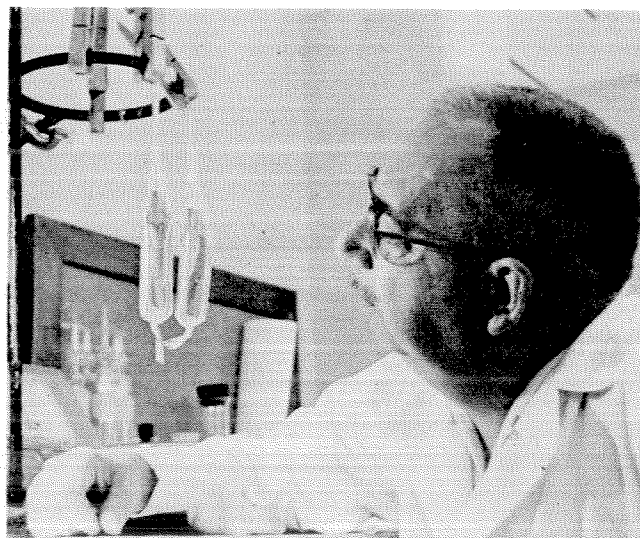


Dan Campbell, head of Caltech's immunochemistry center, studies protein concentration in a current allergy experiment.



Caltech's Immunochemistry Center

It joins in a program designed to find relief for allergy sufferers

Scientists in Caltech's bustling immunochemistry laboratory are piecing together information from a variety of sources about medical problems that range all the way from house dust allergies to radiation damage.

The research is part of a nationwide program by allergists, immunochemists, and the U.S. Public Health Service to find some kind of relief for the 17,000,000 allergy sufferers in America. The Caltech laboratory is one of the principal immunochemical centers in the nation. The laboratory is not only engaged in research; it is also an advanced training center for graduate students, postgraduate and postmedical students in the comparatively new field of immunochemistry.

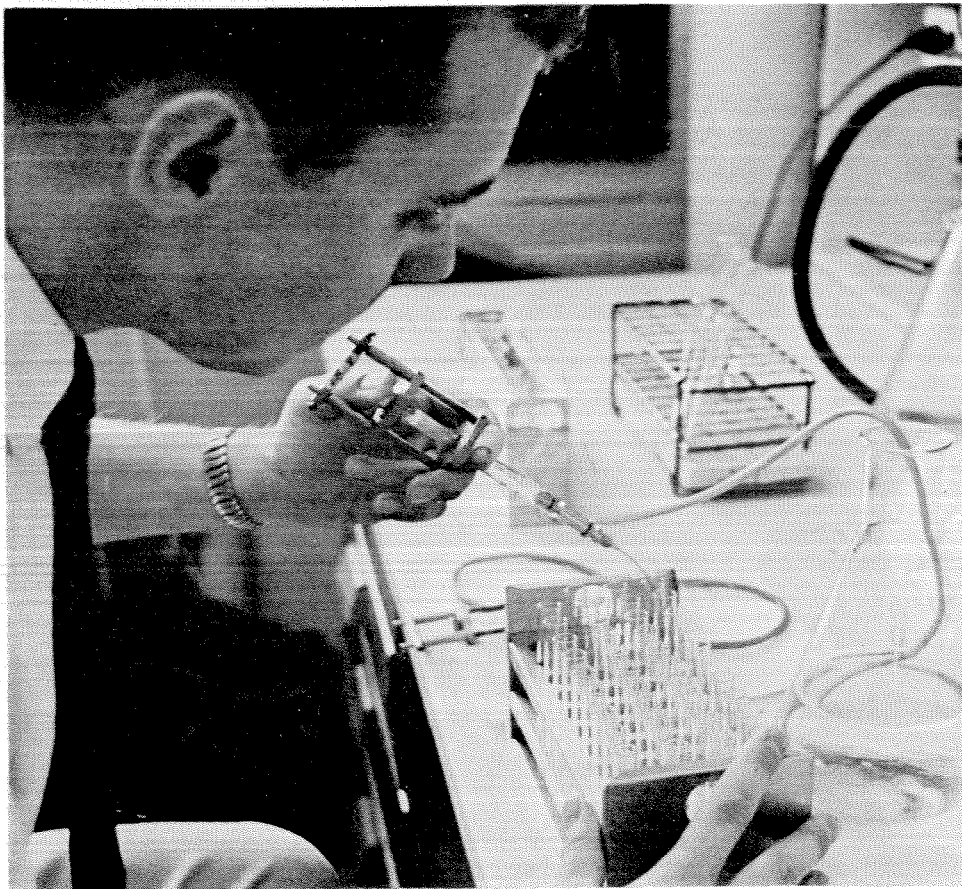
Immunochemistry is the study of antigen-antibody reactions. These reactions occur when the body produces specific proteins (antibodies) which may combat the harmful effects of foreign substances (antigens) that invade the body. The antigen-antibody reactions can also produce diseases. Practically any protein can act as an antigen, and antigen-antibody reactions can produce side effects ranging from asthmatic sneezes up through fatal body-wide shock.

Dan Campbell, head of the Caltech research group, has been at the Institute since 1942; and his was probably the first professorship ever given in immunochemistry. His current research interests: studies of the mechanisms of antibody formation and antigen-antibody reactions; isolation of allergy-causing anti-

gens (allergens) in house dust and pollens; and studying the effects of high altitude on immune responses and allergies.

Hypersensitive guinea pigs are used in Dr. Campbell's research into altitude effects on various allergies. With E. M. Heinlich of the Pediatrics Department at UCLA (who was at Caltech last year as a research fellow), Dr. Campbell took asthmatic guinea pigs up to a 14,000-foot altitude at White Mountain, California. At this high altitude, their antibody production jumped drastically for two or three weeks. At the same time, the guinea pigs' asthma improved. Research into the "how" and "why" of the increased antibody production is still going on.

Sources of many of the antibodies produced in men and beasts may be the liver, spleen, and lymph nodes. One of the Caltech immunochemists investigating these organs is Dieter H. Sussdorf, a research fellow recently arrived from Argonne National Laboratory near Chicago. While at Argonne, Dr. Sussdorf found that rabbits produced far fewer antibodies after having been exposed to radiation. He encased the appendixes (which are extra large in rabbits) of a few animals in lead, and exposed these rabbits to radiation. Unlike the non-shielded animals, these rabbits produced normal amounts of antibodies. The antibodies came from the radiation-damaged spleen. Dr. Sussdorf's conclusion was that the lymph cells from the undamaged appendix had migrated to the spleen and there produced antibodies — something they never



Dieter H. Sussdorf, Caltech research fellow, determines the amount of antibodies in rabbit serum (left) by adding antigen to various dilutions of serum. The antigen will precipitate the antibody in the tubes. Below, the precipitated antibodies are then separated from the solution by centrifugation and the precipitate is analyzed for its antibody content.

did in the appendix. Dr. Sussdorf is now following up his previous research by attempting to fractionate the spleen (and its lymph cells) into antibody-producing and non-antibody-producing parts.

Researchers all over the nation are trying to isolate and standardize the substances called allergens which cause symptoms like sneezing, asthma, and rashes. Dr. Campbell is chairman of a committee set up by the National Institutes of Health to standardize these allergens.

One of the chief difficulties faced by the committee, when testing and treating persons for allergies, is that the substances used for these purposes are prepared in different laboratories under different conditions, and are not similar enough to produce precise clinical results. For example, a person is tested for sensitivity to ragweed (more than 5,000,000 Americans have this sensitivity) by being injected with ragweed pollen in a saline solution. If he is sensitive to ragweed, a welt will appear. He is then given a series of these same injections until he develops an immunity to ragweed.

The particular pollen used on this patient probably contains several allergens. He may be allergic to one or more of these. Researchers must isolate the exact fraction of every type of ragweed that seems to be causing the trouble until, eventually, standards for each allergen will be established.

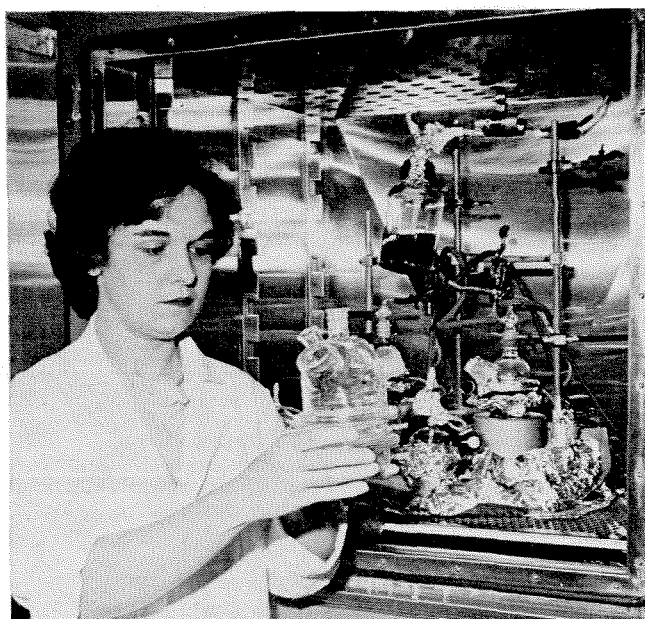
Dr. Campbell and research fellow Wilton E. Vanier, who received his PhD at Caltech in 1958, are



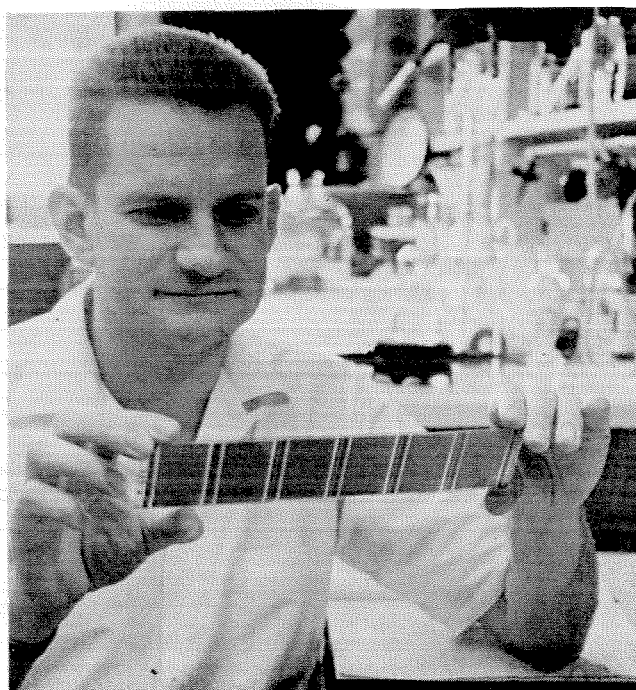
working on the isolation of active house dust allergen fractions. These materials have been found to consist of a mixture of acidic polysaccharides (a complex sugar compound) combined with polypeptides. The importance of house dust in allergy studies has grown since a demonstration in 1922 revealed that this combination of substances contained materials that would produce intense skin reactions in specifically sensitive individuals. About one-third of all allergic individuals give a positive skin reaction to house dust extracts.

Senior research fellow Justine Garvey has been using radioactive tracers to find out what happens to antigens when they enter the body. Instead of being eliminated completely, they often go to certain locations in the body — especially the liver. There are often several thousand molecules of a particular antigen to one liver cell and thousands of these antigen molecules have remained in the liver for as long as 500 days or more. After this time, antigens in the liver are not found in conjunction with any antibodies in the blood.

The immunologists think the reason for this is that when antigens enter body cells they get entangled with ribonucleic acid (RNA), which has a great deal to do with the formation of proteins. The antigen-RNA combination leads to antibody synthesis, and the antibodies react in the cells with the antigens and with RNA. As this occurs, antibody production drops. For some reason, the antigens in the liver are not destroyed during this process. Dr. Garvey is trying to find out why — with the help of an amazing arrangement of glass tubing dubbed a “Marsman.” This instrument was developed by research fellow Herman



Senior research fellow Justine Garvey and the “Marsman,” a complicated collection of glass tubing used to grow tissue and produce antibodies in vitro. Dr. Garvey holds the core of the “Marsman” where nutrients are fed to the tissue.



Wilton E. Vannier, staff member of the Laboratory of Immunology at the National Institute of Allergy and Infectious Diseases in Bethesda, Md., studies ultracentrifuge photographs of antibodies which exist in rabbit serum, to determine their molecular weights.

Ainis, who is currently using it to culture and produce antibodies in vitro.

Research fellow Arthur A. Hirata, who is also studying antibody formation, has found that antibody concentration in the blood of neonatal chicks is much lower than in chickens six weeks old. Apparently antigens injected into neonatal chicks go directly to various tissues and there suppress antibody production. The same effect occurs in adult animals if they are given massive doses of antigens.

The problems being explored by Drs. Garvey, Ainis, and Hirata may have great application to medicine, since human babies as well as chicks apparently are unable to make antibodies. This often leads to severe staphylococcus infections among infants, since an antibody for staph bacteria is not included among the ones a baby receives from its mother before birth. Similarly, adult humans seemingly lose the ability to synthesize antibodies to certain substances after long exposure to them.

Caltech’s immunochemists are also studying the effects of the well-known plasma constituent, gamma globulin, on antibody formation. And they are investigating the possibilities of immunizing animals against their own tumors. By means of this slow, painstaking research and the discoveries these researchers are making about the behavior of immunochemical reactions, we may reach an increased understanding of immune reactions that occur in many diseases.

— Lance Taylor '62