between 101° and 102°; those treated by cold showed a temperature range of between 99° and 100°.

Results seem to indicate that the local application of heat and cold to the surface of the abdomen in the treatment of experimentally produced peritonitis is a matter of relative indifference. The raising or the lowering of the general body temperature by approximately a degree apparently has no influence on the ultimate survival of the animal, since as many animals survived when treated by heat as when treated by cold. It seems quite possible, however, that the application of heat or cold is of some value since a larger number of animals so treated survived than in the series untreated by either method.

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Further Studies on the Pathogenicity of Br. Abortus and Br. Melitensis for Monkeys.

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The following observations have been made in the course of preliminary studies with 48 cultures of the brucella group on 74 rhesus and 14 cynomolgus monkeys:

A single oral administration of 21 different *Br. abortus* strains produced in 24 *Macacus rhesus* and 1 *M. cynomolgus* monkeys nonfebrile infections, followed by the formation of specific agglutinins of moderately high value. The dosage varied from 7 to 400 million and in some experiments it consisted of many billions. The strains identified serologically as abortus or para-abortus varieties and in the dye test as "bovis" or "melitensis" types had been isolated from bovine pathological specimens in the United States, Germany, Hungary, Italy and Switzerland.

Blood cultures have not been successful. The value of the serum agglutinins and their persistence depends on the feeding dose. Rapid disappearance of the agglutinative power to a low titer or to the zero point is worthy of note. A cutaneous application of approximately 20,000 bacteria has induced an infection. The incubation period as indicated by the appearance of the serum reaction varied from 9 to 30 days and is influenced by the infective dose.

The absolute evidence of infection has been secured through the recovery of the organisms from the tissues of 4 monkeys which have been sacrificed on the 34th to 52nd day. Three animals killed on the 43rd, 56th, 199th day furnished sterile cultures. Probably every *Br. abortus* strain when fed in sufficiently large dosage is pathogenic provided susceptible monkeys are used.

By feeding 100 million *Br. abortus* type "suis" of bovine, but in all probability of porcine origin which has retained its characteristics through the passage, a febrile disease with anatomical lesions indistinguishable from those of a *Br. melitensis* infection has been produced. During artificial cultivation the febrigenic properties on feeding have been lost but they have been retained when applied cutaneously. The milk of the cow which furnished one of the pathogenic "suis" strains has been consumed by a group of people without any bad effects.

An old laboratory culture of a *Br. abortus,* type "suis" of porcine origin infected via the alimentary tract when fed in large doses. The infection ran an afebrile course, stimulated after an incubation time of from 9 to 10 days a powerful agglutinative value of the serum with an abundance of specific organisms in the tissues.

A *Br. abortus* type "bovis" isolated from a swine foetus infected and immunized a monkey in a manner similar to that of the "bovis" types of bovine origin.

"Melitensis" strains of American origin possess a low virulence for monkeys; they may act like "bovis" cultures and they may lose their pathogenicity entirely within 6 months of artificial cultivation. Test-tube strains several years old are non-pathogenic and when administered by mouth they lack immunizing properties. One culture, which produced no lesions in guinea pigs by injection, infected a rhesus by mouth.

Tunisian strains of *Br. melitensis* fed or inoculated in doses of 100 million bacteria give rise to a febrile disease which is generally considered characteristic for this group of organisms. Even recently isolated strains may induce merely serologic but no febrile reactions.

A brucella organism serologically and biochemically an "abortus" and in its behavior towards dyes a "melitensis" type, acted like a typical melitensis by feeding and inoculation one month after isolation from a California case of undulant fever. In contrast 9 other strains kept under artificial cultivation for from 1 to 24 months and isolated from human abortus fever cases in Michigan, Iowa, North-

ern Germany and Denmark, infect monkeys when fed in a manner characteristic for the *Br. abortus*, "bovis" type.

Three *Br. abortus* type "suis" strains of human origin have not exhibited any striking pathogenicity or marked febrigenic properties neither by feeding nor by cutaneous or intravenous infection.

Serum agglutinins specific for the brucella group are formed only in the presence of a definite infection. The ingestion of heat killed abortus bacilli with or without bile is antigenically ineffective in monkeys and rabbits.

Over 10% of the rhesus and cynomolgus monkeys possess a natural immunity against brucella infections via the alimentary tract. Animals which react to the oral administration of virulent abortus organisms with moderate and in general transitory serum reactions resist subsequent feeding infections with *Br. abortus* "bovis" and "suis" but not with a Tunisian *Br. melitensis.* Continuous ingestion of small numbers of abortus may lead to mild, unrecognized or "silent" yet immunizing infections. At least in one observation, the local and general immunity thus induced has been definite.

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Relation of Stainability and Electric Potential Differences to the pH Value.

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As shown previously[1] the addition of a water insoluble acid to a fat mixture leads to basophilic staining and a relative positive potential. The addition of a water insoluble base has the opposite effect on both properties. In tissues, basophilic staining is also associated with a positive potential, acidophilic staining with a negative potential. Water immiscibility of the acid or of an added base is essential. By the addition of a water-soluble acid or base both stainability and e.m.f. are influenced in opposite directions.

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[1] Beutner, R., PROC. SOC. EXP. BIOL. AND MED., 1929, xxvii, 44.