In October 1945 one of us was discharged from the Navy and this investigation ceased, although cultures of the organism were carried for future work. Eight months later an attempt was made to repeat and amplify the above experiments. During the extended period of storage and irregular transfer, however, the organism had apparently lost its ability to produce the inhibitory effect, and no antagonistic activity was demonstrable. Prior to loss of this effect no attempt was made to separate the diphtheritic exotoxin from the possible antibiotic substance.

Since there is no previous record of antagonistic activity of *C. diphtheriae*, this note is presented merely to record the fact that *C. diphtheriae gravis* may produce an antibiotic substance and to stimulate others to look for it among strains of this genus.

Mechanism of Sex Determination

LEONARD WALKER

University of California, Berkeley

It has long been known that the ratio of males to females, 106:100 (*7*) in man, deviates appreciably from the 100:100 ratio which is predicted on the basis of the chromosome theory. This deviation has also been observed in plants and in other animals. Correns (*3*) thought that in plants, among other influences, might be the different masses of the male- and female-producing pollen grains. Bluhm (*2*), in her work with white mice, suggested the different masses of the two types of sperm as a factor, stating that male-producing sperms (androsperms) may have a better chance to reach the egg than the gynosperms because of their lesser mass of chromosome. Zeleny and Faust (*6*) found dimorphism in the sperm cells of 15 animal species. They believe that the two types of sperm are androsperms and gynosperms and that, due to their different masses, they may have different chances to reach the egg. Parkes (*5*) found dimorphism in the case of man, the rat, and the mouse.

This explanation involves the assumption that the average kinetic energy of both types of cell is the same, so that the two types travel with different velocities due to their differences in mass.

The purpose of this paper is to show that, to produce an appreciable difference between the velocities of the two types of cells, the differences in mass would have to be larger than could reasonably be expected.

By the definition of kinetic energy,

$$KE_x = \tfrac{1}{2}m_x v_x^2 \quad \text{and} \quad KE_y = \tfrac{1}{2}m_y v_y^2,$$

where KE_x is the average kinetic energy of a gynosperm; KE_y, that of an androsperm; m_x, the average mass of a gynosperm; and v_x, the average velocity of a gynosperm.

If the average kinetic energy of androsperms and gynosperms is equal,

$$\tfrac{1}{2}m_x v_x^2 = \tfrac{1}{2}m_y v_y^2.$$

Hence,

$$\frac{m_x}{m_y} = \left(\frac{v_y}{v_x}\right)^2.$$

Thus, the ratio of the masses of gynosperms to androsperms must be equal to the inverse ratio of the velocities of the two types of cells, squared. However, the number of males born must be proportional to v_y, and the number of females to v_x; hence, for a ratio of, for example, 106 males:100 females, we have:

$$\frac{v_y}{v_x} = \frac{106}{100} = 1.06. \quad \text{Since } \left(\frac{v_y}{v_x}\right)^2 = 1.1236, \ \frac{m_x}{m_y} = 1.1236.$$

This means that, to account for a ratio of 106:100, an average difference of about 12 per cent would have to exist between the masses of androsperms and gynosperms. If one takes into consideration the high index of mortality of male zygotes, the primary ratio of males to females must be at least 116:100 (*1*). Using this ratio in the above calculation, one obtains: $\frac{m_x}{m_y} = 1.3456$, which would be a difference of about 35 per cent in the average masses of androsperms and gynosperms.

The difference is mass is presumably due to that of only one chromosome (*4*). It then becomes apparent that the difference in mass between androsperms and gynosperms would have to be far greater than cytological evidence permits us to deduce in order to explain this great deviation from the normally expected 100:100 ratio, if mass of chromosome alone were to be considered the decisive factor.

References

1. AUERBACH, E. *Arch. Rass. Gesellsch.*, 1912, **9**, 10–17.
2. BLUHM, A. *Sitz. Preuss. Akad. Wiss.*, 1921, **34**, 549.
3. CORRENS, C. *Handb. Ver.*, 1928, **2**, 94.
4. OGUMA, K. *J. Morphol.*, 1937, **61**, 59.
5. PARKES, A. S. *Quart. J. micro. Sci.*, 1923, **67**, 617.
6. ZELENY, C., and FAUST, E. C. *J. exp. Zool.*, 1915, **18**, 187.
7. ———. *U. S. Census Report*, 1915–23.