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Fuhs G W. Phosphorus content and rate of growth in the diatoms *Cyclotella nana* and *Thalassiosira fluviatilis*. *J. Phycology* 5:312-21, 1969.
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On the basis of continuous-culture experiments with two marine plankton diatoms and with phosphate as limiting nutrient, a relationship between phosphate supply and growth rate was developed. Cell phosphorus content was identified as a variable which can be used to express phosphate limitation mathematically. The contribution of several other cell constituents to cell mass varied with the degree of phosphate growth limitation. [The *SCI*® indicates that this paper has been cited in over 110 publications, making it one of the five most-cited papers for this journal.]

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"The idea for these experiments came quite naturally. As a microbiologist with leanings toward quantitative ecologic studies, I was quite intrigued by the potential of the continuous-culture technique in its several forms. While working in Central Europe, I had also become thoroughly familiar with the problem of eutrophication of freshwater lakes and with the evidence linking it to increased discharges of phosphates in domestic wastewater.

"By the 1960s, when I was a research scientist for the New York State government, lake eutrophication had become a major issue for the state. At my new workplace there was the opportunity—even a tradition—for thorough research related to the state's needs. From every possible angle, these experiments were 'the thing to do.' The only odd element was the selection of two coastal or marine (rather than freshwater) diatoms for study. This is explained by my previous experience with euryhaline plankton diatoms in the Werra River in Germany[1] and the fact that they were easier to grow.

"The paper and the concurrent work by M.R. Droop[2] on vitamin B_{12} and by Eppley[3] on nitrogen as a limiting nutrient established a mathematical formulation for microbial growth limited, not by an energy source, but by nutrients which are building blocks of the organism. The original measurements did merely indicate that the relationship was in the form of a saturation curve. After more accurate measurements by others, the hyperbolic curve became the preferred representation. It is easier to manipulate than the exponential, but in any case the basis for the relationship is empirical. The intercept of the curve on the abscissa designates the minimum amount of nutrient (what Droop calls the 'subsistence quota') that the organism must contain to maintain its integrity and viability.

"Thoughtful work by many others followed. Here in Albany, painstaking measurements by Rhee refined the kinetic relationships for phosphate and extended them for dual-nutrient (nitrate and phosphate) limitation.[4] The cooperation of several local groups led to examination of continuous cultures of algae in cycling light.[5] Droop[6] has recently summarized his view of 25 years of studies in this field. The kinetic relationships that have evolved have been incorporated into mathematical models of algal production as related to lake and coastal eutrophication.

"Continuous culture techniques are now standard tools for the study of algal growth kinetics, but despite many refinements, their limitations have become apparent. The new step is to determine, with quite different measurements, how the fundamental relationships discovered in single-species laboratory cultures apply to the members of species assemblages under field conditions. Fortunately, many new techniques for such measurements are now available.

"Researchers who want to write a highly cited paper should attempt to develop a new, widely applicable method of testing. In this work, a versatile method, continuous culture, is applied to the analysis of one key aspect of a highly visible phenomenon, lake eutrophication."

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2. **Droop M R.** Vitamin B_{12} and marine ecology. IV. The kinetics of uptake, growth and inhibition in *Monochrysis lutheri*. *J. Mar. Biol. Assn. UK* 48:689-733, 1968. (Cited 155 times.)
3. **Eppley R W & Strickland J D H.** Kinetics of phytoplankton growth. (Droop M R & Ferguson Wood E J, eds.) *Advances in microbiology of the sea*. London: Academic Press, 1968. Vol. 1. p. 23-62.
4. **Rhee G Y.** Phosphate uptake under nitrate limitation by *Scenedesmus* sp. and its ecological implications. *J. Phycology* 10:470-5, 1974. (Cited 65 times.)
5. **Rhee G Y, Gotham I J & Chisholm S W.** Use of cyclostat cultures to study phytoplankton ecology. (Calcott P H, ed.) *Continuous culture of cells*. Boca Raton, FL: CRC Press, 1981. p. 159-86.
6. **Droop M R.** 25 years of algal growth kinetics: a personal view. *Bot. Mar.* 26:99-112, 1983.