

# Computers and Biology

## Class Notes - partial

Friday, Sept. 16, 1983, night - class notes

Reproduction is a fundamental characteristic of life.  
A single cell divides into two. All of the substances are duplicated.  
The two cells become four with the reduplication of two.

At some point the cells do not duplicate exactly.  
Each pre-existent cell does not divide  
to produce another cell of exactly the same kind at exactly the same rate.  
These differentiations relate to the position of the cell.  
A geometry of tissues and organs is generated  
by the posture and geometry of the cells  
as well as their scale and proportions.

There is a correlation between the dimensions  
and proportions of a cell and its composition.

Information is contained with varying energy levels.  
Information containing and conveying is characterized  
by information / energy ratios.  
Every atom has pattern, contains meaning in the pattern  
and each component of that pattern has a domain of energy.

This is the interdisciplinary science of molecular biology  
and physical biochemistry.

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After November 10th, 1983 - class notes

Exploratory Data Analysis: Addison Wesley,  
Tukey, J. W., 1977

### Elephant Population

The first breeding pair commences breeding at age 30.  
So commencing with the first breeding pair for the first 30 years  
only 2 elephants constitute the elephant population.

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After the first pair bred the first offspring  
the population increased by at least one, but Darwin states  
that during a 60 year interval three pairs of offspring are produced.  
This means, following the assumptions of Darwin,  
that the population would be increased by the continuous breeding  
of the original pair and by the breeding of the offspring of the original pair.

Noting the survival until 100 years old,  
that would determine the contribution to the population  
of the original pair of elephants through that period.

### Critical elements:

Assuming the first pair produced one offspring in 30 years,  
that offspring would not be ready for breeding for another 30 years.

### Calculations:

15,000,000 elephants  
5 centuries (500 years)  
60 years of breeding  
3 pairs (6 elephants)  
1 elephant per 10 years average

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Thursday, November 17th, 1983 - class notes

- 1) The ideal taxonomy is that in which the \_\_\_\_\_ ?  
have the greatest content of information  
and which is based on as many characters as possible

"There are no good or bad classifications - only useful / useless

SPECERE - Latin "to look at"

Linnaeus 1758 - System Natural 7 taxonomic levels  
Simpson 1958? 21 taxonomic levels

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### Reference:

Scientific American 1966, December

Re: Numerical Taxonomy

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Thursday, October 13th, 1983 - class notes

### Biological Modeling

System	Elements
X	ABCDEF
Y	ACEF
Z	BDGH

Y is a model of X

X is an analogue of Y

Z is an analogue of X

X is an analog of Z

Characteristic is equal to the mean re: Poisson

frequency distribution

$s^2 < x$  underdispersed {should be a line over each 'x'}

$s^2 = x$  random (Poisson)

$s^2 > x$  overdispersed

overdispersion is the common state in biological systems  
negative binomial is a means of expressing overdispersion  
analysis of variance!

total number of population

total area of population distribution

average number per unit area

property of individuality

Taylor  $s^2 = a(x)^b$

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no date, class notes

### Principles of Distribution

If one first takes the total population  
then takes the total area, time or volume  
then calculates the unit area, unit time  
or unit volume per member of the  
distribution pattern

then the properties of the area, time or volume  
can be considered with respect to its  
scale, proportions and geometry.

This may yield a periphery to area ratio and  
a ratio of periphery per member can result.

An absolutely uniform area per member can be defined.  
A range of areas per member can be defined.

The nearest and next nearest distance between members  
can be defined.

The number of members within a given range can be observed.

Progressive correlations can be accrued.

Range with respect to the periphery or boundary of the area,  
time or volume per member.

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Friday, October 7th, 1983

### Models

#### 1. Physical:

A. Iconic: maps, globes, scale models

B. Analogue: mechanical, hydraulic, electrical, electronic devices

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### 2. Symbolic:

mathematics and logical equations  
algorithms, computer programs

### Shellarn:

"Ancient Greeks seem to have regarded the Theoretical Conception as the model . . ."

"Leonardo proclaimed nature as his model . . ."

". . . some biometricians speak of fitting the data to the model; others of fitting the model to the data . . ."

Only those who know how to relate what is seen to what gets drawn know how to relate what has been drawn to what could have been seen.

{Diagram - references - symbols - meaning (related triangle)}

". . . application of mathematics to science bears some analogy to pictorial expression. The pen sketches fine lines, the brush yields gradations of light and shade. In all cases color and detail are lost."

{Diagram - aggregate

cases: find one - increase probability of finding another  
find one - diminish probability of finding another}

### Z. P. Charnoe thought:

If, as you increase temporal area or spatial area,  
at what rate do you encounter an event?

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### Reference:

#### **Gels**

Toyoichi Tanaka, *Scientific American*, date and title unknown

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"Among the secrets of the Soviet training, according to Kreskin, is learning to mentally erase past mistakes and fear of failure and learning to picture mentally the successful outcome of an activity.

You don't tell your mind what you want.

You tell it that what you want you already have."

" . . . focus solely on success"

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### APL Program Function

(del) AVEL - Average (delta) Velocity; R; T

[1] R ..  $8.31 \times 10^7$  (null cap) ergs per mole degree

[2] T .. -273 - 272 - 271 - 720 . . . (null cap) degrees kelvin

[3] M .. (null cap) molecular weight grams / mol

[4] V ..  $((8 \times R) \times T) / (P \times M)$  (star) 0.5

[5] V .. This is average molecular velocity, maximum and minimum molecular velocity may be expressed as velocity contrast. A velocity distribution may then be examined. The velocity distribution can be the product of certain properties of the molecules. One of these properties will be the state, solid, liquid, or vaporous.