tween those which are not homologous. They show, furthermore, that the correlation between the winter periods of the first and second year is the lowest of any of the four correlations between the productions of homologous periods. The difference between the winter-winter correlation and the spring-spring correlation is not large, but the differences between the winter-winter correlation and the summer-summer and the autumn-autumn coefficients are more substantial, the two latter being 2.57 and 6.10 times as large as their probable error.

In so far as this type of evidence is pertinent to the problem, it indicates that in the White Leghorn at least there is no evidence of special factors which distinguish the "winter cycle" from any other period of the year.

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THE EFFECT OF X RAYS ON CHEMICAL REACTIONS

WHILE investigating with Dr. E. Dershem absorption coefficients for X rays, a brass cell with aluminum windows containing cyclohexanol was subjected to the X rays and afterwards opened. The contents showed very striking and unexpected consequences due to this exposure. The colorless hexanol had turned to greenish-blue, and later analysis showed that about 0.1 of a gram of copper had gone into solution.

The intensity of the X rays was so small, coming as a nearly monochromatic beam from a crystal grating, that the amount of chemical action produced was most surprising. The geometry of our apparatus and the power used by the X ray bulb enabled us to calculate the maximum energy which could be involved. Assuming the target and the crystal grating to be 100 per cent. efficient, and taking one hour as the maximum time exposure, the energy received by the cell could not be greater than 3×10^6 ergs, or less than 0.1 of a calorie.

Using the quantum theory, we may calculate from the wave length, approximately 0.2 Å, the number of quanta entering the cell. The energy per quantum is 1×10^{-7} ergs. Therefore the number of quanta received could not be greater than 3×10^{13}. Since about 0.1 gram of copper went into solution each quantum must have caused at least 3.3×10^7 atoms of copper to react.

The small amount of energy involved, and the small number of quanta relative to the number of atoms reacting, indicate that the reaction is an exothermal one. The quantum voltage producing the X rays was approximately 10^5 volts. Since each quantum caused 3.3×10^7 atoms to react, not more than 3×10^{-3} volts could be expended on each atom if the reaction were endothermal. This value is only one five-hundredth of the smallest known resonance potential, that for cæsium as determined by Foote, Rognley and Mohler,[2] being 1.48 volts.

We therefore must conclude that the X rays produced some sort of trigger action of the type studied by Bodenstein and Taylor[3] and by Jorissen and Ringer[4] in their work on the formation of hydrochloric acid from hydrogen and chlorine by means of alpha particles. An excellent discussion of this work will be found in a monograph by Lind.[5]

Mesitylene showed a behavior similar to that of cyclohexanol, but in this case the color was a yellowish green. This difference in color may be due to concentration effects.

On account of the large effect produced by relatively small amounts of energy, it seems that the use of X rays may acquire great importance in the production of organic compounds, especially if substances are produced in this manner which can not be obtained by other means.

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[2] Foote, Rognley and Mohler, *Phys. Rev.*, 61 (1919).

[3] (M. Bodenstein) and H. S. Taylor, *J. Am. Chem. Soc.*, 37: 24 (1915).

[4] Jorissen and Ringer, Ber., 39: 2095 (1906).

[5] S. C. Lind, *The Chemical Effects of Alpha Particles and Electrons*, Chemical Catalog Co., New York (1921).