

Claims:

1. A method, comprising:
conducting multiple tests of a complex system by applying varying combinations of input parameters from a pool of input parameters;
fitting results of the tests into a model of the complex system by using multi-dimensional fitting; and
using the model of the complex system, identifying at least one optimized combination of input parameters to yield a desired response of the complex system,
wherein the model of the complex system is a low order model.
2. The method of claim 1, wherein the complex system is at least one of a biological system, a chemical system, and a physical system.
3. The method of claim 2, wherein the pool of input parameters corresponds to a pool of drugs, and identifying the at least one optimized combination of input parameters includes identifying at least one optimized combination of dosages of drugs from the pool of drugs.
4. The method of claim 1, wherein the model of the complex system includes m constants, and fitting the results of the tests includes deriving values of the m constants.
5. The method of claim 4, wherein conducting the multiple tests of the complex system includes conducting n tests of the complex system, with $n \geq m$.
6. The method of claim 1, wherein fitting the results of the tests includes fitting the results into a multi-dimensional response surface of the complex system, and identifying the at least one optimized combination of input parameters includes identifying at least one extremum in the response surface.
7. A method, comprising:

conducting multiple *in vivo* or *in vitro* tests by applying varying combinations of drug dosages from a pool of drugs;

fitting results of the tests into a multi-dimensional response surface of drug efficacy; and

using the response surface, identifying at least one optimized combination of drug dosages to yield a desired drug efficacy,

wherein the response surface is a quadratic function of drug dosages.

8. The method of claim 7, wherein the response surface is represented by m constants, and fitting the results of the tests includes deriving values of the m constants.

9. The method of claim 8, wherein the pool of drugs includes N total drugs, and $m = 1 + 2N + (N(N - 1))/2$.

10. The method of claim 8, wherein the pool of drugs includes N total drugs, one drug dosage from the pool of drugs is kept constant, and $m = 1 + 2(N - 1) + ((N - 1)(N - 2))/2$, for $N > 1$.

11. The method of claim 8, wherein conducting the multiple tests includes conducting n tests, with $n \geq m$.

12. The method of claim 11, wherein $n = m$.

13. The method of claim 7, wherein identifying the at least one optimized combination of drug dosages includes identifying at least one maximum in the response surface.

14. A method, comprising:

providing a model of a complex system, the model representing a response of the complex system as a low order function of N input parameters; and

using the model of the complex system, identifying multiple optimized sub-combinations of the N input parameters that yield desired responses of the complex system.

15. The method of claim 14, wherein the complex system is a biological system, and each of the N input parameters is a dosage of a respective drug from a pool of N drugs.
16. The method of claim 14, wherein the low order function is a quadratic function of the N input parameters.
17. The method of claim 14, wherein the low order function includes m fitting constants, and $m = 1 + 2N + (N(N - 1))/2$.
18. The method of claim 14, wherein the low order function includes m fitting constants, and $m = 1 + 2(N - 1) + ((N - 1)(N - 2))/2$, for $N > 1$.
19. The method of claim 14, wherein identifying the multiple optimized sub-combinations includes identifying multiple extrema in the low order function.