

$$\begin{array}{l}
 \text{f (fonction objective)} \\
 \text{D (densité cytosol)} \\
 \text{M (densité membrane)} \\
 \text{taille Nm (flux)} \\
 \text{taille Nm (flux)} \\
 \text{ATP maintenance}
 \end{array}
 \begin{array}{c}
 \begin{bmatrix} 1 \\ 0 \\ 0 \\ 0 \end{bmatrix} \\
 \begin{bmatrix} \text{CD\_M} & \text{CD\_R} & \text{CD\_C} \\ \text{CD\_M} \\ -\text{Pm.keff} \\ -\text{Pm.keff} \end{bmatrix} \\
 \begin{bmatrix} 1 \\ -1 \end{bmatrix} \\
 \text{nu\_ATP} = -1
 \end{array}
 = \mathbf{A} \leq \mathbf{b} =
 \begin{array}{c}
 \begin{bmatrix} \text{D - CD\_G.C\_PGcyt} \\ \text{Ptot.Pmem - CD\_G.C\_PGmem} \\ \\ \\ -\text{atp\_maintenance} \end{bmatrix}
 \end{array}$$
  

$$\begin{array}{l}
 \text{Ribosomes} \\
 \text{Chaperones} \\
 \text{Xe} \\
 \text{Xp} \\
 \text{Xpm} \\
 \text{Xr} \\
 \text{Xrm} \\
 \text{Xc} \\
 \text{Xm} \\
 \text{Coût flagelles}
 \end{array}
 \begin{array}{c}
 \begin{bmatrix} \text{muCR\_M} & \text{muCR\_R} & \text{muCR\_C} \\ & -\text{kT.p\_act} & \\ \text{muCC\_M} & \text{muCC\_R} & \text{muCC\_C} \\ & & -\text{kC} \end{bmatrix} \\
 \begin{bmatrix} \text{muCMP\_M} & \text{muCMP\_R} & \text{muCMP\_C} \\ \text{muCMr\_M} & \text{muCMr\_R} & \text{muCMr\_C} \end{bmatrix} \\
 \begin{bmatrix} -\text{Sp} \\ -\text{Spm} \\ \text{Sr} \\ \text{Srm} \\ -\text{Sc} \\ -\text{Sm} \end{bmatrix} \\
 \text{nu\_H+} = -1
 \end{array}
 = \mathbf{Aeq} = \mathbf{beq} =
 \begin{array}{c}
 \begin{bmatrix} -\text{CR\_G.mu.C\_PG} \\ -\text{CR\_G.pch.mu.C\_PG} \\ 0 \\ -\text{muCMP\_G} \\ -\text{muCMr\_G} \\ -\text{muXc} \\ -\text{muX\_metab} \\ -\text{muX\_nmp} \\ -\text{h\_flagelle} \end{bmatrix}
 + \begin{bmatrix} 0 \\ -\text{mu.Xp\_metab} \\ 0 \\ -\text{mu.Xr\_m} \end{bmatrix}
 \end{array}
 +
 \begin{array}{c}
 \begin{bmatrix} -\text{nu\_dmrna (X\_H2O)} \\ \text{nu\_dmrna (X\_H+)} \\ -\text{kd.Xc (X\_mrna)} \\ \text{comp\_AGCU.nu\_dmrna} \end{bmatrix}
 \end{array}$$

**mRNA**