axis of its base, the voltage registered by all 3 leads will diminish in proportion to the angle of inclination between the plane of the leads and the electrical axis. When they are parallel the voltage registered is maximum, and when they are perpendicular it is minimum, without regard to the relations already existing between them within the plane of the leading. Therefore a heart in which the electrical axis approaches the perpendicular to the plane of the 3 usual points of leading yet is otherwise perfectly normal will present very low voltage in all 3 leads. This can be illustrated by tilting the exposed heart in the dog while the electrocardiogram is written with the axial lead (Fig. 1). The presence of conditions such as this must be considered before assigning a value of significance to low voltage in the diagnosis or prognosis of heart disease.

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Aerobic and Anaerobic Examples of Hemolytic Bacterial Synergism.

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While studying the bacterial flora in the exudate in a case of chronic empyema of tuberculous origin 2 organisms were found which performed a function which neither could accomplish alone. One was a double-zoned *Staphylococcus aureus.* The other was a nonhemolytic diphtheroid bacillus.

On blood agar plates the colony of the double-zoned *Staphylococcus aureus* has a narrow zone of clear hemolysis about twice the diameter of the colony immediately around it and a wide zone of partial hemolysis about 8 times the diameter of the colony. Among the anaerobic bacteria this double zone is seen about certain strains of *C. welchii* while non-hemolytic strains of *C. welchii* have the outer zone only. The nature of these 2 changes in the hemoglobin is not fully understood.

While working with the culture from the pleural exudate it so happened that when the colonies were fished from the original blood agar culture to a fresh plate the diphtheroid bacillus and the double-zoned Staphylococcus were streaked side by side. After incubation, this plate showed that on the side toward the diphtheroid bacillus the outer zones of the Staphylococcus colonies were completely hemolyzed over an area very evidently under the influence of some diffusible substance or physical force emanating from the colonies of the diphtheroid bacillus. Immediately around these colonies no change in the red cells was visible but over an area 8 or 10 times the diameter of the colony some chemical substance or physical force was operating which, whenever it came in contact with the outer zone of partial hemolysis from the Staphylococcus colonies, completed the hemolytic process not only of laking the red cells but of changing the color from red to yellow. In order that this effect might be brought out more clearly a design was made on another plate by alternately dotting with the 2 cultures. Photographs of those plates show the effect produced by these 2 organisms when in juxtaposition. It was found that control nonhemolytic colonies of several other species did not have this effect, but the diphtheroid bacillus had the same effect on the outer zone of both hemolytic and non-hemolytic strains of *C. welchii.* If the Staphylococcus was planted alone and incubated for 24 hours and the bacillus was subsequently planted on the same plate. The result was the same and *vice versa* this bears out the opinion of Castellani[1] and of Holman and Meekison[2] that when 2 organisms accomplish together what they cannot do separately one initiates the process and the other finishes it.

Some months later in culturing a specimen of surgical catgut, 2 anaerobic organisms were found which had exactly the same relationship to one another. They were a double-zoned hemolytic strain of *C. welchii* and a nonhemolytic strain of *C. oedematoides.*[3,4] The plate after anaerobic incubation gave the same appearance as the 2 aerobic organisms did before.

Recently a third example of the same phenomenon was observed when from another specimen of catgut a hemolytic strain of *C. welchii* and a hemolytic strain of *B. subtilis* were recovered. In this case, the colony of *B. subtilis* had a narrow zone of clear hemolysis about it and an outer zone of influence not visible until it came in contact with the outer zone of the hemolytic *C. welchii* colony which it completely hemolysed.

In these 3 examples, the general principle of bacterial synergism is illustrated in a strikingly visible manner.

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1 Castellani, A., *J. Am. Med. Assn.*, 1926, lxxxvii, 15.

2 Holman, W. L., and Meekison, D. M., *J. Inf. Dis.*, 1926, xxxix, 145.

3 Meleney, F. L., Humphreys, F. B., and Carp, L., PROC. SOC. EXP. BIOL. AND MED., 1927, xxiv, 675.

4 Humphreys, F. B., and Meleney, F. L., PROC. SOC. EXP. BIOL. AND MED., 1928, xxv, 611.