COVID-19: Preventing Future Pandemics

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ABSTRACT

The COVID-19 pandemic has had global health and economic adverse impacts. The main measures being taken to control the spread of SARS-CoV-2 (the virus associated with COVID-19) are conceptually those that were taken to control the spread of SARS-CoV in the previous coronavirus-driven pandemic of 2002-2003: good hygiene, facemasks, and quarantine (lockdown). The difference is the larger scale of these measures for SARS-CoV-2.

A weakened immune system appears to be the main determinant of serious/fatal reaction to viral infection (for COVID-19, SARS, and influenza alike). There are four major approaches being employed or considered presently to augment or strengthen the immune system, in order to reduce adverse effects of viral exposure. The three approaches that are mainly focused on augmenting the immune system are based on the concept that pandemics can be controlled/prevented while maintaining the immune-weakening lifestyles followed by much of the global population. The fourth approach is based on identifying and introducing measures aimed at strengthening the immune system intrinsically in order to minimize future pandemics.

The four measures are: 1) restricting exposure to virus; 2) providing reactive/tactical treatments to reduce viral load; 3) developing vaccines to prevent, or at least attenuate, the infection; 4) strengthening the immune system intrinsically, by a) identifying those factors that contribute to weakening the immune system, then eliminating/reducing them as comprehensively, thoroughly, and rapidly as possible, and b) replacing the eliminated factors with immune-strengthening factors.

The present monograph focuses mainly on strengthening the immune system intrinsically. It identifies many hundreds of factors that contribute to weakening the immune system, as well as measures that can strengthen it. It also addresses the vaccine issue, since vaccine development has been emphasized in myriad forums. Potential mid- and long-term adverse vaccine effects that cannot be identified in short-term tests characteristic of efficacy testing are identified. To ensure safety, long-term testing under real-life conditions (exposures to multiple toxic stimuli) is required. There is an incompatibility between the accelerated vaccine development times being pursued by government and industry and the long times required for validation of vaccine safety.

In summary, 1) there is not unanimity within the medical community for continuing post-lockdown severe restrictions on activities of the vast majority of the total population that are mainly applicable to the most vulnerable very small minority of the total population; 2) repurposed (mainly) antiviral treatments can only be expected to have very limited results in controlling SARS-CoV-2 viral load of the most severely impacted, based on trials conducted so far; 3) it is difficult to see how safe COVID-19 vaccines can be developed and fully tested on time scales of one or two years, as proposed presently; 4) the only real protection against a future COVID-19 pandemic or any other viral pandemic is the one that was demonstrated to work in the SARS pandemic, the MERS pandemic, the COVID-19 pandemic, and in the annual influenza pandemics: a healthy immune system capable of neutralizing incoming viruses as nature intended. We need an Operation Warp Speed (a USA Federal Administration effort currently targeted to produce a vaccine in a record short time period) to identify and eliminate those factors that weaken the immune system as thoroughly, comprehensively, and rapidly as possible!
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CHAPTER 1 - INTRODUCTION

1A. Background

Over the past two decades, there have been at least three major coronavirus-based infectious disease outbreaks/epidemics/pandemics: Severe Acute Respiratory Syndrome (SARS), 2002-2003; Middle East Respiratory Syndrome (MERS), starting in 2012; COVID-19, starting in December 2019. There are a number of similarities among these three infectious diseases, including abnormal values of selected biomarkers (e.g., neutrophils, lymphocytes, albumin, CRP, TNF-alpha, etc.), pulmonary inflammation, pulmonary damage. The most important similarity among these infectious diseases is the demographic affected most severely. These tend to be the elderly, with comorbidities and weakened immune systems, and others with weakened immune systems [1-11].

There are also similarities of COVID-19 with influenza: “Both (COVID-19 and influenza) cause fever, cough, body aches and fatigue; sometimes vomiting and diarrhea; can be mild or severe, even fatal in rare cases; can result in pneumonia” (https://www.hopkinsmedicine.org/health/conditions-and-diseases/coronavirus/coronavirus-disease-2019-vs-the-flu). Additionally, “Neither virus is treatable with antibiotics, which only work on bacterial infections; both are treated by addressing symptoms, such as reducing fever; severe cases may require hospitalization and support such as mechanical ventilation”.

How do COVID-19 and influenza compare in number of fatalities? According to the above link (and other supporting references), for influenza, the estimate is “1 billion cases worldwide; 9.3 million to 45 million cases in the U.S. per year”, accompanied by “291,000 to 646,000 deaths worldwide; 12,000 to 61,000 deaths in the U.S. per year”. For the previous coronavirus-based outbreaks/epidemics/pandemics, these cases/fatalities numbers have been orders of magnitude less than the influenza numbers. The SARS pandemic involved about 8,000 people who presented with SARS symptoms, of whom ~800 died [12-13]. The MERS epidemic involved ~2,500 cases, with almost 900 deaths (http://www.emro.who.int/pandemic-epidemic-diseases/mers-cov/mers-situation-update-january-2020.html). For COVID-19 (as of 8 June 2020): “There have been approximately 403,267 deaths reported worldwide. In the U.S, 110,514 people have died of COVID-19”, according to the Hopkins link above. The validity of these numbers will be addressed in Appendix 2.

The main measures being taken to control the spread of the SARS-CoV-2 coronavirus (responsible for COVID-19) are conceptually those that were taken to control the spread of the SARS-CoV coronavirus in 2002-2003: good hygiene and quarantine (lockdown). The difference is the scale of these measures. Currently, many countries are on lockdown (at different levels of severity), restricting many activities and businesses that involve gatherings of large numbers of people in close proximity. As of early June, 2020, it is unknown how long these restrictions will be in place.

1B. Treatments

The measures proposed in this monograph to prevent future pandemics are targeted towards the larger population in general, and towards the most vulnerable demographic in particular. As stated above, this vulnerable demographic consists of “elderly, with comorbidities and weakened immune systems, and others with weakened immune systems”. While there is some decline in the immune system with age, comorbidity is a better predictor of impaired immunity, than chronological age, in older adults [14-15].
Comorbidity in common usage is typically used to mean other diseases. From the perspective of our past studies aimed at preventing and reversing chronic diseases [16], each of these diseases is a proxy for the hundreds of foundational factors that contribute to its development (e.g., smoking, excess alcohol, pesticides, high fat diet, PFOS (Perfluorooctanesulfonic acid), PFAS (Per- and polyfluoroalkyl substances), etc.). In other words, the foundational contributing factors to the disease can be viewed as the true independent variables (over which the individual and/or the government have some measure of control), and the disease is the dependent variable. Thus, if we switch co-ordinate systems from diseases to foundational contributing factors, we could then state that the main demographic that succumbed to both SARS and COVID-19 had/were exposed to high numbers of foundational contributing factors to disease.

This parallels the experience with influenza: “Comorbidities are really what put people at the highest risk of complications from influenza. Asthma, chronic obstructive pulmonary disease (COPD), other pulmonary conditions, even heart conditions, and the immunocompromised population, all of these patients are at a significantly higher risk of complications from influenza than the general population” [https://www.contagionlive.com/news/us-flu-cases-reach-32-million-pediatric-hospitalization-rates-hit-record-high]. The most vulnerable demographic of these lethal infectious diseases having high numbers of foundational contributing factors to disease is the key point that underlies the approach in this monograph to prevent future pandemics!

In the current COVID-19 pandemic, we see some commonalities with what happened in the SARS pandemic. Most of the deaths in both cases resulted from pneumonia. Most (not all) of the deaths are among the elderly, and appear to be most prevalent among those with high comorbidities and weakened immune systems. Switching co-ordinate systems in our description, most of the fatalities are among those exposed (over their lifetime, as well as currently) to large numbers of contributing factors to disease and/or those with weakened immune systems.

The contributing factors to disease also trigger a positive feedback mechanism. The contributing factors weaken the immune system (as the results of the present study will show), which in turn increases vulnerability to infection. Infections, in turn, weaken the immune system further, which again enhances vulnerability to infection. The intervention under our control to disrupt this feedback loop is to reduce/eliminate the contributing factors to a weakened immune system.

1C. Treatment Definition

Given that weakened immune systems increase vulnerability to infectious diseases, and especially to the worst outcomes of infectious disease, then preventing future pandemics requires adopting measures that will strengthen the immune system. There are two main options to strengthen the immune system. One is vaccines, and this is discussed in more detail in Appendix 3. The other option is to remove those exposures and behaviors that weaken the immune system, and, in some cases, replace them with exposures and behaviors that strengthen the immune system. The latter approach is termed ‘strategic’ treatments [17]. The following section will define strategic treatments, and place them in the larger treatment context.

If treatments are defined as a set of actions that improve health, then (at least) two types of treatments are possible [17]. The first type can be defined as positive treatments. They can be subdivided into high-tech treatments and low-tech treatments. The high-tech are the classical treatments
where drugs (or supplements) and/or radiation and/or surgery are implemented, and symptoms are alleviated. These high-tech positive treatments are basically a reactive tactical response to abnormal markers of health. They can be applied for the short-term (e.g., antibiotics for bacterial infections, antivirals for viral infections, etc.), or for the long-term (e.g., statins, blood thinners, antihypertensives, etc.). The low-tech treatments involve dietary, sleep, and other behavioral changes shown to impact the immune system positively (see section A4-C for a brief bibliography of low-tech treatments). For long-term benefit, these low-tech treatments need to be maintained indefinitely. On average, the high-tech treatments have greater risk than the low-tech treatments.

The second type can be defined as negative-negative treatments, where those factors that contribute to disease are first identified and then removed. The name derives from the mathematics world, where a negative of a negative is a positive. These negative-negative treatments are basically a proactive strategic response to abnormal markers of health, and typically involve long-term changes in lifestyle and harmful exposures for improved health.

1D. Tactical Treatments

Much of the effort to help the most vulnerable demographic at this time has been searching for, and experimenting with, treatments that were/are used to combat other (mainly) viral diseases. As of 8 June 2020, 233 treatments are under consideration (and 161 vaccines are in development) [https://milkeninstitute.org/covid-19-tracker]. These treatments include, but are not limited to:

Actemra/Tocilizumab; Avigan/Favipiravir; Azithromycin; Baricitinib/Olumiant; Bevacizumbo/Avasitn; Calquence/Acalabrutinib; Chloroquine; Colcrys/Colchicine; Convalescent Plasma; EIDD-2801; Fingolimod/Gilenya; Galidesivir; Hydroxychloroquine; Ilaris/Canakinumab; Ivermectin; Jakafi/Ruxolitinib; Kaletra/Lopinavir/Ritonavir; Kevzara/Sarilumab; Kineret/Anakinra; Leronlimab; Mavrilimumab; Methylprednisolone; Olumiant/Baricitinib; Otezla/Apremilast; Remdesivir; Tamiflu/Oseltamivir; Umifenovir/Arbidol; Xeljanz/Tofacitinib [https://milkeninstitute.org/covid-19-tracker; https://www.drugs.com/condition/covid-19.html; https://www.goodrx.com/blog/coronavirus-treatments-on-the-way/].

Other novel treatments could be identified using our Literature-Related Discovery and Innovation (LRDI)-based treatment repurposing methodology [18].

1E. Strategic Treatments

Strategic treatments are the focus of this monograph. Their identification is a two-step process. First, markers of immune system health (ranging from specific biomarkers to more general descriptors) are selected. Second, those substances (e.g., smoking, excess alcohol, pesticides, etc.) behaviors (e.g., sedentary lifestyle, substance abuse, etc.), etc., that degrade the levels of these markers (i.e., lead to immune dysfunction, immunotoxicity, immunosuppression, etc.) are then identified and recommended for elimination. The strategic treatments identified in the present study are those contained within the immune system core literature (defined in Chapter 2). Additional novel strategic treatments could also be identified using our LRDI-based treatment repurposing methodology [18].
1F. Reactive Tactical vs Proactive Strategic Treatments

The reactive tactical treatment approach for countering infections from viral exposure improves biomarker levels and reduces symptoms (if successful), but ordinarily does little to improve the body’s resistance to disease. For viral infections, the tactical treatments will do little to strengthen the weakened immune (and other) system. After tactical treatments for one viral infection, people with weakened immune systems will again be vulnerable to serious infectious consequences from exposure to the next harmful virus they encounter.

The proactive strategic treatment approach will strengthen the immune (and other) system by removing those critical factors that contribute to disease and a weakened immune system (unless irreversible damage has been done to the immune system, or individuals possess congenital or other hereditary damage to their immune system). These strategic treatments tend to require long-term adherence by their recipients. In turn, these recipients of strategic treatments will be less vulnerable to infection from exposure to the next harmful virus they encounter (SARS-CoV-2 or otherwise). Like many healthy people who were exposed to SARS-CoV and SARS-CoV-2, these people who follow the (typically) long-term proactive strategic treatment regimen successfully may not even be aware they have been exposed to, or infected by, the coronavirus. The only indication of their infection will be coronavirus antibodies in their serum.

1G. Structure of Monograph

The remainder of this monograph is structured as follows. Chapter 2 presents the Methodology used to identify the strategic treatments for strengthening the immune system. Chapter 3 presents the Results of the study, including Discussion and Conclusions. Chapter 4 contains the References.

Appendix 1 frames the role of viruses in the much larger context of their place in the ecosystem. Appendix 2 addresses the nature of viral pandemics, accuracy of numbers of COVID-19 deaths, and financial incentives for over-reporting COVID-19 cases and deaths. Appendix 3 addresses the prospects for a COVID-19 vaccine. Appendix 4 contains the complete list of contributing factors to a weakened immune system identified in this study, a limited bibliography of source records for these contributing factors, and a limited bibliography of (mainly low-tech) factors that contribute to strengthening the immune system.

1H. Economic Aspects

We end this Introduction with a brief discussion of economic aspects of response to the COVID-19 pandemic, or any future viral pandemic. As the previous sections have shown, there are two general types of responses (tactical/reactive and strategic/proactive), and these can be done in parallel in the short-term. For the long-term, realistically, emphasis would have to be placed on one or the other.

1H1. Reactive approaches

First are the (mainly) tactical/reactive approaches to reduce viral loads/augment the immune system with the aid of exogenous measures (quarantine, newly developed treatments, repurposed treatments, vaccines, etc), and second are the (mainly) strategic approaches to strengthen endogenous immune defenses to neutralize the viral exposures.

The revenues lost are essentially the reduction in economic activity due to the global lockdowns. This number is equally difficult to estimate/predict, but losses of trillions of dollars, or perhaps tens of trillions over a five-year period, may be possible, based on some present predictions (https://www.marketwatch.com/story/today-in-scary-numbers-pandemic-could-cost-global-economy-82-trillion-2020-05-19). There are important costs/benefits associated with other aspects of the lockdown (lives lost from non-infectious causes (suicide, etc.), reduced carbon emissions, etc.), and these need to be considered in a more detailed cost/benefit study.

1H2. Proactive approaches

For the strategic/proactive treatment approaches, there may be added investment expenditures required if advanced technologies (and their adverse effects on health) are utilized less through stricter emissions regulations, and either no technologies or less efficient, but lower emissions, technologies are substituted in their place. We have seen no estimates of such added costs, mainly because little attention has been given to issues associated with implementation of the strategic treatment approaches.

The revenues lost from implementing the strategic treatment approaches derive from reduced economic activity resulting from eliminating/reducing harmful technologies. For example, wireless radiation technologies are forecast to generate trillions of dollars in potential revenue after implementation. Reducing radiation emission limits (by orders of magnitude to safe levels) for these technologies will translate into many of the wireless radiation applications not being feasible economically, and therefore not pursued. Given the sheer number of immune system-damaging technologies identified in the present monograph, and the added number that could be identified with a much larger study, the economic activity lost by reducing dependence on these technologies would easily be in the neighborhood of tens of trillions of dollars. To partially balance out those losses, lockdowns could conceivably be avoided if there were wide-scale strengthening of the public’s immune systems, and the economic losses due to lockdown could be avoided.

Thus, for both the (mainly) tactical approaches, and the (mainly) strategic approaches, economic losses incurred -- or avoided -- will be staggering, if the response to the present pandemic is any indication of response to future pandemics. The strategic approach offers the potential benefits of 1)
improved health and longevity by having a strengthened immune system and 2) reduced economic losses by avoiding future lockdowns. Additionally, because of the pervasive nature of many of the contributing factors to a weakened immune system (they are contributing factors to many other infectious and chronic diseases as well [16]), their elimination will result in reduced suffering from these myriad diseases and resulting further increased longevity. Choosing between these two approaches (for the longer-term) translates into a classic tradeoff between 1) improved health/longevity and 2) improved prosperity from implementing advanced, but also harmful, technologies!
CHAPTER 2 – METHODOLOGY

The main analytical objective of this study is to identify factors that contribute to weakening of the immune system. Toward this end, a query was generated that would retrieve records with high probability of containing such factors. The query retrieved 10,733 records from Medline. Some additional records (identified from those records retrieved with the query) were also used for the analysis. The retrieved records were inspected visually, and contributing factors were extracted manually. These contributing factors were then categorized according to a pre-existing taxonomy [19], and are presented summarily in Chapter 3 and fully in Appendix 4.

The query used to retrieve these records from SCI-Medline is shown boxed below.

![FINAL QUERY USED FOR STUDY](SCI-MEDLINE)

<table>
<thead>
<tr>
<th>MESH</th>
<th>(/adverse effects OR /toxicity OR /poisoning) AND</th>
</tr>
</thead>
<tbody>
<tr>
<td>TITLE</td>
<td>(immun* AND (expos* OR induc* OR exacerbat* OR aggravat* OR trigger* OR disrupt* OR impair* OR dysfunction* OR suppress*))</td>
</tr>
<tr>
<td>OR</td>
<td></td>
</tr>
<tr>
<td>MESH</td>
<td>(/adverse effects OR /toxicity OR /poisoning) AND</td>
</tr>
<tr>
<td>TITLE</td>
<td>immun*</td>
</tr>
<tr>
<td>AND</td>
<td></td>
</tr>
<tr>
<td>TOPIC</td>
<td>IMMUNOTOXIC*</td>
</tr>
<tr>
<td>OR</td>
<td></td>
</tr>
<tr>
<td>TITLE</td>
<td>IMMUNOTOXIC* OR IMMUN* NEAR/3 IMPAIR*</td>
</tr>
</tbody>
</table>

Initially, a much broader query was developed, and it retrieved tens of thousands of records. However, given that the projected analysis would be labor intensive, with visual inspection of the retrieved records and manual extraction of contributing factors, it was decided to generate a more focused query that would retrieve fewer records, but with higher probability of relevance (precision). The boxed query achieved that goal.
CHAPTER 3 – RESULTS, DISCUSSION, AND CONCLUSIONS

Approximately 65% of the retrieved records were evaluated. The extracted contributing factors were assigned to one of five categories (Lifestyle, iatrogenic, Biotoxin/Biomaterial, Occupational/Environmental, Psychosocial/Socioeconomic); many of the contributing factors could have been assigned to multiple categories. In future studies, other categorizations may provide further insights. Table 3-1 contains contributing factors that have been shown repeatedly (appeared with high frequency in the database) to weaken the immune system. They include:

TABLE 3-1
HIGH-FREQUENCY CONTRIBUTING FACTORS TO WEAKENED IMMUNE SYSTEM

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>CONTRIBUTING FACTOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>LIFESTYLE</td>
<td>smoking, excess alcohol, substance abuse, high-fat diet, protein-deficient diet, high-cholesterol diet, Western-style diets, chronic sleep restriction, etc.</td>
</tr>
<tr>
<td>IATROGENIC</td>
<td>immunosuppressive drugs, gamma radiation treatments, nanomedicinal products, adjuvanted vaccines, acetaminophen, non-steroidal antiinflammatory drugs (NSAIDs), surgical stress, serotonin reuptake inhibitors, selected anesthetics, selected antibiotics, highly active antiretroviral therapy drugs, etc.</td>
</tr>
<tr>
<td>BIOTOXIN/ BIOMATERIAL</td>
<td>aflatoxin, ochratoxin, T-2 toxin, anatoxin-A, mycotoxins, microcystin-LR, dietary toxic cyanobacteria, yessotoxin, scorpion venom; Streptomyces californicus; Pseudomonas aeruginosa; Rhinovirus, respiratory syncytial virus, etc.</td>
</tr>
<tr>
<td>OCCUPATIONAL/ ENVIRONMENTAL</td>
<td>microplastics, endocrine-disrupting chemicals, heavy metals, pesticides/insecticides/herbicides, nanoparticles, perfluorooctanoic acid (PFOA), polychlorinated biphenyls (PCBs), polyaromatic hydrocarbons (PAHs), perfluorooctanesulfonate (PFOS), fine particulate matter, air pollution, acrylamide, aromatic halogenated disinfection byproducts, benzene, benzo(a)pyrene, crude oil, corexit, ultraviolet (UV) radiation, wireless radiation-cell phones/cell towers/WiFi, sodium fluoride, etc.</td>
</tr>
<tr>
<td>PSYCHOSOCIAL/ SOCIOECONOMIC</td>
<td>depression, chronic stress, restraint stress, social isolation, stressful life events, childhood adversity, etc.</td>
</tr>
</tbody>
</table>

Eliminating/ameliorating these toxic exposures/behaviors will require a combination of individual motivations/efforts and government efforts, especially at the regulatory level. The factors in the Lifestyle category mainly require motivation and willpower to eliminate, although government regulation would be beneficial for controlling food additives and labelling contents of processed foods. For the iatrogenic category, government regulation is necessary for ensuring treatment safety. There is room for individual motivation in eliminating excessive or unnecessary use of painkillers, such as NSAIDs or opioids, and unnecessary/elective surgeries.
Members of the Biotoxin/Biomaterial category (especially the Biotoxin component) are more difficult for individuals to eliminate. As we are seeing with COVID-19, virus exposure is difficult to control (as is bacterial exposure). There are many mycotoxins listed in Table 3-1. Those found in food may result from improper storage and insufficient processing to eliminate mycotoxins. Those in indoor environments may result from insufficient moisture/humidity control. Some of these problems can be addressed by stricter government regulations.

The Occupational/Environmental category could benefit substantially from more rigorous government regulation. Most of the exposures are beyond the control of the individual; in fact, the individual most probably doesn’t know he/she is being exposed to these substances.

For example, the Occupational Safety and Health Administration (OSHA) has responsibility for regulating most workplace toxic exposures. Out of the more than 85,000 chemicals registered with the EPA, OSHA only issues Federally-enforceable Permissible Exposure Limits (PELs) for about 500 of these chemicals. In 2018, the first author published a study of the adequacy of OSHA's PELs [20], using a sampling technique. Of those substances that were sampled, their PELs were one to four orders of magnitude higher than exposures shown in the biomedical literature to cause damage.

As another example, the radiation exposure limits for wireless radiation (cell phone/cell towers/WiFi, etc.) approved by the FCC are from three to six orders of magnitude higher than exposures shown in the biomedical literature to cause damage, the discrepancy varying with the level of damage [21].

But, even in this category, individual choice and motivation play a role. People who want to strengthen their immune systems can choose (especially in the home environment, and partly in the work environment) to reduce exposure to wireless radiation, water with sodium fluoride, strong pesticides, strong disinfectants, etc.

The PsychoSocial/SocioEconomic category could benefit from some government interventions that reduce stressful situations for the individual (e.g., providing economic/health/occupational security, providing more protections for the most vulnerable (very young, elderly, disabled), etc.). Some of the types of adverse events and stresses are beyond the control of government or the individual, but here again, individuals can take steps to improve their responses to many of these types of stress.

Most of the studies, especially the laboratory studies, that gathered the data reported in Table 3-1 (and the more extensive Tables shown in Appendix 4) focused on the effects of one stressor/toxic stimulus in isolation. In real-life, people are exposed to myriad toxic stimuli, both in parallel and over different time periods. Typically, when toxic stimuli are combined, less of each constituent of the combination is required to cause damage compared to the amount determined from single stressor experiments [22]. Thus, real-life weakening of the immune system from myriad exposures to the toxic stimuli in Table 3-1 (and the Tables shown in Appendix 4) is far greater than that reported in the single toxic stimulus studies.

To summarize, repurposed (mainly) antiviral treatments can only be expected to have very limited results in controlling SARS-CoV-2 viral load of the most severely impacted, based on trials conducted so far. Further, based on the findings of Appendix 3, it is difficult to see how safe COVID-19 vaccines can be developed and fully tested on time scales of one or two years, as proposed presently.
Finally, the only real protection against a future COVID-19 pandemic or any other viral pandemic is the one that was demonstrated to work in the SARS, MERS, COVID-19 and annual influenza pandemics: a healthy immune system capable of neutralizing incoming viruses as nature intended. We need an Operation Warp Speed (the Federal Administration Program currently targeted to produce a vaccine in a record short time period in the USA) to identify and eliminate those factors that weaken the immune system as thoroughly, comprehensively, and rapidly as possible!
CHAPTER 4 – REFERENCES


Appendix 1 – ROLE OF VIRUSES IN ECOSYSTEM

The role of viruses in pandemics cannot be understood without enumeration of their larger role in the ecosystem. The guiding principle of the biosphere is optimization of ecosystem sustainability. The operational principle by which this goal is achieved is “survival of the fittest”. This can be seen most clearly when examining all creatures on Earth (with the exception of humans), whose lifestyles are textbook examples of ecosystem sustainability (not to be equated with species sustainability; species come and go, but the ecosystem endures).

The operational principle is enforced by a process familiar to security personnel as a Red Team/Blue Team approach, involving constant probing of an organization’s defenses to identify their weakness, and improving the defenses in the process. These continual challenges of the biosphere to life on Earth are manifested at roughly three levels: macro, species, and micro. At the macro level (wind, rain, sun, heat, cold, humidity, etc.), there are continual challenges to living creatures (and plants, etc.) that require continual adaptation (at typically hormetic levels, but sometimes large challenges). The weakest creatures will succumb under the large-scale challenges.

At the species level, there are continual attacks by predators, which require that the prey remain in peak condition if they are to have any chance of survival. There is an old saying that the day the slowest Gazelle cannot outrun the fastest Lion will be the Gazelle’s last day on Earth!

At the micro level, myriad micro-organisms including viruses, bacteria, fungi, parasites, etc., can offer challenges. Of interest to this monograph is the role of viruses. The box below offers a summary perspective on the beneficial and pathogenic effects of viruses.
BENEFICIAL AND PATHOGENIC EFFECTS OF VIRUSES [23]

Viruses are parasites of host organisms. They may be beneficial or pathogenic to their hosts.

**Beneficial Effects**
- Infection with one virus may protect the host from a superinfection with another pathogen.
- Some viruses also have beneficial effects with respect to non-infectious diseases.
- Virus infection sometimes confers benefits including the regulation of microbiota in the gut; in particular, bacteriophages are thought to modulate the gut microbiota by infecting specific bacterial populations.
- Some endogenous retroviruses have been shown to play beneficial roles in their hosts, including host evolution.

**Pathogenic Effects**
“a virus is generally considered to be a causative agent like a poison that causes infectious diseases. These tiny, living entities have considerable import, because they can cause substantial damage to humans and non-human animals and other living organisms”.

**Diversity of Viruses**
- Currently, there are approximately 263 viruses from 25 viral families that are known to be able to infect humans.
- Most emerging infectious diseases are zoonotic (an infectious disease caused by a pathogen that has jumped from an animal to a human), mainly from wild animals such as primates, rodents, and bats.
- The PREDICT program has found over 1100 viruses in animals and humans.
- The Global Virome Project participants estimate that ~1.67 million yet-to-be-discovered viral species from key zoonotic viral families exist in mammal and avian hosts, and expect that 631 000–827 000 of these unknown viruses have zoonotic potential.

A subset of the virome, those zoonotic viruses that appear to be pathogenic in humans, challenge the immune system continually. This process appears to be a dual-edged sword. Immune systems that are strong are strengthened further by the continual challenges, offering additional protection against other viral challenges. Immune systems that are weak are unable to prevent the occurrence of life-threatening symptoms as a result. This is how nature implements ‘survival of the fittest’ at the microbial level.
Appendix 2 – VIRAL PANDEMICS AND STATISTICS

A2-A. Viral Pandemics

Appendix 1 showed some of the roles played by viruses in the biosphere, and their centrality to life itself. The present appendix examines how this key component of the life process has morphed into a dangerous entity in the public consciousness.

Sometimes analogies can be highly instructive. We start this appendix with two analogies that illustrate the contributions of viruses to pandemics. The following boxes contain these analogies.

**FIRST ANALOGY WITH VIRAL PANDEMIC**

There is a large house in the desert; the roof has been completely neglected for thirty years. Ten large holes have opened up on the roof. Because there has been no rain, these holes have not been repaired, but have continued to grow. One day, a once-in-a-thousand-year rainstorm arrives. Water comes pouring through the holes in the roof. An emergency request for help is sent. First responders, neighbors, etc., come to help, and spend the day with buckets and pumps bailing out the water. They leave, the owners of the house have survived, but, because dry conditions re-emerge, they do absolutely nothing to repair the holes in the roof. Three years later, another once-in-a-thousand-year rainstorm arrives, and another panic response ensues.

Was the rain the cause of the chaos and damage; was it the holes in the roof; was it both? **Would we have worried about the rain if there were no holes in the roof?**

Metaphorically, the rain is the coronavirus, and the holes in the roof are the toxic stimuli to which each person is exposed, and which contribute to weakening the immune system. Without the toxic stimuli and the associated weakened immune system, the coronavirus exposure/infection has little/no effect, except to (typically) generate antibodies that show up in the serum. That is seen in many healthy people, and the same was seen in the 2002-2003 SARS pandemic. It’s hard to get exact numbers of people exposed but minimally affected, since not everyone is being tested, and those who are tested tend to be heavily weighted towards those exhibiting serious symptoms.

In this hypothetical case, is the rain the culprit? In the case of no holes in the roof, the rain had no effect. It only had an effect when combined with the holes in the roof. If a cause must be assigned, why shouldn't it be assigned to the holes in the roof, rather than the rain?
SECOND ANALOGY WITH VIRAL PANDEMIC

Assume there is a person standing in a room, with nothing else in the room but four metallic walls, a metallic ceiling, and a metallic floor. This person lights a match, and throws it on the floor. What will happen? Answer: nothing. The match burns itself out.

Now assume there's a flammable handkerchief on the floor. This person throws the lighted match on the handkerchief. What will happen? Answer: the handkerchief will burn for about a minute, and burn itself out. Still no problem.

Now assume there are a hundred pounds of ammonium nitrate (an explosive also used in agriculture) on the floor, as well as ten other flammable/explosive compounds. The person throws the lighted match on the floor. What will happen? Answer: the person will be transported to the next world!!!

Metaphorically, the match is the coronavirus, and the explosive/flammable components are the toxic stimuli to which the person is exposed, and which contribute to weakening the immune system. Without the toxic stimuli and the associated weakened immune system, the coronavirus exposure has little/no effect, except to (typically) generate antibodies that show up in the serum. That is seen in many healthy people, and the same was seen in the 2002-2003 SARS pandemic. It's hard to get exact numbers of people exposed but minimally affected, since not everyone is being tested, and those who are tested tend to be heavily weighted towards those exhibiting serious symptoms.

In this hypothetical case, is the match the culprit? In the completely bare room, the match had no effect. It only had an effect when combined with the explosive/flammable material. If a cause must be assigned, why shouldn't it be assigned to the ammonium nitrate, or some of the other explosive/flammable materials?

Both of the above analogies reflect the fact that we may be looking at the trees, and missing the forest, with respect to COVID-19. Let’s focus on the quarantine (lockdown). It has been implemented widely across the globe. Those affected most severely by SARS-CoV-2 typically develop pneumonia, and die from pneumonia (or other severe respiratory disease). That's the official version, but it's far more nuanced and complicated. Some background, first.

The first author has developed a general protocol for preventing and reversing chronic diseases, and has developed protocols specifically for three chronic diseases (CKD (Chronic kidney disease), AD (Alzheimer’s disease), PN (Peripheral neuropathy)/PAD (Peripheral arterial disease)) [16]. The key component of the protocol is identifying the foundational contributing factors to the diseases (i.e., the causes), and eliminating those foundational causes. The qualifier 'foundational' is used, since the causes identified are not other diseases (which some/much of the medical community uses in part when talking about causes), but rather tangible items that are (in theory) under individual or government regulatory control (e.g., smoking, excess alcohol, brominated flame retardants, heavy metals, pesticides, wireless radiation, etc.).
For the three chronic diseases examined, anywhere from 500-1,000 foundational causes each have been identified from the premier biomedical literature, and this number was viewed as a gross under-estimation of the actual number of foundational causes that exist in reality. Many of these foundational causes (such as those listed above) are pervasive, meaning that they impact multiple diseases [24]. One would expect that pneumonia (the central fatal consequence of the COVID-19 (and SARS-CoV) coronavirus infection) would also have hundreds of foundational causes as well. This is a key point.

The first author also studied the SARS coronavirus pandemic of 2002-2003, and published two papers on the topic [12-13]. The key takeaway from those studies was that there were roughly three types of consequences for the people who were exposed to/infected by the SARS coronavirus (SARS-CoV). One group exhibited no symptoms, and the only measures of exposure/infection were SARS coronavirus antibodies in their blood (where the blood was tested for non-SARS-related reasons). The second group exhibited symptoms characteristic of respiratory infections, and recovered after some level of discomfort. There were about 8,000 people globally who exhibited these symptoms, and went for medical care. The third group mainly developed pneumonia, and those that eventually succumbed died from the pneumonia. There were about 800 people globally in this latter group. However, this latter group was not a random selection of the 8,000. Its members had high comorbidity, weakened immune systems, and tended to be heavily populated by the elderly.

Comorbidity in common usage is typically used to mean other diseases. As stated in the main text of this monograph, each of these diseases can be viewed as a proxy for the hundreds of foundational factors that contribute to its development. Thus, if the cause-related co-ordinate systems are switched from diseases to foundational contributing factors (where the foundational causes are the independent variables and the diseases are the dependent variables), the high comorbidity group that succumbed to SARS had high numbers of foundational contributing factors to disease. This is the key point.

The current COVID-19 pandemic has some commonalities with the SARS pandemic. Most of the deaths in both cases resulted from pneumonia. Most of the deaths are among the elderly, and appear to be most prevalent among those with high comorbidities and weakened immune systems. From the perspective of the foundational contributing factor-based co-ordinate system, most of the fatalities are among those exposed (over their lifetime, as well as currently) to large numbers of foundational contributing factors to disease. There may be some fatalities for people born with weakened immune systems.

In general, the public is being exposed to a mixture of toxic stimuli, and it is the effect of the mixture that is driving the myriad consequences [22]. Different people will be exposed to different mixtures, and, based on the composition of the mixtures and a person's genetic makeup and overall level of health, will respond differently. There can be substantial synergies among the mixture constituents, resulting in enhanced adverse effects from the combination [22, 25]. The key concept here is that the mixture is determining the outcome, not necessarily any one of its constituents in isolation.
The response of the governments worldwide (including the USA) to COVID-19 has been to impose a quarantine on the public, to restrict exposure to *only one of the many constituents* of the toxic stimuli mixture, SARS-CoV-2. This is one of the few constituents of the mixture that cannot be related to a technology offshoot, or to a technology that has production and/or consumption stakeholder backing (e.g., pesticides, industrial chemicals, radiation sources, etc.).

Thus, the present quarantine eliminates only one of the many constituents of the mixture, and it is the component that does not have strong production and/or consumption stakeholder backing!

If blame for the pandemic can be assigned to the one constituent of the toxic mixture with no backing from the aforementioned powerful stakeholders, then these production and/or consumption stakeholders are protected from responsibility and ensuing legal consequences. Assigning blame for the pandemic to Mother Nature rather than those who bear the major responsibility ensures that these harmful practices and their associated pandemics (including the annual deaths of the most vulnerable demographic related to the so-called influenza pandemics) will continue unabated.

Why are not any of the other constituents of the mixture being placed under quarantine? Why are not smoking, or air pollution, or excess alcohol, or wireless radiation, or agrochemicals, or industrial chemicals, being placed under quarantine? Approximately 403,000 deaths globally (as of 8 June 2020) [https://www.hopkinsmedicine.org/health/conditions-and-diseases/coronavirus/coronavirus-disease-2019-vs-the-flu] have been ascribed to SARS-CoV-2, and the total deaths ascribed to the three coronavirus pandemics over the past two decades would raise the above estimate by an additional 1,700 deaths. The fatalities that can be related to some (perhaps most) other constituents of the toxic stimulus mixture of foundational causes are far greater globally, when all their adverse effects are integrated.

Placing responsibility for the pandemic (and especially the deaths associated with the pandemic) on non-anthropogenic causes is not limited to the SARS-CoV-2 virus. In both the SARS pandemic and COVID-19, another of the factors assigned responsibility for some of the deaths is immune dysfunction and the associated ‘cytokine storm’: “the severity of disease might be due to immune dysregulation, rather than to the level of viremia. This dysregulation would be characterized by an insufficient type I interferon response (too little and too late), paralleled by an aberrant pro-inflammatory chemokine secretion by alveolar macrophages, dendritic cells and pneumocytes” [26]. Stated another way: “one could describe the unsuccessful immune response to SARS as “stuck in innate immunity,” whereas the progression to adaptive immunity, with antibody production, strongly correlated with favorable outcomes.” [27]. In other words, in some cases, the severe problems experienced by the most vulnerable demographic stem from the immune system’s inability to switch from innate defense to adaptive defense in a timely manner.
As the main body of the text has shown, there are many hundreds of foundational factors that contribute to the weakening of the immune system. The most vulnerable demographic tends to have many comorbidities, which translates to exposure to many of the foundational factors that contribute to a weakened immune system. Therefore, the weakened immune system becomes the dependent variable, and its inability to switch from innate mode to adaptive mode may not be due (in some/many/most cases) to some intrinsic defect, but rather to the adverse effects from exposures to the many foundational factors that contribute to its dysfunction. Again, the responsibility for immune system dysfunction reported in both the mainstream media and the biomedical literature is not assigned to production and/or consumption stakeholder interests behind the foundational contributing factors, but rather assigned to some defect in the immune system for which the production and/or consumption stakeholders bear no responsibility.

It is clear from the SARS results (and probably the present COVID-19 results) that exposure to the coronavirus (for the most part) results in no outward symptoms or mild symptoms, in the absence of large numbers of other toxic stimuli. Thus, a more protective quarantine, for the current pandemic and against future pandemics, would be to impose quarantines against the intrinsically toxic constituents of the mixture. Whether they would have the same very-short-term benefits as the present coronavirus quarantine/lockdown is questionable, but from the long-term perspective, the broader quarantine would be very protective against future viral attacks on the most vulnerable demographic, including the annual influenza infections.

To be fully protective in the present pandemic and against future pandemics, both tactical reactive responses to survive the immediate threat and strategic proactive responses to prevent the problem and damage from re-occurring are required. Toward that end, the first author published a document on identifying tactical and strategic treatments for COVID-19 [17]. That document serves as the basis for the analysis presented in the present monograph.

A2-B. Assignment of Deaths in Viral Pandemics

Much of the discussion concerning the COVID-19 pandemic in the media and elsewhere revolves around the number of deaths attributed to COVID-19. There are two main problems here: the validity of assigning deaths to the consequences of SARS-CoV-2 exposure, and the uniformity of the criteria for assigning deaths to COVID-19. The previous section presented the argument that the deaths are mainly a consequence of exposure to a toxic mixture, and any assignment of responsibility or blame should be to the toxic mixture rather than any one pre-selected constituent. The virus is the trigger, and if there are no bullets in the chamber, pulling the trigger has no effect!

The criteria for assigning deaths to COVID-19 are not uniform across countries and, in the USA, not uniform across states. In addition, the highest-level guidance in the USA for assigning COVID-19 deaths is somewhat ‘soft’. For example, consider the guidance for assigning deaths to COVID-19 distributed to medical personnel by the National Center for Health Statistics [28]:

“If the death certificate reports terms such as “probable COVID-19” or “likely COVID-19,” these terms would be assigned the new ICD code. It is not likely that NCHS will follow up on these cases ... COVID-19 should be reported on the death certificate for all decedents where the disease caused or is assumed to have caused or contributed to death.”
This wording allows a substantial level of flexibility in assigning a death to COVID-19, or any of the other comorbidities with which the most vulnerable demographic is associated. This is an important factor, since there are myriad political and financial motivations associated with assigning deaths to COVID-19.

For example, as stated by Scott Jensen, a physician in Minnesota and member of the State Senate [https://www.usatoday.com/story/news/factcheck/2020/04/24/fact-check-medicare-hospitals-paid-more-covid-19-patients-coronavirus/3000638001/]:

“Because if it’s a straightforward, garden-variety pneumonia that a person is admitted to the hospital for – if they’re Medicare – typically, the diagnosis-related group lump sum payment would be $5,000. But if it's COVID-19 pneumonia, then it's $13,000, and if that COVID-19 pneumonia patient ends up on a ventilator, it goes up to $39,000.”

So, while there is no uniformity in assigning deaths to SARS-CoV-2, even if there were, the basic concept and the basic data are completely flawed, as shown above. This assignment of deaths to one constituent of a multi-constituent mixture is purely arbitrary, and a political act done for political (and financial) purposes.
Appendix 3 – PROSPECTS FOR COVID-19 VACCINES

A3-A. Overview

The main body of this document addressed the first type of strategic treatment: 1) identification and removal of factors contributing to weakening the immune system (see section A4-A for a table of these contributing factors), and 2) identification and addition of factors contributing to strengthening the immune system (see section A4-C for a bibliography of low-tech immune system strengthening factors). The present appendix addresses the second type of strategic treatment: development and implementation of a COVID-19 vaccine. The prospects for such a vaccine will be addressed from three criteria perspectives: development time, efficacy, and safety.

A recent study evaluated the ongoing approaches to COVID-19 vaccine development, and stated: “Normally, the period of development of a vaccine is 12-15 years” [29]. Against this backdrop, SARS-CoV-2 vaccines are targeted for accelerated development, safety testing, manufacturing, and distribution by an order of magnitude. Each of the accelerated steps listed in this reference has drastically reduced the time required from normal development.

A3-B. Past Coronavirus Vaccine Development History

There have been two prior coronavirus pandemics in the 21st century: SARS in 2002-2003, and MERS starting in 2012. Vaccine development for each started/accelerated during the height of each pandemic. What have been the results of these prior coronavirus vaccine development efforts?

According to a comprehensive 2019 article on MERS vaccine development [30], “To date, there is no specific treatment proven effective against this viral disease. In addition, no vaccine has been licensed to prevent MERS-CoV infection thus far ... In general, the potential vaccine candidates can be classified into six types: viral vector-based vaccine, DNA vaccine, subunit vaccine, nanoparticle-based vaccine, inactivated-whole virus vaccine and live-attenuated vaccine”

According to a comprehensive 2020 article on SARS and MERS vaccine development [31], “As of April 2020, no vaccine is commercially available for these coronavirus strains”. The rationale for lack of a vaccine is given by the following: “Reasons for the lack of commercial and effective vaccines for SARS and MERS are varied. In the case of MERS, it is likely that the vaccine development was delayed because of the scarcity of suitable and cost-effective small animal models during pre-clinical experimentation. In addition, it is probable that a vaccine has not been delivered because of the low interest in investing in a vaccine for a disease that has produced relatively low and geographically centralized cases (compared with other more global and persistent infectious diseases such as influenza, HIV and tuberculosis). This last factor might have also contributed to the lack of a vaccine for SARS, in the sense that it was considered pointless to continue investing in a vaccine for a disease whose cases ceased to be reported in 2004.”

While interest in a vaccine may have waned after the SARS pandemic seemed to have terminated, research on such a vaccine persisted. References in the above article showed SARS vaccine research continued for a decade or more after the pandemic had ended [32-33].
Based on the experiences with SARS and MERS, successful vaccine development was not achieved after about a decade of research, or even more. That does not bode well for COVID-19 coronavirus vaccine development/safety testing/distribution on the order of one-year timescales being projected.

A3-C. Problems for Successful Vaccine Development

A3-C1. Overview

The main problems facing successful coronavirus vaccine development can be summarized as time to development, efficacy of the vaccine and, most importantly, safety of the vaccine. A complementary perspective on some of the problems listed in [29] can be stated as follows:

“First, although the virus’s spike protein is a promising immunogen for protection, optimizing antigen design is critical to ensure optimal immune response. Debate continues over the best approach — for example, targeting the full-length protein or only the receptor-binding domain.

Second, preclinical experience with vaccine candidates for SARS and the Middle East respiratory syndrome (MERS) have raised concerns about exacerbating lung disease, either directly or as a result of antibody-dependent enhancement. Such an adverse effect may be associated with a type 2 helper T-cell (Th2) response. Hence, testing in a suitable animal model and rigorous safety monitoring in clinical trials will be critical” [34].

Numerous mid- and longer-term potential adverse effects from vaccines have been identified. These include: 1) Antibody-Dependent Enhancement (where enhanced virus entry and replication in a number of cell types is enabled by antibodies) [35-36]; 2) Vaccine-associated Virus Interference (where vaccinated individuals may be at increased risk for other respiratory viruses because they do not receive the non-specific immunity associated with natural infection) [37-38]; 3) Vaccine-Associated Imprinting Reduction (where vaccinations could also reduce the benefits of ‘imprinting’, a protection conferred upon children who experienced infection at an early age) [39-40]; 4) Non-Specific Vaccine Effects on Immune System (where previous infections can alter an individual's susceptibility to unrelated diseases) [41-42]; 5) Impact of Infection Route on Immune System (where immune protection can be influenced by the route of exposure/delivery) [43-44]; and 6) Impact of Combinations of Toxic Stimuli (where people are exposed over their lifetime to myriad toxic stimuli that may impact the influence of any vaccine) [25]. Each of these effects will be addressed in more detail.

A3-C2. Antibody-Dependent Enhancement

The following amplifies further the concern about vaccine-induced enhancement: “Examples of vaccine-induced enhancement of susceptibility to virus infection or of aberrant viral pathogenesis have been documented for infections by members of different virus families. Several mechanisms, many of which still are poorly understood, are at the basis of this phenomenon ... Certain experimental lentiviral vaccines even proved to be counterproductive: they rendered vaccinated subjects more susceptible to infection rather than protecting them. For vaccine-induced enhanced susceptibility to infection with certain viruses like feline coronavirus, Dengue virus, and feline immunodeficiency virus, it has been shown that antibody-dependent enhancement (ADE) plays an important role ... Consequently, vaccine-induced enhancement has been a major stumble block in the development of certain flavi-, corona-, ...
paramyxo-, and lentivirus vaccines. Also recent failures in the development of a vaccine against HIV may at least in part be attributed to induction of enhanced susceptibility to infection” [35].

For another perspective on the ADE mechanism:

“For a number of viral pathogens, under certain conditions, antibodies provide an attractive means of enhanced virus entry and replication in a number of cell types. Known as antibody-dependent enhancement (ADE) of infection, the phenomenon occurs when virus-antibody immunocomplexes interact with cells bearing complement or Fc receptors, promoting internalization of the virus and increasing infection. Frequently associated with exacerbation of viral disease, ADE of infection presents a major obstacle to the prevention of viral disease by vaccination and is thought to be partly responsible for the adverse effects of novel antiviral therapeutics such as intravenous immunoglobulins.” [36]. These effects are confirmed further in numerous studies [45-49]

A3-C3. Vaccine-Associated Virus Enhancement

In addition to ADE, the effect of vaccine-associated virus interference (vaccinated individuals may be at increased risk for other respiratory viruses because they do not receive the non-specific immunity associated with natural infection) [37] need to be addressed. Consider the following examples:

“We identified a statistically significant increased risk of noninfluenza respiratory virus infection among TIV {trivalent inactivated influenza vaccine} recipients, including significant increases in the risk of rhinovirus and coxsackie/echovirus infection ... Receipt of TIV could increase influenza immunity at the expense of reduced immunity to noninfluenza respiratory viruses” [38];

“prior receipt of 2008-09 TIV was associated with increased risk of medically attended pH1N1 illness during the spring-summer 2009, with estimated risk or odds ratios ranging from 1.4 to 2.5” [50];

“Among children there was an increase in the hazard of ARI {acute respiratory illness} caused by non-influenza respiratory pathogens post-influenza vaccination compared to unvaccinated children during the same period.” [51];

“when influenza type A hit early, RSV {respiratory syncytial virus} outbreaks tended to be delayed, coronavirus outbreaks tended to be intensified,” [52];

“Examining non-influenza viruses specifically, the odds of both coronavirus and human metapneumovirus in vaccinated individuals were significantly higher when compared to unvaccinated individuals (OR = 1.36 and 1.51, respectively) ... the laboratory data in our study showed increased odds of coronavirus and human metapneumovirus in individuals receiving influenza vaccination ... While influenza vaccination offers protection against influenza, natural influenza infection may reduce the risk of non-influenza respiratory viruses by providing temporary, non-specific immunity against these viruses ... On the other hand, recently published studies have described the phenomenon of vaccine-associated virus interference; that is, vaccinated individuals may be at increased risk for other respiratory viruses because they do not receive the non-specific immunity associated with natural infection” [37]; and
"Here we show that reported influenza vaccination coverage rates for 29 OECD countries are associated significantly with recently observed SARS-CoV-2 infection rates in these countries. This early result, which merits further investigation, suggests that during the current coronavirus outbreak an influenza vaccination background might be a relevant factor for SARS-CoV-2 infection” [https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3558270].

A3-C4. Vaccine-Associated Imprinting Reduction

Vaccination could also reduce the benefits of ‘imprinting’, a protection conferred upon children who experienced infection at an early age, as the following shows:

“Imprinting by the first childhood influenza infection is known to confer long-lasting immunity focused toward priming epitopes. Our findings suggest vaccine mismatch may negatively interact with imprinted immunity. The immunological mechanisms for imprint-regulated effect of vaccine (I-REV) warrant investigation.” [39]; and

“we suggest that the potential impact of distant influenza immune imprinting on current vaccination outcomes should be considered in the design of next generation or universal vaccine candidates” [40].

A3-C5. Non-Specific Vaccine Effects on Immune System

“vaccines against infectious diseases have nonspecific effects on the ability of the immune system to handle other pathogens. For instance, in randomized trials tuberculosis and measles vaccines are associated with a substantial reduction in overall child mortality, which cannot be explained by prevention of the target disease. New research suggests that the nonspecific effects of vaccines are related to cross-reactivity of the adaptive immune system with unrelated pathogens, and to training of the innate immune system through epigenetic reprogramming ... diphtheria-tetanus-pertussis (DTP) vaccine, although protective against the three target diseases, increases female mortality from other infectious diseases ... and it turned out that DTP vaccine administered after the measles vaccine was the explanation for the increased female mortality observed in the high-titer measles vaccine trials ... The effects of vaccines on the immune system may be modulated by other immune-modulating factors. Interactions are found between vaccines and high-dose vitamin A supplementation ... and two vaccines may have completely different effects when administered simultaneously ... We need to explore systematically what is likely to happen when our effective interventions are administered with other vaccines, drugs, or micronutrients and in different sequences.” [41]; and

“Epidemiological data suggest that previous infections can alter an individual's susceptibility to unrelated diseases ... Substantial research efforts have expanded the classical concept of immune memory to also include long-lasting changes in innate immunity and antigen-independent reactivation of adaptive immunity. Collectively, these processes provide possible explanations on how acute infections might induce long-term changes that also affect immunity to unrelated diseases ... This heightened state of alert enhances the ability of the immune system to combat even unrelated infections but may also increase susceptibility to autoimmunity. At the same time, infection-induced changes in the regulatory compartment may dampen subsequent immune responses and promote pathogen persistence.” [42].
A3-C6. Impact of Infection Route on Immune System

Vaccine-based infections have different routes of exposure from natural exposure, and this could lead to different impacts on the immune system. The typical vaccine is injected directly into the bloodstream, thereby bypassing much of the innate immune system, while the naturally acquired infection evolves through the time-consuming process of delay and resistance by the innate immune system. Studies have been performed examining the effects of different routes of exposure. For example:

“our study demonstrates that the identification of candidate LAVs (live attenuated viruses) and immune protection markers in an animal model can be strongly affected by the route of infection used” [43]; and

“vaccine formulation and route of delivery can influence outcomes as suggested by our studies ... Consideration of alternative methods rather than reliance on parenteral methods for vaccination can lead to vaccination strategies that produce improved efficacy and long-term memory response. Such improvements in protection came about by considering brucellosis as a mucosal disease, rather one that solely produces a systemic disease. Empowering mucosal approaches could harness additional lymphocytes to protect against infection, particularly since most infections occur following a mucosal exposure” [44].

A3-C7. Impact of Combinations of Toxic Stimuli

“In the combination case, typically less of each constituent of the combination is required to cause damage compared to the amount determined from single stressor experiments. Thus, exposure limits based on single toxic stimulus experiments are inadequate for setting limits for stressor combinations.” [22].

A3-C8. Long-Term Safety Requirements

While the efficacy issues for a COVID-19 vaccine have been enumerated extensively in recent reviews [29, 34], more emphasis needs to be placed on ensuring mid- and long-term safety are achieved. Vaccines do not appear to have the same safety requirements as many drugs. For example, consider the following excerpts from selected vaccine inserts relative to safety [https://www.vaccinesafety.edu/package_inserts.htm]:

- MMR Vaccine “M-M-R II has not been evaluated for carcinogenic or mutagenic potential, or potential to impair fertility ... Animal reproduction studies have not been conducted with M-M-R II.”;

- Influenza Vaccine “FLUARIX QUADRIVALENT has not been evaluated for carcinogenic or mutagenic potential or male infertility in animals.”;

- DTAP Vaccine “INFANRIX has not been evaluated for carcinogenic or mutagenic potential or for impairment of fertility.”; and

- HPV Vaccine “GARDASIL 9 has not been evaluated for the potential to cause carcinogenicity, genotoxicity or impairment of male fertility.”
Long-term safety studies of vaccines are rare (however, see bibliography at the end of this Appendix for some examples). The typical vaccine study is aimed at efficacy. Such studies tend to be a few months long, and the main evaluation criterion is titers of antibody in the serum.

Vaccines, especially childhood vaccines, are administered according to a schedule, which now comprises about seventy+ doses covering about sixteen vaccines. The schedule-based combination effects of these seventy+ vaccine doses have not been tested, and, therefore, adverse effects due to real-life vaccine synergies are unknown.

Much of the published data for vaccine adverse events (at least in the USA) originates from the VAERS database. VAERS is a passive monitoring system, and, like all similar systems, suffers from substantial under-reporting of adverse events [53]. A groundbreaking study [54], performed by Harvard Pilgrim Healthcare, Inc, reported that “fewer than 1% of vaccine adverse events are reported”. In other words, the actual numbers of adverse reactions to vaccines are one to two orders of magnitude higher than those reported in VAERS!

The methodology for obtaining this result was as follows: “Every patient receiving a vaccine was automatically identified, and for the next 30 days, their health care diagnostic codes, laboratory tests, and medication prescriptions are evaluated for values suggestive of an adverse vaccine event. When a possible adverse event was detected, it was recorded, and the appropriate clinician was to be notified electronically.”

Thus, these adverse events are single-visit short-term adverse events (within thirty days of the vaccination). They do not reflect the results of vaccination combinations administered over a longer period than thirty days, and they do not reflect results of vaccinations of any type in the mid- or long-term [54].

If fewer than 1% of vaccine adverse events are reported, how well does this sample reflect the total number of adverse events actually experienced? This is not a randomly-selected sample, as would be required for a statistically-valid result. Thus, even analyses of short-term adverse effects based on VAERS data are severely flawed. And, if fewer than 1% of these short-term adverse events are reported, what fraction of longer-term adverse events (where the connection between the adverse event and the vaccination becomes more tenuous as time proceeds) would be reported? One can only conclude that a negligible fraction of long-term adverse events is reported in a passive monitoring system like VAERS.


As the above results have shown, vaccines can have long-term impacts on the immune system (positive and negative), and short and long-term effects on other diseases. The effects of vaccines can vary according to route of infection, prior history of vaccinations, and, as stated by Benn et al above, administration “with other vaccines, drugs, or micronutrients and in different sequences.” [41]. To accelerate the time required to demonstrate long-term safety, laboratory experiments are usually done using animals with relatively short lifespans whose responses to myriad toxic stimuli are similar to that of human beings.

One major difference between these animal experiments and the human model is that the laboratory experiments are usually performed with the administration of a single toxic stimulant, or maybe two, while the human model lives in a sea of toxic stimuli.
There are many examples in the biomedical literature where combined exposures to toxic stimuli showed adverse effects whereas exposures to the same stimuli in isolation (at the same dosages) showed no adverse effects [25, 55]. Thus, unless these laboratory experiments are performed with a range of combinations of associated immunomodulators, they would not be credible for safety assessment purposes. Such experiments would require enormous amounts of financial and time resources.

The other alternative is to perform these safety studies with human beings. For long-term safety studies, decades could be required for credible results. Thus, there is a major disconnect between the time required for credible safety studies of a COVID-19 vaccine and the one-year or less vaccine commercialization being propounded by decision-makers in the media today.

A3-D. Vaccine Bibliography - Short and Long-Term Vaccine Impacts

The following is a short sampling of records showing potential adverse short and long-term vaccine effects.


Classen JB, Classen DC. Public should be told that vaccines may have long term adverse effects. British Medical Journal. 1999;318(7177):193-.


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Payne DC, Rose CE, Jr., Kerrison J, Aranas A, Duderstadt S, McNeil MM. Adverse reactions to anthrax vaccine (eg, optic neuritis) may be more complex or delayed than reported initially by Payne et al (2006) - In reply. Archives of Neurology. 2007;64(3):458-.


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Appendix 4 – FACTORS THAT WEAKEN AND STRENGTHEN IMMUNE SYSTEM; BIBLIOGRAPHIES

A4-A. Contributing Factors to Weakened Immune System

This section presents the complete list of factors that contribute to weakening of the immune system based on our analysis of the retrieved data base. About 10,800 records were retrieved using the query shown in Chapter 2 (and other records identified in the course of the analysis), about 7,000 of these records were analyzed, and about 4,700 (of the 7,000) records identified factors that contributed to weakening of the immune system. The contributing factors from these ~4,700 records were aggregated, and slightly over 2,200 contributing factors were entered into the tables below. Not all redundancies were eliminated, but if even on the order of 30% redundancy exists, this means that about 1,500 contributing factors to weakening the immune system have been identified.

This is a very conservative estimate. The query in Chapter 2 was written to retrieve those articles most relevant to immune-weakening factors, given the labor-intensive approach taken to identify these factors from the retrieved articles. A much more expansive query, albeit with less precision, would have retrieved tens of thousands of articles, and produced many more contributing factors.

But, the 1,500 constitute a large number, are far more than we have seen in any one article, and probably cover all the major contributing factors. Any measures that an individual or government regulator can take for protecting the health of the immune system will only be able to deal with a small fraction of the 1,500 already identified, at least initially.

Tables A4-1 to A4-5 contain the ~2,200 contributing factors, divided into five categories: Lifestyle, Iatrogenic, Biotoxin/Biomaterial, Occupational/Environmental, Psychosocial/Socioeconomic. This is a categorization we have been using for the past few years [16]. Many other categorizations are possible, and may offer additional insights.

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<tr>
<th>TABLE A4-1. CONTRIBUTING FACTORS TO WEAKENED IMMUNE SYSTEM (LIFESTYLE)</th>
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TABLE A4-2. CONTRIBUTING FACTORS TO WEAKENED IMMUNE SYSTEM

(IATROGENIC)

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**TABLE A4-3. CONTRIBUTING FACTORS TO WEAKENED IMMUNE SYSTEM (BIOTOXINS/BIOMATERIALS)**

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### TABLE A4-4. CONTRIBUTING FACTORS TO WEEKENED IMMUNE SYSTEM

(OCCUPATIONAL/ENVIRONMENTAL)

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<th>(90)Sr</th>
<th>2,3,7,8-Tetrachlorodibenzofuran</th>
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<td>(Z)-Cis-Bifenthrin</td>
<td>2,3,7,8-Tetrachlorodibenzo-P-Dioxin</td>
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<td>1,1,1-Trichloro-2,2-Bis(4-Methoxyphenyl)Ethene</td>
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<td>Wide-Band Modulated Electromagnetic Field</td>
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TABLE A4-5. CONTRIBUTING FACTORS TO WEAKENED IMMUNE SYSTEM
(PSYCHOSOCIAL/SOCIOECONOMIC)

<table>
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<tr>
<th>Xylene</th>
<th>Zinc Oxide Nanoparticles</th>
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<tr>
<td>Zinc</td>
<td>Zinc Pyrithione</td>
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<td>Zinc Chloride</td>
<td>Ziram</td>
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Accumulated Life Stress | Male Partner Violence
Acute Psychological Stressors | Mild Stress
Adverse Life Events | Negative Stressful Life
Anxiety | Posttraumatic Stress
Anxious Women | Psycho-Emotional Stress
Childhood Adversity | Psychological Stress
Chronic Life Stress | Restraint Stress
Chronic Mild Stress | Social Behaviour Deficits
Chronic Restraint Stress | Social Disruption
Chronic Social Stress | Social Isolation
Chronic Stress | Social Stress
Combined Stress | Stress
Depression | Stressful Life Events
Disaster | Stress-Related Behavior
Distress | Traumatic Life Events
Intense Intellectual Stress | Vulnerability
Life Stress | Work Stress

A4-B. Bibliography – Contributing Factors to Weakened Immune System – Titles Only

As stated in the previous section, approximately 4,700 records included factors that contributed to weakening the immune system, and these records formed the basis of the analysis. The titles of these records follow. To retrieve the abstract, or in some cases the full-text of these records, insert the title shown below into Pubmed.

18beta-Glycyrrhetinic acid from licorice root impairs dendritic cells maturation and Th1 immune responses
192IgG-saporin-induced immunotoxic lesions of cholinergic basal forebrain system differentially affect glutamatergic and GABAergic markers in cortical rat brain regions
2,2',4,6,6'-Pentachlorobiphenyl-induced apoptosis is limited by cyclooxygenase-2 induction
2,3,7,8-TCDD neurotoxicity in neuroblastoma cells is caused by increased oxidative stress, intracellular calcium levels, and tau phosphorylation

2,3,7,8-Tetrachlordibenzo-p-dioxin affects the differentiation of CD4 helper T cell

2,3,7,8-Tetrachlordibenzo-p-dioxin (TCDD) and long term immunologic memory

2,3,7,8-Tetrachlordibenzo-p-dioxin (TCDD) induced suppression of the local immune response

2,3,7,8-Tetrachlordibenzo-p-dioxin (TCDD)-induced immunotoxicity

2,3,7,8-Tetrachlordibenzo-p-dioxin impairs stable establishment of oral tolerance in mice

2,3,7,8-Tetrachlordibenzo-p-dioxin-mediated impairment of B cell differentiation involves dysregulation of paired box 5 (Pax5) isoform, Pax5a

21 Days head-down bed rest induces weakening of cell-mediated immunity - Some spaceflight findings confirmed in a ground-based analog

2’3’-Dideoxyinosine inhibits the humoral immune response in female B6C3F1 mice by targeting the B lymphocyte

25 years of UV-induced immunosuppression mediated by T cells-from disregarded T suppressor cells to highly respected regulatory T cells

2-Methoxyestradiol protects against IgG immune complex-induced acute lung injury by blocking NF-kappaB and CCAAT/enhancer-binding protein beta activities

3,3’-Diindolylmethane induces immunotoxicity via splenocyte apoptosis in neonatal mice

3,4-Dichloropropionanilide-induced atrophy of the thymus: mechanisms of toxicity and recovery

3-Methylcholanthrene induces lymphocyte and phagocyte apoptosis in common carp (Cyprinus carpio L) in vitro

3-Methylindole-induced splenotoxicity: functional analysis of immune parameters and lymphocyte phenotyping by flow cytometry

51Cr release assay of clozapine-induced cytotoxicity: evidence for immunogenic mechanism

5-azacytidine promotes an inhibitory T-cell phenotype and impairs immune mediated antileukemic activity

6:2 fluorotelomer sulfonamide alkylbetaine (6:2 FTAB), a novel perfluorooctane sulfonate alternative, induced developmental toxicity in zebrafish embryos

6-Methylprednisolone does not impair anti-thymocyte globulin (ATG) immunosuppressive activity in non-human primates

7,12-Dimethylbenz[a]anthracene-induced bone marrow toxicity is p53-dependent

8:2 Fluorotelomer alcohol causes immunotoxicity and liver injury in adult male C57BL/6 mice

954 MHz microwaves enhance the mutagenic properties of mitomycin C.
A 33-year-old patient with human immunodeficiency virus on antiretroviral therapy with efavirenz-induced complex partial seizures: a case report

A case of daptomycin-induced immune thrombocytopenia

A case of drug-induced hypersensitivity syndrome induced by icotinib managed by intravenous immunoglobulin and systemic corticosteroids

A Case of Heparin-Induced Thrombocytopenia with Discrepancy in the Results of Anti-Platelet Factor 4/Heparin Antibodies between Latex-Particle-Enhanced Immunoturbidimetric Assay and Enzyme Immunoassay

A case of inflammatory pseudotumor of the lung with suppressed immune response in the patient with renal cell carcinoma after nephrectomy and administration of interferon

A case of isoniazid-induced thrombocytopenia: recovery with immunoglobulin therapy

A case of linear immunoglobulin A bullous dermatosis in a patient exposed to sun and an analgesic

A case of pembrolizumab-induced type-1 diabetes mellitus and discussion of immune checkpoint inhibitor-induced type 1 diabetes

A case of profound and prolonged tirofiban-induced thrombocytopenia and its correction by intravenous immunoglobulin G

A case of thrombocytopenia induced by digitoxin--antibody immune complex

A clinical and immunologic study of workers with trimellitic-anhydride-induced immunologic lung disease after transfer to low exposure jobs

A commercial sunscreen's protection against ultraviolet radiation-induced immunosuppression is more than 50% lower than protection against sunburn in humans

A comparative evaluation of immunotoxicity of DDT and its metabolites in rats

A comparative evaluation of immunotoxicity of malathion after subchronic exposure in experimental animals

A comparative evaluation of the immunotoxicity and immunomodulatory effects on macrophages exposed to aromatic trihalogenated DBPs

A Comparative Study on the Effects of Different Parts of Panax ginseng on the Immune Activity of Cyclophosphamide-Induced Immunosuppressed Mice

A comparison of immunotoxic effects of nanomedicinal products with regulatory immunotoxicity testing requirements

A Comparison of Two Types of Rabbit Antithymocyte Globulin Induction Therapy in Immunological High-Risk Kidney Recipients: A Prospective Randomized Control Study

A comprehensive review of pesticides and the immune dysregulation: mechanisms, evidence and consequences
A cooperative effect of surgical stress-induced immunomodulation with the cessation of immunosuppression on hepatitis C virus elimination

A critical reappraisal of the current data on drug-induced linear immunoglobulin A bullous dermatosis: a real and separate nosological entity

A critical review of perfluorooctanoate and perfluorooctanesulfonate exposure and immunological health conditions in humans

A cross-sectional study of changes in markers of immunological effects and lung health due to exposure to multi-walled carbon nanotubes

A cytokine cascade including prostaglandin E2, IL-4, and IL-10 is responsible for UV-induced systemic immune suppression

A detailed study of developmental immunotoxicity of imidacloprid in Wistar rats

A dose-response study of the effects of prenatal and lactational exposure to TCDD on the immune response to influenza a virus

A double-edged sword: does highly active antiretroviral therapy contribute to syphilis incidence by impairing immunity to Treponema pallidum

A flow immunoassay for studies of human exposure and toxicity in biological samples

A health food high-peptide meal alleviates immunosuppression induced by hydrocortisone and cyclophosphamide in mice

A high SPF sunscreen's effects on UVB-induced immunosuppression of DNCB contact hypersensitivity

A higher anxiety state in old rats after social isolation is associated to an impairment of the immune response

A high-throughput screening method based on stably transformed human cells was used to determine the immunotoxic effects of fluoranthene and other PAHs

A meta-analysis and morphological review of cyclosporine-induced nephrotoxicity in auto-immune diseases

A method of assessing impairment of immunity after trauma

A model of immune-mediated lung disease in rats sensitized to house dust mite and upregulation of immunity following exposure to nitrogen dioxide

A model of immunologic lung injury induced by trimellitic anhydride inhalation: antibody response

A monoclonal antibody to hippuric acid: an improved enzyme-linked immunosorbent assay for biological monitoring of toluene exposure

A multivariate assessment of innate immune-related gene expressions due to exposure to low concentration individual and mixtures of four kinds of heavy metals on zebrafish (Danio rerio) embryos
A murine model of the effects of inhaled CuO nanoparticles on cells of innate and adaptive immunity - a kinetic study of a continuous three-month exposure

A neurotoxic regimen of methamphetamine exacerbates the febrile and neuroinflammatory response to a subsequent peripheral immune stimulus

A new assay system for evaluation of developmental immunotoxicity of chemical compounds using respiratory syncytial virus infection to offspring mice

A new model for an etiology of rheumatoid arthritis: smoking may trigger HLA-DR (shared epitope)-restricted immune reactions to autoantigens modified by citrullination

A new pathologic pathway for pulmonary fibrosis induced by silica: involvement of immunosuppressive responses

A new side effect of immunosuppression: high incidence of hearing impairment after liver transplantation

A nontoxic Pseudomonas exotoxin A induces active immunity and passive protective antibody against Pseudomonas exotoxin A intoxication

A novel immunochromatographic electrochemical biosensor for highly sensitive and selective detection of trichloropyridinol, a biomarker of exposure to chlorpyrifos

A novel immunosuppressive drug, FTY720, prevents the cancer progression induced by cyclosporine

A novel mouse model of chronic prostatitis/chronic pelvic pain syndrome induced by immunization of special peptide fragment with aluminum hydroxide adjuvant

A novel T(H)17-type cell is rapidly increased in the liver in response to acetaminophen-induced liver injury: T(H)17 cells and the innate immune response

A phase-I study of repeated therapy with radiolabelled antibody to carcinoembryonic antigen using intermittent or continuous administration of cyclosporin A to suppress the immune response

A Potential Mechanism for Immune Suppression by Beta-Adrenergic Receptor Stimulation following Traumatic Injury

A predictive F344 rat immunotoxicology model: cellular parameters combined with humoral response to NP-CgammaG and KLH

A preliminary evaluation of immune stimulation following exposure to metal particles and ions using the mouse popliteal lymph node assay

A prospective, double-blind, randomized study of high-versus low-dose OKT3 induction immunosuppression in cadaveric renal transplantation

A protective effect of vitamin E and selenium in ameliorating the immunotoxicity of malathion in chicks

A proteomic approach for the identification of immunotoxic properties of Tulipalin A
A randomized controlled trial of late conversion from calcineurin inhibitor (CNI)-based to sirolimus-based immunosuppression in liver transplant recipients with impaired renal function

A randomized, double-blinded comparison of Thymoglobulin versus Atgam for induction immunosuppressive therapy in adult renal transplant recipients

A rare case report of acyclovir-induced immune thrombocytopenia with tongue hematomas as the first sign, and a literature review

A review of the immunotoxicity of the pesticide 3,4-dichloropropionanalide

A role for associated transition metals in the immunotoxicity of inhaled ambient particulate matter

A role for HO-1 in renal function impairment in animals subjected to ischemic and reperfusion injury and treated with immunosuppressive drugs

A role for neuropeptides in UVB-induced systemic immunosuppression

A role for oxidative stress in suppressing serum immunoglobulin levels in lead-exposed Fisher 344 rats

A role for reactive oxygen species in endotoxin-induced elevation of MOR expression in the nervous and immune systems

A semiquinone glucoside derivative isolated from Bacillus sp. INM-1 provides protection against 5-fluorouracil-induced immunotoxicity

A single dose of trichloroethylene given during development does not substantially alter markers of neuroinflammation in brains of adult mice

A site involving the "hybrid" and PSI homology domains of GPIIIa (beta 3-integrin subunit) is a common target for antibodies associated with quinine-induced immune thrombocytopenia

A soy-derived immunostimulating peptide inhibits etoposide-induced alopecia in neonatal rats

A statement on the developmental immunotoxicity of bisphenol A (BPA): answer to the question from the Dutch Ministry of Health, Welfare and Sport

A study of autoantibodies and circulating immune complexes in mercury-exposed chloralkali workers

A study on behavioral, neurotoxicological, and immunotoxicological effects of subchronic arsenic treatment in rats

A study on geno- and immunotoxicological effects of subacute propoxur and pirimicarb exposure in rats

A study on immunotoxicological effects of subacute amitraz exposure in rats

A study on the effects of exposure to benzene on the activity of immunoglobulin E

A toxicokinetic study of nickel-induced immunosuppression in rats

A UVB wavelength dependency for local suppression of recall immunity in humans demonstrates a peak at 300 nm

Ability of Lactobacillus plantarum MON03 to mitigate aflatoxins (B1 and M1) immunotoxicities in mice
Ability of Lactobacillus rhamnosus GAF01 to remove AFM1 in vitro and to counteract AFM1 immunotoxicity in vivo

Abnormal immunostaining for dystrophin in isoproterenol-induced acute myocardial injury in rats: evidence for change in dystrophin in the absence of genetic defect

Abnormalities of cellular immune response in arthritis induced by rubella vaccination

Absorption of PCB126 by upper airways impairs G protein-coupled receptor-mediated immune response

Accelerated induction of skin cancers by ultraviolet radiation in hairless mice treated with immunosuppressive agents

Accumulation and immunotoxicity of microplastics in the estuarine worm Hediste diversicolor in environmentally relevant conditions of exposure

Accumulation of polychlorinated biphenyls (PCBs) and evaluation of hematological and immunological effects of PCB exposure on turtles

Accumulation, histopathology and immunotoxicological effects of waterborne cadmium on gilthead seabream (Sparus aurata)

Acephate immunotoxicity in White Leghorn cockerel chicks upon experimental exposure

Acetaldehyde accelerates HCV-induced impairment of innate immunity by suppressing methylation reactions in liver cells

Acetaldehyde-serum protein adducts inhibit interleukin-2 secretion in concanavalin A-stimulated murine splenocytes: a potential common pathway for ethanol-induced immunomodulation

Acetaminophen toxicity revisited: is drug-induced hepatotoxicity immune mediated

Acetaminophen-induced immunosuppression associated with hepatotoxicity in mice

Acetylcholinesterase inhibition as a biomarker of adverse effect. A study of Mytilus edulis exposed to the priority pollutant chlorfenvinphos

Acetylcholinesterase monoclonal antibody-induced sympathectomy: effects on immune status and acute morphine-induced immunomodulation

Acrylamide induced immunosuppression in rats and its modulation by 6-MFA, an interferon inducer

Acrylamide induces immunotoxicity through reactive oxygen species production and caspase-dependent apoptosis in mice splenocytes via the mitochondria-dependent signaling pathways

Actions of alcohol on immunity and neoplasia in fetal alcohol exposed and adult rats

Activating transcription factor 4 underlies the pathogenesis of arsenic trioxide-mediated impairment of macrophage innate immune functions

Activation-induced T-cell death and immune dysfunction after implantation of left-ventricular assist device
Active immunization with amyloid-beta 1-42 impairs memory performance through TLR2/4-dependent activation of the innate immune system

Acute 3,4-methylendioxymethamphetamine (MDMA) administration produces a rapid and sustained suppression of immune function in the rat

Acute and subchronic immunotoxicity of p-chloronitrobenzene in mice. I. Effect on natural killer, cytotoxic T-lymphocyte activities and mitogen-stimulated lymphocyte proliferation

Acute and subchronic toxic effects of atrazine and chlorpyrifos on common carp (Cyprinus carpio L.): Immunotoxicity assessments

Acute effects of 2-bromopropane and 1,2-dibromopropane on hepatotoxic and immunotoxic parameters in female BALB/c mice

Acute exposure to crotonaldehyde induces dysfunction of immune system in male Wistar rats

Acute exposure to perfluorononanoic acid in prepubertal mice: Effect on germ cell dynamics and an insight into the possible mechanisms of its inhibitory action on testicular functions

Acute exposure to waterborne cadmium induced oxidative stress and immunotoxicity in the brain, ovary and liver of zebrafish (Danio rerio)

Acute exposure to ZnO nanoparticles induces autophagic immune cell death

Acute immunoallergic hemolytic anemia induced by sulindac

Acute Immunotoxic Effects of Perfluorononanoic Acid (PFNA) in C57BL/6 Mice

Acute immunotoxicity of gallium to carp (Cyprinus carpio L)

Acute immunotoxicity of p-chloronitrobenzene in mice: II. Effect of p-chloronitrobenzene on the immunophenotype of murine splenocytes determined by flow cytometry

Acute infection of mice with highly virulent group B streptococci as a host resistance model for immunotoxicity assessment

Acute inflammation and immunoresponses induced by ortho-phthalaldehyde in mice

Acute kidney injury as the presenting complaint of ceftazidime-induced immune-mediated haemolysis

Acute microplastic exposure raises stress response and suppresses detoxification and immune capacities in the scleractinian coral Pocillopora damicornis

Acute myocardial infarction caused by delayed heparin-induced thrombocytopenia and acute immunoreaction due to re-exposure to heparin in a systemic lupus erythematosus patient with HIT antibodies

Acute rejection risk in kidney transplant recipients on steroid-avoidance immunosuppression receiving induction with either antithymocyte globulin or basiliximab

Acute renal failure induced by intravenous immune globulin
Acute symptomatic hypocalcemia from immune checkpoint therapy-induced hypoparathyroidism

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Author Correction: Immunotoxicological impact and biodistribution assessment of bismuth selenide (Bi2Se3) nanoparticles following intratracheal instillation in mice

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Condensed tannins decreased the growth performance and impaired intestinal immune function in on-growing grass carp (Ctenopharyngodon idella

Conjunctiva-associated lymphoid tissue (CALT) reactions to antiglaucoma prostaglandins with or without BAK-preservative in rabbit acute toxicity study

Consecutive evaluation of graphene oxide and reduced graphene oxide nanoplatelets immunotoxicity on monocytes

Constant illumination reduces circulating melatonin and impairs immune function in the cricket Teleogryllus commodus
Constant light exposure impairs immune tolerance development in mice
Constant light suppresses production of Met-enkephalin-containing peptides in cultured splenic macrophages and impairs primary immune response in rats
Consumption of home-made spirits is one of the main source of exposure to higher alcohols and there may be a link to immunotoxicity
Contact dermatitis: from pathomechanisms to immunotoxicology
Contaminant exposure and effects in pinnipeds: implications for Steller sea lion declines in Alaska
Contaminant-induced immunosuppression and mass mortalities among harbor seals
Contaminant-induced immunotoxicity in harbour seals: wildlife at risk
Continuous and discontinuous cigarette smoke exposure differentially affects protective Th1 immunity against pulmonary tuberculosis
Contrasting effects of immunosuppression on herpes simplex virus type I (HSV I) induced central nervous system (CNS) demyelination in mice
Contributions of nonhematopoietic cells and mediators to immune responses: implications for immunotoxicology
Conventional and novel "omics"-based approaches to the study of carbon nanotubes pulmonary toxicity
Coplanar and non-coplanar congener-specificity of PCB bioaccumulation and immunotoxicity in sea stars
Copper hypersensitivity: dermatologic aspects
Copper hypersensitivity: dermatologic aspects--an overview
Copper induced immunotoxicity promote differential apoptotic pathways in spleen and thymus
Copper nanoparticles induce early fibrotic changes in the liver via TGF-beta/Smad signaling and cause immunosuppressive effects in rats
Copper nanoparticles induced oxidation stress, cell apoptosis and immune response in the liver of juvenile Takifugu fasciatus
Copper-induced immunotoxicity involves cell cycle arrest and cell death in the liver
Copper-induced immunotoxicity involves cell cycle arrest and cell death in the spleen and thymus
Cord blood gene expression supports that prenatal exposure to perfluoroalkyl substances causes depressed immune functionality in early childhood
Coronary vasomotor dysfunction in the cardiac allograft: impact of different immunosuppressive regimens
Correlation between change of immunotoxicology indexes of cerum and the occurrence of anaphylaxis in patients induced by qingkailing injection: a clinical study
Correlation between HLA antigens and immune status in dust-induced lung diseases in workers of machine-building industry

Correlation between mast cell-mediated allergic inflammation and length of perfluorinated compounds

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Corrigendum to "Benzanthrone induced immunotoxicity via oxidative stress and inflammatory mediators in Balb/c mice" [Immunobiology 220, (March) (2015) 369-381

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Corticosteroid-free immunosuppression with tacrolimus following induction with daclizumab: a large randomized clinical study

Corticosteroid-free immunosuppression with tacrolimus, mycophenolate mofetil, and daclizumab induction in renal transplantation

Corticosteroid-induced lymphopenia, immunosuppression, and body defense

Corticosteroids, immune suppression, and psychosis

Cortisol plays a role in the high environmental ammonia associated suppression of the immune response in zebrafish

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Could goserelin acetate induce autoimmune-like hepatitis

Coxsackievirus-induced myocarditis in mice: a model of autoimmune disease for studying immunotoxicity

CpG-based immunotherapy impairs antitumor activity of BRAF inhibitors in a B-cell-dependent manner

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Curcumin modulates the immune response associated with LPS-induced periodontal disease in rats

Curcumin protects against nicotine-induced stress during protein malnutrition in female rat through immunomodulation with cellular amelioration

Current developments in reproductive toxicity testing of pesticides

Current understanding of interactions between nanoparticles and the immune system

Cutaneous and Visceral Chronic Granulomatous Disease Triggered by a Rubella Virus Vaccine Strain in Children With Primary Immunodeficiencies

Cutaneous immunopathology of cyclosporin-A-induced autoimmunity in the rat

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Cyclophosphamide and the Teratology Society: an awkward marriage

Cyclophosphamide effects on immune function of European starlings

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Cyclosporine-induced autoimmunity and immune hyperreactivity
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Cytokines related to three major types of cell-mediated immunity in short- and long-term exposures to lead compounds
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Daily exposure to dust alters innate immunity

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Deficient Th1-type immune responses via impaired CD28 signaling in ultraviolet B-induced systemic immunosuppression and the restorative effect of IL-12

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Deflazacort induced stronger immunosuppression than expected

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DEHP induces immunosuppression through disturbing inflammatory factors and CYPs system homeostasis in common carp neutrophils

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Evaluation of immunotoxicity induced by pirimiphos-methyl in male Balb/c mice following exposure to for 28 days

Evaluation of immunotoxicity induced by single or concurrent exposure to N,N-diethyl-m-toluamide (DEET), pyridostigmine bromide (PYR), and JP-8 jet fuel

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Evaluation of neurotoxic and immunotoxic effects of trichloroacetic acid on rats

Evaluation of niridazole as a suppressant of cellular immunity in chickens

Evaluation of non-specific immune functions in dab, Limanda limanda L., following short-term exposure to sediments contaminated with polyaromatic hydrocarbons and/or polychlorinated biphenyls

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Evaluation of the immunotoxic potential of chlordecone with comparison to cyclophosphamide

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Evaluation of the potential immunotoxicity of 3-monochloro-1,2-propanediol in Balb/c mice. I. Effect on antibody forming cell, mitogen-stimulated lymphocyte proliferation, splenic subset, and natural killer cell activity

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Experimental T-2 toxicosis in swine following inhalation exposure: effects on pulmonary and systemic immunity, and morphologic changes
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Exposure to inhibitors of the renin-angiotensin system is a major independent risk factor for acute renal failure induced by sucrose containing intravenous immunoglobulins. A case-control study

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Hydroxylated fullerenes inhibit neutrophil function in fathead minnow (Pimephales promelas Rafinesque, 1820)

Hygienic evaluation of immune and endocrine systems and modifications of their relationship in reproductive-age women working under exposure to chemical factors in activated carbon emissions

Hypercholesterolemia impairs immunity to tuberculosis

Hypergravity-induced immunomodulation in a rodent model: hematological and lymphocyte function analyses
Hyperinsulinemia induced by highly active antiretroviral therapy in an adolescent with polycystic ovary syndrome who was infected with human immunodeficiency virus

Hypertension induced by immunosuppressive drugs: a comparative analysis between sirolimus and cyclosporine

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Hypothermal stress induced differential expression profiles of the immune response gene, warm-temperature-acclimation associated 65-kDa protein (Wap65), in the liver of fresh water and seawater milkfish, Chanos chanos

Hypothesis: is Alzheimer's disease a metal-induced immune disorder

Hypoxia inducible factor-1alpha contributes to UV radiation-induced inflammation, epidermal hyperplasia and immunosuppression in mice

Iatrogenic skin cancer: induction by psoralen/ultraviolet A and immunosuppression of organ transplant recipients

Iatrogenically induced spondylodiskitis due to Mycobacterium xenopi in an immunocompetent patient

Idelalisib impairs T-cell-mediated immunity in chronic lymphocytic leukemia

Identification of AhR-regulated genes involved in PAH-induced immunotoxicity using a highly-sensitive DNA chip, 3D-Gene Human Immunity and Metabolic Syndrome 9k

Identification of crassin acetate as a new immunosuppressant triggering heme oxygenase-1 expression in dendritic cells

Identification of informative features for predicting proinflammatory potentials of engine exhausts

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IgE antibodies to betalactams: relationship between the triggering hapten and the specificity of the immune response

IgY Reduces AFB1-Induced Cytotoxicity, Cellular Dysfunction, and Genotoxicity in Human L-02 Hepatocytes and Swan 71 Trophoblasts

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Immune effects of nickel

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Immune response due to silica exposure in Egyptian phosphate mines

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Immunoochemical methods of studying the mechanism of diclofenac-induced hepatitis [corrected

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Immunosuppression-induced leukoencephalopathy from tacrolimus (FK506)

Immunosuppressive activities of polychlorinated dibenzofuran congeners: quantitative structure-activity relationships and interactive effects

Immunosuppressive activity of a new pteridine derivative (4AZA1378) alleviates severity of TNBS-induced colitis in mice

Immunosuppressive activity of deer antler extracts of Cervus korean TEMMINCK var. manchuricus Swinhoe, on type II collagen-induced arthritis

Immunosuppressive activity of polychlorinated biphenyl mixtures and congeners: nonadditive (antagonistic) interactions

Immunosuppressive drug-induced diabetes

Immunosuppressive drug-induced leukoencephalopathy in patients with liver transplant

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Immunotoxic effects of diethylstilbestrol on host resistance: comparison with cyclophosphamide

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Immunotoxicity: the risk is real
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Impaired long-term immune protection following pneumococcal 13-valent/23-valent polysaccharide vaccine in systemic lupus erythematosus (SLE)

Impaired Microcirculation in Children After Kidney Transplantation: Everolimus Versus Mycophenolate Based Immunosuppression Regimen

Impaired mononuclear cell immune function in extreme obesity is corrected by weight loss

Impaired non-viral specific immune function of dendritic cell does not interfere with clearance and cytotoxic T lymphocyte response to HBV or HCV

Impaired outcome of continuous ambulatory peritoneal dialysis in immunosuppressed patients

Impaired phosphate handling of renal allografts is aggravated under rapamycin-based immunosuppression

Impaired pulmonary immunity post-bone marrow transplant
Impaired responses to gliadin and gut microbes of immune cells from mice with altered stress-related behavior and premature immune senescence

Impaired serotype-specific immune function following pneumococcal vaccination in infants with prior carriage

Impairment of cell-mediated immune responses by Pseudomonas aeruginosa

Impairment of Immunonutritional Status During Treatment is a Factor Associated With Oncologic Outcomes in Patients With Rectal Cancer Treated With Preoperative Chemoradiotherapy

Impairment of Immunoproteasome Function by Cigarette Smoke and in Chronic Obstructive Pulmonary Disease

Impairment of innate immune function by hydroxyethyl starch

Impairment of innate immune killing mechanisms by bacteriostatic antibiotics

Impairment of innate immune responses of airway epithelium by infection with bovine viral diarrhea virus

Impairment of non-specific immunity in patients under persistent vegetative state resulting from trauma

Impairment of renal function after islet transplant alone or islet-after-kidney transplantation using a sirolimus/tacrolimus-based immunosuppressive regimen

Impairment of several immune functions in anxious women

Impairment of T cell immunity by the respiratory syncytial virus: targeting virulence mechanisms for therapy and prophylaxis

Impairment of the immune response after transcuticular introduction of the insect gonadoinhibitory and hemocytotoxic peptide Neb-colloostatin: A nanotech approach for pest control

Impairment of the immune system in GH-overexpressing transgenic zebrafish (Danio rerio)

Implementation of toxicokinetics in toxicity studies--Toxicokinetics of 4-methylanisole and its metabolites in juvenile and adult rats

Implications of the new FDA/CDER immunotoxicology guidance for drugs

Implications of UV-induced inflammation and immunomodulation

Importance of innate immunity and collagen binding integrin alpha1beta1 in TNBS-induced colitis

In altering the release of glucocorticoids, ketorolac exacerbatess the effects of systemic immune stimuli on expression of proinflammatory genes in the brain

In contrast to morphine, buprenorphine enhances macrophage-induced humoral immunity and, as oxycodone, slightly suppresses the effector phase of cell-mediated immune response in mice

In situ (mesocosm) assessment of immunotoxicity risks to small mammals inhabiting petrochemical waste sites
In utero arsenic exposure is associated with impaired thymic function in newborns possibly via oxidative stress and apoptosis

In utero exposure to arsenic alters lung development and genes related to immune and mucociliary function in mice

In Utero exposure to genistein enhanced intranasal house dust mite allergen-induced respiratory sensitization in young adult B6C3F1 mice

In utero exposure to immunosuppressive drugs

In utero ultrafine particulate matter exposure causes offspring pulmonary immunosuppression

In vitro analysis of verapamil-induced immunosuppression: potent inhibition of T cell motility and lymphocytic transmigration through allogeneic endothelial cells

In vitro and in vivo comparison of the immunotoxicity of single- and multi-layered graphene oxides with or without pluronic F-127

In vitro and in vivo immunotoxic and immunomodulatory effects of nonsupplemented and selenium-supplemented cigarette smoke condensate

In vitro assays supporting the safety assessment of immunomodulatory monoclonal antibodies

In vitro characterization of cutaneous immunotoxicity of immortalized human keratinocytes (HaCaT) exposed to reactive and disperse textile dyes

In vitro characterization of the immunotoxic potential of several perfluorinated compounds (PFCs)

In vitro cytokine release from human peripheral blood mononuclear cells in the assessment of the immunotoxic potential of chemicals

In vitro cytopathic effects of mycotoxin T-2 on human peripheral blood T lymphocytes

In vitro effect of 4-pentylphenol and 3-methyl-4-nitrophenol on murine splenic lymphocyte populations and cytokine/granzyme production

In vitro enhancement of mouse T helper 2 cell sensitization to ovalbumin allergen by carbon black nanoparticles

In vitro evaluation of the effects of perfluorooctanesulfonic acid (PFOS) and perfluorooctanoic acid (PFOA) on IL-2 production in human T-cells

In vitro evaluation of the immunotoxic potential of perfluorinated compounds (PFCs)

In Vitro Exposure of Harbor Seal Immune Cells to Aroclor 1260 Alters Phocine Distemper Virus Replication

In vitro hematological and in vivo immunotoxicity assessment of dextran stabilized iron oxide nanoparticles
In vitro immune toxicity of polybrominated diphenyl ethers on murine peritoneal macrophages: apoptosis and immune cell dysfunction

In vitro immunotoxicity and cytotoxicity of trichosanthin against human normal immunocytes and leukemia-lymphoma cells

In vitro immunotoxicity of bis(tri-n-butyltin)oxide (TBTO) studied by toxicogenomics

In vitro immunotoxicity of untreated and treated urban wastewaters using various treatment processes to rainbow trout leucocytes

In vitro immunotoxicological effects of heavy metals on European sea bass (Dicentrarchus labrax L.) head-kidney leucocytes

In vitro immunotoxicology of quantum dots and comparison with dissolved cadmium and tellurium

In vitro lymphotoxicity and selective T cell immunotoxicity of high doses of acyclovir and its derivatives in mice

In vitro Modulating Activity of aqueous extracts from American Plants on Chlorpyrifos-induced toxicity on Murine Splenocytes

In vitro nanoparticle toxicity to rat alveolar cells and coelomocytes from the earthworm Lumbricus rubellus

In vitro nephrotoxicity induced by chloronitrobenzenes in renal cortical slices from Fischer 344 rats

In vitro nephrotoxicity induced by propanil

In vitro potency of inhibition by antiviral drugs of hematopoietic progenitor colony formation correlates with exposure at hemotoxic levels in human immunodeficiency virus-positive humans

In vitro stimulatory effect of N-acetyl tryptophan-glucopyranoside against gamma radiation induced immunosuppression

In vitro studies on immunotoxic potential of Orange II in splenocytes

In vitro study on the immune effects of the exposure to palladium nanoparticles

In vitro tests to evaluate immunotoxicity: a preliminary study

In vitro toxicity and interactions of environmental contaminants (Arochlor 1254 and mercury) and immunomodulatory agents (lipopolysaccharide and cortisol) on thymocytes from lake trout (Salvelinus namaycush)

In vitro VLA-4 blockade results in an impaired NK cell-mediated immune surveillance against melanoma

In vitro comparative immune effects of different titanium compounds

In vitro effects of different arsenic compounds on PBMC (preliminary study)

In vivo activation of a T helper 2-driven innate immune response in lung fibrosis induced by multi-walled carbon nanotubes
In vivo and in vitro immunosuppressive effects of benzo[k]fluoranthene in female Balb/c mice

In vivo effects of immunostimulating lipopeptides on mouse liver microsomal cytochromes P-450 and on paracetamol-induced toxicity

In vivo immunotoxicity of SiO2@(Y0.5Gd0.45Eu0.05)2O3 as dual-modality nanoprobes

In vivo induction of apoptosis and immune responses in mice by administration of lipopolysaccharide from Porphyromonas gingivalis

In vivo short-term exposure to residual oil fly ash impairs pulmonary innate immune response against environmental mycobacterium infection

In vivo studies on the immunotoxic effects of microcystins on rabbit

In Vivo toxicological assessment of biologically synthesized silver nanoparticles in adult Zebrafish (Danio rerio)

Inactivation of cadmium induced immunotoxicological alterations in rats by Tunisian montmorillonite clay

Incidence and etiology of hepatic dysfunction in heart transplant recipients receiving a cyclosporine-based triple immunosuppressive therapy

Incidence and natural history of intravenous immunoglobulin-induced aseptic meningitis: a retrospective review at a single tertiary care center

Incidence of cytomegalovirus in cardiac transplant recipients receiving induction immunosuppression with antithymocyte globulin

Incident stressful and traumatic life events and human immunodeficiency virus sexual transmission risk behaviors in a longitudinal, multisite cohort study

Inconsistently impairment of immune function and structural integrity of head kidney and spleen by vitamin A deficiency in grass carp (Ctenopharyngodon idella)

Increase in level of tumor necrosis factor-alpha in 6-hydroxydopamine-lesioned striatum in rats is suppressed by immunosuppressant FK506

Increased affective ultrasonic communication during fear learning in adult male rats exposed to maternal immune activation

Increased expression of immune modulator proteins and decreased expression of apolipoprotein A-1 and haptoglobin in blood plasma of sarin exposed rats

Increased expression of platelet IgG Fc receptors in immune heparin-induced thrombocytopenia

Increased immune and inflammatory responses to dust mite antigen in rats exposed to 5 ppm NO2

Increased immunoreactive rat lung ICAM-1 in oleic acid-induced lung injury
Increased immunoreactivity of POMC-derived neuropeptides and immediate-early gene-derived proteins (c-Fos and Egr-1 proteins) as an early step of acute cocaine-induced stressor effects: comparison with the effects of immobilization stress

Increased levels of glutathione S transferases and appearance of novel alpha class isoenzymes in kidneys of mice exposed to mercuric chloride. I. Biochemical and immunohistochemical studies

Increased levels of numerical chromosome aberrations after in vitro exposure of human peripheral blood lymphocytes to radiofrequency electromagnetic fields for 72 hours.

Increased total and mite-specific immunoglobulin E in patients with aspirin-induced urticaria and angioedema

Indicators of immunotoxicity in populations of cotton rats (Sigmodon hispidus) inhabiting an abandoned oil refinery

Individual and combined cytotoxicity of major trichothecenes type B, deoxynivalenol, nivalenol, and fusarenon-X on Jurkat human T cells

Individual responsiveness to induction of micronuclei in human lymphocytes after exposure in vitro to 1800-MHz microwave radiation.

Individual susceptibility to hexavalent chromium of workers of shoe, hide, and leather industries. Immunological pattern of HLA-B8, DR3-positive subjects

Indoxacarb interaction alters immunotoxic and genotoxic potential of endotoxin

Indoxyl sulfate (IS)-mediated immune dysfunction provokes endothelial damage in patients with end-stage renal disease (ESRD

Induced resistance to Candida albicans in BALB/c mice during short-term immunosuppression with cyclophosphamide

Induced sensitization to nickel in guinea pigs immunized with mycobacteria by injection of purified protein derivative with nickel

Inducible headkidney cytochrome P450 contributes to endosulfan immunotoxicity in walking catfish Clarias gariepinus

Induction and activation of adaptive immune populations during acute and chronic phases of a murine model of experimental colitis

Induction and Amelioration of Methotrexate-Induced Gastrointestinal Toxicity are Related to Immune Response and Gut Microbiota

Induction and modulation of pulmonary inflammation by organic dusts: cytokines, immune complexes and 'all of those things

Induction Immunosuppression in High-risk Kidney Transplant Recipients

Induction immunosuppression in kidney transplant recipients older than 60 years of age: safety and efficacy of ATGAM, OKT3 and Simulect
Induction immunosuppression with interleukin-2 receptor antibodies (basiliximab and daclizumab) in renal transplant recipients

Induction immunosuppression with OKT3 monoclonal antibody in cardiac transplant recipients

Induction immunosuppressive therapy in kidney transplantation

Induction immunosuppressive therapy in renal transplantation: does basiliximab make the difference

Induction immunosuppressive therapy in the elderly kidney transplant recipient in the United States

Induction immunosuppressive therapy stratified according to risk categories in renal transplantation

Induction of a type 1 immune response to a recombinant antigen from Mycobacterium tuberculosis expressed in Mycobacterium vaccae

Induction of alloreactive immunosuppression by 1,4-bis [(2-aminoethyl)amino]-5,8-dihydroxy-9,10-anthracenedione dihydrochloride (CL 232,468)

Induction of an autologous immune-complex glomerulonephritis in the rat by intravenous injection of heterologous anti-rat kidney tubular antibody IV: Effect of injection of HgCl2 prior to the antibody

Induction of antiviral cytotoxic T cells by plasmacytoid dendritic cells for adoptive immunotherapy of posttransplant diseases

Induction of apoptotic lesions in liver and lymphoid tissues and modulation of cytokine mRNA expression by acute exposure to deoxyxivalenol in piglets

Induction of autoimmunity through bystander effects. Lessons from immunological disorders induced by heavy metals

Induction of cancer, actinic keratosis, and specific p53 mutations by UVB light in human skin maintained in severe combined immunodeficient mice

Induction of colitis in mice with food allergen-specific immune response

Induction of eruptive benign melanocytic naevi by immune suppressive agents, including biologicals

Induction of experimental systemic lupus erythematosus in mice by immunization with a monoclonal anti-La autoantibody

Induction of IDO-1 by immunostimulatory DNA limits severity of experimental colitis

Induction of Immune Reaction in Benign Melanocytic Nevi Without Halo During Nivolumab Therapy in a Patient With Melanoma

Induction of immunomediated diseases by recombinant human granulocyte-macrophage colony-stimulating factor during cancer treatment

Induction of immunosuppression with rabbit antithymocyte globulin: five-year experience in cardiac transplantation

Induction of immunotoxicity by polycyclic hydrocarbons: role of the Ah locus
Induction of immunotoxicity in mice by polyhalogenated biphenyls

Induction of innate immune gene expression following methyl methanesulfonate-induced DNA damage in sea urchins

Induction of Maternal Immune Activation in Mice at Mid-gestation Stage with Viral Mimic Poly(I:C

Induction of multiple melanocytic nevus cell nevi in 2 children with malignant hematologic systemic diseases and chemotherapy-induced immunosuppression

Induction of neutralizing antibodies against Tityus serrulatus toxins by immunization with a recombinant nontoxic protein

Induction of neutralizing antibodies in mice immunized with scorpion toxins detoxified by liposomal entrapment

Induction of oxidative stress by Taxol vehicle Cremophor-EL triggers production of interleukin-8 by peripheral blood mononuclear cells through the mechanism not requiring de novo synthesis of mRNA

Induction of sarcomas by a single subcutaneous injection of 7,12-dimethylbenz[a]anthracene into neonatal male Sprague-Dawley rats: histopathological and immunohistochemical analyses

Induction of serum-borne immunomodulatory factors in B6C3F1 mice by carbon tetrachloride. I. Carbon tetrachloride-induced suppression of helper T-lymphocyte function is mediated by a serum borne factor

Induction of TGF-beta 1, not regulatory T cells, impairs antiviral immunity in the lung following bone marrow transplant

Induction Therapy With ATG Compared With Anti-IL2 Basiliximab in Low-Immunologic Risk Kidney Transplant Recipients

Induction versus noninduction in renal transplant recipients with tacrolimus-based immunosuppression

Industry experience in the identification of the immunotoxic potential of agrochemicals

Ineffectiveness of folic acid supplementation against phenytoin-induced decrease in salivary immunoglobulin A concentration of epileptic patients

Infection with the Lyme disease pathogen suppresses innate immunity in mice with diet-induced obesity

Infection with Vpr-positive human immunodeficiency virus type 1 impairs NK cell function indirectly through cytokine dysregulation of infected target cells

Inflammation caused by peripheral immune cells across into injured mouse blood brain barrier can worsen postoperative cognitive dysfunction induced by isoflurane

Inflammation induced by influenza virus impairs human innate immune control of pneumococcus

Inflammatory and immunological responses to subchronic exposure to endotoxin-contaminated metalworking fluid aerosols in F344 rats

Inflammatory and oxidative stress-related effects associated with neurotoxicity are maintained after exclusively prenatal trichloroethylene exposure
Inflammatory potential in relation to the microbial content of settled dust samples collected from moisture-damaged and reference schools: results of HITEA study

Infliximab in the treatment of anti-CTLA4 antibody (ipilimumab) induced immune-related colitis

Influence of 1.8 GHz microwave on DNA damage induced by 4 chemical mutagens.

Influence of arecoline on immune system: II. Suppression of thymus-dependent immune responses and parameter of non-specific resistance after short-term exposure

Influence of cadmium on murine thymocytes: potentiation of apoptosis and oxidative stress

Influence of chlorpyrifos on the profile of subpopulations of immunoactive cells and their phagocytic activity in an experimental in vivo model

Influence of environmental and industrial immunotoxic hazards on clinical course of HIV-infection

Influence of Human Leukocyte Antigen (HLA) Alleles and Killer Cell Immunoglobulin-Like Receptors (KIR) Types on Heparin-Induced Thrombocytopenia (HIT

Influence of immunization on the pulmonary inflammatory response of rabbits induced by Pasteurella haemolytica A1 lipopolysaccharide

Influence of immunization with non-genotoxic PAH-KLH conjugates on the resistance of organisms exposed to benzo(a)pyrene

Influence of induction therapy, immunosuppressive regimen and anti-viral prophylaxis on development of lymphomas after heart transplantation: data from the Spanish Post-Heart Transplant Tumour Registry

Influence of life stress on immunological reactivity to mild psychological stress

Influence of low-level exposure to Fusarium mycotoxins on selected immunological and hematological parameters in young swine

Influence of melatonin on immunotoxicity of cadmium

Influence of melatonin on immunotoxicity of lead

Influence of perinatal ochratoxin A exposure on the immune system in mice

Influence of stress on DDT-induced humoral immune responsiveness in mice

Influence of subchronic exposure to lindane on humoral immunity in mice

Influence of the Ah locus on the humoral immunotoxicity of 2,3,7,8-tetrachlorodibenzo-p-dioxin: evidence for Ah-receptor-dependent and Ah-receptor-independent mechanisms of immunosuppression

Influenza A virus protein PB1-F2 impairs innate immunity by inducing mitophagy

Influenza A virus protein PB1-F2 translocates into mitochondria via Tom40 channels and impairs innate immunity

Ingestion of low doses of deoxynivalenol does not affect hematological, biochemical, or immune responses of piglets
Inhalation toxicity studies of methyl isocyanate (MIC) in rats: Part IV--Immunologic response of rats one week after exposure: effect on body and organ weights, phagocytic and DTH response

Inhaled isobutyl nitrite compromises T-dependent, but not T-independent, antibody induction

Inhaled particles and respiratory disease

Inhibition of 3,3',4,4',5-pentachlorobiphenyl-induced fetal cleft palate and immunotoxicity in C57BL/6 mice by 2,2',4,4',5,5'-hexachlorobiphenyl

Inhibition of cytochrome P-450 with 2-diethylamino-ethyl-2,2-diphenylpropylacetate (SKF-525A) reduces immunotoxicity of chlorinated carbohydrates

Inhibition of HIV-1-specific T-cells and increase of viral load during immunosuppressive treatment in an HIV-1 infected patient with Chlamydia trachomatis induced arthritis

Inhibition of immune responses and related proteins in Rhamdia quelen exposed to diclofenac

Inhibition of immune-mediated concanavalin a-induced liver damage by free-radical scavengers

Inhibition of in vitro cytokine production by human peripheral blood mononuclear cells treated with xenobiotics: implications for the prediction of general toxicity and immunotoxicity

Inhibition of LPS-induced splenocyte proliferation by ortho-substituted polychlorinated biphenyl congeners

Inhibition of mite-induced immunoglobulin E synthesis, airway inflammation, and hyperreactivity by herbal medicine STA-1

Inhibition of TC-1 cytokine production, effector cytotoxic T lymphocyte development and alloantibody production by 2,3,7,8-tetrachlorodibenzo-p-dioxin

Inhibition of tumor necrosis factor activity fails to restore 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD)-induced suppression of the antibody response to sheep red blood cells

Inhibition of type II collagen induced arthritis in mice by an immunosuppressive extract of Tripterygium wilfordii Hook f

Inhibitory effect of Platycodon grandiflorum on T(H)1 and T(H)2 immune responses in a murine model of 2,4-dinitrofluorobenzene-induced atopic dermatitis-like skin lesions

Inhibitory effect of the immunosuppressant FK506 on apoptotic cell death induced by HIV-1 gp120

Initial experience of combined immunosuppressive induction therapy with polyclonal antithymocyte antibody, FK 506 (tacrolimus), and prednisolone in clinical liver transplantation

Initial immunosuppression in liver transplant recipients with impaired renal function

Innate immune parameters and haemolymph protein expression profile to evaluate the immunotoxicity of tributyltin on abalone (Haliotis diversicolor supertexta

Innate immune processes are sufficient for driving cigarette smoke-induced inflammation in mice
Innate immune response of silver catfish (Rhamdia quelen) exposed to atrazine

Innate immunity conferred by Toll-like receptors 2 and 4 and myeloid differentiation factor 88 expression is pivotal to monosodium urate monohydrate crystal-induced inflammation

Innate immunity drives xenobiotic-induced murine autoimmune cholangitis

Innate Lymphoid Cells Mediate Pulmonary Eosinophilic Inflammation, Airway Mucous Cell Metaplasia, and Type 2 Immunity in Mice Exposed to Ozone

Inorganic and methylated arsenic compounds induce cell death in murine macrophages via different mechanisms

Inorganic arsenic causes apoptosis cell death and immunotoxicity on European sea bass (Dicentrarchus labrax)

Insights into the heavy metal-induced immunotoxic and genotoxic alterations as health indicators of Clarias gariepinus inhabiting a rivulet

Integration of the human lymphocyte into immunotoxicological investigations

Integrative assessment of enantioselectivity in endocrine disruption and immunotoxicity of synthetic pyrethroids

Intensive postgrafting immune suppression combined with nonmyeloablative conditioning for transplantation of HLA-identical hematopoietic cell grafts: results of a pilot study for treatment of primary immunodeficiency disorders

Interaction of aflatoxin B1 and fumonisin B1 in mice causes immunotoxicity and oxidative stress: Possible protective role using lactic acid bacteria

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Interactions of malnutrition and immune impairment, with specific reference to immunity against parasites

Interactions of nanomaterials with the immune system

Interferon-gamma and immunoglobulin enhance mineral dust-induced production of reactive oxygen metabolites by human macrophages

Interleukin-1 receptor signaling is required to overcome the effects of pertussis toxin and for efficient infection- or vaccination-induced immunity against Bordetella pertussis

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Interrelationship between splenocyte immunomodulating factors in animals undergoing combined exposure to ethanol and tetrachloromethane

Interruption of immune responses in primary macrophages exposed to nonylphenol provides insights into the role of ER and NF-KB in immunotoxicity of Persian sturgeon

Intervention of Grape Seed Proanthocyanidin Extract on the Subchronic Immune Injury in Mice Induced by Aflatoxin B1

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Intimate male partner violence impairs immune control over herpes simplex virus type 1 in physically and psychologically abused women

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Intrauterine cocaine exposure of rabbits: persistent elevation of GABA-immunoreactive neurons in anterior cingulate cortex but not visual cortex

Intravenous cyclosporine to induce immunosuppression in cardiac allograft recipients

Intravenous Immune Globulin for Statin-Triggered Autoimmune Myopathy

Intravenous immunoglobulin as an adjunct therapy in persisting heparin-induced thrombocytopenia

Intravenous immunoglobulin as prophylaxis of chemotherapy-induced oral mucositis

Intravenous immunoglobulin followed by platelet transfusion in the acute treatment of trimethoprim/sulfamethoxazole-induced immune thrombocytopenia

Intravenous immunoglobulin G use in patients with chronic inflammatory demyelinating polyneuropathy: An uncommon cause of drug-induced discoid lupus erythematosus

Intravenous immunoglobulin in the treatment of severe methotrexate-induced acral erythema

Intravenous immunoglobulin induced meningoencephalitis

Intravenous immunoglobulin induced-nephropathy: a complication of IVIG therapy

Intravenous immunoglobulin preparation attenuates LPS-induced production of pro-inflammatory cytokines in human monocyctic cells by modulating TLR4-mediated signaling pathways
Intravenous immunoglobulin-induced acute thrombocytopenia

Intravenous immunoglobulin-induced haemolysis: a case report and review of the literature

Intravenous immunoglobulin-induced hemolytic anemia after thoracoscopic thymectomy for myasthenia gravis

Intravenous immunoglobulin-induced hemolytic anemia in a patient with juvenile dermatomyositis

Intravenous immunoglobulin-induced lichenoid dermatitis: a unique adverse reaction

Intravenous immunoglobulin-induced neutropenia

Intravenous immunoglobulin-induced neutrophil apoptosis in the lung during murine endotoxemia

Intravenous immunoglobulin-induced osmotic nephrosis

Intravenous Immunoglobulin-Induced Profound Bradycardia in a Patient With Idiopathic Thrombocytopenic Purpura

Intravenous Immunoglobulin-Induced Pulmonary Embolism: It Is Time to Act

Intravenous immunoglobulin-induced reversible neutropenia in a renal transplant patient

Intravenous immunoglobulin-induced, non-eczematous, vesiculobullous eruptions in Stevens-Johnson syndrome

Intravenous immunoglobulins-induced eczematous eruption: a long-term follow-up study

Investigating the Effects of Particulate Matter on House Dust Mite and Ovalbumin Allergic Airway Inflammation in Mice

Investigation of a screening battery for immunotoxicity of pharmaceuticals within a 28-day oral toxicity study using azathioprine and cyclosporin A as model compounds

Investigation of immunotoxicity of supercypermethrin forte in the Wistar rat

Investigation of neurotoxic and immunotoxic effects of some plant growth regulators at subacute and subchronic applications on rats

Investigation of sensitive biomarkers to determine cadmium inducing hepato- and nephro-toxicity in cattle by immunofluorescence method

Investigation of the adjuvant and immuno-suppressive effects of benzyl butyl phthalate, phthalic acid and benzyl alcohol in a murine injection model

Investigation of the preventive effect of Sijunzi decoction on mitomycin C-induced immunotoxicity in rats by 1H NMR and MS-based untargeted metabolomic analysis

Investigations into the Immunotoxicity and Allergic Potential Induced by Topical Application of N-Butylbenzenesulfonamide (NBBS) in a Murine Model

Investigations of immunotoxicity and allergic potential induced by topical application of triclosan in mice
Invitro immunotoxicity of environmentally representative antibiotics to the freshwater mussel Elliptio complanata

Invivo immunotoxicity of perfluorooctane sulfonate in BALB/c mice: Identification of T-cell receptor and calcium-mediated signaling pathway disruption through gene expression profiling of the spleen

Involvement of altered B7 expression in dioxin immunotoxicity: B7 transfection restores the CTL but not the autoantibody response to the P815 mastocytoma

Involvement of cellular immunity and humoral immunity in mixed allergy induced by trichloroethylene

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Involvement of oxidative stress in tri-ortho-cresyl phosphate-induced autophagy of mouse Leydig TM3 cells in vitro

Iodine induced lymphocytic thyroiditis in the BB/W rat: early and late immune phenomena

Ipilimumab-induced Guillain-Barre Syndrome Presenting as Dysautonomia: An Unusual Presentation of a Rare Complication of Immunotherapy

Ipilimumab-induced immune-related renal failure—a case report

Ipomoea obscura ameliorates cyclophosphamide-induced toxicity by modulating the immune system and levels of proinflammatory cytokine and GSH

Iron Deficiency Impairs Intra-Hepatic Lymphocyte Mediated Immune Response

Iron oxide particles modulate the ovalbumin-induced Th2 immune response in mice

Is Chronic Exposure to Low-Dose Organochlorine Pesticides a New Risk Factor of T-cell Immunosenescence

Is hydroxylamine-induced cytotoxicity a valid marker for hypersensitivity reactions to sulfamethoxazole in human immunodeficiency virus-infected individuals

Is impaired immunity a consequence of surgery in patients infected by the human immunodeficiency virus

Is murine gammaherpesvirus-68 (MHV-68) a suitable immunotoxicological model for examining immunomodulatory drug-associated viral recrudescence

Is opioid-induced immunosuppression a clinically relevant problem? Innocent until proven guilty

Is there a human health risk associated with indirect exposure to perfluoroalkyl carboxylates (PFCAs

Is there a potential immune dysfunction with anabolic androgenic steroid use?: A review

Is there evidence that environmental noise is immunotoxic

Is type 1 diabetes a disease of the gut immune system triggered by cow's milk insulin

Isocyanate exposure and hypersensitivity pneumonitis—report of a probable case and prevalence of specific immunoglobulin G antibodies among exposed individuals
Isoflavonoid compounds from red clover (Trifolium pratense) protect from inflammation and immune suppression induced by UV radiation

Isoflurane anesthesia impairs the expression of immune neuromodulators in the hippocampus of aged mice

Isolated herpes simplex in the adult larynx as a rare complication of methotrexate-induced immunosuppression

Isolation and characterization of microglia from adult mouse brain: selected applications for ex vivo evaluation of immunotoxicological alterations following in vivo xenobiotic exposure

Issues raised by the reference doses for perfluorooctane sulfonate and perfluorooctanoic acid

iTRAQ: a method to elucidate cellular responses to mycotoxin zearalenone

Jeju ground water containing vanadium induced immune activation on splenocytes of low dose gamma-rays-irradiated mice

Jet fuel-induced immunotoxicity

JP-8 induces immune suppression via a reactive oxygen species NF-kappabeta-dependent mechanism

JP-8 jet fuel exposure results in immediate immunotoxicity, which is cumulative over time

JP-8 jet fuel exposure suppresses the immune response to viral infections

Kaposi’s sarcoma-associated herpesvirus-encoded replication and transcription activator impairs innate immunity via ubiquitin-mediated degradation of myeloid differentiation factor 88

Kawasaki syndrome. Association with exposure to carpet shampoo and successful therapy with immunoglobulins in the second week of the illness

Keratinocyte-derived cytokines and UVB-induced immunosuppression

Ketoprofen impairs immunosuppression induced by severe sepsis and reveals an important role for prostaglandin E2

Keyhole limpet haemocyanin - a model antigen for human immunotoxicological studies

Keynote lecture in the 13th Japanese Society of Immunotoxicology (JSIT 2006) : -Pathophysiological Development and Immunotoxicology: what we have found from research related to silica and silicate such as asbestos

Kidney disorders induced by non-steroidal anti-inflammatory agents and immunomodulators

Kinetic determination of vitellogenin induction in the epidermis of cyprinid and perciform fishes: Evaluation of sensitive enzyme-linked immunosorbent assays

Kinetic of the CMV-specific T-cell immune response and CMV infection in CMV-seropositive kidney transplant recipients receiving rabbit anti-thymocyte globulin induction therapy: A pilot study
Kinin B1 receptor deficiency attenuates cisplatin-induced acute kidney injury by modulating immune cell migration

Klotho protects human monocytes from LPS-induced immune impairment associated with immunosenescent-like phenotype

Laboratory diagnosis of heparin-associated thrombocytopenia and comparison of platelet aggregation test, heparin-induced platelet activation test, and platelet factor 4/heparin enzyme-linked immunosorbent assay

Laboratory diagnosis of heparin-induced thrombocytopenia in Asian Indians as investigated with functional and immunologic methods

Laboratory diagnosis of immune heparin-induced thrombocytopenia

Lack of autoantibody induction by mercury exposure in artisanal gold mining settings in Colombia: Findings and a review of the epidemiology literature

Lack of effect of Vitamin A on corticosteroid-induced immunosuppression

Lack of immunotoxicity of saquinavir (Ro 31-8959) used alone or in double or triple combination with AZT and ddC

Lactic acidemia in human immunodeficiency virus-uninfected infants exposed to perinatal antiretroviral therapy

Lactobacillus casei HY7213 ameliorates cyclophosphamide-induced immunosuppression in mice by activating NK, cytotoxic T cells and macrophages

Lactobacillus delbrueckii ssp. bulgaricus OLL1073R-1 feeding enhances humoral immune responses, which are suppressed by the antiviral neuraminidase inhibitor oseltamivir in influenza A virus-infected mice

Lactobacillus johnsonii provides a dose-dependent protection against UVR-induced immunosuppression

Lactobacillus paracasei BEJ01 prevents immunotoxic effects during chronic zearalenone exposure in Balb/c mice

Lactobacillus plantarum KLDS1.0318 Ameliorates Impaired Intestinal Immunity and Metabolic Disorders in Cyclophosphamide-Treated Mice

Lactobacillus plantarum NCU116 Attenuates Cyclophosphamide-Induced Immunosuppression and Regulates Th17/Treg Cell Immune Responses in Mice

Lactobacillus reuteri CRL 1098 and Lactobacillus acidophilus CRL 1014 differently reduce in vitro immunotoxic effect induced by Ochratoxin A

Lamotrigine-induced common variable immune deficiency

Lamotrigine-induced toxic epidermal necrolysis treated with intravenous cyclosporin: a discussion of pathogenesis and immunosuppressive management
L-arginine and L-glutamine as immunonutrients and modulating agents for oxidative stress and toxicity induced by sodium nitrite in rats

L-Arginine reverses radiation-induced immune dysfunction: the need for optimum treatment window

Lasting effects of an impairment of Th1-like immune response in gamma-irradiated mice: A resemblance between irradiated mice and aged mice

Late conversion from tacrolimus to a belatacept-based immuno-suppression regime in kidney transplant recipients improves renal function, acid-base derangement and mineral-bone metabolism

Late onset neutropenia and immunoglobulin suppression of the patients with malignant lymphoma following autologous stem cell transplantation with rituximab

Late-onset pericardial tamponade, bilateral pleural effusions and recurrent immune monoarthritis induced by ipilimumab use for metastatic melanoma

Lead alters the immunogenicity of two neural proteins: a potential mechanism for the progression of lead-induced neurotoxicity

Lead and immune function

Lead exposure reduces carotenoid-based coloration and constitutive immunity in wild mallards

Lead induced modulation of splenic macrophage responses on humoral and cell mediated immunity

Lead toxicity on non-specific immune mechanisms of freshwater fish Channa punctatus

Lead toxicity: from overt to subclinical to subtle health effects

Leakage of mitochondrial and cytosolic GOT in isolated rat hepatocytes exposed to halothane: an immunohistochemical study

Lethal and sub-lethal evaluation of Indigo Carmine dye and byproducts after TiO2 photocatalysis in the immune system of Eisenia andrei earthworms

Letter: Tinea faciei exacerbated by topical immunomodulation: Two case reports

Leukopenia and altered hematopoietic activity in mice exposed to the abused inhalant, isobutyl nitrite

Levels of serum oxidoreductases (LD, MD, ICD), blood proteins, immunoglobulins, and ceruloplasmin in a group of workers exposed to carbon disulfide

Levocarnitine administration in multiple sclerosis patients with immunosuppressive therapy-induced fatigue

Lichen planus and lichenoid drug-induced eruption: a histological and immunohistochemical study

Life events, frontal electroencephalogram laterality, and functional immune status after acute psychological stressors in adolescents

Life stress and cervical squamous intraepithelial lesions in women with human papillomavirus and human immunodeficiency virus
Lifelong persistent viral infection alters the naive T cell pool, impairing CD8 T cell immunity in late life

Lifespan-extending caloric restriction or mTOR inhibition impair adaptive immunity of old mice by distinct mechanisms

Life-threatening piperacillin-induced immune haemolysis in a patient with cystic fibrosis

Life-threatening rituximab-induced pyoderma gangrenosum successfully treated with intravenous immunoglobulin

Life-threatening ceftriaxone-induced immune hemolytic anemia in a child with Crohn’s disease

Limited immunotoxic potential of technical formulation of the herbicide atrazine (AAtrex) in mice

Lindane-induced immunological alterations in human poisoning cases

Linear immunoglobulin A bullous dermatosis induced by gemcitabine

Linear immunoglobulin A bullous dermatosis possibly induced by mefenamic acid

Links between prolonged exposure to xenobiotics, increased incidence of hepatopathies, immunological disturbances and exacerbation of latent Epstein-Barr virus infections

Lipoic acid attenuates high fat diet-induced chronic oxidative stress and immunosuppression in mice jejunum: a microarray analysis

Lipopolysaccharide (LPS) induced activation of the immune system in control rats and rats chronically exposed to a low level of the organothiophosphate insecticide, acephate

Lipopolysaccharide impairs mucin secretion and stimulated mucosal immune stress response in respiratory tract of neonatal chicks

Lipopolysaccharide induces paired immunoglobulin-like receptor B (PirB) expression, synaptic alteration, and learning-memory deficit in rats

Lipopolysaccharide levels adherent to PM2.5 play an important role in particulate matter induced-immunosuppressive effects in mouse splenocytes

Lipopolysaccharide-induced immune activation impairs attention but has little effect on short-term working memory

Liposome-mediated combinatorial cytokine gene therapy induces localized synergistic immunosuppression and promotes long-term survival of cardiac allografts

Liver antioxidant and plasma immune responses in juvenile golden grey mullet (Liza aurata) exposed to dispersed crude oil

Liver enzyme function and humoral immunity in workers exposed to vinyl chloride

Local immunity and methods for its assessment upon exposure to ambient air-polluting biologicals

Local versus systemic immunotoxicity of isobutyl nitrite following subchronic inhalation exposure of female B6C3F1 mice
Localization and composition of renal immunodeposits in mice developing HgCl₂-induced autoimmune process

Long term effects of carbaryl exposure on antiviral immune responses in Xenopus laevis

Long-term effect of Spirulina platensis extract on DMBA-induced hamster buccal pouch carcinogenesis (immunohistochemical study)

Long-term effects of immunotoxic cholinergic lesions in the septum on acquisition of the cone-field task and noncognitive measures in rats

Long-term effects on humoral immunity among workers exposed to 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD)

Long-term effects on the immune system following local irradiation for breast cancer. Pokeweed mitogen induced immunoglobulin secretion by blood lymphocytes and serum immunoglobulin levels

Long-term exposure to arsenic affects head kidney and impairs humoral immune responses of Clarias batrachus

Long-term exposure to high levels of decabrominated diphenyl ether inhibits CD4 T-cell functions in C57Bl/6 mice

Long-term exposure to PCB in broiler chickens--metabolic and immunotoxic effects

Long-term immune dysfunction after radiotherapy to the head and neck area

Long-term immune dysfunction in rainbow trout (Oncorhynchus mykiss) exposed as embryos to aflatoxin B1

Long-term Immunotoxic Effects of Oral Prenatal and Neonatal Atrazine Exposure

Long-term moderate calorie restriction inhibits inflammation without impairing cell-mediated immunity: a randomized controlled trial in non-obese humans

Long-term sun exposure alters the collagen of the papillary dermis. Comparison of sun-protected and photoaged skin by northern analysis, immunohistochemical staining, and confocal laser scanning microscopy

Long-term toxicity of immune suppression in juvenile rheumatic diseases

Long-Time Instead of Short-Time Exposure in Vitro and Administration in Vivo of Ochratoxin A Is Consistent in Immunosuppression

Long-wave UVA offers partial protection against UVB-induced immune suppression in human skin

Loperamide-induced expression of immune and inflammatory genes in Collies associated with ivermectin sensitivity

Low dose exposure to cadmium and its health effects. (3) Toxicity in laboratory animals and cultured cells

Low dose TBT exposure decreases amphipod immunocompetence and reproductive fitness
Low doses of monocrotaline in rats cause diminished bone marrow cellularity and compromised nitric oxide production by peritoneal macrophages

Low level exposure to chemicals and immune system

Low levels of residual oil fly ash (ROFA) impair innate immune response against environmental mycobacteria infection in vitro

Low or excess levels of dietary cholesterol impairs immunity and aggravated inflammation response in young grass carp (Ctenopharyngodon idella)

Low-dose azathioprine effectively suppresses clinical and immunological manifestations of generalized myasthenia

Low-dose exposure to inorganic mercury accelerates disease and mortality in acquired murine lupus

Low-dose inorganic mercury increases severity and frequency of chronic coxsackievirus-induced autoimmune myocarditis in mice

Low-dose interleukin-2 impairs host anti-tumor immunity and inhibits therapeutic responses in a mouse model of melanoma

Low-dose synergistic immunosuppression of T-dependent antibody responses by polycyclic aromatic hydrocarbons and arsenic in C57Bl/6J murine spleen cells

Lower endotoxin immunity predicts increased cognitive dysfunction in elderly patients after cardiac surgery

Low-level dietary deoxynivalenol and acute exercise stress result in immunotoxicity in BALB/c mice

Low-level methylmercury exposure causes human T-cells to undergo apoptosis: evidence of mitochondrial dysfunction

LPS regulation of the immune response: Bacteroides endotoxin induces mitogenic, polyclonal, and antibody responses in classical LPS responsive but not C3H/HeJ mice

LPS-induced systemic inflammation reveals an immunomodulatory role for the prion protein at the blood-brain interface

Lycopene alleviates AFB1-induced immunosuppression by inhibiting oxidative stress and apoptosis in the spleen of mice

Lymphocyte dysfunction after DNA damage by toxic oxygen species. A model of immunodeficiency

Lymphocyte loss and immunosuppression following acetaminophen-induced hepatotoxicity in mice as a potential mechanism of tolerance

Lymphocyte proliferative response and tissue distribution of methylmercury sulfide and chloride in exposed rats

Lymphocyte subsets and Langerhans cells in sun-protected and sun-exposed skin of immunosuppressed renal allograft recipients
Macrophages are involved in hexachlorobenzene-induced adverse immune effects

Mafosfamide induces DNA fragmentation and apoptosis in human T-lymphocytes. A possible mechanism of its immunosuppressive action

Maintenance rituximab following induction chemo-immunotherapy for mantle cell lymphoma: long-term follow-up of a pilot study from the Wisconsin Oncology Network

MAIT cells launch a rapid, robust and distinct hyperinflammatory response to bacterial superantigens and quickly acquire an anergic phenotype that impedes their cognate antimicrobial function: Defining a novel mechanism of superantigen-induced immunopathology and immunosuppression

Maize prolams could induce a gluten-like cellular immune response in some celiac disease patients

Malathion immunotoxicity in the American lobster (Homarus americanus) upon experimental exposure

Malathion, lindane, and piperonyl butoxide, individually or in combined mixtures, induce immunotoxicity via apoptosis in murine splenocytes in vitro

Malnutrition and impaired immune response to infection

Malnutrition, urocanic acid, and sun may interact to suppress immunity in sojourners to high altitude

Mammalian immunoassays for predicting the toxicity of malathion in a laboratory fish model

Management of adverse events induced by next-generation immunomodulatory drug and proteasome inhibitors in multiple myeloma

Management of immune dysfunction after adult cardiac surgery

Managing immune checkpoint-inhibitor-induced severe autoimmune-like hepatitis by liver-directed topical steroids

Manganese tissue accumulation and tyrosine hydroxylase immunostaining response in the Neotropical freshwater crab, Dilocarcinus pagei, exposed to manganese

Manifestations of cellular immunity in the rat after prolonged asbestos inhalation. II. Alveolar macrophage-induced splenic lymphocyte proliferation

Markers for immunotoxic effects in rodents and man

Mast cells in the intestine and gills of the sea bream, Sparus aurata, exposed to a polychlorinated biphenyl, PCB 126

Mast cells mediate the immune suppression induced by dermal exposure to JP-8 jet fuel

Maternal adrenalectomy alters the immune and endocrine functions of fetal alcohol-exposed male offspring

Maternal and early postnatal polychlorinated biphenyl exposure in relation to total serum immunoglobulin concentrations in 6-month-old infants
Maternal exposure to airborne particulate matter causes postnatal immunological dysfunction in mice offspring.

Maternal exposure to fish oil primes offspring to harbor intestinal pathobionts associated with altered immune cell balance.

Maternal exposure to particulate matter alters early post-natal lung function and immune cell development.

Maternal exposure to silver nanoparticles are associated with behavioral abnormalities in adulthood: Role of mitochondria and innate immunity in developmental toxicity.

Maternal Immune Activation Causes Behavioral Impairments and Altered Cerebellar Cytokine and Synaptic Protein Expression.

Maternal Lipopolysaccharide Exposure Promotes Immunological Functional Changes in Adult Offspring CD4+ T Cells.

Maternal lipopolysaccharide-induced inflammation during pregnancy programs impaired offspring innate immune responses.

Maternal obesity programs offspring nonalcoholic fatty liver disease by innate immune dysfunction in mice.

Maternal separation in early life impairs tumor immunity in adulthood in the F344 rat.

Maternal smoking is associated with impaired neonatal toll-like-receptor-mediated immune responses.

Maternal transfer and sublethal immune system effects of brevetoxin exposure in nesting loggerhead sea turtles (Caretta caretta) from western Florida.

Maternal undernutrition induces neuroendocrine immune dysfunction in male pups at weaning.


MDCO-216 Does Not Induce Adverse Immunostimulation, in Contrast to Its Predecessor ETC-216.

Measurement of airborne flour exposure with a monoclonal antibody-based immunoassay.

Measures of resting immune function and related physiology in juvenile rainbow trout exposed to a pulp mill effluent.

Mechanical ventilation of healthy rats suppresses peripheral immune function.

Mechanism of 7,12-dimethylbenz[a]anthracene-induced immunotoxicity: role of metabolic activation at the target organ.

Mechanism of deoxynivalenol effects on the reproductive system and fetus malformation: Current status and future challenges.

Mechanism of immunosuppression in zebrafish (Danio rerio) spleen induced by environmentally relevant concentrations of perfluorooctanoic acid.
Mechanism of immunotoxicological effects of tributyltin chloride on murine thymocytes

Mechanism of perfluorooctanesulfonate (PFOS)-induced apoptosis in the immunocyte

Mechanism of systemic immune suppression by UV irradiation in vivo. II. The UV effects on number and morphology of epidermal Langerhans cells and the UV-induced suppression of contact hypersensitivity have different wavelength dependencies

Mechanism of TCDD-induced suppression of antibody production: effect on T cell-derived cytokine production in the primary immune reaction of mice

Mechanism of UVB-induced suppression of the immune response to Mycobacterium bovis bacillus Calmette-Guerin: role of cytokines on macrophage function

Mechanisms for how inhaled multiwalled carbon nanotubes suppress systemic immune function in mice

Mechanisms involved in the immunotoxicity induced by dermal application of JP-8 jet fuel

Mechanisms of 1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin (HpCDD)-induced humoral immune suppression: evidence of primary defect in T-cell regulation

Mechanisms of dimethylbenzanthracene-induced immunotoxicity

Mechanisms of ethanol-induced immunosuppression

Mechanisms of immune dysfunction in stem cell transplantation

Mechanisms of immunotoxic effects of acrylonitrile

Mechanisms of organophosphorus pesticide toxicity in the context of airway hyperreactivity and asthma

Mechanisms underlying the suppression of established immune responses by ultraviolet radiation

Mechanisms underlying UV-induced immune suppression: implications for sunscreen design

Medical management and sublingual immunotherapy practices in patients with house dust mite-induced respiratory allergy: a retrospective, observational study

Melatonin alleviates aluminium chloride-induced immunotoxicity by inhibiting oxidative stress and apoptosis associated with the activation of Nrf2 signaling pathway

Melatonin ameliorates ochratoxin A-induced oxidative stress and apoptosis in porcine oocytes

Mercuric chloride induces a strong immune activation, but does not accelerate the development of dermal fibrosis in tight skin 1 mice

Mercury Accumulation, Structural Damages, and Antioxidant and Immune Status Changes in the Gilthead Seabream (Sparus aurata L.) Exposed to Methylmercury

Mercury and autoimmunity: implications for occupational and environmental health

Mercury compounds and the immune system: a review

Mercury exposure and children's health
Mercury Exposure and Heart Diseases

Mercury exposure in protein A immunoadsorption

Mercury exposure, serum antinuclear/antinucleolar antibodies, and serum cytokine levels in mining populations in Amazonian Brazil: a cross-sectional study

Mercury impairment of mouse thymocyte survival in vitro: involvement of cellular thiols

Mercury-induced autoimmune glomerulonephritis in inbred rats. II. Immunohistopathology, histopathology and effects of prostaglandin administration

Meropenem-induced immune thrombocytopenia and the diagnostic process of laboratory testing

Mesenteric lymph node Tgammadelta cells induced by gastrectomy in mice suppress cell-mediated immune response in vitro via released TGF-bta

Metabolic and immune impairments induced by the endocrine disruptors benzo[a]pyrene and triclosan in Xenopus tropicalis

Metabolic and immunological disorders induced by long-term treatment with phenytoin

Metabolic pathways of ochratoxin A

Metabolic profiling study on potential toxicity and immunotoxicity-biomarker discovery in rats treated with cyclophosphamide using HPLC-ESI-IT-TOF-MS

Metabolic requirements for induction of contact hypersensitivity to immunotoxic polyaromatic hydrocarbons

Metabolic Syndrome after Hematopoietic Cell Transplantation: At the Intersection of Treatment Toxicity and Immune Dysfunction

Metabolism and toxicity of aflatoxins M1 and B1 in human-derived in vitro systems

Metabolite-specific (IgG) and drug-specific antibodies (IgG, IgM) in two cases of trimethoprim-sulfamethoxazole-induced immune thrombocytopenia

Metal allergens of growing significance: epidemiology, immunotoxicology, strategies for testing and prevention

Metal-induced impairment of the cellular immunity of newborn harbor seals (Phoca vitulina)

Metallothionein-null mice are highly susceptible to the hematotoxic and immunotoxic effects of chronic CdCl2 exposure

Methamphetamine activates nuclear factor kappa-light-chain-enhancer of activated B cells (NF-kappaB) and induces human immunodeficiency virus (HIV) transcription in human microglial cells

Methamphetamine induces trace amine-associated receptor 1 (TAAR1) expression in human T lymphocytes: role in immunomodulation
Method for evaluation of immunotoxicity of dioxin compounds using human T-lymphoblastic cell line, L-MAT

Methods for Analysis of Nanoparticle Immunosuppressive Properties In Vitro and In Vivo

Methods for Assessing Mast Cell Responses to Engineered Nanomaterial Exposure

Methotrexate-induced iatrogenic immunodeficiency-associated lymphoproliferative disorder causing hypercalcaemia

Methylenedioxymethamphetamine (‘Ecstasy’) - induced immunosuppression: a cause for concern

Methylmercury/copper effects on hemosiderin: possible mechanism of immune suppression in fish

Methylmercury-induced movement and postural disorders in developing rat: loss of somatostatin-immunoreactive interneurons in the striatum

Methylprednisolone-induced immune thrombocytopenia

Methylprednisolone-Induced Lymphocytosis in Patients with Immune-Mediated Inflammatory Disorders

Mice repeatedly exposed to Group-A beta-Haemolytic Streptococcus show perseverative behaviors, impaired sensorimotor gating, and immune activation in rostral diencephalon

Mice with genetically determined high susceptibility to ultraviolet (UV)-induced immunosuppression show enhanced UV carcinogenesis

Microbial Degradation of Cellular Kinases Impairs Innate Immune Signaling and Paracrine TNFalpha Responses

Microcystin-LR exposure to adult zebrafish (Danio rerio) leads to growth inhibition and immune dysfunction in F1 offspring, a parental transmission effect of toxicity

Microcystin-LR Induced Immunotoxicity in Mammals

Microcystin-LR induces cytotoxicity and affects carp immune cells by impairment of their phagocytosis and the organization of the cytoskeleton

Microcystin-LR modulates selected immune parameters and induces necrosis/apoptosis of carp leucocytes

Microcystin-LR toxicodynamics, induced pathology, and immunohistochemical localization in livers of blue-green algae exposed rainbow trout (oncorhynchus mykiss

Microgravity inhibits resting T cell immunity in an exposure time-dependent manner

Micronized, Heat-Treated Lactobacillus plantarum LM1004 Alleviates Cyclophosphamide-Induced Immune Suppression

Micronutrient deficiencies are associated with impaired immune response and higher burden of respiratory infections in elderly Ecuadorians
MicroRNA-155 and microRNA-181a, via HO-1, participate in regulating the immunotoxicity of cadmium in the kidneys of exposed Cyprinus carpio

Microsomal expoxide hydrolase is required for 7,12-dimethylbenz[a]anthracene (DMBA)-induced immunotoxicity in mice

Midazolam impairs immune functions: it's time to take care of dendritic cells

Miliary Mycobacterium bovis induced by intravesical bacille Calmette-Guerin immunotherapy

Minimal immunological changes in structurally malformed rats after prenatal exposure to cyclophosphamide

Minimal immunological effects on workers with prolonged low exposure to inorganic mercury

Minimum doses of ultraviolet radiation required to induce murine skin edema and immunosuppression are different and depend on the ultraviolet emission spectrum of the source

Minocycline-induced immune thrombocytopenia presenting as Schamberg's disease

Minor effects of low exposure to inorganic mercury on the human immune system

MiR-122 partly mediates the ochratoxin A-induced GC-2 cell apoptosis

MiR-582-5p/miR-590-5p targeted CREB1/CREB5-NF-kappaB signaling and caused opioid-induced immunosuppression in human monocytes

Misoprostol impairs female reproductive tract innate immunity against Clostridium sordellii

Mitigation of Hydrophobicity-Induced Immunotoxicity by Sugar Poly(orthoesters)

Mitochondrial functions of THP-1 monocytes following the exposure to selected natural compounds

Mitochondrial peroxiredoxin 3 (Prx3) from rock bream (Oplegnathus fasciatus): immune responses and role of recombinant Prx3 in protecting cells from hydrogen peroxide induced oxidative stress

Mitotic activity of keratinocytes in nifedipine- and immunosuppressive medication-induced gingival overgrowth

Mixed mold mycotoxicosis: immunological changes in humans following exposure in water-damaged buildings

MNU-induced rat mammary carcinomas: immunohistology and estrogen receptor expression

Modeling and predicting immunological effects of chemical stressors: characterization of a quantitative biomarker for immunological changes caused by atrazine and ethanol

Modeling the Function of TATA Box Binding Protein in Transcriptional Changes Induced by HIV-1 Tat in Innate Immune Cells and the Effect of Methamphetamine Exposure

Modeling toxicodynamic effects of trichloroethylene on liver in mouse model of autoimmune hepatitis

Modelling the immunopathophysiology of Brucella melitensis and its lipopolysaccharide in mice infected via oral route of exposure
Moderate prenatal alcohol exposure suppresses the TLR4-mediated innate immune response in the hippocampus of young rats

Modification of immunoreactive EGF and EGF receptor after acute tubular necrosis induced by tobramycin or cisplatin

Modification of primary amines to higher order amines reduces in vivo hematological and immunotoxicity of cationic nanocarriers through TLR4 and complement pathways

Modifications of immunological and neuro-endocrine parameters induced by antiorthostatic bed-rest in human healthy volunteers

Modifications of neuronal phosphorylated tau immunoreactivity induced by NMDA toxicity

Modulating effect of MgO-SiO2 nanoparticles on immunological and histopathological alterations induced by aflatoxicosis in rats

Modulation of benzo[a]pyrene induced immunotoxicity in mice actively immunized with a B[a]P-diphtheria toxoid conjugate

Modulation of benzo[a]pyrene induced neurotoxicity in female mice actively immunized with a B[a]P-diphtheria toxoid conjugate

Modulation of biochemical parameters by Hemidesmus indicus in cumene hydroperoxide-induced murine skin: possible role in protection against free radicals-induced cutaneous oxidative stress and tumor promotion

Modulation of immune and antioxidant responses by azinphos-methyl in the freshwater mussel Diplodon chilensis challenged with Escherichia coli

Modulation of immune response by organophosphorus pesticides: fishes as a potential model in immunotoxicology

Modulation of immune responses with nanoparticles and reduction of their immunotoxicity

Modulation of immune-associated parameters and antioxidant responses in the crab (Scylla serrata) exposed to mercury

Modulation of macrophage activation by ammonium metavanadate

Modulation of murine peritoneal macrophage function by chronic exposure to arsenate in drinking water

Modulation of N-methyl-N-nitrosourea-induced crypt restricted metallothionein immunopositivity in mouse colon by a non-genotoxic diet-related chemical

Modulation of signal transduction pathways in lymphocytes due to sub-lethal toxicity of chlorinated phenol

Modulation of T-helper cell populations: potential mechanisms of respiratory hypersensitivity and immune suppression
Modulatory efficacy of green tea polyphenols on glycoconjugates and immunological markers in 4-Nitroquinoline 1-oxide-induced oral carcinogenesis-A therapeutic approach

Modulatory role of dietary Chlorella vulgaris powder against arsenic-induced immunotoxicity and oxidative stress in Nile tilapia (Oreochromis niloticus

Modulatory role of dietary Thymus vulgaris essential oil and Bacillus subtilis against thiamethoxam-induced hepatorenal damage, oxidative stress, and immunotoxicity in African catfish (Clarias garipenus

Modulatory role of L-carnitine against microcystin-LR-induced immunotoxicity and oxidative stress in common carp

Molecular and immune toxicity of CoCr nanoparticles in MoM hip arthroplasty

Molecular and immunological toxic effects of nanoparticles

Molecular cloning, immunohistochemical localization, characterization and expression analysis of caspase-8 from the blunt snout bream (Megalobrama amblycephala) exposed to ammonia

Molecular determinants of UV-induced immunosuppression

Molecular insight of arsenic-induced carcinogenesis and its prevention

Molecular mechanisms of amitraz mammalian toxicity: a comprehensive review of existing data

Molecular mechanisms underlying mancozeb-induced inhibition of TNF-alpha production

Monitoring antioxidant defenses and free radical production in space-flight, aviation and railway engine operators, for the prevention and treatment of oxidative stress, immunological impairment, and premature cell aging

Monitoring of azathioprine-induced immunosuppression with thiopurine methyltransferase activity in kidney transplant recipients

Monoclonal gammopathy after intense induction immunosuppression in renal transplant patients

Morphine impairs host innate immune response and increases susceptibility to Streptococcus pneumoniae lung infection

Morphine induced, behavioural, biochemical and immunological correlations

Morphine or U-50,488 suppresses Fos protein-like immunoreactivity in the spinal cord and nucleus tractus solitarii evoked by a noxious visceral stimulus in the rat

Morphological alteration, lysosomal membrane fragility and apoptosis of the cells of Indian freshwater sponge exposed to washing soda (sodium carbonate

Morphological analysis of glomerular lesions in renal transplants immunosuppressed with cyclosporine A (CYA): has CYA induced a new transplant glomerular lesion

Morphological and immunohistochemical analysis of the liver in L-arginine induced experimental chronic pancreatitis
Morphological and immunohistochemical changes on rat skin exposed to nitrogen mustard

Morphological and immunohistochemical characteristics of the thymus during chemical carcinogenesis induced by 1,2-dimethylhydrazine administration

Morphological and immunohistochemical studies on porcine serum-induced rat liver fibrosis

Morphological changes in the thyroid and adrenals under the bitemporal action of a UHF electrical field and decimeter waves (experimental research).

Morphological features of the organs of the immune system in conditions of exposure to chromium and benzene

Mouse allergen exposure and immunologic responses: IgE-mediated mouse sensitization and mouse specific IgG and IgG4 levels

Mouse lung immune response after acute exposure to flour dust

Moxifloxacin as the likely cause of drug-induced linear immunoglobulin A bullous dermatosis

Mucosal-associated invariant T cells from patients with tuberculosis exhibit impaired immune response

Multilaboratory evaluation of 15 bioassays for (eco)toxicity screening and hazard ranking of engineered nanomaterials: FP7 project NANOVALID

Multiorgan failure induced by intravenous immunoglobulin

Multiparametric immunotoxicity screening in mice during early drug development

Multiple biomarkers of the cytotoxicity induced by BDE-47 in human embryonic kidney cells

Multiple enlarged metabolically active lymph nodes in 18F-FDG PET/CT after anti-CTLA-4 antibody therapy in metastatic melanoma - disease progression or immunologically induced side effect

Multiple experimental approaches of immunotoxic effects of mercury chloride in the blue mussel, Mytilus edulis, through in vivo, in tubo and in vitro exposures

Multiple myeloma: clusters, clues, and dioxins

Murine membranous nephropathy: immunization with alpha3(IV) collagen fragment induces subepithelial immune complexes and FcγR-independent nephrotic syndrome

Murine model of ethanol-induced immunosuppression

Mutagenic and morphologic impacts of 1.8GHz radiofrequency radiation on human peripheral blood lymphocytes (hPBLs) and possible protective role of pre-treatment with Ginkgo biloba (EGb 761).

Mutual augmentation of the induction of the histamine-forming enzyme, histidine decarboxylase, between alendronate and immuno-stimulants (IL-1, TNF, and LPS), and its prevention by clodronate

Myasthenia triggered by immune checkpoint inhibitors: New case and literature review

Mycobacterium infection from a cardiopulmonary bypass heater-cooler unit in a patient with steroid-induced immunosuppression
Mycobiota and Ochratoxin A in laboratory mice feed: preliminary study

Mycolactone-producing Mycobacterium marinum infection in captive Hong Kong warty newts and pathological evidence of impaired host immune function

Mycophenolate mofetil and reduced doses of cyclosporine in pediatric liver transplantation with chronic renal dysfunction: changes in the immune responses

Mycophenolate mofetil-based calcineurin inhibitor reduced immunosuppressive protocol for the improvement of renal dysfunction after liver transplantation

Mycophenolate mofetil-based, cyclosporine-free induction and maintenance immunosuppression: first-3-months analysis of efficacy and safety in two cohorts of renal allograft recipients

Mycotoxicoses in children

Mycotoxins, general view, chemistry and structure

Myeloid-derived suppressor cells accumulate in the liver site after sepsis to induce immunosuppression

N,N-,diethyl-m-toluamide (DEET) suppresses humoral immunological function in B6C3F1 mice

Nanomaterial Exposure Induced Neutrophil Extracellular Traps: A New Target in Inflammation and Innate Immunity

Nanomaterial Induced Immune Responses and Cytotoxicity

Nanoparticles of zinc oxide defeat chlorpyrifos-induced immunotoxic effects and histopathological alterations

Nanosafety studies of nanomaterials about biodistribution and immunotoxicity

Natural killer activity in Fischer-344 rat lungs as a method to assess pulmonary immunocompetence: immunosuppression by phosgene inhalation

Naturally occurring level of mixed aflatoxins B and G stimulate toll-like receptor-4 in bovine mononuclear cells

Necrotizing Autoimmune myopathy: A case report on statin induced rhabdomyolysis requiring immunosuppressive therapy

Negative effect of chronic cadmium exposure on growth, histology, ultrastructure, antioxidant and innate immune responses in the liver of zebrafish: Preventive role of blue light emitting diodes

Neonatal exposure to mild hyperoxia causes persistent increases in oxidative stress and immune cells in the lungs of mice without altering lung structure

Neonatal exposure to UVR alters skin immune system development, and suppresses immunity in adulthood

Neonatal phytoestrogen exposure alters oviduct mucosal immune response to pregnancy and affects preimplantation embryo development in the mouse
Neonicotinoid-induced pathogen susceptibility is mitigated by Lactobacillus plantarum immune stimulation in a Drosophila melanogaster model.

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Neuroendocrine and Eosinophilic Granule Cells in the Gills of Tilapia, Oreochromis niloticus: Effects of Waterborne Copper Exposure.

Neuroendocrine and immunotoxicity of polyaromatic hydrocarbon, chrysene in crustacean post larvae.

Neuro-immune interactions in psychopathology with the example of interferon-alpha-induced depression.

Neurologic and immunologic effects of exposure to corticosterone, chlorpyrifos, and multiple doses of tri-ortho-tolyl phosphate over a 28-day period in rats.

Neuro-Modulation of Immuno-Endocrine Response Induced by Kaliotoxin of Androctonus Scorpion Venom.

Neuron specific enolase (NSE) immunostaining detection of endocrine cell hyperplasia in adult rats exposed to asbestos.

Neuron-immune interactions in the sensitized thalamus induced by mustard oil application to rat molar pulp.

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Neurotoxic Anatoxin-a Can Also Exert Immunotoxicity by the Induction of Apoptosis on Carassius auratus Lymphocytes in vitro When Exposed to Environmentally Relevant Concentrations.

Neurotoxic and immunotoxic effects of fenthion and omethoate on frogs at acute exposure.

Neurotoxic and immunotoxic effects of Indole-3-butyric acid on rats at subacute and subchronic exposure.

Neurotoxic effects of ochratoxin A on the subventricular zone of adult mouse brain.

Neurotoxicity and immunotoxicity assessment in CBA/J mice with chronic Toxoplasma gondii infection and multiple oral exposures to methylmercury.

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Neurotoxicity of toluene

Neutralizing antibodies obtained in a persistent immune response are effective against deleterious effects induced by the Thalassophryne nattereri fish venom

Neutrophil depletion during Toxoplasma gondii infection leads to impaired immunity and lethal systemic pathology

Neutrophil function after exposure to polychlorinated biphenyls in vitro

Neutrophil protease inhibition reduces neuromyelitis optica-immunoglobulin G-induced damage in mouse brain

New insights into the mechanisms of polymorphic light eruption: resistance to ultraviolet radiation-induced immune suppression as an aetiological factor

New mechanism of organophosphorus pesticide-induced immunotoxicity

NF-kappaB activation via MyD88-dependent Toll-like receptor signaling is inhibited by trichothecene mycotoxin deoxynivalenol

Nickel - role in human organism and toxic effects

Nicotinamide reduces photodynamic therapy-induced immunosuppression in humans

Nitric oxide appears to be a mediator of solar-simulated ultraviolet radiation-induced immunosuppression in humans

Nitric oxide synthase immunolocalization and expression in the rat hippocampus after sub-acute lead acetate exposure in rats

Nitric oxide synthase inhibitor, aminoguanidine reduces intracerebroventricular colchicine induced neurodegeneration, memory impairments and changes of systemic immune responses in rats

Nitrofurantoin-induced immune-mediated lung and liver disease

Nivolumab-induced acute-onset type 1 diabetes mellitus as an immune-related adverse event: A case report

Nivolumab-Induced Subcutaneous Fat Necrosis: Another FDG-Avid Immune-Related Adverse Event

Nivolumab-induced type 1 diabetes mellitus as an immune-related adverse event

Non-analgesic effects of opioids: mechanisms and potential clinical relevance of opioid-induced immunodepression

Noncardiogenic pulmonary edema triggered by intravenous immunoglobulin in cancer-associated thrombotic thrombocytopenic purpura-hemolytic uremic syndrome

Nonclinical regulatory immunotoxicity testing of nanomedicinal products: Proposed strategy and possible pitfalls
Non-coplanar PCB-mediated modulation of human leukocyte phagocytosis: a new mechanism for immunotoxicity

Non-coplanar polychlorinated biphenyl (PCB)-induced immunotoxicity is coincident with alterations in the serotonergic system

Non-cytotoxic hydroxyl-functionalized exfoliated boron nitride nanoflakes impair the immunological function of insect haemocytes in vivo

Non-immunologic factor: immunosuppressive drug-induced nephrotoxicity

Normal development of tyrosine hydroxylase and serotonin immunoreactive fibers innervating anterior cingulate cortex and visual cortex in rabbits exposed prenatally to cocaine

Normalizing effect of plant-originated glycoprotein (116 kDa) on G0/G1 arrest in cadmium chloride-induced primary cultured mouse myelocytes

Novel Acaricidal Drug Fluazuron Causes Immunotoxicity via Selective Depletion of Lymphocytes T CD8

Novel Approach in Monocyte Intracellular TNF Measurement: Application to Sepsis-Induced Immune Alterations

Novel biomarkers of mercury-induced autoimmune dysfunction: a cross-sectional study in Amazonian Brazil

Novel CD3-specific antibody induces immunosuppression via impaired phosphorylation of LAT and PLCgamma1 following T-cell stimulation

Novel compound 2-methyl-2H-pyrazole-3-carboxylic acid (2-methyl-4-o-tolylazo-phenyl)-amide (CH-223191) prevents 2,3,7,8-TCDD-induced toxicity by antagonizing the aryl hydrocarbon receptor

Novel evidence of microglial immune response in impairment of Dengue infection of CNS

Novel gene markers of immunosuppressive chemicals in mouse lymph node assay

Novel mechanisms of gliadin immunotoxicity

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Nrf2 Regulates the Risk of a Diesel Exhaust Inhalation-Induced Immune Response during Bleomycin Lung Injury and Fibrosis in Mice

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Opioid-induced immunosuppression

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Oral (gavage), in utero and postnatal exposure of Sprague-Dawley rats to low doses of tributyltin chloride. Part II: effects on the immune system

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Protective effects of diallyl sulfide on N-nitrosodimethylamine-induced immunosuppression in mice

Protective effects of different antioxidants against endosulfan-induced oxidative stress and immunotoxicity in albino rats

Protective effects of gamma-irradiated Astragalus polysaccharides on intestinal development and mucosal immune function of immunosuppressed broilers

Protective effects of meat from lambs on selenium nanoparticle supplemented diet in a mouse model of polycyclic aromatic hydrocarbon-induced immunotoxicity
Protective effects of melatonin in reduction of oxidative damage and immunosuppression induced by aflatoxin B1-contaminated diets in young chicks

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Protein malnutrition impairs the immune response and influences the severity of infection in a hamster model of chronic visceral leishmaniasis

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Pulmonary glass particles may persist in the lung suppressing function of immune cells

Pulmonary immunotoxic potentials of metals are governed by select physicochemical properties: vanadium agents

Pulmonary immunotoxic potentials of metals are governed by select physicochemical properties: chromium agents

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Pulmonary immunotoxicology of select metals: aluminum, arsenic, cadmium, chromium, copper, manganese, nickel, vanadium, and zinc

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Purinergic system as a potential target for inflammation and toxicity induced by thymol in immune cells and tissues
Pyrethroids used indoors--immune status of humans exposed to pyrethroids following a pest control operation--a one year follow-up study

QSAR models for prediction of the physico-chemical properties and biological activity of polychlorinated diphenyl ethers (PCDEs)

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Quantitative assessment of mesangial immunoglobulin A (IgA) accumulation, elevated circulating IgA immune complexes, and hematuria during vomitoxin-induced IgA nephropathy

Quantitative modeling of suppression of IgG1, IgG2a, IL-2, and IL-4 responses to antigen in mice treated with exogenous corticosterone or restraint stress

Quantitative Proteomic Analysis Reveals That Arctigenin Alleviates Concanavalin A-Induced Hepatitis Through Suppressing Immune System and Regulating Autophagy

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Rapid cytoskeleton modification in thymocytes induced by the immunotoxicant tributyltin

Rapid granulomatosis with polyangiitis induced by immune checkpoint inhibition

Rapid immunoassays for diagnosis of heparin-induced thrombocytopenia: Comparison of diagnostic accuracy, reproducibility, and costs in clinical practice

Rat extracorporeal circulation model for evaluation of systemic immunotoxicity

Re: Biochemical evaluation of immunotoxic effects of cadmium in rats

Re: Nitrofurantoin-induced pulmonary hemorrhage in a renal transplant recipient receiving immunosuppressive therapy: case report and review of the literature

Reaction of the immune system to low-level RF/MW exposures.

Reactions to rubella vaccine and persistence of antibody in virgin-soil populations after vaccination and wild-virus-induced immunization

Reactive oxygen species (ROS) induced cytokine production and cytotoxicity of PAMAM dendrimers in J774A.1 cells

Reactive oxygen species sources and biomolecular oxidative damage induced by aflatoxin B1 and fumonisin B1 in rat spleen mononuclear cells

Recent advances in understanding the mechanisms of TCDD immunotoxicity

Recent studies on the effects of fetal alcohol exposure on the endocrine and immune systems

Recent US Food and Drug Administration warnings on hepatitis B reactivation with immune-suppressing and anticancer drugs: just the tip of the iceberg

Recommendations issued by the Spanish Society of Pediatric Infectious Diseases for the follow-up of the child exposed to the human immunodeficiency virus and to antiretroviral drugs during pregnancy and the neonatal period
Reconstitution of cyclophosphamide-induced, impaired function of the immune system in animal models

Recovery from 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanol-induced immunosuppression in A/J mice by treatment with nonsteroidal anti-inflammatory drugs

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Reduction in peripheral lymphocytes and thymus atrophy induced by organotin compounds in vivo

Reduction in valproic acid-induced neural tube defects by maternal immune stimulation: role of apoptosis

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Release of Danger-Associated Molecular Patterns following Chemotherapy Does Not Induce Immunoparalysis in Leukemia Patients

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Repeated-oral dose toxicity of polyethylene microplastics and the possible implications on reproduction and development of the next generation

Reply to the commentary by Onuigbo on the article "Exposure to inhibitors of the renin-angiotensin system is a major independent risk factor for acute renal failure induced by sucrose-containing intravenous immunoglobulins. A case-control study"


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Resistance to erythropoietin: immunohemolytic anemia induced by residual formaldehyde in dialyzers

Resistance to intestinal parasites during murine AIDS: role of alcohol and nutrition in immune dysfunction

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Resveratrol Pretreatment Attenuates Concanavalin A-induced Hepatitis through Reverse of Aberration in the Immune Response and Regenerative Capacity in Aged Mice

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Rifampicin-induced suppression of antitumor immunity

RIP1 and RIP3 contribute to Tributyltin-induced toxicity in vitro and in vivo

Risk assessment and immunotoxicology

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Subchronic immunotoxicity and screening of reproductive toxicity and developmental immunotoxicity following single instillation of HIPCO-single-walled carbon nanotubes: purity-based comparison
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Sudden collapse during haemodialysis due to immune-mediated heparin-induced thrombocytopenia

Sulfamethoxazole-trimethoprim-induced pneumonitis in a patient with hemophilia B who was infected with the human immunodeficiency virus

Sulfasalazine induced immune thrombocytopenia in a patient with rheumatoid arthritis

Sulfasalazine-induced linear immunoglobulin A bullous dermatosis with DRESS
Sulindac-induced immune hemolytic anemia

Sulphonylurea usage in melioidosis is associated with severe disease and suppressed immune response

Sunlight-induced immunosuppression in humans is initially because of UVB, then UVA, followed by interactive effects

Sunscreen applied at 2 mg cm-2 during a sunny holiday prevents erythema, a biomarker of ultraviolet radiation-induced DNA damage and suppression of acquired immunity

Sunscreen lotions prevent ultraviolet radiation-induced suppression of antitumor immune responses

Sunset yellow FCF, a permitted food dye, alters functional responses of splenocytes at non-cytotoxic dose

Superoxide dismutase 3 controls adaptive immune responses and contributes to the inhibition of ovalbumin-induced allergic airway inflammation in mice

Supplementing an immunomodulatory feed ingredient to modulate thermoregulation, physiologic, and production responses in lactating dairy cows under heat stress conditions

Suppressed T helper 2 immunity and prolonged survival of a nematode parasite in protein-malnourished mice

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Suppression of cell-mediated immunity following oral feeding of mice with palmyrah (Borassus flabellifer L) flour

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Suppression of humoral immunity by perfluorooctanoic acid is independent of elevated serum corticosterone concentration in mice

Suppression of humoral immunity following exposure to the perfluorinated insecticide sulfluramid

Suppression of humoral immunity in mice following exposure to perfluorooctane sulfonate

Suppression of immune parameters in animal models of morphine dependence

Suppression of immune response associated with functions of B-cells, Th1- and Th2-lymphocytes and interleukins produced by these cells, and pharmacological correction of these disturbances upon acute intoxication with methanol

Suppression of immune response in the B6C3F1 mouse after dietary exposure to the Fusarium mycotoxins deoxynivalenol (vomitoxin) and zearalenone

Suppression of immunoglobulin production by a novel dihydroorotate dehydrogenase inhibitor, S-2678

Suppression of local gut-associated and splenic mitogen responsiveness of lymphoid cells following oral exposure of B6C3F1 mice to 7,12-dimethylbenz[a]anthracene

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Suppressor T-cell levels are unreliable indicators of the impaired immune response following thermal injury

Surface charges and shell crosslinks each play significant roles in mediating degradation, biofouling, cytotoxicity and immunotoxicity for polyphosphoester-based nanoparticles

Surface coatings determine cytotoxicity and irritation potential of quantum dot nanoparticles in epidermal keratinocytes

Surface expression of the hRSV nucleoprotein impairs immunological synapse formation with T cells

Surface functionalized mesoporous silica nanoparticles with natural proteins for reduced immunotoxicity

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Surgical damage to the lymphatic system promotes tumor growth via impaired adaptive immune response

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Venom components of Asobara japonica impair cellular immune responses of host Drosophila melanogaster

Venom of parasitoid, Pteromalus puparum, suppresses host, Pieris rapae, immune promotion by decreasing host C-type lectin gene expression

Vigabatrin-induced modification of Ki-67 expression in gingival epithelium: immunohistochemical study of a short series

Vitamin A deficiency impairs the immune response to intranasal vaccination and RSV infection in neonatal calves

Vitamin A deficiency impairs vaccine-elicited gastrointestinal immunity

Vitamin C Modulates the Immunotoxic Effect of 17alpha-Methyltestosterone in Nile Tilapia

Vitamin E pretreatment prevents the immunotoxicity of dithiocarbamate pesticide mancozeb in vitro: A comparative age-related assessment in mice and chick

Vomitoxin-induced cyclooxygenase-2 gene expression in macrophages mediated by activation of ERK and p38 but not JNK mitogen-activated protein kinases

Vulnerability, distress, and immune response to vaccination in older adults

Walnut Polyphenol Extract Attenuates Immunotoxicity Induced by 4-Pentylphenol and 3-methyl-4-nitrophenol in Murine Splenic Lymphocyte
Walnut Polyphenol Extract Protects against Fenitrothion-Induced Immunotoxicity in Murine Splenic Lymphocytes

Walnut Polyphenol Extract Protects against Malathion- and Chlorpyrifos-Induced Immunotoxicity by Modulating TLRx-NOX-ROS

Water Contaminants Associated With Unconventional Oil and Gas Extraction Cause Immunotoxicity to Amphibian Tadpoles

Waterborne microcystin-LR exposure induced chronic inflammatory response via MyD88-dependent toll-like receptor signaling pathway in male zebrafish

Water-soluble polysaccharides from Grifola Frondosa fruiting bodies protect against immunosuppression in cyclophosphamide-induced mice via JAK2/STAT3/SOCS signal transduction pathways

Wavelength dependency for UVA-induced suppression of recall immunity in humans

Well-being and immune response: a multi-system perspective

Western-style diets induce oxidative stress and dysregulate immune responses in the colon in a mouse model of sporadic colon cancer

What is the main source of human exposure to higher alcohols and is there a link to immunotoxicity

Whole blood TNF-alpha production as a sensitive measure for immunotoxicity of anticancer drugs

Whole-body inhalation exposure to 1-bromopropane suppresses the IgM response to sheep red blood cells in female B6C3F1 mice and Fisher 344/N rats

Wild Panax ginseng (Panax ginseng C.A. Meyer) protects against methotrexate-induced cell regression by enhancing the immune response in RAW 264.7 macrophages

Wogonin prevents immunosuppressive action but not anti-inflammatory effect induced by glucocorticoid

Work stress and innate immune response

Workshop on perinatal exposure to dioxin-like compounds. V. Immunologic effects

Yulangsan polysaccharide improves redox homeostasis and immune impairment in D-galactose-induced mimetic aging

Yupingfeng Powder relieves the immune suppression induced by dexamethasone in mice

Zearalenone induces immunotoxicity in mice: possible protective effects of radish extract (Raphanus sativus)

Zearalenone inhibits T cell chemotaxis by inhibiting cell adhesion and migration related proteins

Zearalenone, an estrogenic mycotoxin, is an immunotoxic compound

Zebrafish: A complete animal model to enumerate the nanoparticle toxicity
Zidovudine as an immunomodulatory agent

Zidovudine impairs immunological recovery on first-line antiretroviral therapy: collaborative analysis of cohort studies in southern Africa

Zidovudine-induced fatal lactic acidosis and hepatic failure in patients with acquired immunodeficiency syndrome: report of two patients and review of the literature

Zinc- and tin-induced apoptotic mechanisms in immune system and cranial nerve system

Zinc deficiency impairs immune responses against parasitic nematode infections at intestinal and systemic sites

Zinc oxide nanoparticle induced age dependent immunotoxicity in BALB/c mice

Zinc protects HepG2 cells against the oxidative damage and DNA damage induced by ochratoxin A

Ziram induces apoptosis and necrosis in human immune cells

ZnO nanoparticles induced inflammatory response and genotoxicity in human blood cells: A mechanistic approach
A4-C. Bibliography – Low-Tech Factors that Strengthen Immune System

In the main text, two types of strategic treatments for a weakened immune system were defined: vaccine-based and non-vaccine-based. The vaccine-based treatments were addressed in Appendix 3. The non-vaccine-based treatments were divided into two categories: identifying and eliminating factors that contribute to weakening the immune system, and adding factors that contribute to strengthening a weak immune system. Many factors of the first category were presented in Tables A4-1 to A4-5. In the present section, some factors of the second category (especially low-tech factors that strengthen the immune system) will be presented in the form of a bibliography. Many more factors of this nature exist, and could be identified with a much larger study.

The bibliography follows. It consists of two alphabetized sections. The first group (on average) tends to cover broader issues, while the second group (on average) tends to focus on more specific issues. Many of the documents straddle both groups.

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