Michigan State College presents another in the Cooperative Extension Series. Today's program is brought to you by the School of Veterinary Medicine and features the Department of Bacteriology and Public Health. We have with us today Jack Stockton. And now we take you to the Cooperative Extension Office where Clint Ballard is waiting to tell us about today's program. [Clint Ballard] Hi, friends. I'm Clint Ballard, the Extension Service for Michigan State College. Your television has brought many educational advantages to you and to me. And among them is the opportunity to actually see the scientist at work. And through this experience, we've learned to appreciate the contribution which the scientist makes to our health and our general well being. Today we're going to see a scientist at work, and we take you to the School of Veterinary Medicine, the Department of Bacteriology and Public Health, where doctor Jack Stockton will serve as our instructor. [Jack Stockton] The apparatus which you see on my right is equipment that is used in the process which I am going to attempt to explain. This particular process may be known by any one of three names. It may be called liatization, drying by ice sublimation, or more commonly freeze drying. The procedure is not new by any manner or means. It was first originated in approximately the 18 90. However, its everyday use was not brought into the spotlight until the mid 1930s. At that date, two gentlemen from the University of Pennsylvania put this thing on a more or less commercial basis. They were doctors Plasdorf and Mudd. The process of liatalization is one that was brought primarily to the fore during World War two. It is being used extensively by various biological houses in connection with the war effort during the Korean struggle. The process of liatalization is concerned with the removal of moisture from a product. There are many ways by which water can be removed from a product. Heat is by far the most common. But as far as biological products are concerned, it's highly impractical to attempt to use heat. The heat that is necessary to drive the moisture from a product would destroy the organism that might be being dried in many cases or inactivate an add serum or an antitoxin or something of that nature. So it's necessary that we employ cold. A very common example of drying by ice sublimation or freeze drying is the process of frozen clothing as it hangs on the line. I'm sure many of you have had the experience of hanging clothing on a line, hanging clothing wet. And then when you remove it and take it in the house, when it thaws, you'll find that it is no longer wet, that it has dried. The water that is contained therein has evaporated. It has gone directly from the solid state to a gaseous state in the vapor state without passing through the liquid state, which we commonly know in melting. That is, in essence, the process of free drying. The equipment that you see on my right is a laboratory setup that might be used in such a process. This in no way compares with the equipment that might be used on a commercial basis except it does have the necessary elements present for accomplishing freeze drying. As I mentioned, this is strictly a laboratory model and in no way resembles anything that might be used on a commercial basis. It consists of three essential parts. The three essential parts are starting from the bottom, the vacuum pump. That is the arrangement that you see on the bottom that is necessary to produce the vacuum in the system to lower the pressure. In order to successfully freeze dry, the pressure in the system must be reduced in the neighborhood in the neighborhood of approximately 300 microns of mercury. Now that is roughly three tenths of a millimeter. And when one thinks of atmospheric pressure being at 760 millimeters of mercury, then you can see that a considerable reduction is necessary. The next important part of this particular apparatus is the drying or desiccation chamber. That is the tower which you see on the right. The tower in this particular case is a chemical condenser. That tower is filled with a substance known as dry rnk. Here you see the chemical which is in that particular chamber. Chemically, this is known as anhydrous

calcium sulfate. This has a very great affinity for water, and as the water is removed from the product which is being dried, it is picked up absorbed by this particular des. Commercially, the dessicant that frequently is used is a refrigerator. By means of mechanical refrigeration, the water that is removed from the product is absorbed or condensed onto a refrigerated surface and the water is removed in that particular fashion. The third essential part of this piece of apparatus is the manifold or the arm that you see across the top. This is the thing that holds the vials, which are going to contain a material which we are going to dry. On a commercial commercial piece of apparatus, you will not see a manifold of this type. There they consist of a chamber which is much the same as an oven. In those chambers are shelves which hold trays upon which the product that's going to be dried is placed in a suitable container. Other parts of the apparatus that you see are the gauge, which tells us what pressure we are operating at and A crossfire torch, which is run by ordinary illuminating gas and oxygen, this torch being used to seal the product after it has been dried. The product to be dried first must be frozen since we're going to sublime this, it's necessary that it be frozen. Filling the vials is a very essential part of the procedure, and again, on a commercial basis, requires a considerable amount of time and attention. This is all done under strictly sanitary aseptic conditions. There must be no contaminant introduced into the product. Vils of this nature are filled approximately half full. It is essential that they be filled only approximately half full since the product must be shell frozen. We must freeze it in a thin layer around the inner surface of this container and not in a bleb, as you see here, since we must have a large surface area of which evaporation can take place. The freezing mixture consists of a mixture of dry ice and alcohol. This is at a temperature of approximately 70 degrees below zero centigrade. It is essential that a sharp freeze be given to products which are living in that a sharp freeze will kill fewer of the organisms which might be being dried than would a slow freeze, hence the low temperature which is employed. Here you see a shell of the product. We are going to start the motor and put this on our piece of drying equipment. We'll turn the motor off since it makes considerable noise, and since this process requires any place 24-48 hours, we hardly would have time to finish the drying procedure in the short time that we have. The nature of the product will govern whether or not it has to be dried for 24-48 hours. There are a number of products which we are not concerned with every day, perhaps, but with which the physician and the practicing veterinarian are concerned daily. A number of these products which are dried, which they use in their everyday life. The most important items, I think, which are dried by sublimation are the antibiotics. These are substances which have come into use during the last ten years, and in order to conserve their usefulness to extend their useful time, they are dried by this process of lipaization. Here you see a battery of products which are dried. I'll go through them and list them for you so that you'll have some idea of the products which are processed by liilization. Probably the best known of all the antibiotics is penicillin. At least more has been written about the antibiotic penicillin than any other. Here you see penicillin in a dried state. Notice that it has been shell frozen, that has been desiccated from a shell. You notice the dry powder hanging to the side. Another product which is fairly new yet becoming more and more common every day is another antibiotic known as pterycin. Another antibiotic, again, which is fairly new, but which is becoming more common every day is magnamycin. Another one is neomycin. Another antibiotic, polymyxin. A antibiotic streptomycin, dihydrostreptomycin, certainly a very common antibiotic. Various biological products that may be dried, preserved in this particular fashion and used for the immunization of both man and animals are, first of all, canine distemper vaccine. This is used to immunize dogs against canine distemper. HG Kora vaccine. When hog Kora vaccine

was prepared a few years ago, prior to desiccation under vacuum, the longevity of this product was approximately 90 days. It has been extended now so that this product has an expiration date of about two years. Another common product is Brucella abortus strain 19 vaccine. This is the vaccine that's used in the immunization of cattle against Bangs disease. Sine erysphilis vaccine. Laboratory cultures are preserved in this particular fashion. Aster as used in the laboratory put up in this fashion. Surely freeze drying plays a very important role in the field of bios. [Clint Ballard] We want to thank Jack Stockton for appearing on our program today. Such demonstrations add materially to our appreciation of science and its contribution to our health and general well being. We have seen one demonstration here today. We've seen many of them, and they all add up to what we call our American standard of living in which we are so proud. We want to thank you, the television audience, appearing for being on our program today. Thank you for joining us, and now we bid you goodbye for the extension service to the Michigan State College. This has been another in the Cooperative Extension series. Today's program has been presented by the School of Veterinary Medicine and arranged by the Department of Bacteriology and Public Health. We had with us today Jack Stockton. Join us tomorrow when our program will again be presented by the School of Agriculture. This has been a video recording of Michigan State College Television.