Sequential Simplex Optimization

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Imagine a medium with only two components. There are an infinite number of media possible, each defined by the paired concentrations of each of the two components. Imagine also that we know the response of an embryo when cultured in each medium. Then the totality of responses can be represented by a concentration-response surface (Figure 1). We assume that the maximum response is the optimum response. How do we locate the maximum of the concentration-response surface? With only two components we can choose a set a media that form a grid over the surface. The grid defines a set of media to be compared in a factorial experiment. From the results of this experiment a concentration response surface can be fitted and the maximum located.

When media contain more than two components, the concentration surface will be multi-dimensional. In producing SOM we optimized 10 media so the response surface was modeled in 11-dimensional space. Locating a maximum in this space is logistically impossible using a set of factorially arranged media since a prodigious number of media combinations would be required. An alternative approach is to climb sequentially the surface. Sequential simplex optimization is one of several algorithms that allow this climb to be made.

Data already obtained is used to locate a point of the putative hill; this point defines the composition of a START medium (Figure 1). If the medium consists of two components only, a set of three media are chosen in the neighborhood of the START medium, defined by the loci of three vertices of a triangle (a triangle is a simplex in two-dimensional space). The responses to these media, (in this case passage through the two-cell block) are observed experimentally and the medium that gives the worst response is identified. A new medium is then determined from these results which is higher up the hill, generating a new simplex consisting of the two non-rejected original media and the new medium. The new set of three media are then compared and the experimental procedure repeated. By repeating this procedure the hill will be climbed and its top reached. In the case of 10 media, 11 media are compared at each step. A detailed description of the procedure can be found in the website **http://www.multisimplex.com/algorithms.htm**.

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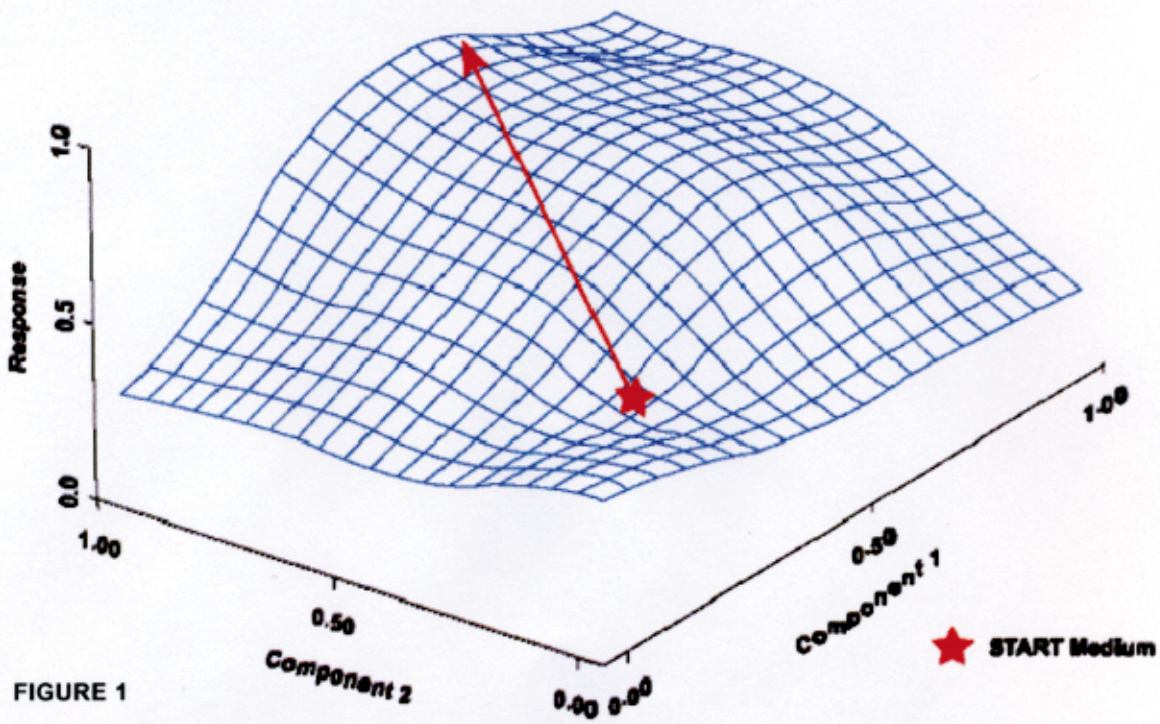

FIGURE 1