

INOCULATE or VACCINATE?

We immunologists do use, misuse and create odd words to describe what we do. I often use inoculate, vaccinate and immunize as though they were synonyms. They are synonyms with some shoulders of overlap related to where they come from. Microbiologists have been inoculating cultures a little longer than immunologists have been inoculating antigens. The connotation is that you are putting something into something to see if it will grow.

Inoculate comes from Microbiology. Early vaccines were replicating organisms so inoculate would be like the process microbiologists use. Inoculation does not specifically mean "inject" but it can. Giving polio vaccine orally is every bit an inoculation as would be scraping smallpox vaccine in the skin or injecting tetanus toxoid into the muscle of your upper arm.

Vaccinate originates from Jenner's smallpox vaccine. The root of the word vaccine or vaccinate is Vacca meaning Cow. Jenner theorized that milk maids had fair "unpocked" skin because they often would get a mild infection with cowpox (caused by the Vaccinia virus) and that might have made them immune to the more disfiguring and lethal Smallpox infection (caused by the Variola virus). So originally, vaccinate was specifically inoculating with cowpox to prevent smallpox. We use the term today more generally to refer to any introduction of antigen when the purpose is to protect the recipient from infection by a disease-causing agent.

Immunize is generic and not necessarily linked to disease prevention. We use the word immunize whenever we describe introduction of antigens into a living being where we expect the antigen to produce some kind of a response that meets the criteria of an immune response. To immunize the antigen may be injected (subcutaneously, intradermally, intramuscularly, or in some body cavity); it may be painted on the skin, or it may be given "mucosally" (ie in the eyes, nose, mouth, respiratory tract, gastrointestinal and urogenital tracts). All of these are "routes" of immunization.

You immunize when you intend to produce a measurable immune response. Of course, other responses may be elicited by the act of immunization. such as acute or chronic inflammation, injury, or atypical cellular transformation. These effects are the kinds of undesirable sequellae that you do not want a "vaccine" to have but in experiments in animal species bred for experimental purpose you may not even look for these effects of the antigen you inoculated so you could study the immune response.

An immune response has certain agreed upon characteristics. Inoculating an antigen may cause the appearance in the blood and body fluids of proteins called antibodies (Humoral Immunity). Antibodies bind specifically to the antigen you inoculated but not to unrelated antigens (we call this Specificity). The antibodies in the blood hasten the "clearance" of the antigen (or prevent disease if the antigen is an infectious disease agent) when the antigen is re-introduced. The immune response is increased after second exposure to the antigen and the body seems to remember that it has been immunized against that antigen because the ability to show a rise in specific antibody levels or protection from the infectious agent related to the antigen lasts for a long time (we call this Specific Anamnesis or Immunological Memory). These principles are also true for cellular immune responses where lymphocytes directly are involved in immunity but the end process is cell killing or release of "cell hormones" that enable other cells to kill the antigen-bearing cell.

I hope my answer clarifies why there seems to be some pattern of use of these terms because of the habits and conventions of the subfields within the larger field of immunology. The antigens we inoculate and the responses they induce are often linked to the nature of the antigens and the route by which they are introduced. We immunologists must always remember to tell those important details when we describe what we did and what we found so other immunologists can understand the results and integrate it with what is known. We often forget to include enough information so that those of you who watch us and provide us support for our research can also understand what we do. I hope this is the kind of answer that will help.