Cours 1-Volume, masse et densité d'une cellule

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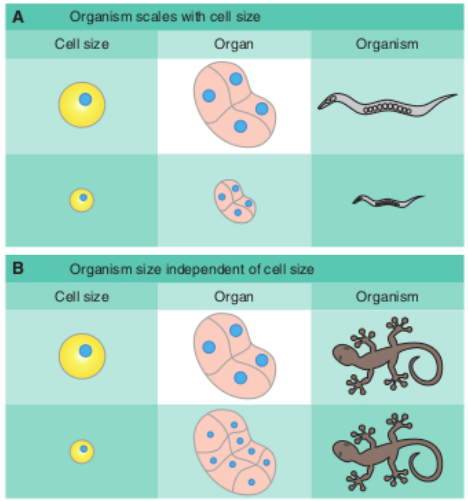
Cours 1, Collège de France, 5 février 2024

Taille d'une cellule



Amodeo

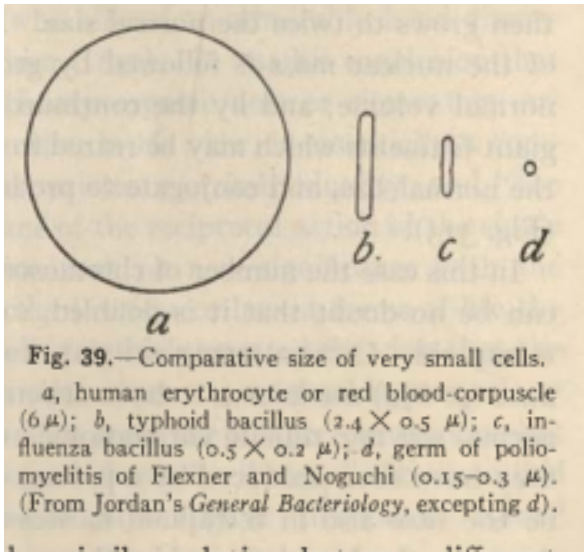
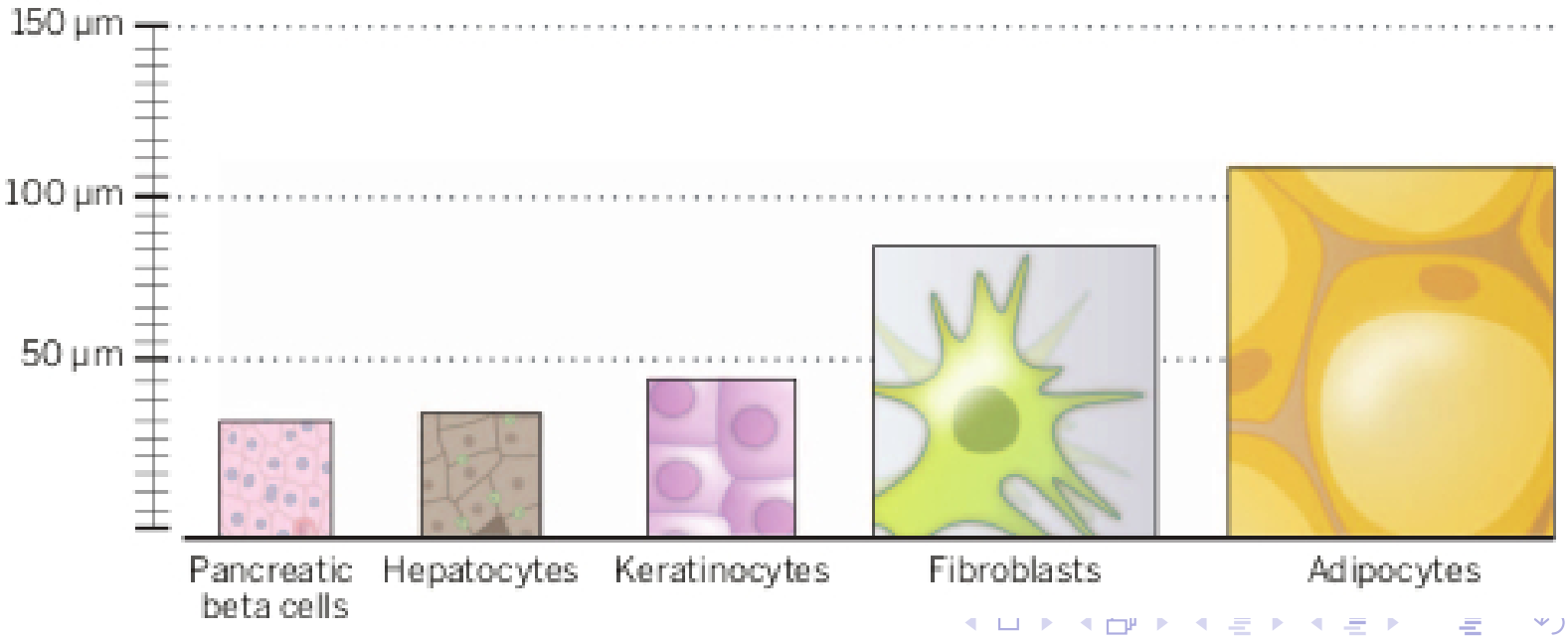


Fig. 39.—Comparative size of very small cells.

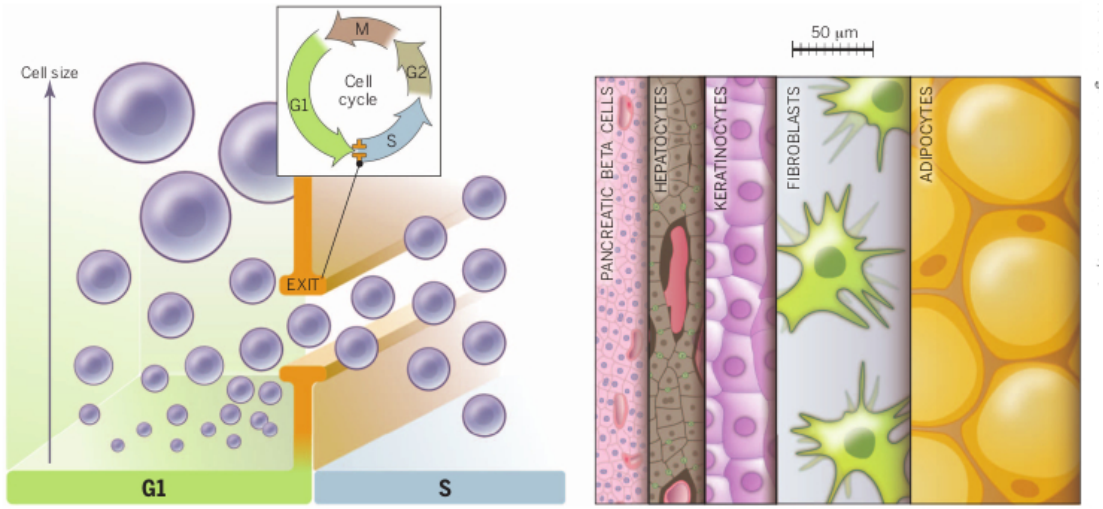
a, human erythrocyte or red blood-corpuscle (6 μ); *b*, typhoid bacillus (2.4 × 0.5 μ); *c*, influenza bacillus (0.5 × 0.2 μ); *d*, germ of poliomyelitis of Flexner and Noguchi (0.15–0.3 μ). (From Jordan's *General Bacteriology*, excepting *d*).

Wilson



Ginzberg

Croissance et division cellulaire



How is cell size specified? (**Left**) In populations of proliferating cells, size uniformity may be ensured by linking the processes of growth and cell-cycle progression. One way this can be accomplished is by restricting progress through a particular cell-cycle stage (for example, the G_1/S transition) to cells that have reached a specific "target" size. (**Right**) Typical sizes of various human cell types. Cells are drawn to scale: pancreatic β cells, hepatocytes, keratinocytes, fibroblasts, and adipocytes.

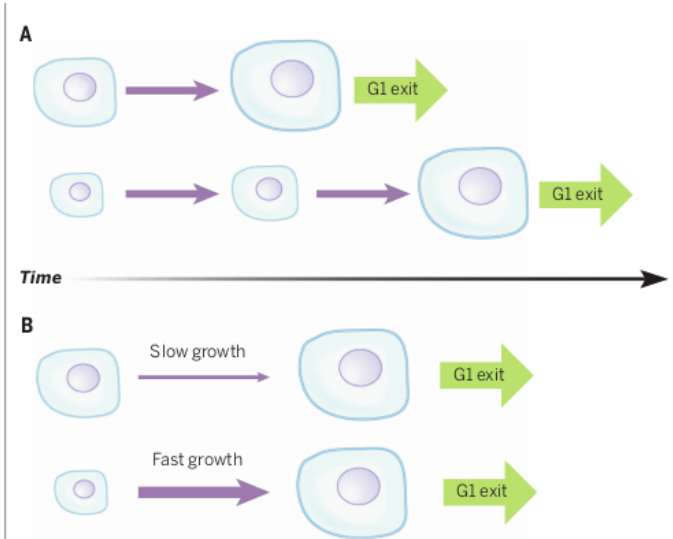
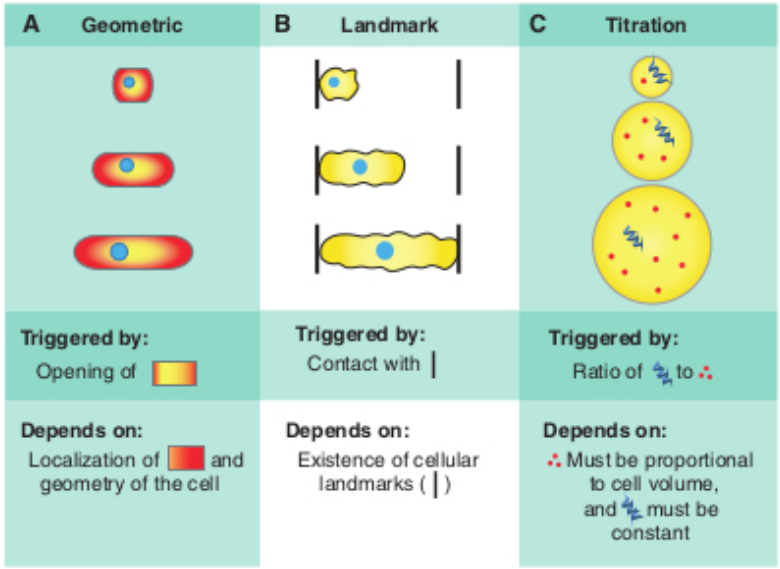


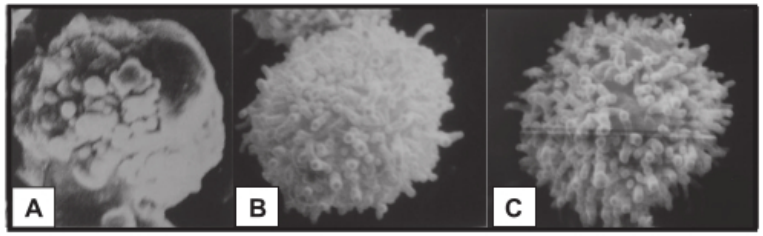
Fig. 3. Size control strategies. To exit G_1 with the appropriate size, cells can adjust either (**A**) the amount of time spent in G_1 or (**B**) the rate at which they grow.

Ginzberg

Comment une cellule mesure-t-elle sa taille?



Amodeo



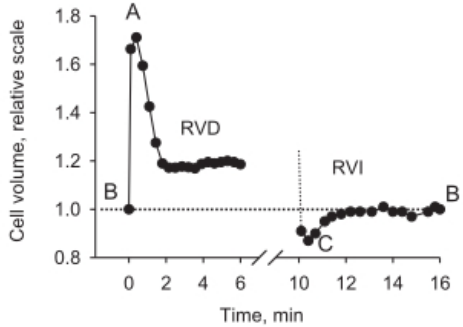
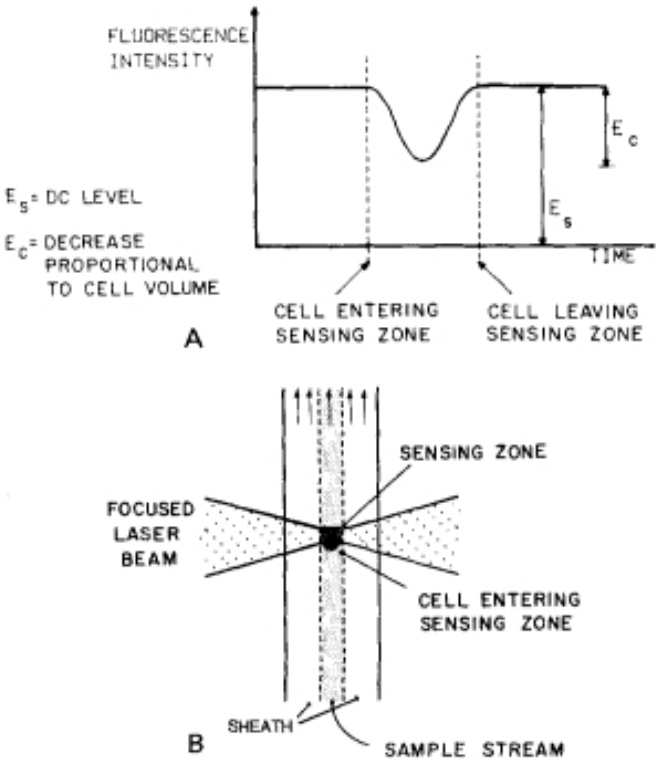


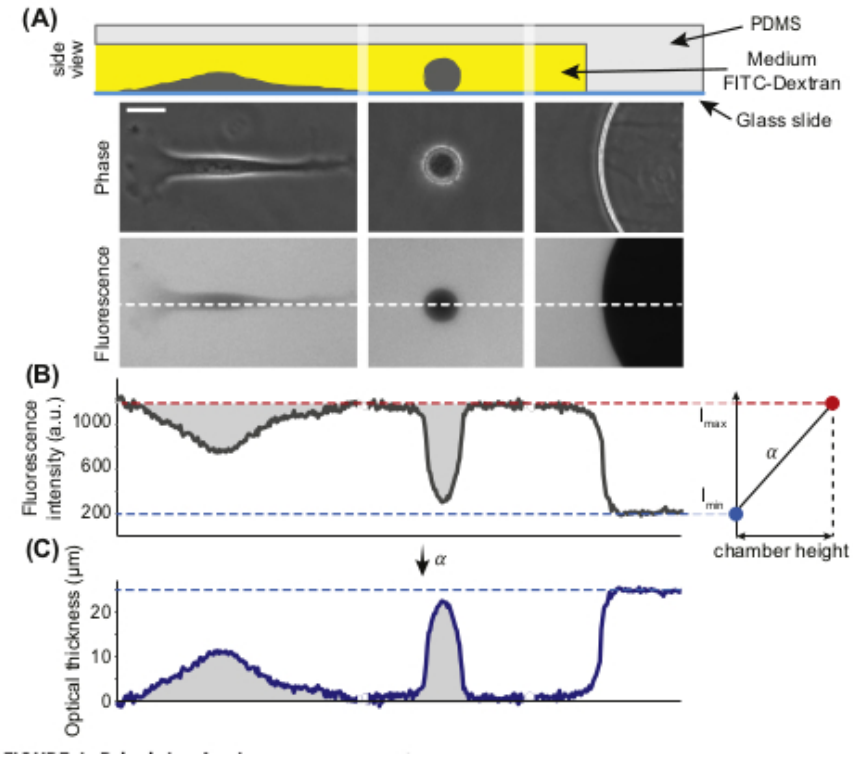
FIG. 1. Regulatory volume decrease (RVD) and regulatory volume increase (RVI) in EAT cells. RVD: EAT cells, preincubated in isotonic (300 mosM) medium for 40 min, were at zero time transferred to hypotonic medium (150 mosM) and the cell volume followed with time in a Coulter counter. Cell volume is given relative to the initial isotonic volume. [Data from Hoffmann (358).] RVI: cells preincubated in hypotonic (225 mosM) medium for 10 min were returned to isotonic medium and cell volume followed with time (Hoffmann, unpublished). Images were taken by scanning electron microscopy at time points indicated under the RVD/RVI time trace (*A*, *B*, and *C*). [Images from Hoffmann (354).]

Hoffmann et al

Mesure du volume d'une cellule: Exclusion de fluorescence



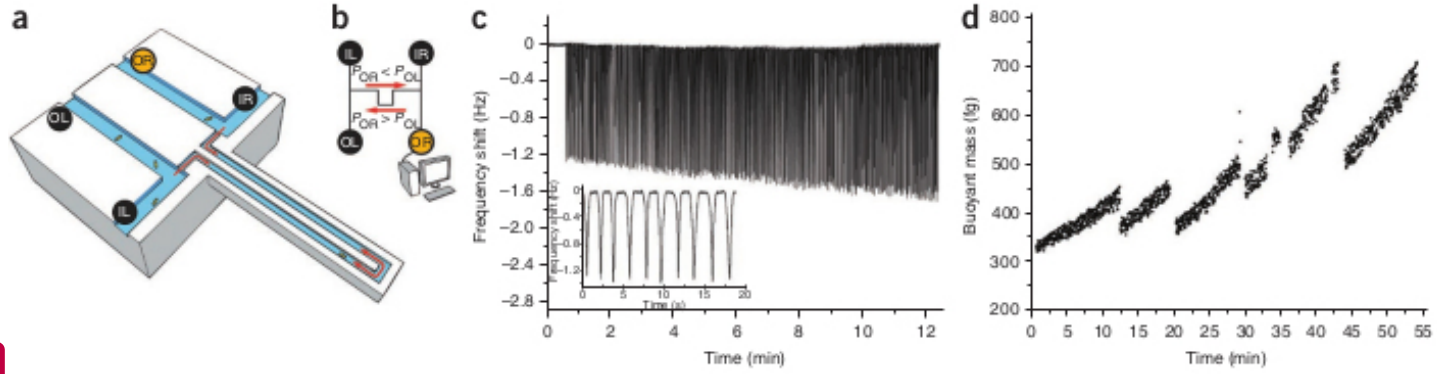
Gray, Hoffman and Hansen



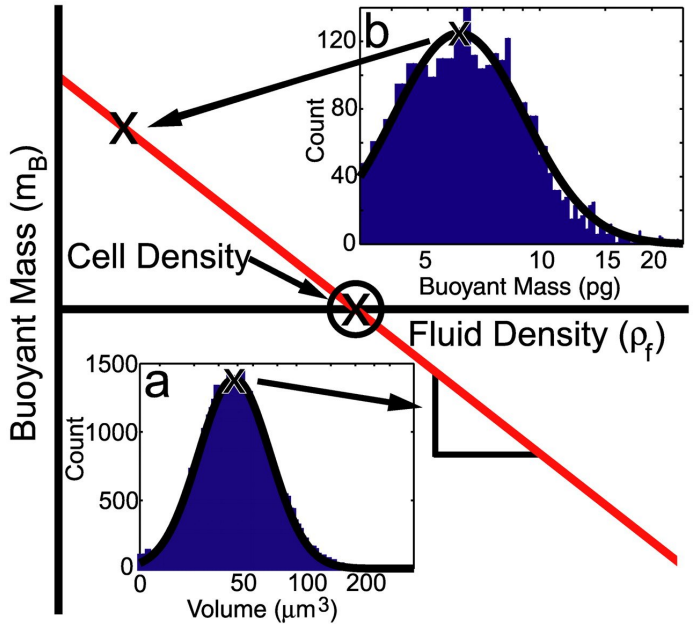
Cadart

Mesure du volume d'une cellule. Résonnateur mécanique

BRIEF COMMUNICATIONS

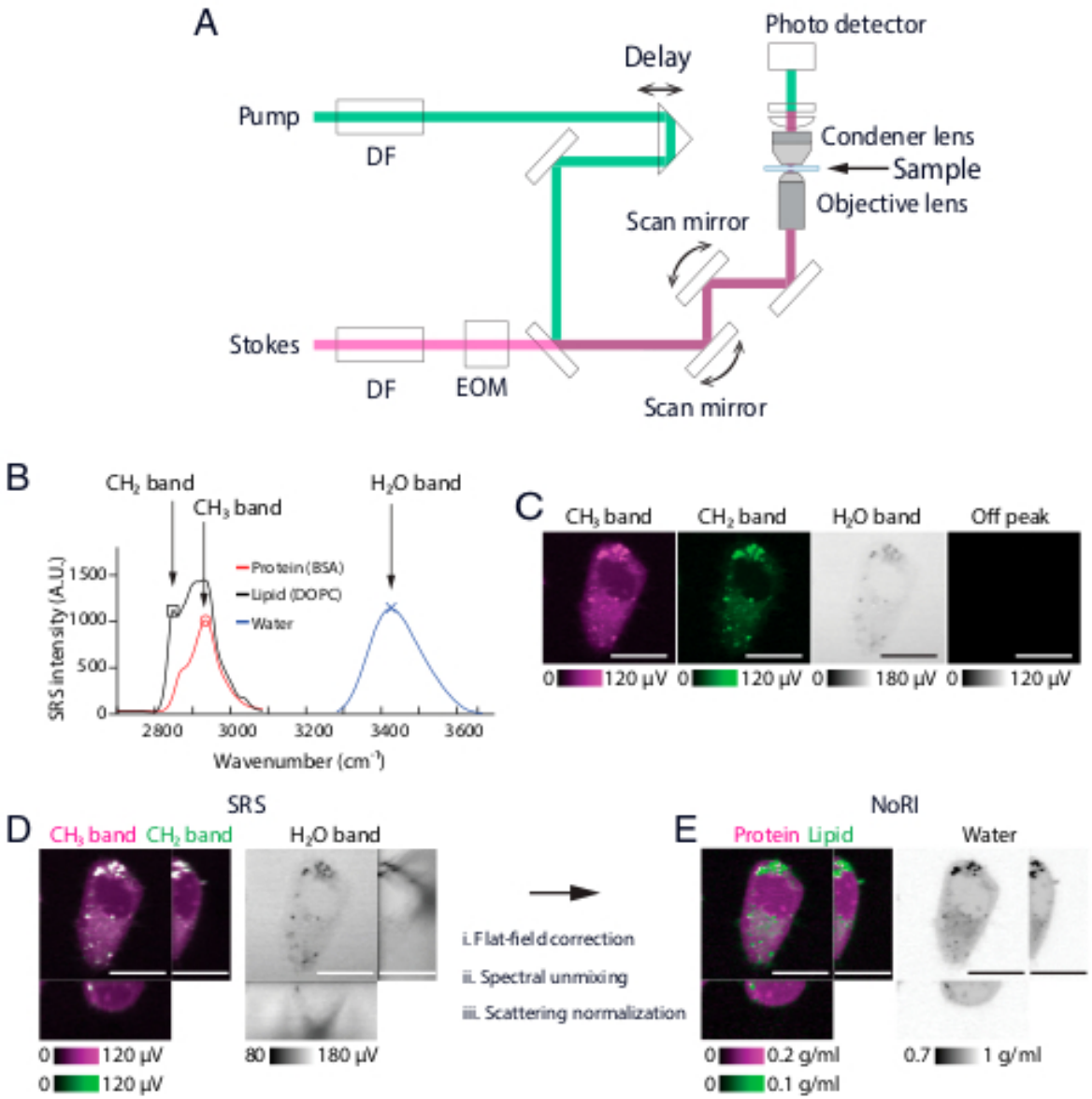


Godin



Bryan

Mesure du volume d'une cellule. Diffusion Raman NORI



Oh

Taux de croissance d'une cellule

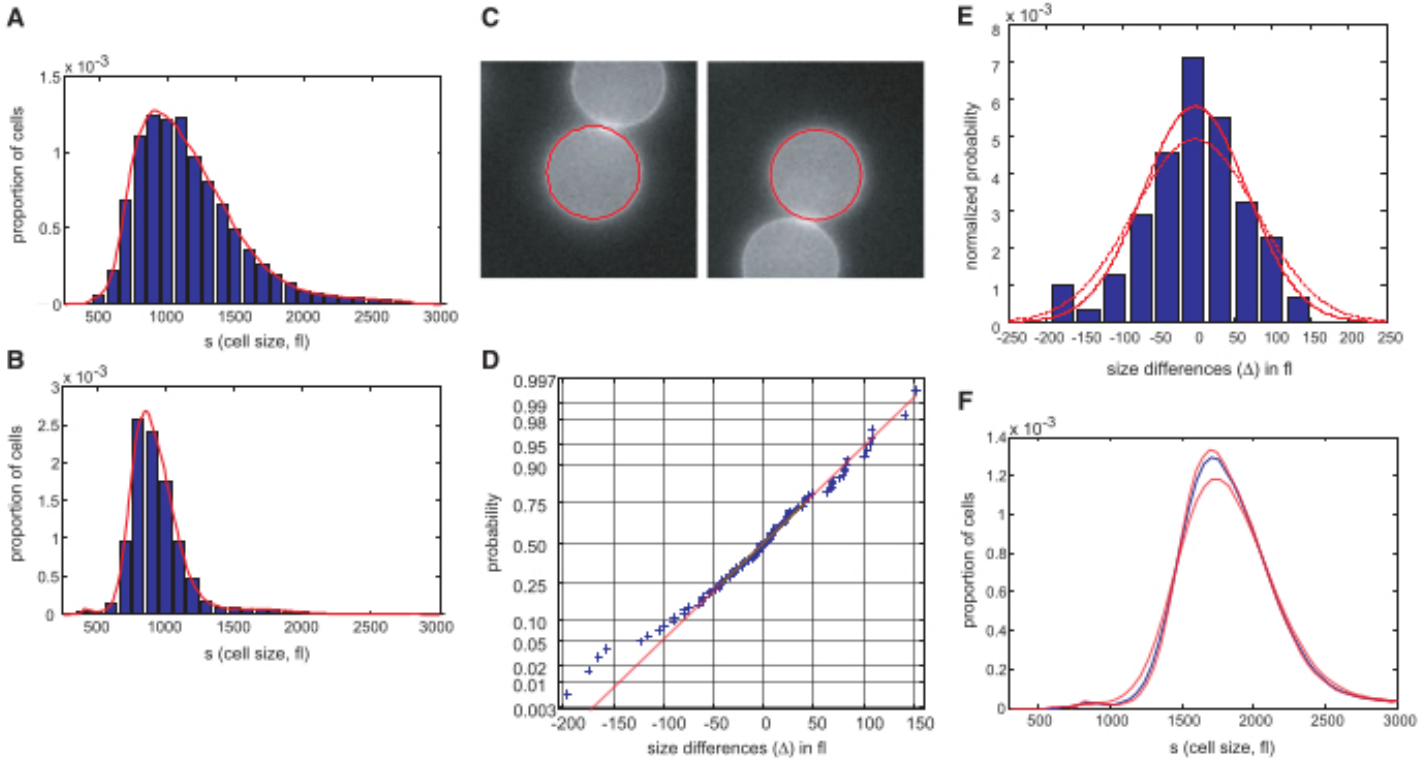
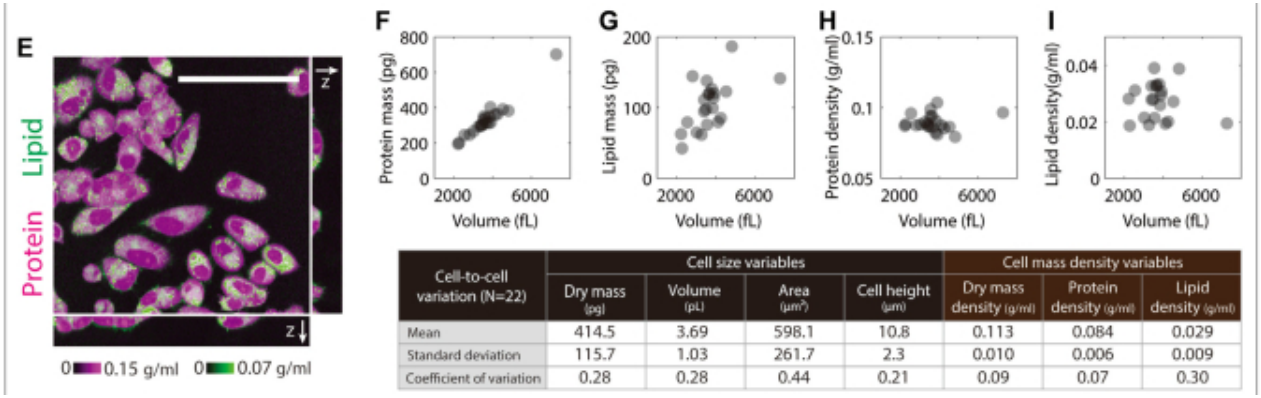


Fig. 1. Extracting parameters for calculating the size dependency of cell growth rate. (**A** and **B**) Size distribution of asynchronous steady-state populations (A) and newborn populations (B), shown by histograms (blue) and kernel density estimates (red). (**C**) L1210 cells, membrane-labeled with green fluorescent protein, were imaged while exiting mitosis. Each cell was fitted in a circle at maximum diameter. See (*20*) for details and error. (**D**) A quantile normal probability plot showing the normality of the daughter cell volume differences, Δ. (**E**) Distribution of size differences between daughter cells. A single parameter for the variance, σ^2, of the Gaussian estimate (solid red line) for the distribution, $\delta(\Delta)$. Also shown is the distribution corresponding to the upper confidence interval of the Gaussian estimate (dashed red line). (**F**) Mitotic size distribution calculated by convolving newborn size distribution with $\delta(\Delta)$. Confidence intervals of the $\delta(\Delta)$ distribution were used to generate the confidence of the mitotic size distribution (shown in red). See (*20*) for details.

Tzur et al.

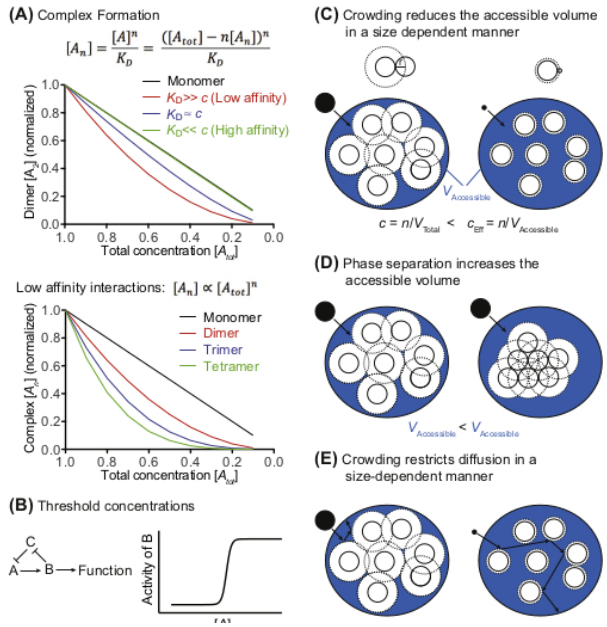
Densité de masse sèche

Liu et al.

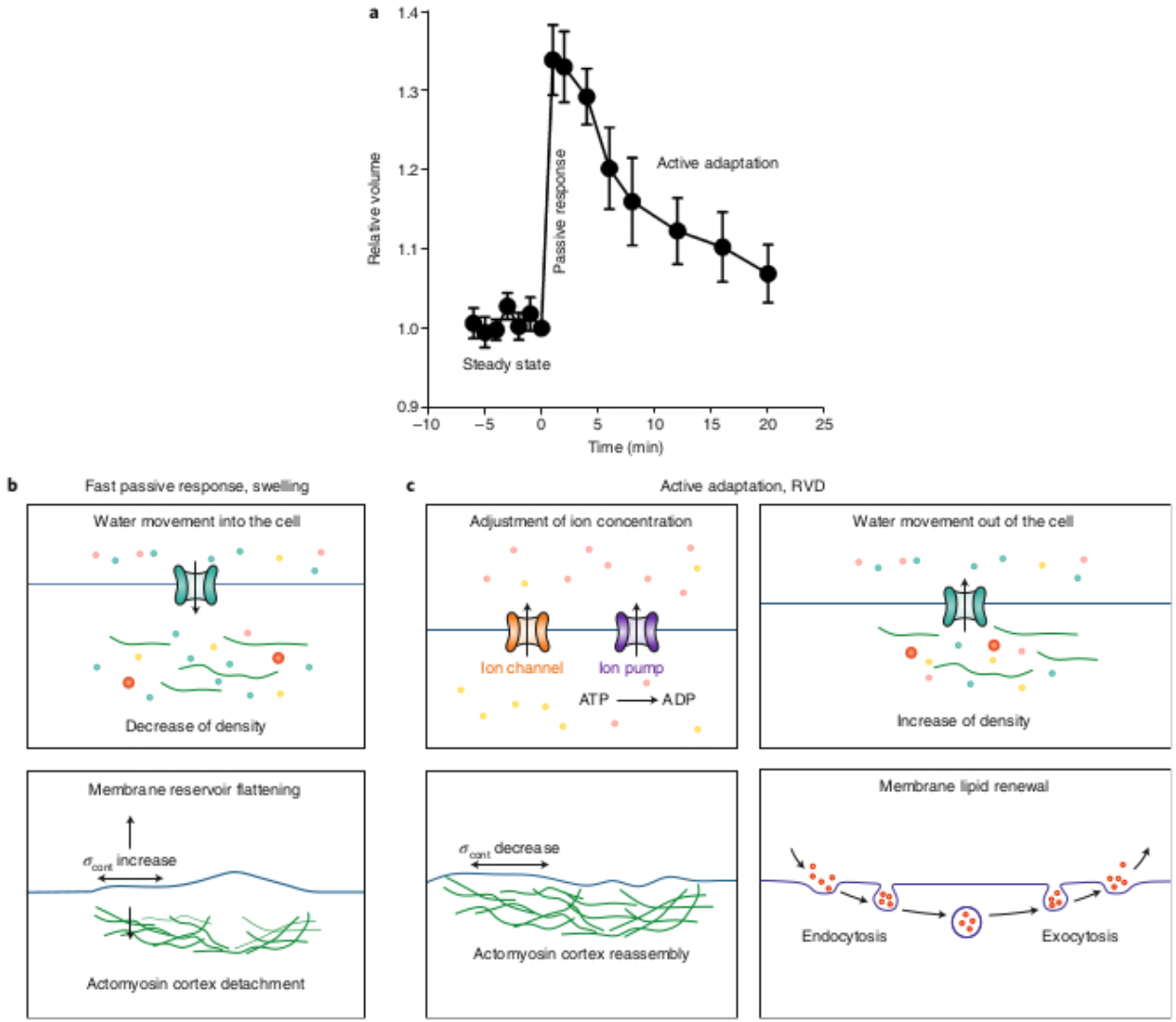


Cell-to-cell variation (N=22)	Cell size variables				Cell mass density variables		
	Dry mass (pg)	Volume (pL)	Area (μm^2)	Cell height (μm)	Dry mass density (g/ml)	Protein density (g/ml)	Lipid density (g/ml)
Mean	414.5	3.69	598.1	10.8	0.113	0.084	0.029
Standard deviation	115.7	1.03	261.7	2.3	0.010	0.006	0.009
Coefficient of variation	0.28	0.28	0.44	0.21	0.09	0.07	0.30

Neurohr et al.

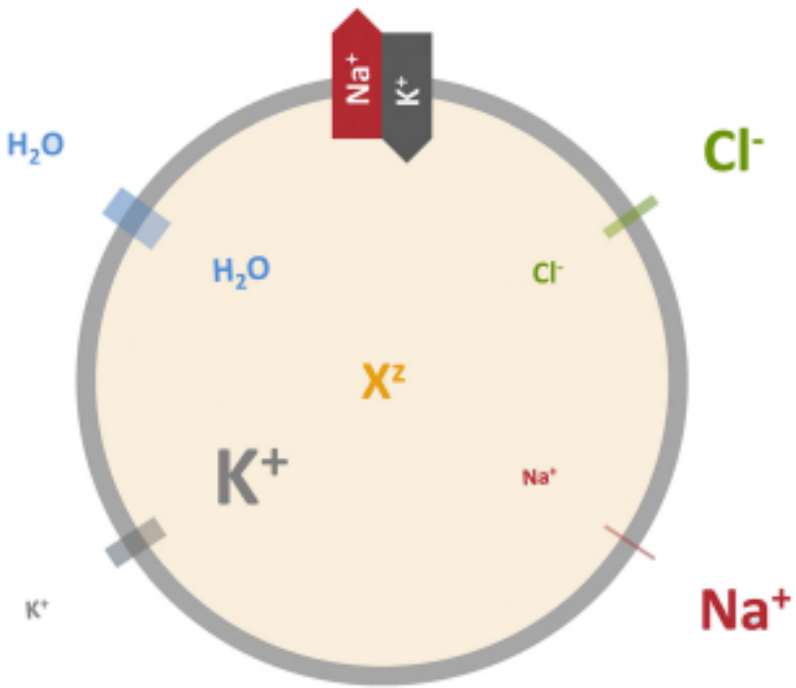


Volume à temps court et à temps long



Cadart et al.

Modèle "Pompes et fuites"



Kay et al.

J.Hoffmann, D. Tosteson

Polyploïdie, rapport karyoplasmique

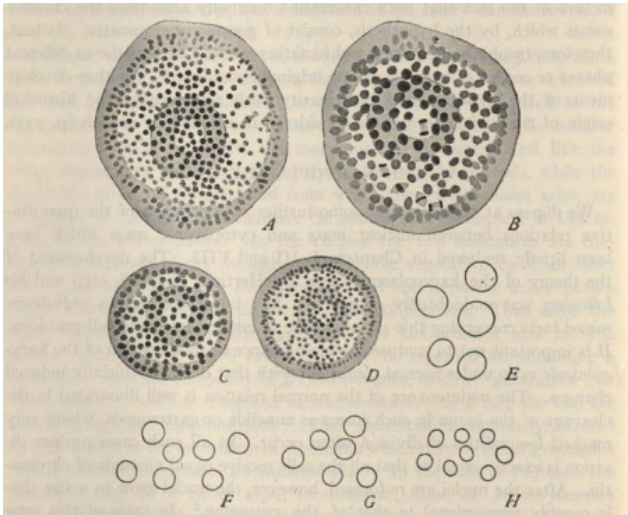


Fig. 349.—Karyoplasmic relation in embryos of the sea-urchin *Paracentrotus* (BOVERI).
A, normal diploid (amphikaryotic) gastrula, from upper pole; *B*, corresponding view of tetraploid (diplokaryotic) gastrula at the same stage (from a monaster-egg); *C*, normal diploid dwarf gastrula, from an egg-fragment; *D*, corresponding stage of haploid (hemikaryotic) dwarf, from merogonic egg-fragment; *E–H*, more enlarged nuclei from larvæ of various types drawn to the same scale; *E*, tetraploid (from *B*); *F*, diploid (from *C*); *G*, diploid (from *A*); *H*, haploid (from *D*).

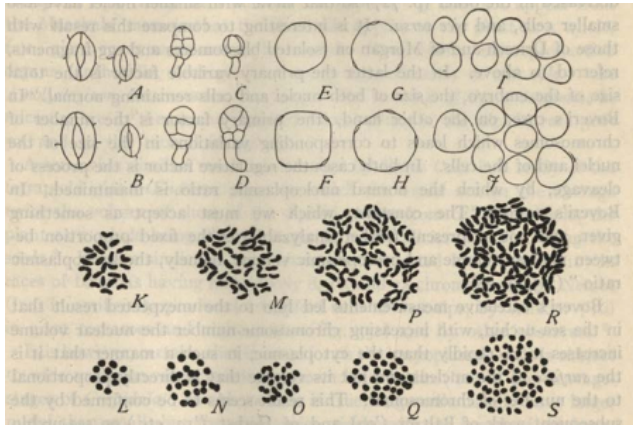


Fig. 350.—Chromosome-number and cell-size in *Solanum* (WINKLER).
A, stomata from normal diploid nightshade (*Solanum nigrum*); *B*, from *gigas tetraploid* mutant of same; *C*, *D*, corresponding views of calyx-hairs from the two forms; *E*, *F*, and *G*, *H*, pollen-grains of the two forms; *I*, chloroplasts from the tomato (*S. lycopersicum*) and *J* from its *gigas* mutant; *K*, somatic diploid chromosome-group from normal tomato (*S. lycopersicum*), 24 chromosomes. *L*, pseudo-haploid group (heterotypic division) from *S. Koelreuterianum* (*Lycopersicum* type) 12 bivalents; *M*, normal tetraploid somatic group from root-tip, *gigas* form (from *S. Koelreuterianum*); 48 chromosomes; *N*, pseudo-haploid group (heterotypic division), 24 bivalents; *O*, haploid group of same, second sporocyte-division, 24 chromosomes; *P*, normal haploid somatic group of *S. tübingense* (*nigrum* form), 72 chromosomes; *Q*, pseudo-haploid group of the same (heterotypic) 36 bivalents; *R*, normal tetraploid somatic group of *gigas* form of last, 144 chromosomes; *L*, pseudo-haploid group of same (heterotypic division) 72 bivalents.

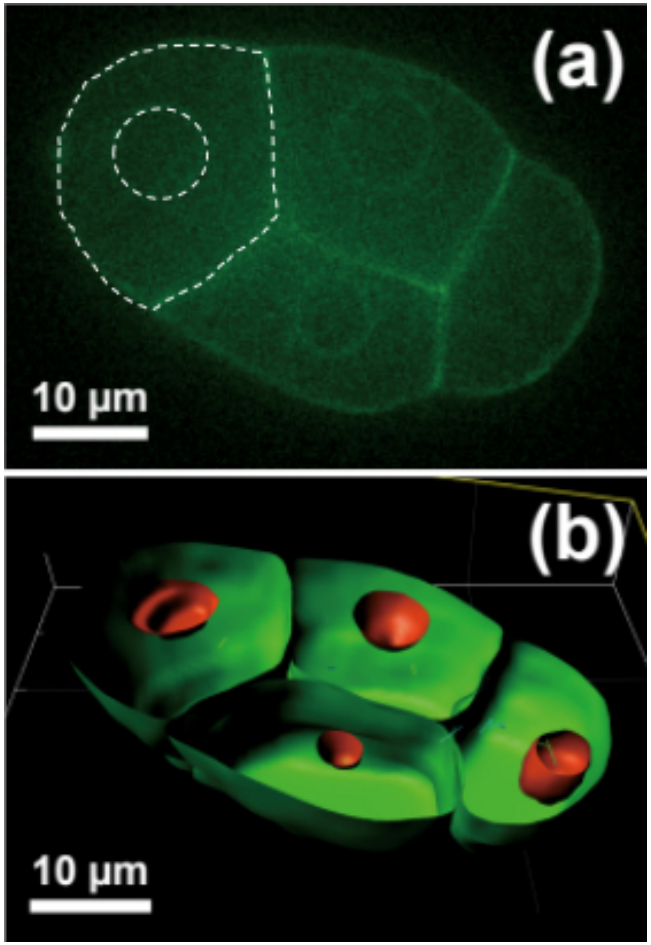
Nucleocytoplasmic ratio

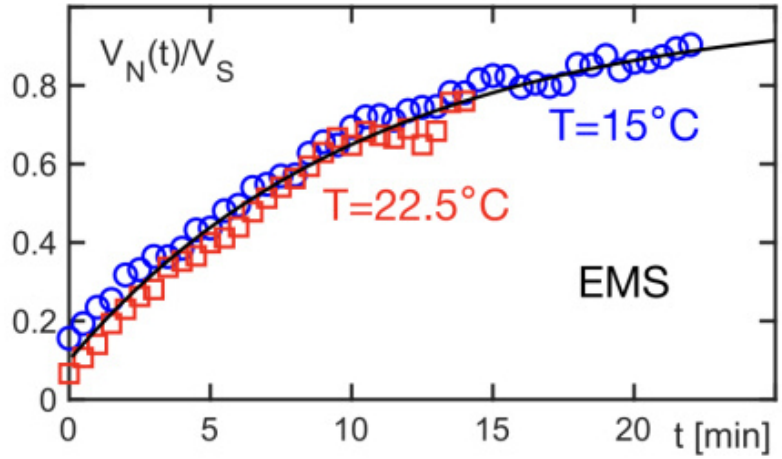
Hertwig R (1903) Ueber die Korrelation von Zell-und Kerngrösse und ihre Bedeutung für die Geschlechtliche Differenzierung und die Teilung der Zelle. Biol Centralbl 23:49–62

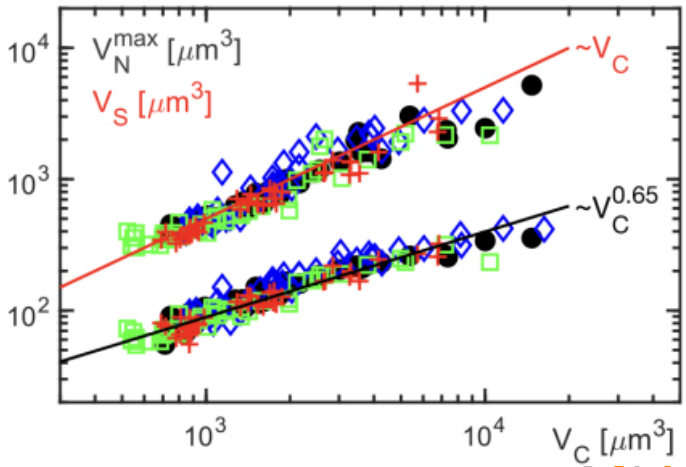
"The constant, which we must accept as something given and not at present further analyzable, is the fixed proportion between nuclear volume and protoplasmic volume, namely, the karyoplasmic ratio."

Theodor Boveri, 1905

Noyau des embryons de C. Elegans M.Weiss







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