values used in the calculations were sometimes the averages of the readings on the individual plums, at other times the averages for the lot. In the 1925 material stages III and IV were used both separately and together. In the other cases all stages were included in one calculation.

It is apparent from the magnitude of the coefficients that a very significant negative correlation exists between the values for the two constants. It should be mentioned that a tough skin gives a high puncture value and a firm flesh a low penetration value. Hence, a negative sign to the cofficients indicates that these two mechanical factors in plums vary together. This relation seems to hold consistently for different seasons, for different varieties, and for different stages of ripeness. It is believed that sufficient evidence is now at hand to warrant the use of the skin test alone in studying the brown rot problem in plums.

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Effect of oxygen and carbon dioxide concentration on inhibition of respiration and photosynthesis by KCN.

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The present paper briefly presents certain facts which extend present knowledge regarding the effects of some of the following external conditions on the velocity of respiration and photosynthesis in the marine kelp *Nereocystis*. Some of the facts do apply, and the others may apply to respiration and photosynthesis of plants in general.

Uniform strips 1 x 10 cm. were cut from the frond of the kelp. The oxygen exchange in respiration and photosynthesis was determined by Winkler's method. Specially made bottles of 25 cc. volume were used. One strip was placed in each bottle for a determination. Three duplicate bottles with strips were used for the same concentration of oxygen, cyanide, etc. Each figure in the tables is, therefore, the average of three duplicate, simultaneous determinations. During the tests the experimental bottles were suitably immersed in the open sea, which afforded a constant temperature to within ±0.5° C. during any one experiment. Light intensity was the same in all the tests of any one experiment, but varied more or less from one experiment to another. Suitable control experiments showed that the effects reported are not due to differences in hydrogen ion concentration.

Effect of oxygen concentration on the rate of respiration and photosynthesis. It is a familiar fact that increase in concentration of oxygen increases the rate of oxygen consumption in many kinds of plants. It is not such a generally recognized fact that increase in concentration of oxygen decreases the rate of photosynthesis. These two effects of oxygen concentration on *Nereocystis* are shown by the three experiments performed simultaneously, and given in Table I.

TABLE I.

Experiment	1	2	3
	O_2 in sea water cc. thio.	O_2 consumed respiration cc. thio.	O_2 produced photosynthesis cc. thio.
1	4.62	2.42	7.23
2	7.66	2.97	5.12
3	13.87	3.67	3.84

Column 1 shows the initial concentration of dissolved oxygen in sea water at which the rates of respiration and photosynthesis were tested. The rates of oxygen consumption at the given concentration of oxygen are shown in column 2. The corresponding rates of oxygen production by photosynthesis are shown in column 3. Note that high concentrations of oxygen increase the rate of respiration while the same initial concentrations of oxygen markedly retard photosynthesis. The experimental error in the determinations does not exceed 0.2 cc. thiosulfate equivalent of oxygen.

Effect of oxygen concentration on the rate of respiration in KCN. Table II is a summary of the results of three separate experiments which are not fully comparable with one another because they were performed at different times. Column 3 shows the rate of respiration in .000076 mol. KCN in per cent of the

TABLE II.

Experiment	1	2	3	4
	O_2 in sea water cc. thio.	O_2 in sea water cc. thio.	O_2 Respiration in KCN in per cent of normal	O_2 Respiration in KCN in per cent of normal
1	4.09	12.66	5%	49%
2	5.02	7.62	11%	69%
3	4.03	11.59	22%	76%

normal respiration in pure sea water, when the initial concentration of oxygen was that given in column 2. Similarly, column 4 shows the rate of respiration in the same concentration of KCN, in per cent of the normal respiration in sea water having the initial concentration of oxygen given in column 2. It is evident that as the concentration of dissolved oxygen is *increased* the magnitude of the inhibitory effect of cyanide is *decreased*. Ex-

TABLE III.

Column 1 shows (in cc. thiosulfate equivalent of oxygen produced) the normal rate of photosynthesis in pure sea water at air saturation. Column 4 shows the rate of photosynthesis in different concentrations of KCN (column 2) in sea water. Two tests were made at each concentration of KCN. To one of these were added 2 cc. or 3 cc. CO_2 saturated sea water column 3. Column 5 shows the rate of photosynthesis and degree of recovery of the same tissue in pure sea water 11 to 19 hours after the first test in KCN, and KCN and CO_2, column 4. Note that additions of CO_2 in experiments 3 and 4 protected the photosynthetic mechanism from injury by light when in the presence of KCN. Each number in columns 4 and 5 is the average of three duplicate tests.

Experiment	1	2	3	4	5	6
	Normal rate of photosynthesis	KCN mol.	cc. CO_2 saturated sea water added	1st test. Rate of photosynthesis. cc. thio.	2nd test. Rate of photosynthesis. cc. thio.	Condition of strip
1	7.37	$.76 \times 10^{-5}$	0	3.95	9.59	All normal
			2 cc.	14.23	10.14	All normal
2	8.86	$.76 \times 10^{-4}$	0	1.55	8.50	All normal
			2 cc.	8.00	7.58	All normal
3	9.73	$.38 \times 10^{-2}$	0	.07	.26	All leached
			3 cc.	1.04	7.34	All normal
4	8.22	$.76 \times 10^{-2}$	0	.86	.50	All leached
			3 cc.	.95	6.44	One leached

periments show that in appropriate concentrations of oxygen and cyanide the inhibitory effect of cyanide on the oxidations may be entirely wiped out.

Table III represents the condensed statements of the results of four experiments, as follows:

Effect of concentration of cyanide on the rate of photosynthesis. The normal rates of photosynthesis in pure sea water, in the four different experiments are given in column 1. The comparatively uniform rates in the different experiments show that external conditions varied within narrow limits from one experiment to the next. In column 4 it will be seen that the rates of photosynthesis in the corresponding concentrations of cyanide given in column 2, were 3.95, 1.55, .07, and .86 cc. thiosulfate equivalent of oxygen. As the concentration of cyanide increases the percentage inhibition increases until it becomes practically complete at $.38 \times 10^{-2}$ mol. KCN. This confirms the observations of Lund and Holt,[1] and the earlier ones by Warburg[2] on the green alga *Chlorella pyrenoidea.* It will be seen in column 5 that after exposure in light to $.76 \times 10^{-5}$ and $.76 \times 10^{-4}$ mol. KCN, complete recovery of the photosynthetic mechanism occurred. This is shown by the fact that the rate of photosynthesis in pure sea water after recovery was 9.59 cc. and 8.5 cc. respectively. In the two high concentrations of cyanide, $.38 \times 10^{-2}$ and $.76 \times 10^{-2}$ mol. inhibition was practically complete, but recovery did not occur in pure sea water. In fact the xanthophyll and the chlorophyll pigments leached out of the chloroplasts and the cells, leaving the tissue colorless and without turgor.

High concentrations of CO_2 protect the chloroplast and cell against the phototoxic action of cyanide. To show the effect of CO_2 on the phototoxic action of KCN, 2 cc. (experiments 1 and 2) and 3 cc. (experiments 3 and 4) of CO_2 saturated sea water were added to each of the duplicate sets of bottles containing the same concentrations of cyanide given in column 2. Note that the increased concentration of CO_2 removes completely the inhibitory effect of the lower concentrations of cyanide in experiments 1 and 2.

Recovery in pure sea water is complete in experiments 1 and 2, column 5. While 3 cc. of CO_2 saturated sea water in experi-

[1] Lund, E. J., and Holt, V., PROC. SOC. EXP. BIOL. AND MED., 1923, xx, 232.

[2] Warburg, Otto, *Biochem. Zeitschr.*, 1920, ciii, 188.

ments 3 and 4 did not prevent the nearly complete inhibition of photosynthesis by the high concentrations of cyanide, it did completely protect the photosynthetic mechanism against injury in $.38 \times 10^{-2}$ mol. KCN because recovery in pure sea water was practically complete and no bleaching of the pigments or loss of turgor occurred. Even in experiment 4 with a concentration of $.76 \times 10^{-2}$ the added CO_2 afforded almost complete protection except to one of the strips.

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Changes in the excretion of uric acid produced by experimental hepatic insufficiency.

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Destruction of uric acid, which is rapid and marked in the normal dog,[2] does not occur if the liver is entirely removed. Complete removal of the liver in the dog produces a very great increase in the uric acid content of the blood and tissues, and also in the urine. Uric acid injected into the dehepatized dog remains unchanged in the blood and tissues and is excreted unchanged in the urine. The destruction of uric acid in the dog seems to be entirely dependent on the presence of the liver,[1] since no uric acid is destroyed in the absence of the liver and no other means of influencing the destruction of uric acid has been demonstrated. Intravenous injection of standard amounts of uric acid into dogs with hepatic insufficiency is followed by a delay in the disappearance of the excess uric acid from the blood, and by an increase in the amount of uric acid excreted in the urine. Both the delay in the disappearance of the excess uric acid from the blood and the amount of uric acid appearing in the urine are greater, the greater the amount of damage or reduction of hepatic tissue. Two

[2] Folin, O., Berglund, H., and Derick, C., *J. Biol. Chem.*, 1924, lx, 361-471.

[1] Bollman, J. L., Mann, F. C., and Magath, T. B., *Am. J. Physiol.*, 1925, lxxii, 629-646.