First model considered for adipocytes "growing".

T triglycerides (= lipids) in the blood
$u(t,r)$ adipocytes number at time t of radius r (containing l lipids)
The link between r and l is the following,

$$V_l l = \frac{4}{3}\pi r^3 - V_0$$

with $V_0 = \dfrac{4}{3}\pi r_0^3$ the minimum volume of adipocytes (r_0 is the minimum radius), so $\dfrac{dl}{dt} = \dfrac{4\pi}{V_l}\dfrac{dr}{dt}r^2$.

Model the lipogenesis and the lipolysis (fluxes of triglycerides l) :

$$\frac{dl}{dt} = ar^2 \frac{T}{T+T_\theta}\frac{r_\theta^n}{r^n + r_\theta^n} - (B + br^2)\frac{l}{l+\ell_\theta}$$

we rewrite with the variable r :

$$\frac{dr}{dt} = a\frac{V_l}{4\pi}\frac{T}{T+T_\theta}\frac{r_\theta^n}{r^n+r_\theta^n} - \frac{V_l}{4\pi}\frac{(B+br^2)}{r^2}\frac{\frac{4}{3}\pi r^3 - V_0}{\frac{4}{3}\pi r^3 - V_0 + V_l \ell_\theta} = \tau(r,T)$$

From these fluxes, the dynamics of the number of adypocytes u is described by

$$\partial_t u(t,r) + \partial_r(\tau(r,T)u - D\partial_r u) = 0$$

with D a diffusion coefficient.

The intracellular quantity of triglycerides is $U(t) = \displaystyle\int l\rho_u dl$ with ρ_u adipocytes density. The total amount of triglycerides is assumed constant over time : $\dfrac{d}{dt}(T(t) + U(t)) = 0$ and $\dfrac{dT}{dt} = -\dfrac{dU}{dt}$ and we denote by Tg_0 the initial quantity of triglycerides so that $T(t) + U(t) = Tg_0$ for every time t.

boundary/initial conditions. $u(0,r) =$ Gaussian density (minimum $= r_0$), first test : unimodal (Q : can we recover the bimodal distribution that is observed).
$T(t) = Tg_0 - U(t)$
$(\tau(r,T)u(t,r) - D\partial_r u(t,r))|_{r_{max}} = 0$

Recruitment of new adipocytes. We assumed that when the level of triglycerides increases too largely, pre-adipocytes differentiate into adipocytes. This recruitment is modeled with the r_0 BC, as follows,

$$(\tau(r,T)u(t,r) - D\partial_r u(t,r))|_{r_0} = f(T)$$

with $f(T) = \alpha T$ or $f(T) = \alpha\dfrac{T}{(T+\kappa_\theta)}$