

# La mineure Mathématiques du parcours international

September 10, 2019

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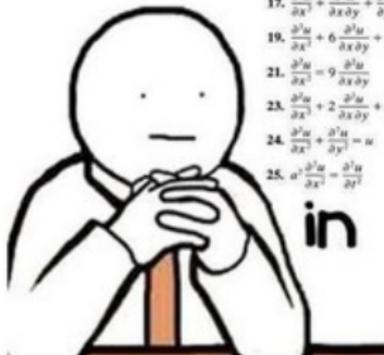
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## Timeline Photos

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I'm still waiting for the  
day that I will actually use



17.  $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial x \partial y} + \frac{\partial^2 u}{\partial y^2} = 0$

19.  $\frac{\partial^2 u}{\partial x^2} + 6 \frac{\partial^2 u}{\partial x \partial y} + 9 \frac{\partial^2 u}{\partial y^2} = 0$

21.  $\frac{\partial^2 u}{\partial x^2} = 9 \frac{\partial^2 u}{\partial x \partial y}$

23.  $\frac{\partial^2 u}{\partial x^2} + 2 \frac{\partial^2 u}{\partial x \partial y} + \frac{\partial^2 u}{\partial y^2} + \frac{\partial u}{\partial x} - 6 \frac{\partial u}{\partial y} = 0$

24.  $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = u$

25.  $a^2 \frac{\partial^2 u}{\partial x^2} = \frac{\partial^2 u}{\partial t^2}$

18.  $3 \frac{\partial^2 u}{\partial x^2} + 5 \frac{\partial^2 u}{\partial x \partial y} + \frac{\partial^2 u}{\partial y^2} = 0$

20.  $\frac{\partial^2 u}{\partial x^2} - \frac{\partial^2 u}{\partial x \partial y} - 3 \frac{\partial^2 u}{\partial y^2} = 0$

22.  $\frac{\partial^2 u}{\partial x \partial y} - \frac{\partial^2 u}{\partial y^2} + 2 \frac{\partial u}{\partial x} = 0$

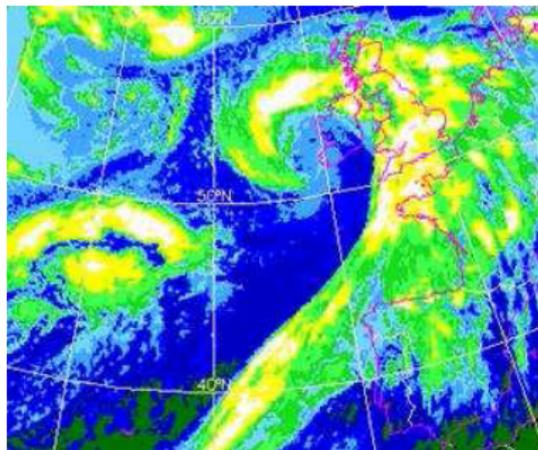
26.  $k \frac{\partial^2 u}{\partial x^2} = \frac{\partial u}{\partial t}$ ,  $k > 0$

in real life

 Chumma Oru Neram Pokkinu Mathram

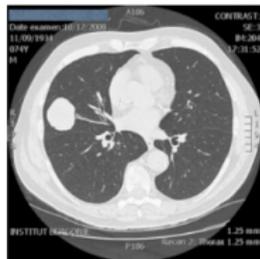
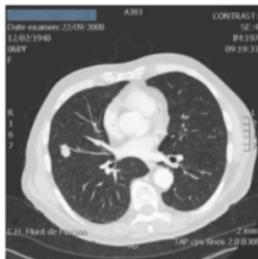
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# Météorologie



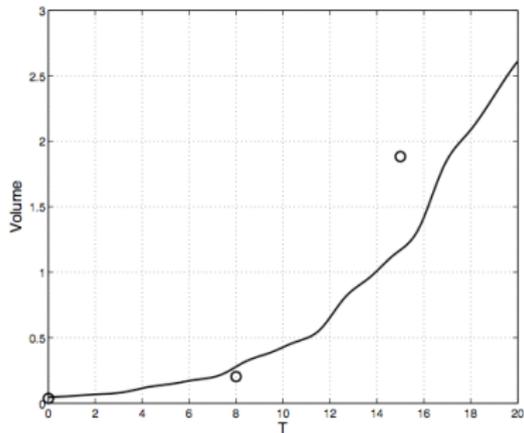
Provenance des images: site web de Météo France

# Prédiction de l'évolution de tumeurs



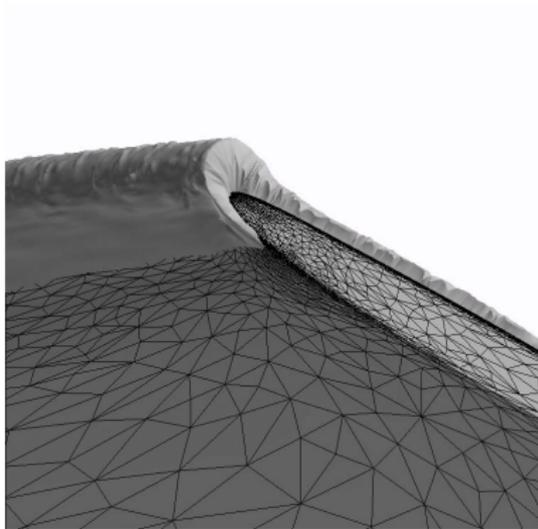
## Volume history:

- Simulation (continuous line);
- scan (circle)



Provenance des images: Thierry Colin, Institut de Mathématiques de Bordeaux

# Aéronautique: givrage des ailes d'avions



Provenance des images: Héroïse Beaugendre, Institut de Mathématiques de Bordeaux

# Programme de la Mineure

Des mathématiques qui vous seront utiles:

- Algèbre linéaire
- Espace Euclidiens
- Probabilités - Statistiques
- Intégration et équations différentielles
- Modélisation et calcul scientifique

# Exemple: Chimie

modèle d'un réacteur chimique CSTR: multivariable

Soit un réacteur chimique où se déroule une réaction de 1<sup>er</sup> ordre:  $A \xrightarrow{K_1} B \xrightarrow{K_2} C$

■ Schéma de principe

■ Schéma bloc

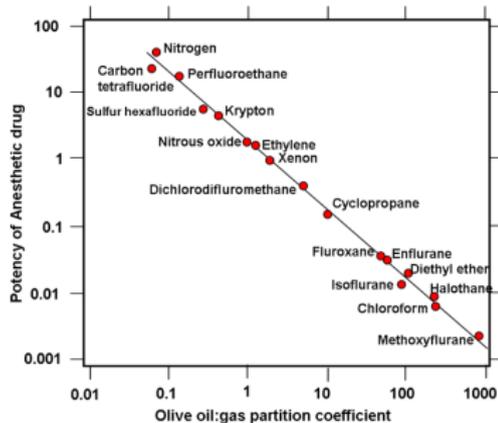
■ Modèle mathématique (en utilisant la loi de continuité)

$$\begin{bmatrix} \frac{d}{dt} [1C_A] \\ \frac{d}{dt} [1C_B] \\ \frac{d}{dt} [1C_C] \end{bmatrix} = \begin{bmatrix} -(Q_s + 1K_1) & 0 & 0 \\ 1K_1 & -(Q_s + 1K_2) & 0 \\ 0 & -1K_2 & -Q_s \end{bmatrix} \begin{bmatrix} C_A \\ C_B \\ C_C \end{bmatrix} + \begin{bmatrix} Q_e & 0 & 0 \\ 0 & Q_e & 0 \\ 0 & 0 & Q_e \end{bmatrix} \begin{bmatrix} C_{Ae} \\ C_{Be} \\ C_{Ce} \end{bmatrix}$$

Provenance des images: <http://www.polytech-lille.fr>

# Exemple: recherche de corrélations

The Meyer-Overton correlation for anesthetics



Provenance des images: Wikipedia et <http://www.pnas.org>

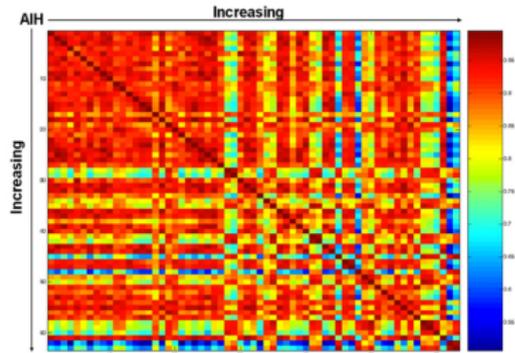
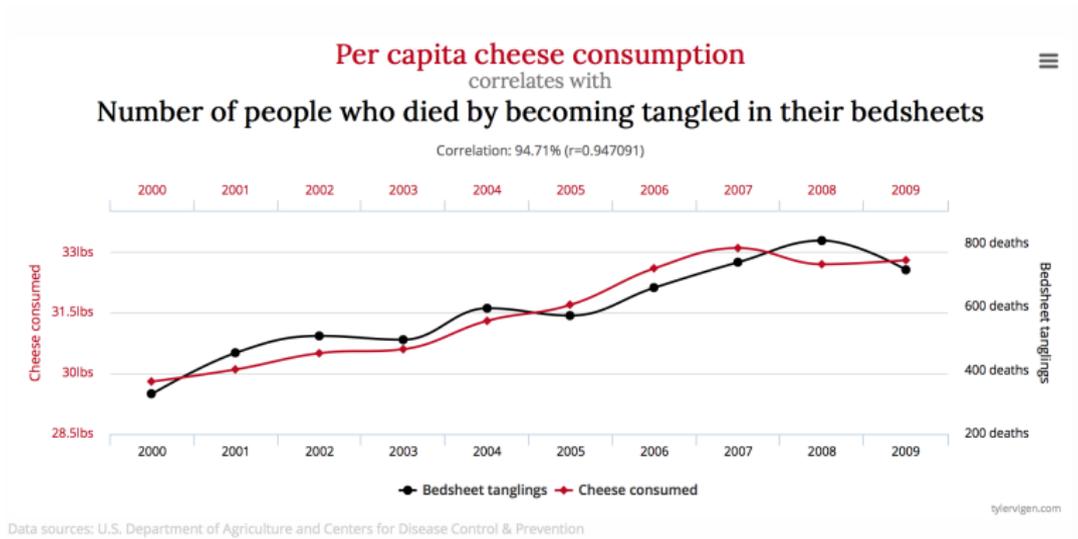


Fig. 5. Pearson correlation coefficient-based heat map representation of the similarity of gene expression profiles of individuals in the study by Rodwell *et al.* (1). Note that the matrix has been ordered by increasing levels of arterial intimal hyalinosis (AIH; see text), a sign of renal pathology.

# Exemple: recherche de corrélations



# Projet: simulations numériques à partir d'articles de recherche

- Réactions chimiques oscillantes
- Modélisation du climat
- Etude épidémiologique d'une invasion de zombies

