Find ODEs for and in the case of foetal development (note , so !)

Predefined reserve dynamics state that change in reserve density is linear in :

Through the chain rule for differentiation we have the relationship between and :

We obtain by filling in our previous expression for :

For growth rate , we have

Gathering terms with

Multiplying all with and isolating

Inserting this in our expression for

Combining these in one fraction

Rewriting in terms of (which is properly defined even when ):

For the increase in structural length we have

Rewriting in terms of (which is properly defined even when ):

Maturity dynamics:

Challenge: we know . What is ? The initial state is

## Von Bertalanffy growth

This occurs at constant reserve density

This has solution

With being the structural length at which growth ceases:

with heating length

And being the von Bertalanffy growth rate

In this case, equals

## V1 morph growth

Reserve turnover and heating are now proportional to structural length

For constant reserve density , this has solution

With

In this case, equals

Then, maturity dynamics can be written as

With prefactor

This has solution

With integration constant