Table 1. Comparative activity of 3-methoxy-catecholamines.

Rabbit smooth muscle preparation			Blood pressure response in cat
Aortic strip		Duodenum	Response of nonmethylated analog (%)‡
Threshold ($\times 10^{-7}$)	Potency*	Potency†	
Epinephrine			
0.1	1.	1.	100
Metanephrine			
3.	1.18	0.025	25.
Normetanephrine			
2.3	0.17	.005	0.16
3-Methoxydopamine			
19.	.04	Contraction	15.

* Ratio between concentrations of epinephrine and methoxy-catecholamines required for production of 50 percent maximum contraction. † Ratio between concentrations of epinephrine and methoxy-catecholamines required to produce the same degree of inhibition. ‡ This percentage was obtained by comparing the doses required to obtain an equal rise of blood pressure with the methylated and nonmethylated catecholamines.

biological inactivation of catecholamines or that this enzyme is not equally effective for the inactivation of all catecholamines.

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25 March 1960

Influence of Uterine Site on Occurrence of Spontaneous Cleft Lip in Mice

Abstract. It has been found that within the A/Jax strain, embryos in the uterine site nearest the ovary develop cleft lip (with or without cleft palate) significantly more often than embryos in other positions in the uterus.

When anomalies occur in an inbred strain of mice, why do they occur only in certain members of the litter and not in others? Litter mates in an inbred strain have very similar, if not identical, genetic constitutions and, furthermore, they are all subject to the same external and maternal environment. The differences that determine that one embryo is abnormal and that others are not must reside within the uterus, and since the differences are not obvious, they must be small, although probably not simple. This report is concerned with one such difference—namely, that of a difference in the sites occupied by embryos within the uterus and the influence of this difference on the occurrence of cleft lip in the highly inbred A/Jax strain of mice. Cleft lip with or without cleft palate has been reported as occurring with a frequency of 6.33 percent in A sublines related to the A/Jax strain (*1*).

The uterus was removed from each of 76 A/Jax females 14 or 15 days after insemination and, after fixation, the positions of embryos with spontaneous cleft lip were noted. A total of 485 embryos from uterine horns containing two or more embryos had an over-all frequency of cleft lip of 8.5 percent. There were no differences in frequency between right and left horns. The frequency of cleft lip at the ovarian site (17/126 = 13.5 percent) is significantly higher ($p < .02$) than the total at all other positions (24/359 = 6.7 percent). This tendency for cleft lip to occur more often in the embryo occupying the site nearest the ovary appears even more clearly when only those horns (35 horns in 29 litters) that contain at least one affected embryo are considered. Again the proportion of embryos with cleft lip is significantly higher ($p < .01$) for embryos nearest the ovary (17/35) than for embryos at other positions (24/116) in the uterine horn. In Table 1 the data are arranged according to the number of embryos in a horn. It can be seen that there is a tendency for embryos with cleft lip to occur more frequently at the site nearest the ovary regardless of the number of embryos within a horn, but that this tendency appears to be greatest when there are either few or many embryos in the horn.

Further support for the foregoing observations was obtained from another group of A/Jax mice primarily intended for another purpose. In this group 48 litters were collected, just before term, from mothers that had received cortisone 11, 12, and 13 days after insemination. In this group of cortisone-treated fetuses (see Table 1) the tendency for cleft lip to occur more often at the ovarian site is again seen, but the difference in over-all frequencies (8/76 versus 8/161) is not significant. However, when only horns containing at least one affected embryo are considered, there are significantly more embryos with cleft lip (8/15) at the ovarian site than at the other sites (8/35); *p*, determined by Fisher's exact method, equals .03.

Table 1. Number and percentage (in parentheses) of cleft-lip (CL) embryos at the site nearest the ovary and at other uterine sites; the data are grouped according to the number of embryos per horn (horns containing one embryo are not included).

Embryos in horn (No.)	CL embryos (No. of total)			
	Ovarian site		Other sites	
	Untreated group			
2	4/26	(15.4)	1/25	(4)
3	5/32	(15.6)	2/64	(3.1)
4	2/31	(6.5)	5/96	(5.2)
5	3/22	(13.6)	6/89	(6.7)
6	1/8	(20.0)	3/40	(11.8)
7	2/4		4/24	
8	0/3		3/21	
Totals	17/126	(13.5)	24/359	(6.7)
	Cortisone-treated group			
2	4/31	(13.0)	1/31	(3.2)
3	1/18	(5.6)	2/36	(5.6)
4	2/16	(9.4)	4/48	(8.3)
5	0/9	(9.1)	1/36	(2.2)
6	1/2		0/10	
Totals	8/76	(10.6)	8/161	(5.0)

The data show clearly that cleft lip is more likely to occur in an A/Jax embryo that occupies the uterine site next to the ovary than in an embryo at any other site. At present it is not known what there is about this part of the uterus that makes it less favorable to normal development than the other parts. Perhaps there is a reduced blood supply which tips the balance, in a developmentally unstable embryo, in favor of abnormal rather than normal development. Since the ovarian site appears to be less favorable whether there are many or few embryos in the horn, the difference is more likely to be an inherent quality of that area of the uterus than an effect of other embryos in the horn competing for nutrients. The idea that this part of the mouse uterus is less favorable to the normal development of the embryo is supported by the work of Hashima (*2*), who found that embryos near term occupying the site nearest the ovary weighed significantly less than those at other uterine sites. It has also been noted by McLaren (*3*) that there is a tendency for "runts" in the TO random-bred strain of mice to occur significantly more often at the ovarian site than at other sites in the uterus. Gross examination of the blood supply, in vivo india-ink injections, and attempts to reduce the blood supply to individual embryos or to the entire uterine horn have not yet led to any significant findings (*4*).

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9 May 1960

"Second Emerson Effect" in the Hill Reaction of Chlorella Cells with Quinone as Oxidant

Abstract. The second Emerson effect can be observed not only in photosynthesis but also in the photoreduction of quinone by *Chlorella* cells. This shows that this effect is not due to respiration and is not associated with the carbon dioxide–reducing phase of photosynthesis. Peaks at 650 and 670 mμ in the action spectra of this effect, in the case of quinone reductions as well as in that of photosynthesis in *Chlorella,* show that light absorbed by chlorophyll *b* as well as that absorbed by chlorophyll *a* 670 can effectively supplement far-red light (> 680 mμ) in both reactions; light absorbed by chlorophyll *a* 680 cannot do so.

The enhancement of the quantum yield of photosynthesis of *Chlorella pyrenoidosa* Chick strain 3 in the far-red region (> 680 mμ) by light of shorter wavelengths was first reported by Emerson and his co-workers (*1*) and was confirmed by Myers and French (*2*). However, there existed no direct evidence that this "second Emerson effect" (so called to distinguish it from the carbon dioxide burst at the beginning of a light period, often designated as the Emerson effect) was not due, at least in part, to light inhibition of respiration rather than to the enhancement of photosynthesis, because the techniques employed (manometry and polarography) could not distinguish positive changes in the rate of photosynthesis from negative changes in the rate of respiration. There was also no evidence as to the localization of the effect, either in the oxygen evolution phase or in the carbon dioxide reduction phase of photosynthesis. It was thought that study of the Hill reaction in quinone-poisoned *Chlorella* cells should provide answers to these two questions.

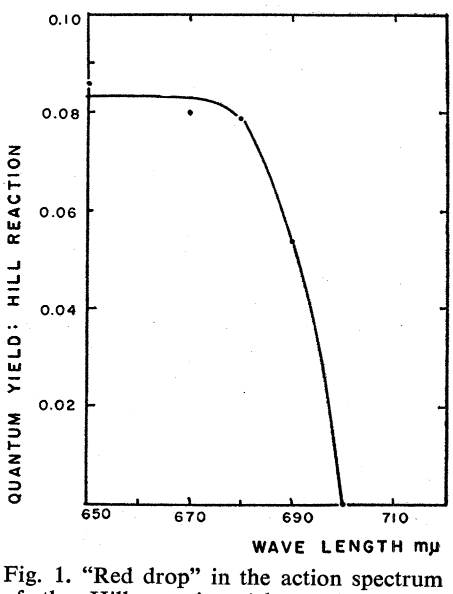

Fig. 1. "Red drop" in the action spectrum of the Hill reaction (photoreduction of quinone) in *Chlorella* cells. Quantum yield is plotted against wavelength of monochromatic light.

Para-benzoquinone (0.2 ml of a solution of 12.5 mg of recrystallized quinone in 5 ml of $0.01N$ sulfuric acid) was added to a thin suspension of *Chlorella* cells. Respiration, as well as capacity for carbon dioxide fixation and reduction, was completely inhibited by the addition of this solution. Nitrogen (99.9 percent N_2) was conducted through the manometer vessel filled with the suspension, for 15 minutes. Manometric measurements of oxygen liberation were then carried out at 10°C. Under these conditions the Hill activity lasted 4 to 5 hours.

Figure 1 shows the "red drop" of the quantum yield of oxygen liberation from quinone solution. The curve strikingly resembles that found for photosynthesis by Emerson *et al.* (*3*).

Figure 2 represents the action spectrum of the second Emerson effect in the quinone-*Chlorella* system. The results were obtained as follows: far-red light was applied to the suspension by placing Schott glass filters (RG8 and RG5, which give a sharp cutoff at 680 mμ) in the beam from an incandescent lamp. The rate of the Hill reaction in this light alone was taken as 100; the rate attributable to this light in the presence of additional shorter-wave light (between 640 and 690 mμ), obtained from the Emerson-Lewis grating monochromator (slit width, 5 mμ) was expressed as a percentage of that in the far-red light alone. In Fig. 2 the results are plotted against the wavelength of the supplementary light.

Govindjee and Rabinowitch (*4*) have demonstrated the existence of (at least) two forms of chlorophyll *a* in *Chlorella,* with different photochemical functions, with absorption peaks around 670 and 680 mμ, respectively. Light absorbed by the first form, like light absorbed by the accessory pigments, can bring about the second Emerson effect; this is revealed by the action spectrum of the second Emerson effect in the photosynthesis of *Chlorella,* which shows two peaks in the red region—at 650 mμ (chlorophyll *b*) and at 670 mμ.

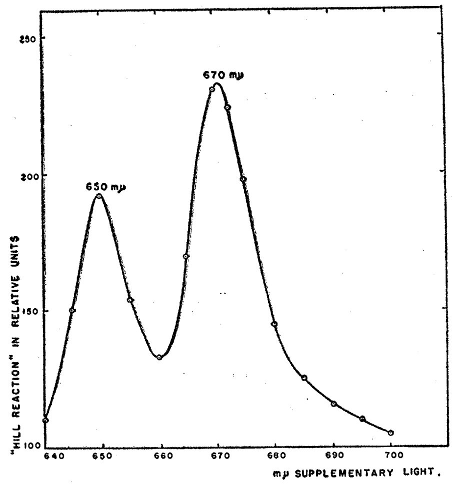

Fig. 2. Action spectrum of the second Emerson effect in the Hill reaction of *Chlorella.* Yield without supplementary light is designated as 100.

In the action spectrum of the second Emerson effect in quinone reduction we find the same two peaks (at 650 and 670 mμ, respectively) as in photosynthesis. This means that in the photoreduction of quinone by *Chlorella* cells, as well as in photosynthesis, the two types of chlorophyll *a* (chlorophyll *a* 670 and chlorophyll *a* 680) play different photochemical roles and that light energy absorbed by chlorophyll *b* probably is transferred to chlorophyll *a* 670.

The complete analogy between photosynthesis and the Hill reaction suggests that the second Emerson effect is not due to the inhibition of respiration and is not associated with the carbon dioxide-reducing mechanism of photosynthesis but with the oxygen-liberating mechanism common to photosynthesis and the Hill reaction (*5*).

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7 June 1960