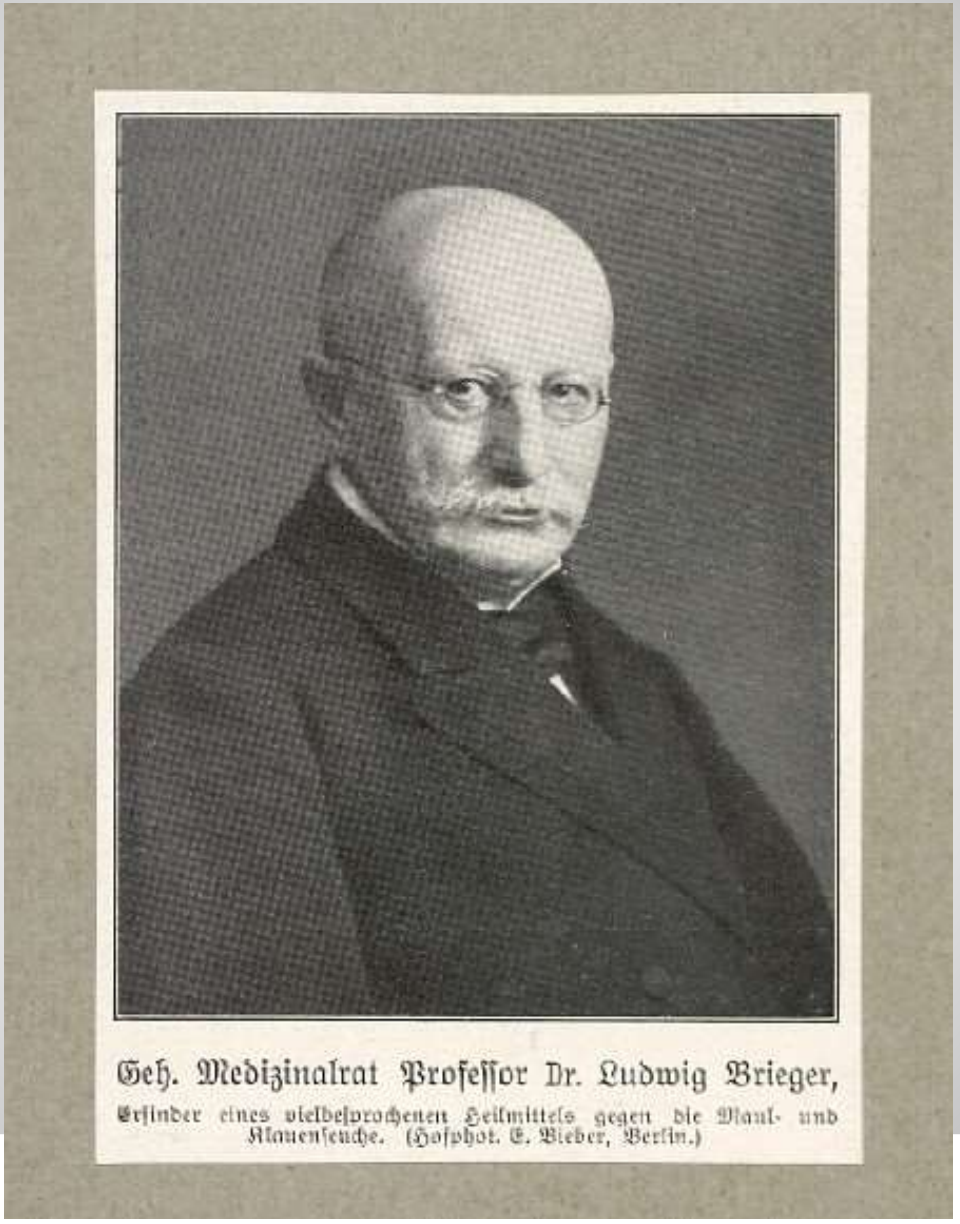
toxins

Overview

- 1) what are toxins.
- 2) what is toxicity.
- 3) effects of toxins.
- 4) anti measures of toxins.

What are toxins?

- A **toxin** (from Ancient Greek is a poisonous substance produced within living cells or organisms) ; synthetic toxicants created by artificial processes are thus excluded. The term was first used by organic chemist Ludwig Brieger .
- Toxins can be small molecules , peptides, or proteins that are capable of causing disease on contact with or absorption by body tissues interacting with biological macromolecules such as enzymes or cellular receptors. Toxins vary greatly in their severity, ranging from usually minor (such as a bee sting) to almost immediately deadly (such as Botulinum toxin).



Geh. Medizinalrat Professor Dr. Ludwig Brieger,

Erfinder eines vielbesprochenen Heilmittels gegen die Maul- und Klauenseuche. (Hofphot. E. Bieber, Berlin.)

- There goes an ongoing terminological dispute between NATO and the Warsaw pact over whether to call a toxin a biological or chemical agent , in which NATO opted for biological agent , and the Warsaw act , for chemical agent.
- According to Title 18 of united states code, the term "toxin" means toxic material or product of plants , animals ,microorganisms (including but not limited to bacteria , viruses , fungi , or protozoa)or infectious substances , whatever their origin and method of production.

Radioactive symbol

Toxic hazard symbol

Biohazard symbol

Different types of toxins

- Hemotoxin , causes destruction of red blood cells.
- Phototoxin , causes dangerous photosensitivity.
- Biotoxins-The term "biotoxin" is sometimes used to explicitly confirm the biological origin.
- Biotoxins in nature have two primary functions:
- Predation in the spider, snake, scorpion, jellyfish, wasp
- Defense in the bee, ant, termite, honeybee, wasp, poison dart frog.
- The term "environmental toxin" can sometimes explicitly include synthetic contaminants such as industrial pollutants and other artificially made toxic substances. As this contradicts most formal definitions of the term "toxin", it is important to confirm what the researcher means when encountering the term outside of microbiological contexts.
- Environmental toxins from food chains that may be dangerous to human health include:
- Paralytic shellfish poisoning (PSP)
- Amnesic shellfish poisoning (ASP)
- Diarrheal shellfish poisoning (DSP)
- Neurotoxic shellfish poisoning (NSP)

TOXICITY DEFINITION

- The degree to which a substance (a toxin or poison) can harm humans or animals. Acute toxicity involves harmful effects in an organism through a single or short-term exposure. Subchronic toxicity is the ability of a toxic substance to cause effects for more than one year but less than the lifetime of the exposed organism. Chronic toxicity is the ability of a substance or mixture of substances to cause harmful effects over an extended period, usually upon repeated or continuous exposure, sometimes lasting for the entire life of the exposed organism.

toxicity

- **Toxicity** is the degree to which a substance can damage an organism . Toxicity can refer to the effect on a whole organism, such as an animal , bacterium , or plant , as well as the effect on a substructure of the organism, such as a cell (cytotoxicity) or an organ such as the liver (hepatotoxicity). By extension, the word may be metaphorically used to describe toxic effects on larger and more complex groups, such as the family unit or society at large.
- A central concept of toxicology is that effects are dose-dependent; even water can lead to water intoxication when taken in too high a dose, whereas for even a very toxic substance such as snake venom there is a dose below which there is

TYPES OF TOXICITY

- There are generally three types of toxic entities; chemical, biological, and physical:
- Chemical toxicants include inorganic substances such as lead, mercury, hydrofluoric acid, and chlorine gas, and organic compounds such as methyl alcohol , most medications, and poisons from living things.
- Biological toxicants include bacteria and viruses that can induce disease in living organisms. Biological toxicity can be difficult to measure because the "threshold dose" may be a single organism. Theoretically one virus, bacterium or worm can reproduce to cause a serious infection.
- Physical toxicants are substances that, due to their physical nature, interfere with biological processes. Examples include coal dust, asbestos fibers or finely divided silicon dioxide , all of which can ultimately be fatal if inhaled. Corrosive chemicals possess physical toxicity because they destroy tissues, but they're not directly poisonous unless they interfere directly with biological activity.

MEASURING TOXICITY

- Assessing all aspects of the toxicity of cancer-causing agents involves additional issues, since it is not certain if there is a minimal effective dose for carcinogens , or whether the risk is just too small to see.
- It is more difficult to determine the toxicity of chemical mixtures than a pure chemical, because each component displays its own toxicity, and components may interact to produce enhanced or diminished effects. Common mixtures include gasoline, cigarette smoke, and industrial waste. Even more complex are situations with more than one type of toxic entity, such as the discharge from a malfunctioning sewage treatment plant, with both chemical and biological agents.
- The preclinical toxicity testing on various biological systems reveals the species-, organ- and dose- specific toxic effects of an investigational product. The toxicity of substances can be observed by (a) studying the accidental exposures to a substance (b) in vitro studies using cells/ cell lines (c) in vivo exposure on experimental animals. Toxicity tests are mostly used to examine specific adverse events or specific end points such as cancer, cardiotoxicity, and skin/eye irritation. Toxicity testing also helps calculate the No Observed Adverse Effect Level (NOAEL) dose and is helpful for clinical studies.

Anti meausures for toxins anti toxins

- An **antitoxin** is an antibody with the ability to neutralize a specific toxin . Antitoxins are produced by certain animals, plants , and bacteria . Although they are most effective in neutralizing toxins, they can kill bacteria and other microorganisms. Antitoxins are made within organisms, but can be injected into other organisms, including humans.

Anti toxin

- This procedure involves injecting an animal with a safe amount of a particular toxin. Then, the animal's body makes the antitoxin needed to neutralize the toxin. Later, the blood is withdrawn from the animal. When the antitoxin is obtained from the blood, it is purified and injected into a human or other animal, inducing passive immunity . To prevent serum sickness , it is often best to use antitoxin generated from the same species . (e.g. use human antitoxin to treat humans).
- Antitoxins to diphtheria and tetanus toxins were produced by Emil Adolf von Behring and his colleagues from 1890 onwards. The use of diphtheria antitoxin for the treatment of diphtheria was regarded by the *Lancet* as the "most important advance of the [19th] Century in the medical treatment of acute infectious disease".

ANTI TOXIN

- **antitoxin,** antibody , formed in the body by the introduction of a bacterial poison, or toxin, and capable of neutralizing the toxin. People who have recovered from bacterial illnesses often develop specific antitoxins that confer immunity against recurrence.
- For medical use in treating human infectious diseases, antitoxins are produced by injecting an animal with toxin; the animal, most commonly a horse, is given repeated small doses of toxin until a high concentration of the antitoxin builds up in the blood. The resulting highly concentrated preparation of antitoxins is called an antiserum.

Types of antitoxins

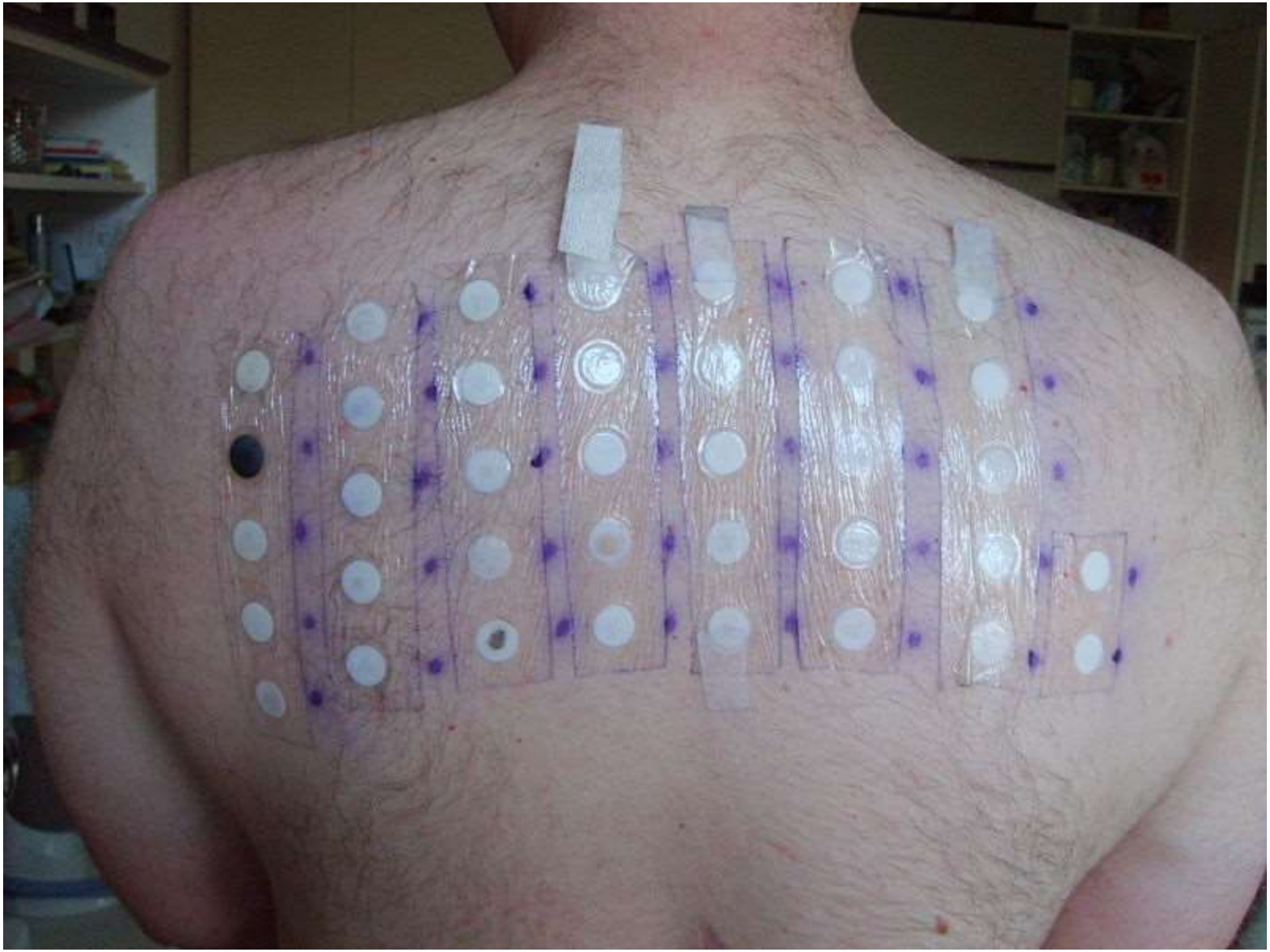
- **antitoxin** - particular kind of ANTIBODY produced in the body in response to the presence of a toxin.
- **botulism antitoxin** an equine antitoxin against the toxins produced by the types A and B and/ or E strains of *Clostridium botulinum;* administered intravenously in the postexposure prophylaxis and treatment of botulism , other than infant botulism . Generally trivalent (ABE) antitoxin is used.
- **diphtheria antitoxin** equine antitoxin from horses immunized against diphtheria toxin or the toxoid ; administered intramuscularly or intravenously in the treatment of suspected cases of diphtheria.
- **equine antitoxin** an antitoxin derived from the blood of healthy horses immunized against a specific bacterial toxin.

Types of anti toxins

- **tetanus antitoxin** - equine antitoxin from horses that have been immunized against tetanus toxin or toxoid ; used for the passive prevention and treatment of tetanus. It is rarely used, tetanus immune globulin being preferred.
- **gas gangrene antitoxin -** serum containing antitoxic antibodies; prepared from the blood of healthy animals immunized against gas-producing organisms of the genus *Clostridium*.
- **tetanus antitoxin -** preparation from the blood serum or plasma of healthy animals immunized against tetanus toxin. Used for prophylaxis after injury because of its immediate effect. Active immunization is preferred for long-term protection, particularly for many clostridial diseases such as tetanus.

Effects of toxins

- The types of toxicities where substances may cause lethality to the entire body, lethality to specific organs, major/minor damage, or cause cancer. These are globally accepted definitions of what toxicity is. Anything falling outside of the definition cannot be classified as that type of toxicant.
- Skin corrosion and irritation are determined though a skin patch test analysis. This examines the severity of the damage done; when it is incurred and how long it remains; whether it is reversible and how many test subjects were affected.



Patch test

Effects of toxins

- **Other categories of toxicity**
- Respiratory sensitizers cause breathing hypersensitivity when the substance is inhaled.
- A substance which is a skin sensitizer causes an allergic response from a dermal application.
- Carcinogens induce cancer, or increase the likelihood of cancer occurring.
- Reproductively toxic substances cause adverse effects in either sexual function or fertility to either a parent or the offspring.
- Specific-target organ toxins damage only specific organs.
- Aspiration hazards are solids or liquids which can cause damage through inhalation.

Effect of toxins

- Environmental hazards tend to focus on degradability, bioaccumulation and aquatic toxicity.
- Toxicity of a substance can be affected by many different factors, such as the pathway of administration (whether the toxin is applied to the skin, ingested, inhaled, injected), the time of exposure (a brief encounter or long term), the number of exposures (a single dose or multiple doses over time), the physical form of the toxin (solid, liquid, gas), the genetic makeup of an individual, an individual's overall health, and many others. Several of the terms used to describe these factors have been included here.
- Acute exposure-A single exposure to a toxic substance which may result in severe biological harm or death; acute exposures are usually characterized as lasting no longer than a day . Chronic exposure - continuous exposure to a toxin over an extended period of time, often measured in months or years; it can cause irreversible side effects.