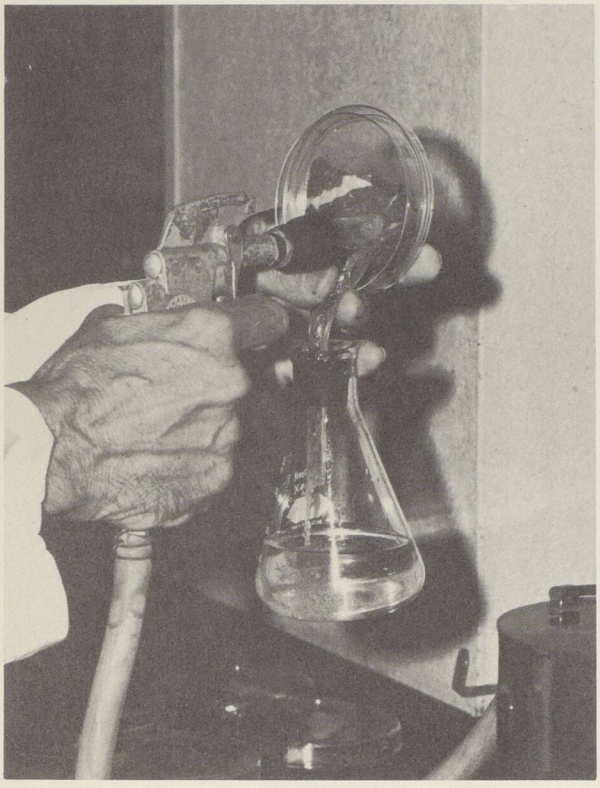
garnish with CO_2



The spray-gun method being used in the laboratory to take bacterial samples from the surface of a slice of lean meat.

Prélèvement au pistolet d'échantillons de bactéries sur une tranche de viande maigre.

The field studies showed that bacterial counts on sides of fresh beef 24 hours after slaughter varied by over a factor of 10 with the area tested, and by over a factor of 20 between plants.

"No explanation was apparent for the variation among the surfaces tested", says Dr. Clark, "but we found that the neck was the most heavily contaminated in both plants."

Slime-producing psychrotolerant bacteria were present on the beef on all areas tested, sometimes in numbers greater than 60 per cent of the total count.

"Again, there was no apparent explanation for the marked variation between plants. The psychrotolerant bacteria from both plants produced off-odor and slime on meat when their numbers reached about one hundred million per square centimeter of surface," says Dr. Clark.

In further laboratory studies, tests were made with samples of lean meat sliced from rump muscle obtained from an Ottawa packing plant after 24 hours of aging. Lean meat was used because preliminary tests with various carcass tissues had shown that lean meat slices could be prepared with little incident contamination and that the inhibitory effect of carbon dioxide was independent of the tissue used. The slices were placed in dishes and the top surface inoculated with a uniform mixture of the 10 selected strains of bacteria. The size of inoculation used was representative of the incidence of psychrotolerant bacteria on beef leaving Western plants. Inoculated samples were incubated for up to 27 days at various temperatures –zero, five, 10 and 20 degrees Centigrade – in a saturated atmosphere containing various concentrations of carbon-dioxide gas – 0, 10, 20, 30, and 40 per cent. Samples were removed at various intervals, checked for the presence of slime, off-odor and color change and the bacterial count determined.

Results of the laboratory tests, showed that shelf-life – the time required after inoculation for development of noticeable off-odor and slime – was extended markedly by carbon-dioxide gas, depending on concentration and temperature.

"Twenty per cent carbon-dioxide gas markedly inhibits the growth of bacteria that cause formation of slime on fresh beef stored at a high humidity, provided that the gas is applied before the organisms have become adjusted to environmental conditions," Dr. Clark says. "A 10 per cent concentration of the gas also inhibits the growth of bacteria, but only significantly at temperatures below five degrees Centigrade."

The extension in the shelf-life of fresh beef resulting from the use of a 20 per cent concentration of the gas at the inoculation level used in this study – 11 days at five degrees Centigrade and four days at 10 degrees Centigrade – will certainly be significant in terms of West-East transportation across Canada, Dr. Clark says.

He adds: "it should be noted that since beef is normally held for about 24 hours in coolers in the plants before shipping, it is difficult to estimate how well the natural contamination on it is adjusted to the environmental conditions prevailing as the beef leaves the plant. This depends on the temperature, degree of surface desiccation, amount and type of contamination and duration of holding, and hence, will vary from plant to plant. The effectiveness of moderate levels of carbon-dioxide gas (10-20%) applied subsequently will depend markedly on how much adjustment has occurred."

Results of the work were put to use almost immediately by the Canadian Pacific Railway. After preliminary road trials to confirm the laboratory results and to devise a practical method of control, CPR fitted out about 40 refrigerated trailers to provide a 20% concentration of carbon dioxide. T. C. Macnabb of Canadian Pacific's research department in Montreal, says these units are in continuing use and giving excellent results in the shipment of fresh beef. These vehicles are of the jacketed type developed previously by Mr. Lentz. □