- Allow natural self regulation of air humidity.
- Allow filtering and absorption of air pollutants by building materials.
- Have adequate amounts of heat storage and thermal insulation in order to create a balanced indoor climate.
- Have optimal air and surface temperatures in the room.
- Heat mainly by thermal radiation and use solar energy extensively.
- Low moisture and quick dessication in new buildings.
- Homes with pleasant or neutral smell, avoiding toxic air pollution.
- Nature adequate lighting and colors.
- Adequate protection from noise and slow vibrations
- Minimal radio activity of building materials.
- Preservation of natural atmospheric electricity.
- No alteration of the natural magnetic field.
- Minimize technical electro magnetic non ionizing radiation.
- Preserve natural cosmic and terrestrial microwave radiation.
- Use physiologically designed furniture.
- Design shapes and proportions in the "harmonical" order.
- Building and production of building materials should not involve environmental problems or high energy costs,
- Nor should it contribute to the overexploitation of limited raw material resources,
- Nor cause social damage through harmful side effects.

A great deal of research still remains to be done in all of these points, mainly concerning the long term aspect.

In toxicology e.g. we know a lot about the immediate response of the body to large doses of poisons. But we know very little about its response to small doses when administered regularly for many years. And the same applies to all kinds of technical electrical and magnetic fields, unnatural lighting and other factors. Though especially the long-term aspect is essential concerning ones dwelling place. Bio-architecture has great positive aspects. "Bio-architectural" home owners report considerable decrease in their susceptibility to disease as well as increase in their feeling of well-being and efficiency.

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## **ENVIRONMENTAL ILLNESSES**

### Illness Induced by Urea Formaldehyde Foam Insulation

W.C., age 43, a farmer and his wife D. age 41, were symptom free until June of 1978 when UFFI was installed in their propane-heated home. Both W. and D. then developed headaches, depression, forgetfulness, inability to concentrate and nasal stuffiness, D. also bloating and impaired hearing. Both also developed sensitivities to food. Both recovered when living away from home, symptoms returning as soon as they lived in the house.

May 1983 - UFFI removed, but when it was removed chemicals were used to caulk leaks around the windows, these chemicals precipitated symptoms.

### Energy-Efficient Homes

M.P., an RN, age 27, was symptom free when, in Dec. 1981, she moved with her husband, an engineer, into an energy-efficient home. Two months later she began to experience spells of vertigo and tachycardia which increased in frequency and severity. Feb. 1983 she moved out of her own home into a safe house, and her symptoms began to clear. Fifteen months after moving into the energy-efficient home formaldehyde levels in the house were 0.28 parts/million.

### Restoration of Home After a Fire

D.B. age 37, a worker at a local pulp mill, his wife E., age 36, and their sons Curtis, age 14, and Cory, age 12, were well and symptom free when, on December 7, 1982 their home was damaged by fire. The house was boarded up, dried out by propane and repaired. The family moved back into the house on February 29, 1983. Two to three weeks later D. and E., both developed headaches, nasal stuffiness, itchiness of eyes and lassitude. Both had to give up work. Their two sons developed existaxes, headaches, an inability to concentrate and think clearly, and their marks at school fell.

When their home was repaired it was sprayed heavily with chemicals to counteract the effect of smoke. Wall-to-wall carpets were installed as well as new furniture. Formaldehyde levels - basement 0.142 ppm. living room 0.26 ppm, kitchen 0.23 ppm.

### Illness Induced by Occupation, House Painting, and Energy-Efficient Home

W.E. was born in 1942. At age 26 he went to Senegal as a missionary. Soon after arriving, he became paralyzed from the waist down, recovering gradually during the next six months. Following this illness he began to complain of headaches and sinus problems, he also had a nervous breakdown.

1972 - age 30, painted during the summer, and drove school bus during the winter. He noted when he painted houses the exposure to certain paints made him ill.

1979 - he moved in the fall into a new energy-efficient home heated by propane, and began to paint during the winter, becoming ill after spraying a building with Alkyd taking three weeks to recover. He found that exposure to oil-base paints was followed by insomnia. During the winter his behavior became unpredictable and his speech incoherent. He was admitted to a psychiatric ward, recovered, was able to paint during the summer, but became ill each winter. Exposure to his paints and confinement to his house results in confusion, depression and incoherence.

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### **RAPID, MARKED CLEARING OF DIVERSE RECALCITRANT CONDITIONS COINCIDENT WITH ADMINISTRATION OF MOLD EXTRACTS AND FOOD AVOIDANCE**

In previous publications we have shown that there are many more fungi prevalent than we were previously aware of. Now we needed to determine whether these fungi can cause disease. We needed to determine whether people react to them and upon receiving them if their symptoms could be improved and last, whether discontinuing the injections could cause a recurrence of the symptoms. This is not easy to evaluate because mold allergy is rarely an isolated event, rather, the total antigenic load must be dealt with.

Sixteen fungi were selected and added to our pollens, four mold, dust, and mite tests. It was winter season. Not only were positive test results obtained to the fungi, but coincident, dramatic improvement of various recalcitrant conditions occurred within two months, (and in some cases within weeks) of administration of these fungal antigens. Dietary manipulation was essential in most for optimum improvement. Coincident with stopping injections, or discontinuing the diet, the conditions would recur.

Before-and-after photos of patients will be shown.

Patient #1 had an IgE of 33,000 with extremely severe total body eczema. He had sought treatment at the Massachusetts General Hospital and from innumerable dermatologist and allergists in three states. His skin started clearing with the second and third injections and was totally clear in two weeks. After four months of treatment, his IgE was 8,000 I.U. At six months, it was 4,000. Single blind saline substitution of his injection 6 months later caused recurrence within two weeks.

Patient #2 had severe acne conglobata which resulted in keloid formation. He had consulted seven dermatologists in three states with no improvement.

Patient #3 had severe adult facial eczematous dermatitis.

Patient #4 had unbearable total body pruritis and pruritic vasculitis of the ankles.

Patient #5 had idiopathic fluid retention of hands, face and feet, unresponsive to diuretics, often making her unrecognizable to friends. She had consulted internists and endocrinologists.

Patient #6 had hyperactivity and at the age of eight years old was on six amphetamines a day by the Medical Center Pediatric Neurology Department. He was still dangerously uncontrollable and unteachable and it took three adults to hold him down during attacks.

All patients were markedly clear within less than two months (many were clear within two weeks) and had been failures with other methods. Either single-blind substitution of injections with normal saline, or dietary indiscretion could cause recurrence of the conditions.

A discussion will follow of how the fungi were chosen, tested, and given; and how the study could be improved if patients were willing to be part of a study where they might receive placebo.

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## **PHARMACOLOGICAL ASPECTS OF FOOD INTOLERANCE**

Diet is the most important environmental factor affecting man. This was recognized from very early times and manipulation of the diet was a major weapon in treating disease. Indeed before the introduction of potent modern drugs, diet was the only effective therapeutic method available to physicians, hence the importance given to fasting in religious practice, because the functions of the physician and priest were combined. The availability of modern drugs led to a decline in interest in diet, but this trend is now being reversed, and modern practice should be to combine diet and drug therapy in the management and prevention of disease.

The purpose of this presentation is to present a classification of food intolerance and to emphasize the importance of recognizing pharmacological reactions in clinical practice.

Psychological Reactions include anorexia nervosa and bulimia and are readily distinguished from organic reactions.

Enzyme Defects include lactose intolerance and avoidance of the relevant food is clinically effective.

Toxic Reactions The use of synthetic chemical additives such as preservatives, colouring and tasting agents, can cause symptoms in sensitive subjects, and the use of toxic chemicals such as DDT in agriculture can lead to serious problems particularly in the chemically sensitive subject.

Pharmacological Reactions are particularly important in clinical practice and produce recognizable clinical syndromes. These will be discussed in detail and include caffeine effects such as a) palpitations and paroxysmal tachycardia, b) indigestion and vomiting, c) anaemia and 3) anxiety states. The recognition and management of these syndromes will be described. Other pharmacological reactions include the production of headaches by amines, and the long-term effects of excessive salt intake which can lead to hypertension in susceptible subjects.

Food Allergy is an important cause of disease in susceptible subjects. IgE reactions occur rapidly and are easily recognized by the patient. The more common slow reactions, possibly initiated by immune complexes are responsible for a much wider range of symptoms and are more difficult to identify. Immunological reactions to food are, however, very common and most individuals have IgG antibodies to common foods, and the relevance of these findings will be discussed.

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## **THE EFFECTS OF POLLUTANTS ON THE NON-IMMUNE SYSTEM OF THE LUNG AND CARDIOVASCULAR SYSTEM**

The effects of inorganic and organic chemical pollutants on the non-immune system of the lung and cardiovascular systems are rapidly becoming recognized. Recent evidence incriminates ozone, nitrous oxide, and phenols. Mild to moderate exposure of these pollutants cause acute toxicological tolerance or a dysfunction to occur in the pulmonary vascular systems.

This adaption is characterized pathologically by damage to the Type I ciliated epithelial cells with replacement by Type II ciliated epithelial cells, interstitial cells, and fibroblasts. This change in cellular make-up allows for return of pulmonary function to control levels, but the lung will have long term damage with repeated episodes.

Metabolic changes occur with mitochondrial damage from the generation of free radicals. Glucose, lipid, and protein metabolism are altered, and RNA and DNA changes occur. Many enzyme systems like the monamine oxidase, cytochrome P-450, and glucose-6-phosphate-dehydrogenase systems are changed. Resultant metabolic dysfunctions and limitations in the detoxification of aromatic hydrocarbons occur. The glutathione system is also effected thereby altering sulfhydryl reduction mechanisms.

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## **FREE RADICAL PATHOLOGY, ENVIRONMENTAL CHEMICAL TOXICITY, AND CHEMICAL HYPERSENSITIVITY**

According to the Second Law of Thermodynamics, all physical or chemical changes tend to proceed irreversibly toward a decrease in utilizable energy and an increase in entropy (disorder). These changes equilibrate when the entropy is the maximum possible under existing conditions.\* This law must be consistent with the degeneration that occurs in disease, as viewed from the atomic, molecular or supramolecular level. The dynamic progression from health (low entropy) towards death and decay (increasing entropy) underlies all disease processes, whether induced by environmental chemicals, infection or emotional stress. These degenerative processes are initiated through lipid peroxidation, free radical damage, the consequent release of inflammatory mediators, and immune suppression. The immune system is a delicate redox system, which when functioning optimally retards entropic decay.

Most research on chemical hypersensitivity has been directed only at the symptoms produced by these chemicals. If we can understand the biochemical mechanisms that underlie this disease, then protective and therapeutic modalities should become evident.

Many symptoms in ecological illness are consistent with deterioration in the antioxidant defense system. This system is composed of enzymes and the very antioxidant nutrients that are most required for immune defense (vitamins A, C and E, Zn, and Se). Effectiveness of antioxidants resides in their electron-rich chemistry. Toxic chemicals either themselves cause oxidant damage, or are metabolized to free radical toxins *in vivo*, their toxicity resulting from their reactivity as oxidants or reductants. When a nonradical molecule loses an electron it becomes unstable, since electrons like to group in pairs. Chemicals are constantly losing and gaining electrons in normal cellular energetics, which is naturally regulated by cellular redox balance and the antioxidant system. In abnormal (stressed) metabolism, the balance is shifted towards an increase in single electron transfer (electron leakage) leading to increased production of radical species. If each radical species is not stabilized with the addition of an electron (supplied by antioxidant molecules) then an electron will be taken from a cellular molecule, often an unsaturated lipid from a cellular membrane, resulting in membrane damage, release of inflammatory prostaglandin-leukotriene agents via membrane peroxidation, formation of (-)foreign(-) antigenic (haptenic) complexes due to covalent modification of tissue macromolecules, and ultimately cell death and necrosis.

Imagine a fire burning in a fireplace. The fire represents normal metabolism, the burning fuel producing energy for bodily functions. Sparks flying from the fire represent the free radicals, which are unstable products of incomplete burning of the fuel. Unrestrained, the sparks can react with other material and damage one's home, even to the point of destroying it. With a screen in front of the fire, the sparks are prevented from doing harm. This is a purposefully simplistic image of antioxidant function. Antioxidants can neutralize the dangerous free radical byproducts from the metabolism of foods, environmental chemicals or drugs. Oxidant stress can locally exhaust or overwhelm the antioxidant defense capability to neutralize free radicals. Reserve antioxidant defenses can be mobilized, as occurs in the lung. However prolonged (chronic)

oxidant stress will eventually lead to systemic exhaustion and inflammatory or autoimmune degeneration.

A particularly important antioxidant enzyme, glutathione peroxidase, detoxifies peroxides, using reduced glutathione and selenium as cofactors. A recent clinical study demonstrated that petrochemically sensitive patients improve with the use of Se. Dr. A. Zamm found three basic responses to treatment with Se as selenite. One group improved slowly, over a two month period. Another group benefitted immediately, within days. The third group initially reacted unfavorably to the Se preparation, but eventually did improve. Those most sensitive patients were started with minute doses, and the doses gradually increased. The improvements in chemical tolerance with Se is a full-spectrum one, supporting my hypothesis that environmental chemicals are consistently toxic to biological systems via redox mechanisms. Selenium is known to modulate the adaptive responses of the antioxidant enzymes, which then provide increased protection against transient increases in oxidant stress.

Selenium has also been proven effective in the treatment of Candida albicans (yeast) infections. Selenium-deficient neutrophils can phagocytize yeast cells, but are unable to kill them. Clinically, supplying Se along with the nystatin antibiotic often assists patients in recovering from yeast infections. Our antioxidant defenses also determine our cellular immune capability. Ascorbate and vitamin E improve immune function, by protecting phagocyte cell membranes against damage from the very oxidants that these cells produce to kill pathogens.

The themes underlying degenerative disease are consistently those of oxidant stress, free radical attack, lipid peroxidation with consequent inflammation, and hapten formation leading to immune dysregulation. Individual cases will vary, but degenerative disease processes must inevitably follow upon universal laws established by the electrochemical nature of physical reality. The present extensive use of (-)anti-inflammatory(-) drugs and (-)antidepressants(-) may be largely replaced by the use of nutritional factors which approach the problem at a more primary level. Clearly this approach to healing or slowing oxidative degeneration will position nutritional medicine as a primary treatment modality.

\*Lehninger AL, Principles of Biochemistry, 1982, P. 362.

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## **METABOLIC ASPECTS OF CHEMICAL SENSITIVITIES**

Many intolerances that individuals present to environmental chemicals and to various foods can be linked to dysfunctions in the individual's metabolism. Such dysfunctions can be identified through laboratory tests and measurements of essential nutrient and metabolite concentrations in

body tissues and fluids: blood cell and hair minerals analyses, functional enzyme tests using erythrocytes, urine and plasma amino acids, etc.

Sensitivity to ammonia, amines and to high-protein foods follows from limited capacity for ammonia detoxification and may involve limited or subnormal liver urea cycle capacity. Catabolism of amino acids from dietary protein can be disordered in numerous ways; impaired amino group transfer due to subnormal coenzyme activity of pyridoxal phosphate or to subnormal levels of  $\alpha$ -ketoglutarate, the primary amino group receptor in human metabolism, are not uncommon. Activity of pyridoxal phosphate can be affected by enzyme assimilation of zinc as well as by intake of precursor vitamin B6.  $\alpha$ -ketoglutarate formation in the tricarboxylic acid cycle (citric acid cycle) is strongly dependent upon enzymes that depend on manganese and magnesium for their catalytic activity.

Sensitivity to alcohol and to aldehydes may occur if the enzyme aldehyde dehydrogenase is weak. This FAD-linked metabolism enzyme normally oxidizes acetaldehyde (from the essential amino acid threonine) to acetic acid. This enzyme uses niacin in the form of NAD as a cofactor, and the enzyme protein contains iron and molybdenum which must be adequate for proper enzyme activity. The enzyme alcohol (ethanol) dehydrogenase is activated by zinc; it forms acetaldehyde from ethanol. Weakness in aldehyde dehydrogenase automatically leads to alcohol intolerance as well as to intolerance of acetaldehyde, formaldehyde, and other aldehydes such as are present in glues, resins, and building insulation material.

The metabolism of the nutritionally essential amino acid methionine is notoriously sensitive to coenzyme activity of pyridoxal phosphate and to other factors which may impair its enzymatic steps. Taurine is an extremely important metabolite of methionine or cystine, and impaired metabolism of methionine tends to lower taurine levels. A low methionine/cystine diet or incomplete digestive proteolysis or malabsorption can cause reduced levels of taurine. Disordered renal transport also can lead to subnormal taurine in liver cells. Inflammation of the epithelial tissue in kidney tubules and hyperaminoacidurias in general (renal acidosis) also appears to affect renal conservation of taurine (clinical observation).

When taurine is low, extreme sensitivities to environmental chemicals can develop. Taurine mediates the chemical oxidation sequence initiated with respiratory burst in phagocytes for microbicidal activity. When taurine levels are low, this immune system chemistry is unregulated with respect to scavenging OCI and formation of aldehydes. Also possible when taurine is low are the following degenerative chemistries: formation of nitriles from chloramines, oxidation of methionine to methionine sulfoxide in chemotactic peptides (inactivation of methionine enkephalin?), and oxidation of mercaptans to sulfur acids.

Taurine is a key component of bile acid (with glycine). If bile synthesis is disordered, then it is also possible that assimilation of vitamins A and E (and other lipid-soluble vitamins) is

disordered since the intestinal absorption of lipid-soluble vitamins is bile sensitive. Assimilation of essential and dietary fatty acids also may be affected. Low taurine can also be coincident with electrolyte mineral imbalances at the cellular level.

Hence and individual's tolerance for ingestion of exogenous chemicals as well as his tolerance for foods strongly depends upon the state of his metabolism. Metabolic weaknesses can lead to a great variety of intolerances. Bolstering metabolism weaknesses must join avoidance strategies, diet rotation, and neutralizing doses in combating allergic-like sensitivities or maladaptive reactions to chemical substances.

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### **A GENERAL MODEL FOR BIOCHEMICAL AND ANATOMICAL SUBSTRATES OF HIGH SENSITIVITY TO ENVIRONMENTAL SUBSTANCES**

The unusual sensitivity of many individuals to environmental agents often results in presenting symptoms that include features suggesting central nervous system mediation. A difficulty has been the diversity of agents that can result in these symptoms, and the variation of the symptoms themselves. We have studied a number of unique cases of such heightened sensitivity and have been able to conduct biochemical, neurological and computerized electroencephalography studies of each case under controlled circumstances. It has become evident that many of the symptoms so often encountered in these individuals clinically are mediated by anterior ventral forebrain structures that have greater accessibility to blood-borne and airborne substances than does the remainder of the central nervous system. Moreover, the biochemical neurotransmitter systems in these specific areas are also affected by certain foodstuffs that occur in the common diet. Amino acids can increase the available pools of certain neurotransmitters. Sugars can seriously reduce the release rate of certain neurotransmitters. In addition, certain synthetic agents can gain rapid access to central nervous sites to perturb metabolism and neurotransmitter or neuro peptide activity.

We have studied several cases with computerized EEG before challenge, during challenge (on a double blind basis) with a known offending agent, and carried out behavioral analysis at each point. These cases provide confirmation, along with on-line biochemical studies of plasma, of the model presented that can account for the locus and biochemical substrate for many types of chemical hypersensitivity syndromes encountered clinically.

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## **THE TWENTY-FOUR HOUR SOCIETY: CONFLICTS BETWEEN ENVIRONMENTAL AND BIOLOGICAL TIME**

The last 100 years—a mere instant on an evolutionary time scale—have seen a fundamental change in the world we live in. Throughout the millions of years of evolution on this steadily-rotating planet, humans have been exposed to a regular 24-hourly cycle of day and night. But in 1882 Thomas Edison unlocked a Pandora's box with his invention of electric light. It not only became a personal choice whether to sleep during the night or the day, but the creation of that option demanded, by 1984, that 21 million Americans work the "graveyard" (night) or evening shifts in order to maintain the services that a 24-hour-a-day society demands. The problem was further compounded by the introduction of the jet airplane in the 1950s which now whisks hundreds of millions of passengers each year across time zones so that their bodies are confronted with day when it ought to be night.

Modern man readily becomes out-of-synch with his environment because he is equipped with circadian (approximately 24-hour) clocks within the brain which govern rhythms of sleep and wakefulness, alertness, performance, and virtually every aspect of our physiology and behavior. These internal clocks, designed for the highly predictable world of our origins, adjust only slowly to changes in the timing of light and dark. The result is that after rapid travel across time zones, or rotation onto a new shift, people are forced to work at a biological time of day when their bodies are geared for sleep. Alertness is low, reaction time is reduced, productivity is seriously decreased, and errors are more likely to be made and accidents to occur. The consequences can be enormous—the Three Mile Island nuclear power plant accident happened at 4 a.m. with a crew that had just rotated onto the night shift; truck drivers have single vehicle accidents eight times more frequently at 5 a.m.; airline pilots fall asleep in the cockpit and overshoot the airport.

The consequences are not confined to increased risk of accidents or to sleep loss and insomnia, although 80-90% of shift workers have serious problems with chronic sleep deprivation. The risk of heart disease and the incidence of stomach ulcers and digestive problems are far higher in rotating shift workers. Animal studies also suggest that life expectancy may be reduced by 5-20%.

Yet this is the way that modern society is developing. Each year an additional ½-1% of the working population is being switched to shift work schedules. One out of every four working men and one out of every six working women now alternate work between day and night. The major TV networks adopted 24-hour-a-day programming during the past year, and five million TV sets are turned on between 2 a.m. and 5 a.m. each day. With increasing automation in industry, and the enormous capital costs of industrial plants, the trend is to require increasing numbers of people to work when their bodies are geared for sleep.

Recent biomedical research has established that there are biological clock (circadian pacemakers) located in the hypothalamus which time our sleep-wake cycle, hormonal patterns, and when we feel alert or drowsy. These clocks have a natural day length, depending on the species, that is either shorter or longer than 24 hours (e.g. 23 hours in mice and 25 hours in humans). To keep in synch with dawn and dusk, these clocks are reset each day by light falling on the eyes, and the information is relayed via a retino-hypothalamic tract to the pacemakers in the brain. The apparent locus of a circadian pacemaker in the human brain was only located three years ago, but many secrets have already been unlocked as to how the clocks work and how they may be reset.

The property of these clocks which made them so well suited to the highly predictable environment of our origins is that they are hard to shift by more than an hour a day. However, this is the root cause of the problem that humans have in adjusting to the schedules of modern society. Many of the people who staff our hospital, fly our planes, or work in our industries and power plants have their body times perpetually out-of-synch with their imposed schedules of work and rest.

In the past few years research in circadian physiology has started to provide some practical solutions. We have shown that when the shift work schedules at an industrial plant were scientifically revised to facilitate the adjustment of the workers' biological clocks to changes between shifts, 20-30% increases in productivity, a 39% reduction in personnel turnover, an 87% increase in satisfaction with the schedules, and a 27% reduction in health complaints were achieved. At the same time, new techniques for correcting certain forms of sleep disorders have been developed that are based on circadian principles. Furthermore, in the laboratory certain pharmacological agents have been shown to be effective in resetting biological clocks and might, in the future, be useful in correcting disparities between body time and the work-rest schedule. Thus biomedical science at last seems ready to tackle a 100-year old problem.

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## **HEALTH ASPECTS OF ENVIRONMENTAL ELECTROMAGNETISM**

Consideration of the role of electrical forces in biological systems began with a move away from a purely chemical view of life, and towards one that emphasized electron dynamics and the electrical properties of biological tissue. Studies of the physiological role of the body's intrinsic electrical signals led to experiments on the therapeutic effects of artificial signals. A variety of devices are now available for treating bone nonunions, and intense efforts have begun to exploit other potential applications of electromagnetic therapy. These efforts include the areas of soft tissue growth, wound healing, infection control, and the diagnosis and treatment of cancer. Preceding this developmental period of bioelectricity, electricity itself had become firmly established in society. There was a proliferation of transmitter towers, high-voltage lines, and the innumerable devices they serve, and it resulted in environmental levels of electromagnetic energy comparable to those being studied in the laboratory and applied clinically. The actual extent of the health consequences attendant uncontrolled environmental exposure to electromagnetic energy are presently only dimly perceivable; the existence of such consequences is no longer in serious doubt.

The first transmission line was built in 1882, and five years later the first transmitter-receiver system was successfully operated. From this beginning came our modern electrical power and communications systems. Traditional engineering concepts, at least in the United States, sanctioned only two electrical bioeffects, namely heating and shock. They became the sole design criteria with regard to possible side-effects. The rule developed that electromagnetic energy could be beamed through the environment or directed along high-voltage lines at any intensity level up to that which produced heating or shock.

It is convenient to divide environmental electromagnetic energy into the power and broadcast regions. The power system operates at a single frequency of 60 hertz and includes all transmission lines and line-powered devices. The Broadcast frequencies are characterized by wireless energy transmission and include radio, TV, radar, and microwave ovens. The traditionally-recognized electrical bioeffects can occur only above 10,000 micro watts (to be read "micro watts per square centimeter") or, at the power frequency, if one touches an energized wire. Thus, in all American jurisdictions and in the military, electrical sources are considered safe with regard to side-effects if these precautions are followed.

In the USSR regulation of environmental electromagnetic energy followed a much different course. Soviet scientific literature contains many reports of biological effects below 10,000 micro watts, and, many reports of biological effects due to power-frequency electric and magnetic fields - effects associated with merely being in the vicinity of high-voltage lines. Based on these studies, national exposure standards were adopted; the standard at broadcast frequencies is 1 micro watt.

What are some typical levels of environmental electromagnetic energy in the United States?  
Mount Wilson is a high point where many commercial broadcast installations have been build to

serve Los Angeles. A level of 1,000 micro watts was measured by the Environmental Protection Agency in the Mount Wilson post office. There is a similar transmitter concentration near most other U.S. Urban areas. The elevation necessary for efficient energy transmission is frequently attained by mounting transmitters on tall buildings. This can produce high levels in nearby buildings. About 2 million Americans are exposed daily to environmental electromagnetic energy above the USSR safety levels.

There have been many studies - mostly Soviet - describing non-thermal biological effects due to broadcast-frequency radiation (Figure 1). Many studies have also shown the existence of biological effects of electrical and magnetic fields such as arise from the electrical power system. Several such studies are shown in relation to the fields produced by a typical high-voltage line (Figure 2). Beischer, at the Naval Aerospace Medical Research Laboratory, found that one day's exposure to a 1-gauss magnetic field caused elevated serum triglyceride levels in humans. We found that electric fields of 3,500-15,000 volts per meter altered the growth rate and mortality of mice. Wertheimer, of the University of Colorado, found an association between child cancer and transmission lines. These studies used fields which exist within the first 100 feet of a high-voltage line. The remaining five studies used field intensities which exist at the indicated distances from a typical 765 kV line. Lott, of North Texas State University, found altered EEGs in rats after 90 minutes' exposure. Wever, of the Max Planck Institute, found that weak electric fields altered human circadian rhythms after several weeks. Noval, of Temple University, found that 30 days' exposure to an electric field equivalent to that at 2,000 feet from the line produced stunted growth in rats. There are many other similar reports of biological effects.

Electromagnetic energy does not act only on a single target organ. There is a clear pattern in the literature indicating that electromagnetic energy is a biological stressor - that it places a nonspecific physiological demand on the exposed organism. When the organism's capacity to resist has been exceeded, a clinical sign - an effect - is manifested whose nature depends in part on the predisposition of the exposed subject. It follows, therefore that the exposure of substantial part of the population in an uncontrolled, random, and essentially involuntary manner amounts to a significant public-health (and ethical) problem.

**Figure 1 and Figure 2 (Not Displayed)**

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**RESPIRATORY EFFECTS OF SULFUR DIOXIDE AIR POLLUTION IN  
ASTHMATICS**

This presentation discusses effects of sulfur dioxide (SO<sub>2</sub>) inhalation in asthmatics, and strategies for personal protection against such exposure. It emphasizes results of laboratory studies of human volunteers exposed to controlled environments containing SO<sub>2</sub>. Epidemiologic studies often have shown associations between elevated ambient levels of SO<sub>2</sub> and/or particulate matter, and increased rates of illness or premature death. Since SO<sub>2</sub> and particulates may be closely associated in the atmosphere, it is often difficult to separate their effects epidemiologically. This is not a problem in controlled studies of human volunteers, which have been applied to SO<sub>2</sub> alone, various particulate species alone, and gas-particulate combinations.

A number of such controlled studies of SO<sub>2</sub> during the 1960's and '70's indicated that increased airway resistance and symptoms of irritation could occur with exposure, but only at concentrations of 1ppm or higher (above the common ambient range) in most subjects. However, in 1980, asthmatic subjects were reported to be consistently and markedly more reactive to SO<sub>2</sub> than similarly exposed healthy subjects. Subsequently, statistically significant increases in airway resistance were reported in a group of moderately exercising asthmatics exposed to as little as 0.25 ppm for 10 minutes.

The first SO<sub>2</sub> exposures of asthmatics in our laboratory failed to show significant effects at 0.25 or 0.50 ppm. This inconsistency with previous findings most likely related to differences in the mode of breathing during exposure. Mouthpiece breathing, as employed originally by other researchers, typically produces more severe responses than natural unencumbered breathing, as employed by our group. The difference is at least partly explainable in terms of the high solubility of SO<sub>2</sub> in aqueous media. Natural breathing occurs at least partly through the nose, even during heavy exercise. The moist surfaces of the nasal cavity scrub SO<sub>2</sub> effectively, reducing the dose to the bronchial passages where constriction occurs. But with sufficiently heavy exercise, we found that even natural breathing of SO<sub>2</sub> can cause some asthmatics to experience symptoms and increased airway resistance at concentrations at least as low as 0.4 ppm. The effects develop in less than 5 minutes. Their severity appears to depend on the dose rate of SO<sub>2</sub> (concentration times the subject's ventilation rate), rather than on the total dose. In most asthmatic subjects, the effects disappear in less than 1 hr with rest, even if SO<sub>2</sub> exposure continues. Many asthmatics experience symptoms and airway constriction with exercise even in very clean air, so care must be taken to differentiate the effect attributable to exercise from that attributable to SO<sub>2</sub>. Also, cold or dry air can aggravate the exercise-induced effect and may enhance the SO<sub>2</sub> response. This is being studied currently.

Recent controlled SO<sub>2</sub> exposure studies leave little doubt that respiratory effects can occur at concentrations within the possible ambient range, in a particular small segment of the population-asthmatics who exercise heavily. Whether these "positive" findings have any connection with earlier "positive" epidemiologic findings (not related specifically to exercising asthmatics) is not yet clear.

Advice about personal protection against impending SO<sub>2</sub> exposure should of course be tailored to individual patients, but the following general recommendations have wide usefulness. First, minimize the need for extra ventilation; there is an approximately proportional increase in ventilation with increased exercise. Second, minimize mouth breathing; mouth breathing is

generally less efficient in scrubbing water-soluble pollutants than nose breathing. Third, stay indoors, but avoid indoor pollutants, including SO<sub>2</sub> producing heating fuels. Fourth, if air purification devices are available, use them.

In summary, recent information from controlled human studies has focused public health concern on short-term peak SO<sub>2</sub> exposures in exercising asthmatics. Lung function decrement or symptoms or both can result, but more attention is needed in assessing the medical importance of these effects. Possible exacerbation of effects by coincidental cold or dry air is being studied. By using certain avoidance strategies and personal protective devices, irritation and broncho spasm from SO<sub>2</sub> exposure can be minimized.

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## **WATER CONTAMINANTS**

Water quality is a persistent problem causing a growing concern by the public and health care professionals. Newer techniques now enable measurement of organic chemicals. Analysis by gas chromatography and mass spectrometer have yielded clues to contaminants and naturally occurring substances. Many compounds once thought safe - especially synthetic organic chemicals can have substantial health risks and effects. "Spring" and bottled water companies have grown dramatically in recent years.

Individuals with hypersensitivity are having more difficulty in finding water they can tolerate. Special attention to the source, handling and treatment and packaging is mandatory. Individual challenges to specific waters are then necessary to determine acceptance.

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## **"AUTOIMMUNE ENDOCRINOPATHY IN ENVIRONMENTAL DISEASE"**

There exists an autoimmune condition consisting in polyendocrinopathy, Candida susceptibility and allergies resulting from immune dysregulation. A higher incidence of cancer is expected in this group because of the immune dysregulation, and, other autoimmune phenomena like lupus and rheumatoid arthritis also occur more frequently in these patients. The most common form we

see in our environmental practice is thyroiditis followed by what we think to be oophoritis and then diabetes. We have not seen adrenalitis or para thyroiditis. Just recently we have been given access to measurement of the ovarian antibodies by which we hope to confirm the diagnosis of oophoritis. Other autoimmune measures which are available include ANA titers, antiparietal cell antibodies, anti-muscle antibodies, parathyroid antibodies and adrenal antibodies. We suspect a specific 'T' suppressor cell defect because total 'T' cells are normal. This syndrome is hereditary and as such must have a trigger. We recognize chemical exposures, viruses, Candida, radiation, physical and emotional trauma, mis-nutrition and perhaps others as the environmental insults that trigger a disease waiting to happen. Chemical overload, childbirth and Candida are the most common initiating events noted in our office.

Thyroiditis: We suspected autoimmune endocrinopathy from the following history, symptoms and signs:

- Family history of endocrine disease, especially thyroid problems.
- Patient history of onset of disease at puberty or postpartum.
- Suspicion by physician of thyroid disease in the patient in the face of normal thyroid indices, or, prescription of thyroid medication at some time in the past.
- Menstrual irregularities.
- A lumpy (not tender) thyroid.
- Universal reactivity on testing with failure to hold endpoints.
- Good but incomplete response to environmental control
- The presence of Candida disease
- Morning fatigue
- Bad asthma.

The commonly used hemagglutination technique is not sensitive enough and so we measured thyroid antibodies by RIA available at Nichol's Labs in Pasadena (800) 854-7197. Out of 375 patients suspected of having thyroiditis and who were tested for the presence of antithyroglobulin and antimicrosomal antibodies by RIA, 88 had one or the other or both antibodies present. It is very important to note that of the 88 antibody positive patients, 86 had normal indices.

It is terribly important to recognize this syndrome of immune dysregulation, endocrine disease, Candida and allergies in order to be forewarned of the increased possibility of cancer, and, in order to provide maximal and optimum medical care of the endocrine disease as well as the allergic problems.

Failure to consider each component of the syndrome lessens the patient's chance for full control and recovery. Treatment of the endocrine component is the keystone in recovery for a number of patients. Best results are achieved when all the factors are balanced and treated.

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## **EFFECTS OF ENVIRONMENTAL POLLUTANTS ON THE THYROID**

Several organic compounds, naturally occurring and anthropogenic, can alter thyroid gland structure and function by acting directly on the gland or indirectly by affecting its regulatory mechanisms and/or the peripheral metabolism and excretion of thyroid hormones. The gland may increase in size becoming a goiter, but thyroid hormone secretion, depending on dietary iodine intake or presence of underlying thyroid disease, may remain adequate or become insufficient inducing hypothyroidism.

A. Resorcinol and Humic Substances - In the 1950's the goitrogenic effect of resorcinol was demonstrated when patients applying resorcinol ointments for the treatment of varicose ulcers developed goiters. Subsequently, investigators confirmed both the in vivo and in vitro antithyroid effect of resorcinol and several other parent phenolic and phenolic-carboxylic compounds. Concomitantly, it was shown that these antithyroid compounds are in fact degradation monomeric products of humic substances.

Humic Substances (HS) are the principal organic components of soils and waters. HS are high molecular weight complex polymeric organic compounds. HS are also important constituents of coals, shales and other carbonaceous sedimentary rocks. At the heart of the process of humification are the production and polymerization of phenolic and carboxylic benzene-rings. Up to 70% of flavonoid HS may be made up of these subunits. This in itself is sufficient reason to question and investigate a relationship between the phenolic derivatives of humic substances and thyroid disease.

However, the need for such investigation has become more imperative, particularly in the U.S., since the limited supply of natural gas and petroleum has focused increased attention on development and expansion of processes for the conversion of coal to liquid and gaseous fuels. Phenols are the major organic pollutants in aqueous effluents from coal-conversion processes. Coal-conversion waste waters contain in addition to phenolics, thiocyanate and disulfides, also known to possess antithyroid and goitrogenic properties. Resorcinol and other antithyroid phenolic pollutants comprise as much as 5 g/liter in aqueous effluent from a bench-scale coal-liquefaction unit. Besides other toxic effects of phenols, we must add at present, their potential for a deleterious effect on the thyroid, reinforcing the need for their removal if coal-conversion processes are to be environmentally acceptable.

B. PCBs, PBBs and Other Organochlorines - Polychlorinated Biphenyls (PCBs) have been of national concern since 1971, but the risk to human health from chronic exposure to these toxic substances is still uncertain, due to imperfection and limitations of risk assessment techniques. The uncertainty extends to the potential harmful effects of PCBs and polybrominated biphenyls (PBBs) on the thyroid. Other organochlorines (pp'-DDT, pp'-DDE and Dieldrin), heavily used as insecticides and resistant to environmental degradation, are known to cause marked alterations in thyroid gland structure and function of birds. However, the impact of these pollutants on the human thyroid is unknown.

C. Phthalates - Phthalate esters are among the priority pollutants listed by the U.S. Environmental Protection Agency. Like resorcinol and organic disulfides, phthalates have been frequently identified as water pollutants in the U.S., as well as in the water supply of an endemic goiter district in western Colombia. Phthalates undergo degradation by bacteria with production of dihydroxybenzoic acid (DHBA) known to possess antithyroid properties. Fish actively concentrate and metabolize phthalates. Whether these abundant pollutants exert deleterious effects on the thyroid of human and other animal species has not been investigated.

D. 2,4-Dinitrophenol - DNP is an insecticide, herbicide and fungicide which causes toxicity by the uncoupling of oxidative phosphorylation. Decrease of serum thyroid hormones concentration occurs after the administration of DNP in man. DNP inhibits pituitary-thyroid regulation and accelerates peripheral metabolism of thyroid hormones in the rat. The public health impact on the thyroid of this toxic pollutant is unknown.

Lack of quantitative assessments of the thyroid risk from exposure to the environmental pollutants precludes valid risk/benefit analysis of their health and social impact versus the cost to remove them from the environment. It is on the basis of such data that policy decisions should be made concerning the need to develop cost/effective techniques for the removal or inactivation of the offensive agents. At present, medical treatments for the individual but not measures for prevention and control at community level, are applied in the United States.

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## **NUTRITION AND AGING**

Although it is often claimed that nutrition influences the aging process, the only unequivocal evidence supporting this view is the action of food restriction on laboratory rodents. It was in 1935 that McCay and his colleagues first described the increase in length of life when weaning rats were food restricted throughout post-weaning life. This basic finding has been repeatedly confirmed and the general conclusions that can be drawn from these subsequent studies are the following: 1) Food restriction extends the life span of rodents; 2) food restriction retards age-related physiological deterioration in rodents; 3) food restriction retards age-related disease processes in rodents.

Our recent research on the male Fischer 344 rat has provided some further understanding of this phenomenon. Food restriction started in early adult life was found to be just as effective in extending life span as food restriction started soon after weaning. On the other hand, food restriction limited to the childhood and adolescent period of life was much less effective. Restriction of protein but not calories from six weeks of age on increased the median length of life, but did not influence life span. Age-related physiological deterioration was markedly retarded by food restriction started soon after weaning or started in early adult life but not by

food restriction limited to childhood and adolescence or by protein restriction without caloric restriction.

Chronic nephropathy and cardiomyopathy are major disease processes occurring in the male Fischer 344 rat. Food restriction started soon after weaning or started in adult life markedly retarded the progression of these disease processes and protein restriction without caloric restriction was also quite effective in this regard. Food restriction started soon after weaning or in early adult life also markedly delayed the occurrence of neoplastic disease, but protein restriction without caloric restriction did not.

Although these findings clearly show that food restriction slows the aging process, they provide no insight on the mechanism of this anti-aging action. However, over the years, several hypotheses have been proposed in regard to mechanism; four of these have been seriously received by the scientific community.

- Food restriction retards the aging process by delaying maturation.
- Food restriction retards the aging process by slowing growth and increasing its duration
- Food restriction retards the aging process by reducing body fat content.
- Food restriction retards the aging process by reducing the metabolic rate.

Data has been obtained in our laboratory that indicate none of these hypotheses is addressing an important mechanism by which food restriction delays the aging process. We propose a general metabolic hypothesis as a framework for the further exploration of this fundamental aging phenomenon.

Is the anti-aging action of food restriction also true of other mammalian species including humans? There are no hard data which can be brought to bear on this question. Nor is it likely that such data will be obtained in the near future because the resources needed to explore this question in long-lived species make the execution of such studies unlikely. However, it seems likely that this highly reproducible effect involving a spectrum of rodent species (rat, mouse, hamster) will be true of most if not all mammalian species. This is not meant to imply that such a manipulation would extend the human life span past the 100- to 115-year range that we have come to accept as the human life span. Indeed, it seems likely that of the many billions of people who have lived, some have had dietary regimens similar to the life-prolonging ones given to rats and that it is this group of people which have yielded those who have lived to the 100- to 115-year human life span.

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## **AROMATIC COMPOUNDS - A NEW DIMENSION IN TREATING ENVIRONMENTAL DISEASES**

Flavanoids, gallo-tannins, and many other aromatic compounds have been identified as toxins inasmuch as they have inhibitory effects on enzyme systems. For example, rutin (quercetin) and gallic acid inhibit the enzyme catechol O-methyl-transferase which catabolizes circulating epinephrine. The result is elevated levels of epinephrine with associated symptomologies. Inhibitors of monoamine oxidase enzymes have likewise been identified in foodstuffs, pollens, perfumes, air pollutants, etc. These chemicals prolong the life of such monoamines as dopamine, noradrenaline, and serotonin. Elevated levels of neurotransmitters may also occur as a result of ingestion, or inhalation, of their precursors, or enzyme co-factors needed in their synthesis. There is likewise evidence that steroids of both endogenous or exogenous origin may have detrimental side effects on both females and males. A successful treatment regimen has been developed which includes systematic challenge of the patient with the chemicals identified as causative agents until tolerance has developed to that chemical and others of like structure.

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## **MODULATION OF NEUROPSYCHIATRIC RESPONSES USING SUBLINGUAL NEUROTRANSMITTERS**

### Abstract

A growing body of neurochemical evidence suggests that the ingestion of large doses of phenyl food constituents which serve as neurotransmitter precursors, affect the rate at which neurons synthesize and release specific neurotransmitters in normal subjects, thereby affecting behavior and other processes controlled by the brain (1)

We showed in short term controlled clinical studies that the neurotransmitter molecule itself (dopamine, norepinephrine) administered in nanogram doses abolished purposeless behavior in children with Attention Deficit Disorder (A.D.D.).(2)

In the present study we assessed the behavioral and neuromuscular effect of the administration of the neurotransmitters dopamine, norepinephrine, serotonin and histamine administered sublingually in nanogram amounts in 28 patients with clinical disorders thought to be related to alterations in either neurotransmitter synthesis, transport, release or receptor-site responsiveness. These include four patients each with schizophrenia, mild Parkinson's disease, myasthenia gravis, narcolepsy, multiple sclerosis and eight patients with catalepsy. These patients also demonstrated cutaneous hypersensitivity (reaginic) to pollens, dust, molds and food allergenic extracts; in addition they demonstrated abnormal reduction in the levels of T suppressor

lymphocytes suggesting the presence of an impairment in immune regulation. We found in this study using scores for the Profile of Mood State (P.O.M.S.) That the administration of serotonin, compared to placebos, significantly increased subjective fatigue and objective sleepiness; histamine consistently provoked anger, hostility and confusion whereas norepinephrine administration was repeatedly associated with elevated levels of tension-anxiety or depression-despair.

Using neurological measures we found that the sublingual administration of histamine, compared to placebos, consistently reversed the narcoleptic state and increased muscle strength in patients with myasthenia gravis. Dopamine administration, compared to placebos, reliably reduced the tremor in mild Parkinson's disease; decreased cutaneous anesthesia and increased deep tendon reflexes and muscle strength in catalepsy; norepinephrine and dopamine were significantly superior to placebos but indistinguishable from each other in modifying distorted ideation in patients with schizophrenia. The neurochemical rationale underlying the potential therapeutic use of these agents will be discussed.

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(1)Wurtman, R. J., Behavioral Effects on Nutrients, Lancet, May 21, 1983, pp. 1145-1147

(2) McGovern, Jr., J.J., Gardner, R. W., Painter, B. S. Rapp, D. J., Natural Food borne Aromatics Induce Behavioral Disturbances in Children with Hyperkinesis, International Journal Biosocial Research, Vol. 4, pp. 40-42, 1983.

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## **FOOD ALLERGY AND DIETARY MANIPULATION IN ATOPIC ECZEMA**

We have completed a long term study on the incidence of food allergy in chronic eczema and the efficacy of dietary manipulation. After a baseline week all 30 subjects went on an elemental diet, Vivonex (V), for 3-12 days. Eighteen (60%) responded to (V) with improvement in eczema and a decrease in severity ( $p < .001$ ) and frequency ( $p < .005$ ) as compared to non-responders. Responses to V occurred in 12/16 (75%) children and 6/14 (43%) adults. In the next month responders were challenged with 50+ foods so that a rotary diet of "safe" foods could be established. On the diet some improvements of eczema continued. Open or double blind challenge with "unsafe" foods caused immediate or delayed flaring of eczema and occasional diarrhea, asthma, rhinitis or edema. Food intolerance appears to play a major role in eczema; immunologic factors such as food specific IgE and IgG<sub>4</sub>, as well as immune complexes are being evaluated.

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## **OSTEOPATHY AND ECOLOGY: THE NEUROL CONNECTION**

The osteopathic and ecological physicians have recognized the importance of the autonomic nervous system's relationship to the state of a patient's health. The ecologic physician recognizes the integration of the autonomic nervous system with the immune system. A competent immune and autonomic nervous system is essential for optimal health.

Early contributors to scientific literature, including Cannon and Selye, describe the physiologic autonomic response of the human to a stressful event. Continuously applied stressors have levels that do not cause mortality lead to chronic unwellness and malaise. These stressors include allergy, hypersensitivity, toxicity, dietary inadequacy, inappropriate exercise, and the osteopathic concept of somatic dysfunction. The ability of an organism to deal with these stressors is primarily genetically mediated.

Any type or combination of stressors, be it physical, psychological or structural, leads to tissue dysfunction if severe or prolonged.

The final target of the autonomic and immune system commonly includes the smooth muscle of the vasculature in the organ system that is involved. This effect is as apparent in the vasculature of the central nervous system as it is peripherally. Vessel spasm commonly associated with vasculitis or sympathetic autonomic input is a recurrent presenting complaint to the osteopathic and ecologic physician. Vascular spasm can be due to a singular environmental cause or through complex humoral neuronal interaction initiated by structural dysfunction and segmentally activated by the spine. A combination of environmental and structural triggers may cause marked vascular reaction readily evaluated by palpatory changes, including changes in temperature, tissue texture, edema, and tenderness.

The ability to diagnose the segmental relationships by tactile skills allows the physician to determine visceral and somatic interrelationships. For example, the gastrointestinal reaction may be readily defined through palpation of the parathoracic tissues from the 5<sup>th</sup> to the 10<sup>th</sup> thoracic segments. These tissue changes allow the physician to determine quantitatively the condition of the visceral target. Furthermore, many painful syndromes associated with ecological triggers are often complicated by structural disorders. Significant symptomatic relief may follow appropriately applied physical therapy and/or manipulative therapy to the stressed areas.

The ecologically-oriented physician may overlook the structural relationships of a stressed organ system. Likewise, the osteopathic physician often does not recognize that an allergic or hypersensitivity reaction may be an important factor in the patient's musculoskeletal complaints. It is important to understand the ecologic and somatic interrelationships so the physician can apply both principles to insure an optimal outcome for the patient. To apply only one of these techniques is similar to rowing a boat with only one oar. One may get to where one wants, but the route is often erratic and prolonged.

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## **ANALYSIS OF CHLOROFORM AND OTHER TRIHALOMETHANES IN THE RESIDENTIAL ENVIRONMENT**

Based on risk assessment models, the U.S. EPA has established maximum contaminant levels for several trihalomethanes in water, the most common being chloroform. The risk assessment model assumes that the only exposure to the contaminated water is by ingestion. This study reports on the effects of inhalation as an exposure route using an experimental shower chamber connected to a municipal water supply containing 80 to 135 ug/l of chloroform. A sampling and analytical method was developed to quantify the levels of chloroform stripped from the heated water used in the test shower. The air sampling train contained a sodium hydroxide desiccant and a charcoal tube. The charcoal was desorbed in trimethylpentane and analyzed for chloroform in the 1 ug/l range by electron capture gas chromatography.

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The study was designed to assess whether ascorbic acid supplementation of up to 1000 mg/day would affect blood lead levels. Non-occupationally exposed healthy adult human male volunteers were randomly divided into three study groups according to the degree of daily ascorbic acid supplementation: control, 500mg, and 1000 mg. The subjects had their baseline blood lead levels taken prior to the start of the study and then on monthly intervals over the next three months. The findings revealed that the ascorbic acid supplementation had no significant affect on the blood lead levels.

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## **ENVIRONMENTALLY-TRIGGERED MUSCLE PAIN**

A 37-year old white female with a strongly positive family and personal history of allergy was initially seen because of recurrent classical, perennial, nasal symptoms evident since age 13. She had chronic idiopathic pruritis noted particularly in the flexures of her extremities. She had had daily headaches, abdominal pain, nausea, abdominal distension, and diarrhea for many years. She had periods of extreme hyperactivity, irritability, depression, and emotional lability, as well as severe episodes of fatigue which interfered with her ability to care for her home or her family. She had muscle aches affecting her neck, shoulders, and back which were so severe at times that they totally incapacitated her. She would spend weeks in traction in the hospital. All three of her children have classical evidence of the allergic-tension-fatigue syndrome.

On physical examination, she had mild hypertension, moderate obesity, marked scoliosis, and the deep tendon reflexes on the right were greater than those on the left.

Exposure to offending foods or chemicals caused reactions which usually occurred within 3-6 hours. She would develop progressively more incapacitating muscle spasms, headaches, intestinal complaints, and depression which usually caused her to be confined to bed. A detailed history frequently would reveal the specific offenders. With appropriate testing, we could exacerbate individual symptoms with one dilution and then relieve her medical complaints with the appropriate neutralizing dose of the antigen. She consistently showed little change to placebo injections given prior to or during antigen testing.

Her typical reaction, unless she arrived crying in severe pain, was that after antigen testing, her normal humor vanished. She would stare into space. She quickly would be placed in a bed and frequently became unconscious. Her fists usually were tightly clenched and her right leg was flexed. As her symptoms worsened, her pulse usually increased. When the neutralizing dose was approached, her eyes would slowly open, she'd begin to speak, and her hands would relax. When the neutralizing dose was found, she could extend her right leg without back pain. Usually her original symptoms would subside to various degrees during testing. Her symptoms often improved 50-100% by the time the testing was completed.

A brief movie demonstrating her typical reactions will be shown and her laboratory findings will be discussed. In this movie, you will see her enter the office with assistance, in tears, and barely able to walk or talk. She had been exposed to a number of chemicals when Christmas shopping several days before and had been so ill that she could not stand until the day she came to the office. We tested her for formaldehyde and the numerous symptoms of which she complained began to recede. We then tested her for hydrocarbons and after a brief exacerbation of symptoms, she improved to a greater degree. When she left the office, she is visible humorous, able to speak, and able to walk on her own. Her improvement is approximately 50-60%.

I have an additional 3-minute movie of the same woman showing severe TMJ pain due to banana and relieved with the correct dilution of banana.

**TYPICAL BLOOD FINDINGS:**

Serotonin (N=50-200 ng/ml, CV=17.6)

IgE - less than 5

	Serotonin (N=50-200 ng/ml, CV=17.6)				Sed Rates (N=0-20)		
	<u>Pre</u>	<u>Peak</u>	<u>Post</u>		<u>Pre</u>	<u>Peak</u>	<u>Post</u>
1 <sup>st</sup> Sugar	60	80	60	3 <sup>rd</sup> Sugar	32	22	23
2 <sup>nd</sup> Sugar	40	150	130	Rice	23	15	3
3 <sup>rd</sup> Sugar	191	190	227	White fish	33	16	30
Cherry	30	50	45	Lobster	22	21	25
Control	80	65	80				

C<sub>3</sub> (N=70-176 mg%, CV=6.3)

	<u>Pre</u>	<u>Peak</u>	<u>Post</u>
1 <sup>st</sup> Sugar	210	120	195
2 <sup>nd</sup> Sugar	170	160	170
3rd Sugar	150	150	160
Cherry	159	135	99
Control	170	160	180

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Marvin Boris, M.D., Stanley Weindorf, M.D., Robert N. Corriel, M.D., Laura S. Inselman, M.D., and Mark Schiff, M.D.

**ANTIGEN INDUCED ASTHMA ATTENUATED BY NEUTRALIZATION THERAPY\***

**ABSTRACT:** The effect of neutralization therapy on animal antigen-induced broncho spasm was evaluated with pulmonary function testing in double-blind study on 19 subjects with a history of wheezing to animal dander. The 9 males and 10 females were challenged with inhaled animal antigen to determine the dose causing a 20% decrease of FEV<sub>1</sub>. The neutralizing dose was determined by the five fold serial dilution skin technique. On two subsequent days, one week apart, the specific antigen neutralizing dose or placebo was injected. Twenty minutes later, broncho provocation was performed with the dose causing the 20% decrease of FEV<sub>1</sub>. The FEV<sub>1</sub> decreased 31.8% from baseline in the controls, 27.4% post placebo, and 10.7% post neutralization injection (p<0.01). The FVC, FEF<sub>25-75</sub>, and PEF had similar responses. These results indicate a diminution in animal dander induced broncho spasm with neutralization therapy and may have a therapeutic implication in wheezing resulting from animal dander exposure.

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## **THE ROLE OF FOLLICULAR DENDRITIC CELLS IN THE LONG TERM MAINTENANCE AND REGULATION OF THE HUMORAL IMMUNE RESPONSE**

The mechanism responsible for the long-term maintenance and regulation of immune responses are clearly of major significance. For example, in many allergic states we are attempting to modulate responses many weeks to years after they were initially induced. If immunological intervention is to be successful in these diseases, it is important that we understand how immune responses are maintained and regulated. Nevertheless, the vast majority of research has been directed toward understanding the induction of immune responses rather than toward understanding mechanisms responsible for long term maintenance of a specific response. Consequently, our understanding of the mechanisms responsible for maintenance of immune responses and our ability to manipulate an immune response during the maintenance phase is limited.

Our work has been primarily directed toward understanding the mechanisms responsible for the long term maintenance and regulation of the humoral immune response. Specific antibody is maintained *in vivo* for months or years. It is catabolized at a reasonably constant rate but it is produced in a cyclical fashion. The regulatory mechanisms responsible for this cyclical production of antibody appear to include an antibody feedback system and unique cells which trap and retain antigens *in vivo* for months or years. Since these special antigen-retaining cells are restricted to lymphoid follicles and since they are dendritic in shape, they are referred to as follicular dendritic cells (FDCs). Lymphoid tissues containing antigen bearing FDCs have been studied in organ cultures as well as in cell cultures. In the absence of specific antibody in the cultures the lymphoid cells spontaneously begin to produce antibody specific for the antigen retained on the FDCs. This production is inhibitable by the addition of specific antibody and the nature of this antibody feedback system has been studied.

Since FDCs appear to play a major role in the maintenance of antibody production, we have recently devised techniques for isolating FDCs and a number of cytological features of these cells have been determined. Most FDCs floated on a BSA column at the low density of 1.065 gm/cc. This procedure provided a means for substantially enriching for FDCs since up to 5% of the cells floating on BSA were FDCs and this contrast with a concentration of less than 1% FDCs in normal lymphoid cell suspensions. Once fixed with glutaraldehyde and stained, FDCs had a characteristic acidophilic cytoplasm and a euchromatic nucleus with marginated chromatin. Under Normarski optics and by scanning electron microscopy, FDCs appeared to possess one or two distinct cell bodies (soma). From one pole of these somata numerous dendritic like cell processes radiated. In whole mount preparations, FDCs had the appearance of "sun bursts." The slightly ovoid somata tended to vary between 4 to 6 um in diameter. The dendritic processes were thicker near the soma (0.2-0.3 um) but distally became thinner (0.1 um) with or without branching. Some of the longer processes measured over 60 um in length. Unlike macrophages

FDCs were nonadherent, nonphagocytic, esterase negative to weakly positive, and lacked macrophage surface markers like Mac 1. However, like macrophages they were Fc positive, Ia positive, and were positive for the common leukocyte antigen. One objective of future work will be to determine if the ability of an animal to maintain an immune response can be reduced or eliminated by selectively damaging antigen bearing FDCs. Work toward developing an FDC specific monoclonal antibody which may service this purpose is in progress.

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### **COMBINED IMMUNOLOGIC - PHARMACOLOGIC (CIP) AGENTS THAT MAY BE USEFUL IN THE MANAGEMENT OF MALIGNANT DISEASE**

There is sufficient information concerning the host defense system, and the abnormal physiology of malignant cells to indicate there are some points at which malignant cells should be vulnerable to a combination of well researched legal, safe, low cost, non toxic and universally available medications.

This paper discusses some of these points, and some agents which meet the criteria of being well researched, legal, safe, abundant, low cost and universally available. It suggests one such combination, and presents case reports.

It is an appeal to the members of this group to apply their unique expertise and knowledge to this field.

It is a call for more workers.

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J. Krop, M.D., J. Swierczek, M.D., Ph.D., C. Radulescu, Ph.D.

### **"THE APPLICATION OF OPIATE RECEPTOR ANTAGONIST IN THE MANAGEMENT OF A UNIVERSAL REACTOR" (Case Presentation)**

#### ABSTRACT

Addiction phenomenon, very well recognized in patients with environmentally induced illness, is poorly understood. With the discovery of the opiate receptors, it has been hypothesized that addiction might be related to endogenous morphine-like substances (enkephalins and endorphins) which action can be effectively blocked by naloxone.

We would like to report a patient who from an ecological point of view is an universal reactor. This was a 33 year old woman (W.W.) who for many years presented psychiatric manifestations and a variety of symptoms from CNS, GI tract and respiratory tract. On many occasions her complaints were induced by food allergens, antibiotics, a majority of drugs and chemicals such as SEA, formaldehyde, TS, perfumes and inhalants; mostly molds and Candida. She was tested for different antigens to find a proper neutralizing dose. The testing usually provoked such severe reactions that the procedure for testing one antigen usually lasted between seven to ten hours without any apparent neutralizing effect. The neutralizing dose very often was not possible to establish and other measures such as oxygen, intravenous Natrium Bicarbonate, Vitamin C IV, Calcium Gluconate, and adrenalin only partially relieved the symptoms.

During the last ecological testing in the office, the patient was re-tested for mold mix (Bencard) because the previous neutralizing dose was no longer effective. During the test she produced the usual severe symptomatology. The best dose was #9 but it was not completely effective and appeared vague. After seven hours of testing, the patient remained un-neutralized and appeared to have many symptoms, the majority of which resembled an overdose of morphine. The symptoms are as follows: clammy hands, tachycardia; 120-130 beats per minutes, hot and cold flushes, severe cough with broncho spasms, uncontrollable sneezing, itchy eyes, ear pressure and pain, headache, dizziness and nausea, mental cloudiness, mood changes ranging from severe depression to extreme highs and uncontrollable laughing, tiredness, abdominal pain, back pain in the right lumbar area, muscular and joint pains, generalized muscular tremors, severe grand mal seizures, generalized muscular spasms and hypocalcemic posturing of hands.

We decided to apply opiate receptor antagonist in an attempt to neutralize nonspecifically the symptoms. Naloxone was injected S.Q. at 0.4 mg. Three minutes after the injection all symptoms had disappeared completely. She was free of all symptoms for one and one half hours and returned to her apartment which is heavy in mold content. Four hours later she became symptomatic again. The next dose of Naloxone was injected resulting in complete disappearance of her symptoms as after the first injection.

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### **THE CHEMICAL EFFECT: ACTIVATOR OF THE PSYCHOTIC PROCESS**

The concept of functional psychosis denotes no known or demonstrable physical or organic base as a prerequisite for that diagnosis. Psychological profiles of environmentally sensitive patients

very often reveal what appear to be active psychotic processes during the reactive phases of the disease. While medical diagnostic techniques fail to expose presence of lesions in these patients, our studies indicate that a diagnosis such as toxic brain syndrome or organic brain syndrome (unknown etiology) could be applicable. Results of extensive psychological testing yield symptom patterns traditionally labeled as "schizophrenic or affective" psychosis related to an ecological patient population. Also, comparisons of a group of environmental patients with a group of orthopedic patients show the environmental patients scoring significantly higher on measures of those symptoms. This syndrome manifests in a pathological level of alienation from self and from others. Preoccupation with physical malfunction is prevalent as well as withdrawal from family and friends. Emotions tend to be flattened, ideation irrational, and patients tend to regress into states of pronounced dependency and immaturity, feeling a loss of impulse control and a sense of emotional, cognitive and perceptual distortion. Symptom formation often varies with chemical precipitant. Reduction of total stress load has been most effective in helping these individuals to regain physical and emotional stability, and remission or partial remission of symptoms usually occurs consistent with avoidance of specific chemicals identified as incitants.

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## **MEASURING DEFICITS IN ODOR PERCEPTION**

No generally accepted protocol for measuring odor deficits exists. The traditional approach to the problem is essentially a taxonomic description of various forms of anosmia but without a clear connection between methods, symptoms, and causes. The present paper will suggest that one can now begin to establish such a rational based on contemporary psychophysics and research on human and animal neurophysiology. While the usual sensory evaluation is largely limited to so-called thresholds, it is proposed that four categories of perceptual abilities can be considered: (1) sensitivity (detection of low odorant concentrations); (2) capacity and tolerance (analogous to pitch and loudness perception, respectively); (3) scaling (variation in perception as a function of variation in odorant concentration); and (4) quality discrimination and veridicality (perception of differences between molecules and ability to identify odorant by name). The last task may be the most important in real life, but all four categories must be considered for a complete assessment. All are defined psycho physically and, whenever possible, illustrated with clinical cases, such as odor deficits in workers in some occupations who have been overexposed to certain chemicals. The discussion also includes malingering and other response problems such as being able to identify odors.

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## **AN ECOLOGIC APPROACH IN CHILD AND FAMILY PSYCHIATRY**

A wide range of longstanding patterns of symptoms may result from individual sensitivity to substances in the environment such as foods, chemicals, dusts and pollens.

The assessment and treatment techniques of clinical ecologists are at last attracting increasing interest within the United Kingdom National Health Service although progress is still unacceptably slow.

Behaviorally disturbed and learning disordered children are common. Their numbers may be increasing and certainly they make great demands on parental understanding and courage as well as on professional judgement and time.

Case studies will be presented which suggest that the difficulties encountered by a significant number of such children have much to do with idiosyncratic responses to foods, "additives" and contaminants in air and water.

Many show "sensitivity" features and exhibit remarkably similar clinical pictures. At least one natural parent is often also affected and a transgenerational history of allergy or migraine is frequently present. The onset of these children's disorders can be related to stress such as the birth of a sibling, death or other significant loss, or viral or other infection. Substantial and lasting improvements often take place as a result of relatively simple environmental manipulation.

These findings have far-reaching implications for the assessment and management of disturbed, delinquent and learning disordered children and their families. Further research is urgently required and certainly much more attention should now be paid to the role of biological and environmental factors in the development of children's problems.

**Case 1** > Patient admitted was a 20 y/o, w/f to Chicago CECU on an emergency basis by ambulance from a physician's office on 1/9/82 in Status Epilepticus. Symptom started January 1979 with headache and hand tremors with first grand mal one week following treatment by dilantin for headache. Her apparent sensitivity extended beyond the dust, molds and pollens with hay fever symptoms to include foods and chemicals. Seen by several neurologists and medical centers with negative reports. Diagnosed as hysteria or in more recent terminology, somatization disorder. She was told two years on psychotherapy would cure her. Massive medications including Tegretol, Phenobarb, Dilantin and Mycelin which were given without seizure control only worsened her condition. On one ER visit she experienced a cardiac arrest secondary to massive anti-seizure medications. She found better control after management by another ecologist along with a series of homeopathic remedies and cranial manipulations. Six weeks before admission to our facility, headaches began again following the placement of an acrylic crown. The immediate causative agent was thought to be ingestion of oranges. She had a history

of irregular periods and was on therapy for a yeast vaginitis. Physical Exam was unremarkable except an eczema of hands and feet.

This patient was admitted six times to our unit with Rx by dimethyl glycine giving some control of her seizures during her later hospitalizations. Her last two hospitalizations included surgery with removal of gall bladder, appendix and right ovary. The ovary contained a dermoid cyst.

This patient shows no food or chemical sensitivities; today is symptom free and living a completely normal life.

**Case 2>** Patient is a 26 y/o, w/f admitted to Chicago CECU, 3/31/83 for recurrent abdominal pain, nausea and vomiting. She had two laparotomies, one in July, 1982 and the second in November, 1982 and on each occasion, non-specific lymph adenitis was found. Abdominal pain and fatigue started April, 1982. Hx of reaction to phenergen with a marked reduction of her white count. She was also sensitive to Zoma, Talwin and Xylocaine. She also complained of muscle joint pains.

Physical exam was not significantly abnormal except for wheezing in the right middle and lower lung and the presence of laparotomy and appendectomy scars.

This patient was followed conservatively and her pneumonitis cleared. She did not react to test waters, carbon filters, commercial foods or test chemicals. She did react rather severely to asparagus, pork, eggs, peanuts and turkey requiring morphine to control her abdominal pain. Orange had a lesser reaction. Candida antigen challenge produced abdominal pain, great fatigue and depression. Ragweed, lambs quarters, grass and birch produced positive skin wheels.

This case demonstrated the acuteness of some food reactions in selected patients. These reactions were so severe as to produce two laparotomies in six months in this case.

**Case 3>** Patient is a 36 year old white female admitted to CECU via stretcher with seizure-like activities, having passed out in x-ray. Developmental history uneventful, except for enuresis until after starting school. She became very fatigued as menarch, which occurred at twelve years of age. History of frequent infections and antibiotic usage. In August of 1977, a day following a bee sting, she experienced anxiety, depression, jerking all over, convulsive-like episodes, chest pain, palpitations and a feeling like she was going to die. She was aware of activities going on around her, but could not respond. She was told it was nerves. Told by a chiropractor it was hypoglycemia and treatment seemed to help for a while but symptoms returned. Again a medical work-up was done and again told it was psychosomatic. Her symptoms developed into crisis proportion April, 1982, with personality changes, unable to cope with children, she might meet husband with a kiss or screaming and yelling. Her husband was convinced she as a schizophrenic. She was referred to an orthomolecular psychiatrist. Patient was fasted and placed on food rotation diet and did better for a while. Began combining her foods and started deteriorating. She became much more reactive to chemicals and lost her "safe" foods.

Some constipation, vaginal yeast infections, severe leg aching at night. Lives in a nine year old double-wide mobile home. Physical exam revealed no significant abnormality.

After five days of fasting and bowel cleaning, this patient was cleared 100% of symptoms. A safe water and filter were found. The most reactive foods were pork, rabbit, corn, eggs, peaches and cauliflower, lamb, tuna, pear, and soybeans. Lesser reactive foods were trout, carrots, shrimp and peas. Organic food symptoms included abdominal cramping, constipation, headache, confusion, fatigue and sore throats. She reacted to her first of six scheduled commercial foods with crying, lisping and confusion. Patient reacted on sublingual challenges to cotton, natural gas, newsprint, tobacco, formaldehyde, chlorine, phenol, fuel oil, synthetic ethanol and Candida. Symptoms included fainting spells, blurred vision, headache, difficulty breathing, confusion, morbid thoughts, feeling drunk, backache, chest, jaw, and shoulder pains. There was no reaction to auto exhaust.

Skin test for estrogen produced confusion and fatigue. She reacted to Nilstat until a dot dose was utilized. She was treated for dust, molds and mites sensitivity, Nystatin powder and vaginal tablets, Vitamin C, calcium carbonate, Pan 5 enzyme and a rotary diet of her safe foods. Cotton, Candida, Estrogen and her most positive chemicals were prescribed as treatment doses.

This patient did well after discharge and by six months felt sufficiently improved, went off of her rotation diet, chemical treatment doses and returned to her previous living habits without apparent return of symptoms after one year.

This case is unique and unusual by having such a complete healing in so short a time.

**Case 4**> This patient is a 52 year old white male admitted to the CECU of Chicago for evaluation and treatment of severe Rheumatoid Arthritis requiring large doses of analgesics.

Past history indicated ulcerative colitis developed at eleven years of age. A colectomy with ileostomy was performed in 1966 followed shortly thereafter with rheumatoid arthritis affecting most joints, especially his hands and knees. His diet consisted almost exclusively of animal protein, very little fruit and vegetables, as he was conditioned that the roughage would be detrimental to the ileostomy.

In June, 1983, he was hospitalized because of a bowel obstruction caused by an adhesion. Shortly thereafter, his arthritis became much worse and unmanageable except on large doses of steroids.

In the CECU, he was fasted 5 ½ days with modest improvement of symptoms. A pulse-taper treatment of prednisone during this time was required to quiet a knee that flared with redness, swelling and severe pain. He required almost nightly doses of narcotics for pain.

Any attempt to feed him after the fast produced severe abdominal pain and vomiting, and even drinking water was a problem. Our differential diagnosis was bowel obstruction from further adhesions, a food reaction or withdrawal from the addictive narcotics. The latter was favored. After five days, G. I. tract was not a major problem. Switching from Demerol-Phenergen to M. S. was very helpful. Liquefied foods were given orally initially and gradually thickened to semi-solid, and finally administered whole.

This patient owned a beef ranch and ate a considerable amount of beef. Beef challenge produced a marked reaction and this made him a real believer. Corn also reacted strongly. He did not react to chemicals or Candida.

The important aspect of this case is the D/D of the reaction G. I. after the fast and the necessity to retrain him to eating a range of foods which he had been conditioned to believe that he never would be able to eat again.

**Case 5**> 33 year old female was admitted to the CECU for evaluation and treatment of severe bronchial asthma that began in childhood to 18 years of age, usually provoked by respiratory infections, for which she was treated with antibiotics. For 15 years no asthma attack occurred, although she experienced severe ragweed hay fever. At age 31, following two successful pregnancies, and six months following an abortion, she started a full-fledge attack of wheezing and coughing - her asthma was back. She was in and out of the hospital three times and Emergency Rooms innumerable times for epinephrine. She had been on many drugs, over the counter and prescribed. Prednisone treatment was variable from 60 mgm. daily to 15 mgm every other day in the past ten months. Some food cravings, binge eating were present plus an acute sense of smell, especially to natural gas. She also complained of anxiety, depression, irritability, loss of memory at times, and a short attention span.

Except for a 3 cm. thyroid nodule in the right lobe, tendency for keloid formation and some wheezing, no significantly abnormality was found on physical exam. This patient had marked reactions to corn, wheat, shrimp, chicken, eggs, lamb, carrots, oranges and beef. Some of the reactions including wheezing, coughing, nasal congestion, headaches, joint pains, fatigue, sleepiness and insomnia. Chemical challenges showed reactions to commercial foods, synthetic ethanol, auto exhaust, phenol, tobacco smoke, glycerin and natural gas. Candida was also positive, all with treatment doses found. The diluent, normal saline, was without reaction. Also, dust, mites and molds were reactive with a treatment dose established.

Her second admission to the CECU was February 24, 1982, with a history of nausea, fear, paranoia, hallucination, lightheadedness, and on two mgm. Prednisone daily. She was eating organic food as prescribed by her initial hospitalization, but was found not to be rotating her food as previously instructed. Nilstat powder ingestion also provoked paranoia and hallucinations.

This patient was fasted three days as she was phasing in and out of psychosis, requiring restraints. As this patient cleared her symptoms of psychosis, her asthma symptoms, which were not present on admission, started reappearing. The most severe food reactions were milk, kiwi, yeast, apples, filberts, brazil nuts and halibut. Corn, wheat, shrimp, egg, lamb, orange and beef were not tested on the second hospitalization. Reaction to foods included aggression, tension, fears, depression, loss of emotional control, loss of concentration and loss of touch with reality.

She was discharged with her asthma back, but without psychosis. This case clearly fulfilled the history noted previously in the literature of an alternation between asthma and psychosis.

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