

water-bath when the pus was still moist; other instruments, after the pus had become quite dry; the result was the same in every instance, complete sterilization after five minutes' boiling.

He tested the water in which the instruments had been boiled, taking samples with specially constructed tubes from different parts of the vessel, near the surface, near the bottom, near the sides and in the centre, and invariably found it sterilized.

Dr RAND.—I have had no experience with dry heat in the sterilization of instruments, and until the last few months I have been satisfied with the process described by Dr. Wunderlich; it has always seemed to me that boiling water was a good agent by which to thoroughly sterilize instruments.

The last few months I have used the apparatus sold in the market for sterilizing milk, the name of it I have forgotten, but it consists of a copper basin and a receptacle above in which you can place your instruments and steam them under a certain amount of pressure, and the steam is generated very rapidly. My habit has been to steam instruments after they have been used; and then before an operation, if it is one of importance, I steam them again and turn them out of the apparatus into a sterilized towel, and carry them in this way, without drying, to the operation. If dry heat is better than steam I should like to try it, but heretofore I have been satisfied with steam. Steam has seemed to me especially useful where hollow instruments and instruments that contain a great many joints are to be sterilized.

Dr. ROBERTS.—I would like to add one word more. What drove me to the use of dry heat was the very difficulty mentioned here by Dr. Rand, the difficulty of getting instruments boiled. I used to try to boil my instruments. At the hospital I could generally get boiling water, but not always; sometimes the engineer would be out or the plumber would be fixing pipes; and a number of times it seemed impossible to get boiling water. At private houses it is frequently impossible to get boiling water unless you waste a good deal of time, and I find I

can do better work and get away quicker by taking everything with me, dressings, solutions, scrubbing material, and sometimes soap, particularly among the poorer classes. That was one thing that made me abandon the use of hot water.

I am inclined to believe from my reading that any ordinary bacillus or coccus, that is, the common pyogenic germs that surgeons are apt to come in contact with in surgical practice in this country, are destroyed by the boiling or a few degrees above the boiling point when moist heat is used. Dr. Wunderlich has truly said it takes a higher degree of dry heat than moist heat to kill germs or spores. It is known, moreover, that spores can stand a great deal more heat than the mycotic individuals. But all ordinary forms, except the anthrax bacillus, are killed a very little above boiling point. Spores are killed by a variable heat, but whether the heat be moist or dry, in each instance the spores require more heat than the individual; 130 degrees Centigrade, which would be 266 degrees Fahrenheit, will kill all spores and all individual germs that exist, as far as known, if this heat is kept up for a couple of hours. I believe I am correct in stating those facts. Now, if we can by running our instruments up to 120 degrees Centigrade, which my practical experience seems to show to be not deleterious, and if we can take our instruments so made sterile in a box and not open them until we begin to operate, it seems to me that we can go to an operation with a quiet conscience. I can go to the dirtiest house in Philadelphia and feel that my operation is absolutely aseptic if I have my hands sterile; for I can take sterile instruments, dressings and towels boxed in a box, such as I have described, and feel that I am technically and theoretically and conscientiously aseptic. It gives me a confidence that I never had before; and I do not think it a misplaced confidence. Moreover I gain time, and as time is money, when I save it, I feel that something has been gained. After finding out what the instruments would stand (it took me some little time to find that out and caused me to throw away some instruments which I spoiled) I have realized exceedingly great comfort