DEB 2023

AmP projects: setting up

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TÉCNICO LISBOA

University of Crete

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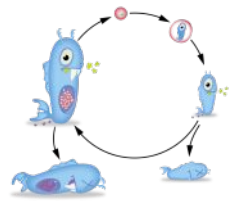
deb2023.sciencesconf.org

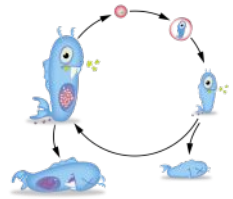


Overview

- Set up individual objectives and plan for the “own project” time : 14.5 Hrs
- Final day: 3 hours total of AmP presentations. Groups of 1 till three people. 7 min/person - or 10 min/ group

Main topic of this lecture:

Auxiliary theory

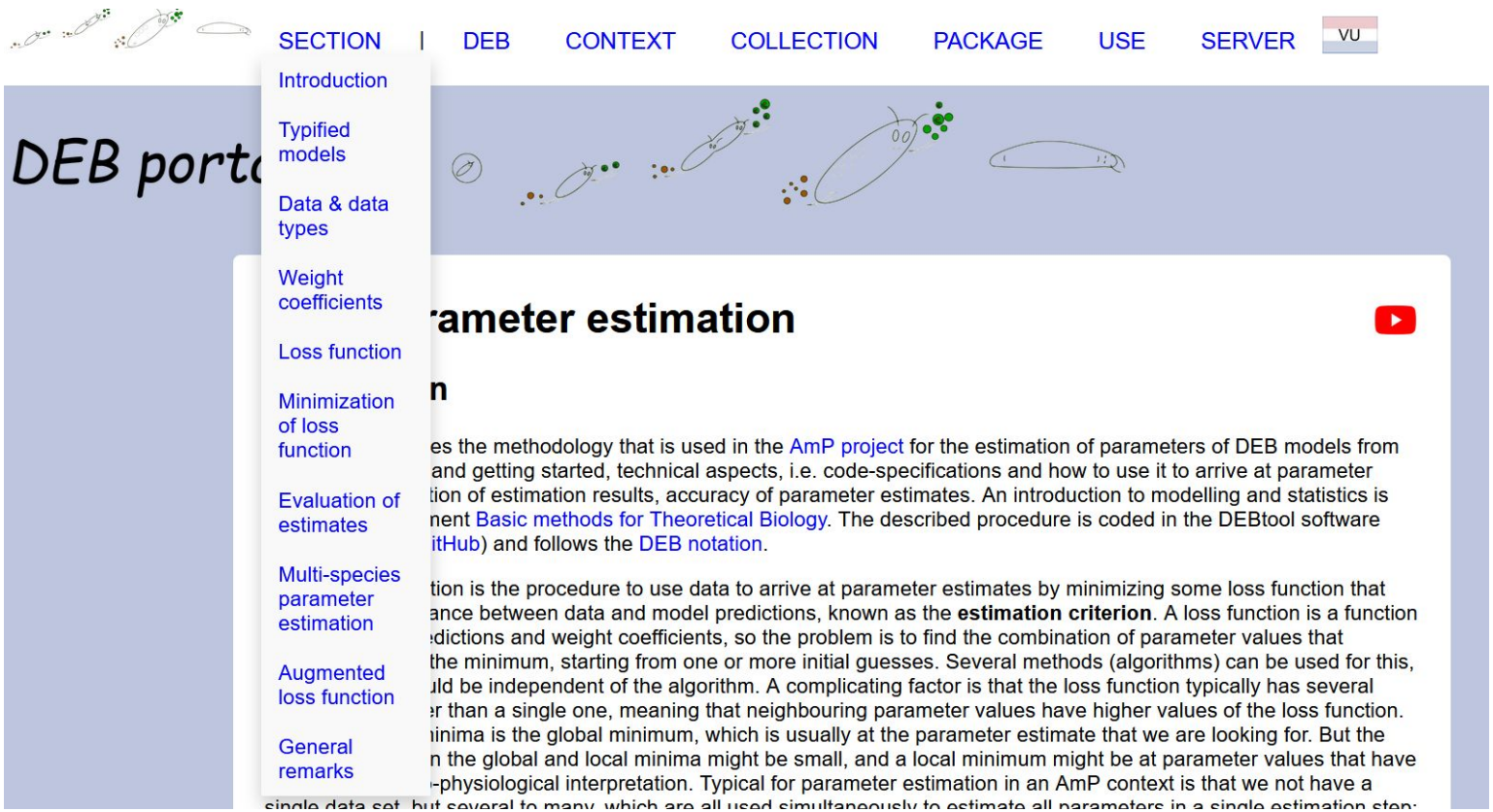


Learning Objectives

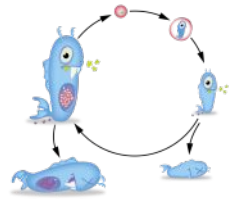
- Know the difference between core DEB theory assumptions and auxiliary theory assumptions
- Know how to navigate the AmP database and associated resources to find user-defined predictions for you type of data

Know your data labels

debportal.debtheory.org/docs/AmPestimation.html

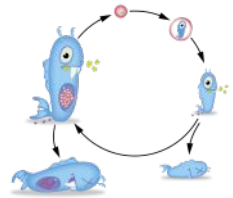


First change equations and assumptions in your notes



Only after that can change them in the code

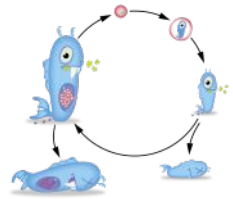
When modelling with the PC you need to distinguish between an error coding a quantity and a model term that need to be changed because assumptions have been updated.



Some suggestions

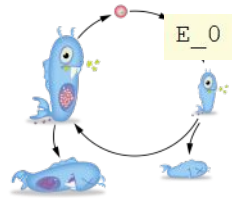
- Have zotero standalone with DEB library
- Have handy the papers with the most useful appendixes (or main papers) with the equations you will be using.
- Always have DEB notation handy. Follow the nomenclature in the equations but also how the code relates to the symbols.
- Write units in comments next to quantities in code

Data finding takes the most time



- Stay on top of references and units for data.
- Make notes of important details to help modelling and interpretation
- Do not transform data in the data file

Work with standardized nomenclature



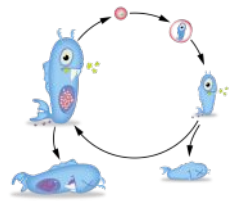
DEB nomenclature

Standardized link between symbols and **code**

units ←

E_0	E_0
a_b, a_p	aT_b
a_m	
L_b, L_p	
L_∞	
W_w^b	
W_w^p	Ww_p
W_w^∞	
N_∞	

Work with your own equation notes



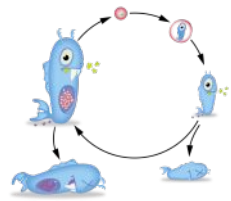
$$L(t) = L_\infty - (L_\infty - L_b)\exp(-t\dot{r}_B) \quad \text{or } t(L) = \frac{1}{\dot{r}_B}\ln\frac{L_\infty - L_b}{L_\infty - L}$$

$$\dot{r}_B = \frac{1}{3/\dot{k}_M + 3fL_m/\dot{v}} = \frac{\dot{k}_M/3}{1+f/g}$$

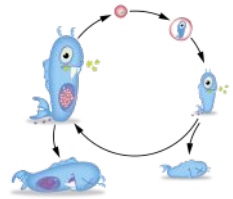
$$L_\infty = fL_m - L_T$$

```
% time-length
rT_B = kT_M/ 3/ (1 + f_tL/ g); L_i = L_m * f_tL; L_b = L_m * get_lb([g k v_Hb], f_tL);
L = L_i - (L_i - L_b) * exp( - rT_B * tL_f(:,1)); % cm, structural length at time
ELw_f = L/ del_M;                                  % cm, shell length
```

Calculating Quantities with DEBtool:



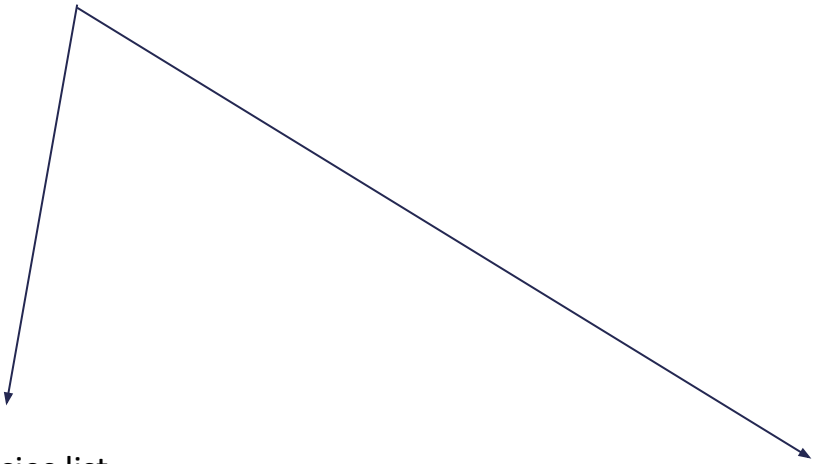
Symbol	Units	Interpretation	
E_0	J	initial energy in egg	initial_scaled_reserve
a_b, a_p	d	age at birth, puberty	get_tj
a_m	d	age at death	get_tm_mod
L_b, L_p	cm	structural length at birth, puberty	get_tj
L_∞	cm	ultimate volumetric length	$s_{\mathcal{M}} f L_m$
W_w^b	g	wet weight at birth	$L_b^3(1+f\omega)$
W_w^p	g	wet weight puberty	$L_p^3(1+f\omega)$
W_w^∞	g	ultimate wet weight	$L_\infty^3(1+f\omega)$
N_∞	#	life time reproductive output	cum_reprod (std-DEB) or cum_reprod_j (abj-DEB)



Finding predictions

Know your labels !!!

debportal.debtheory.org/docs/Uni-variate_data.html



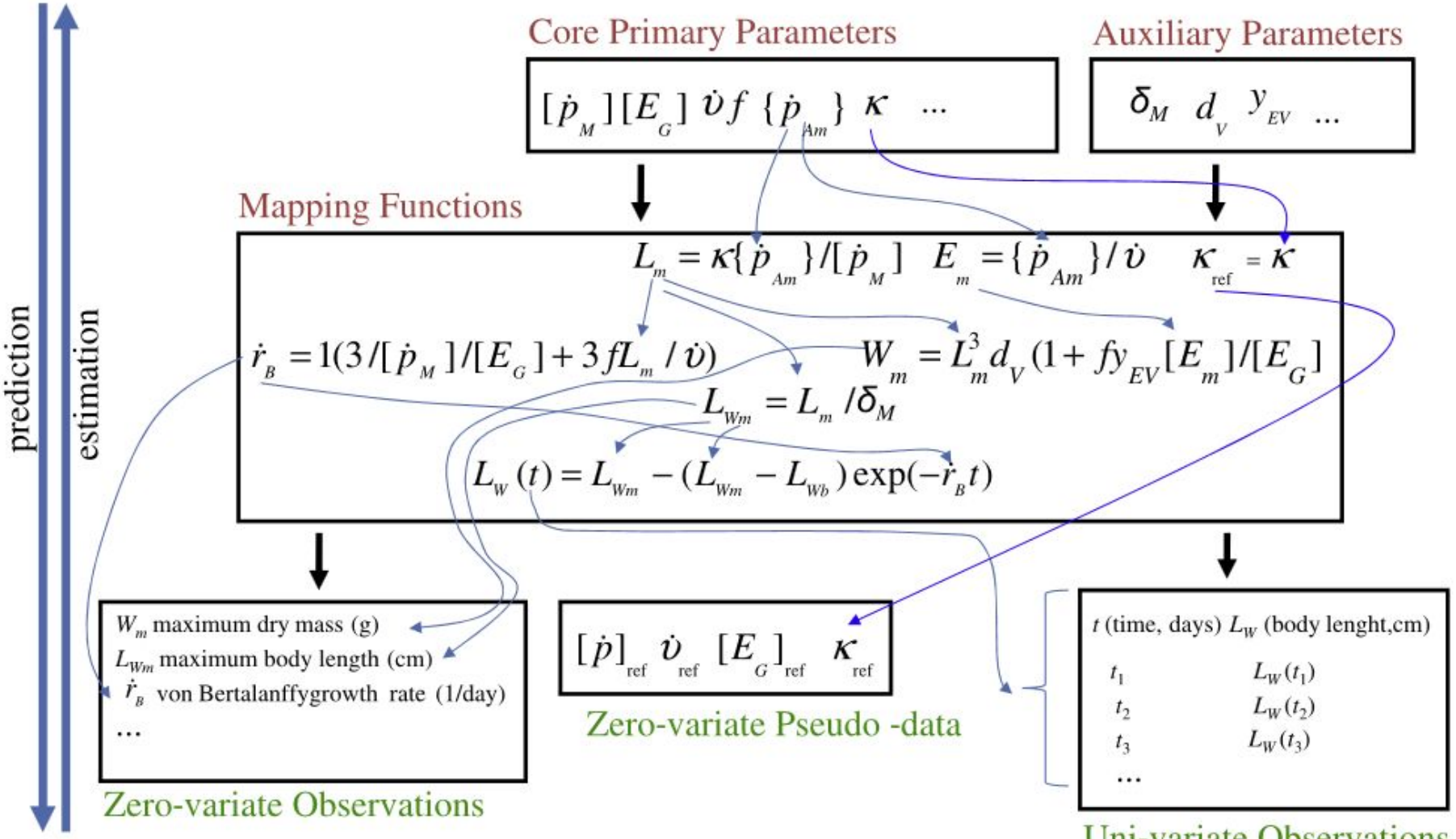
Look in species list

Use AmPtool functions **amptool.debtheory.org/docs/**

```
select_data({'t-Le','Wwb'},'std')
```

```
[species, nm] = select_predict('f = spline1(t, tf)'); select_predict(nm, 'males')
```

Abstract World

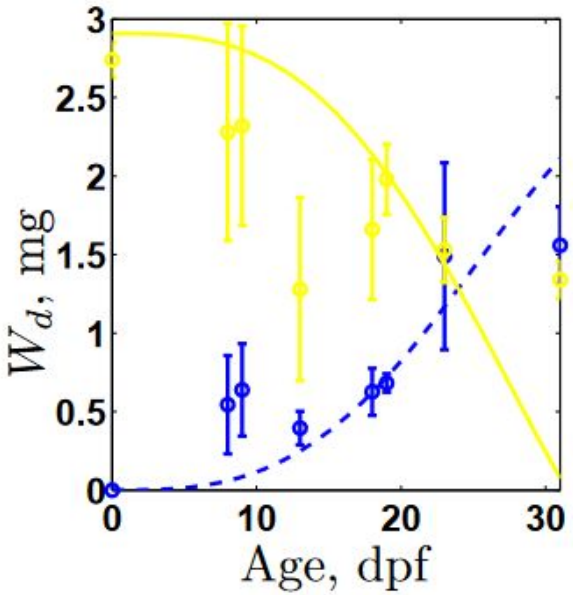


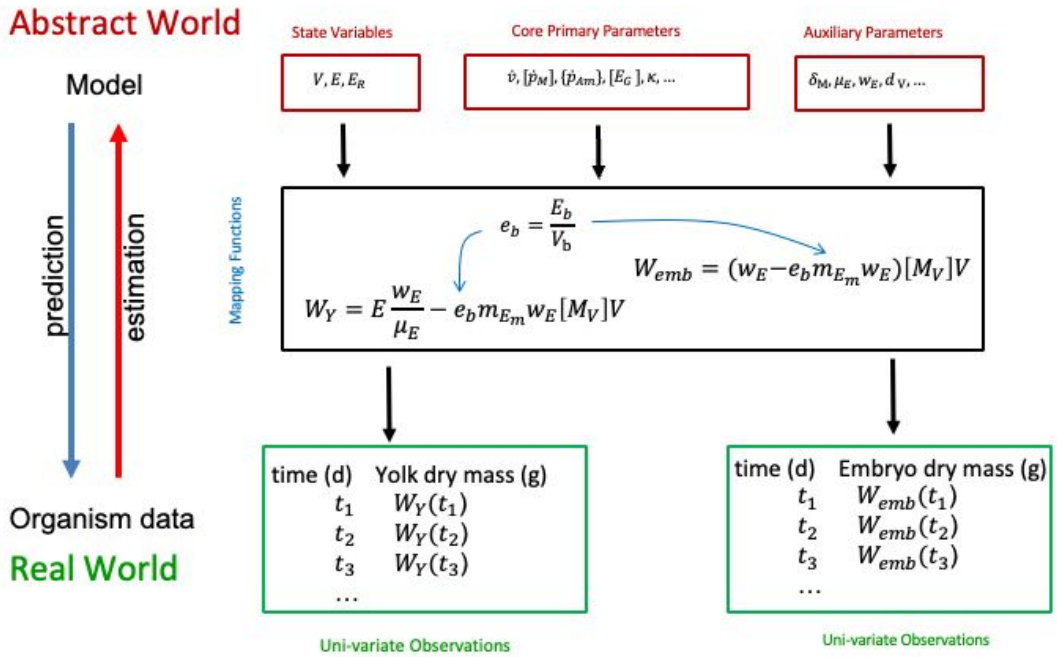
Real World

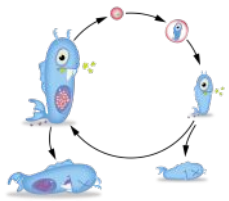
Examples of “maps” :

Embryo yolk

and body:

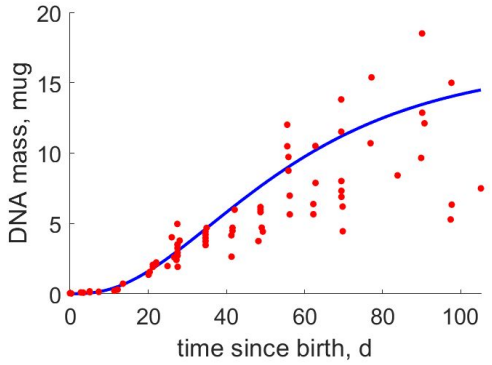


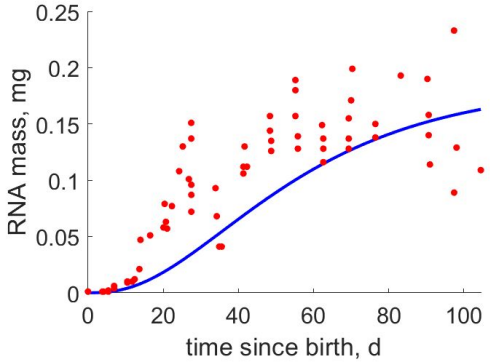


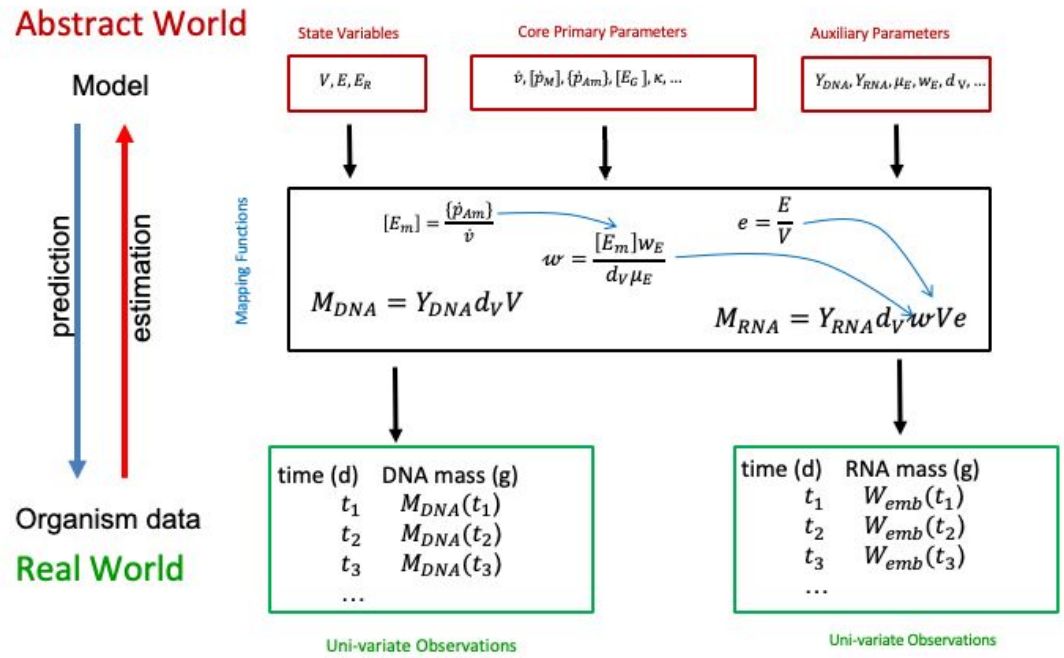


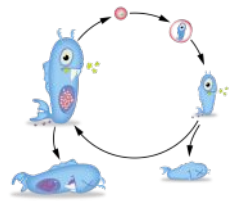
Examples of “maps”

DNA and RNA weights



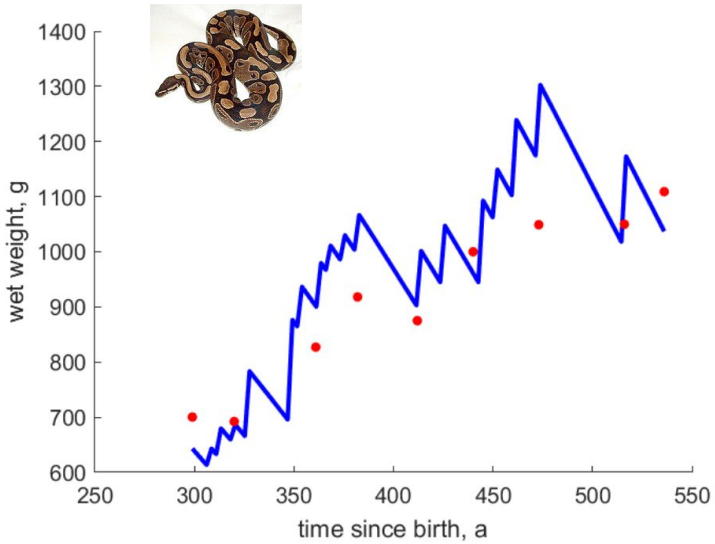






Examples of “maps”:

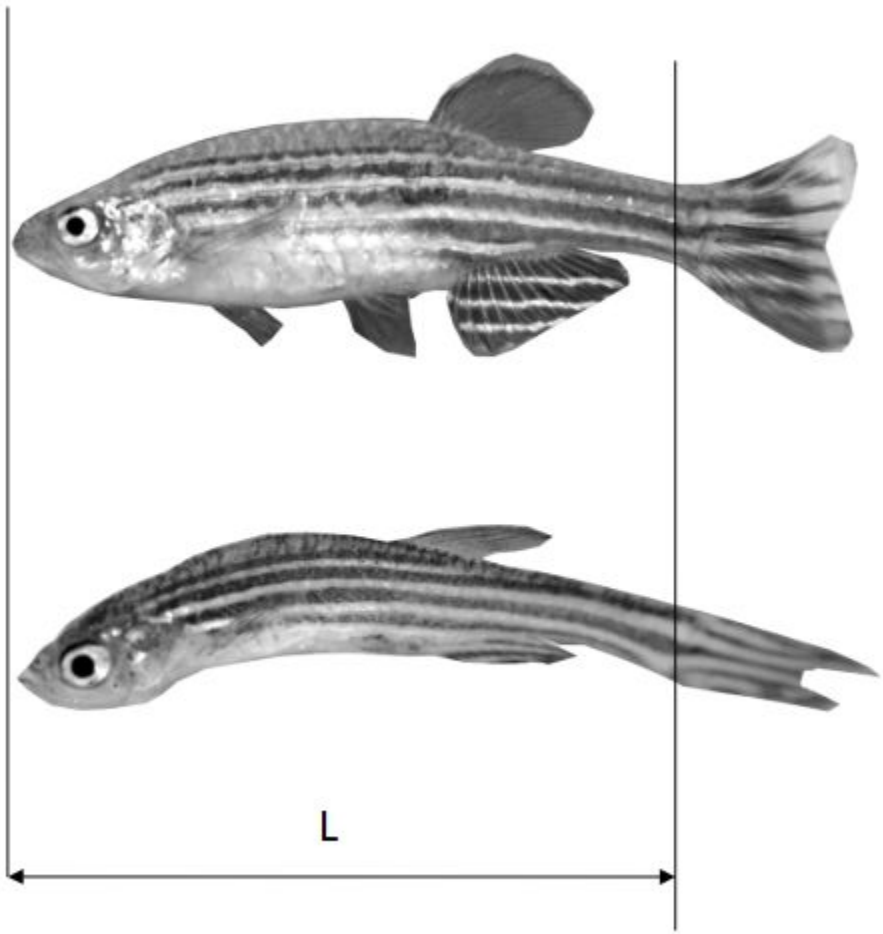
Python regius eats mice

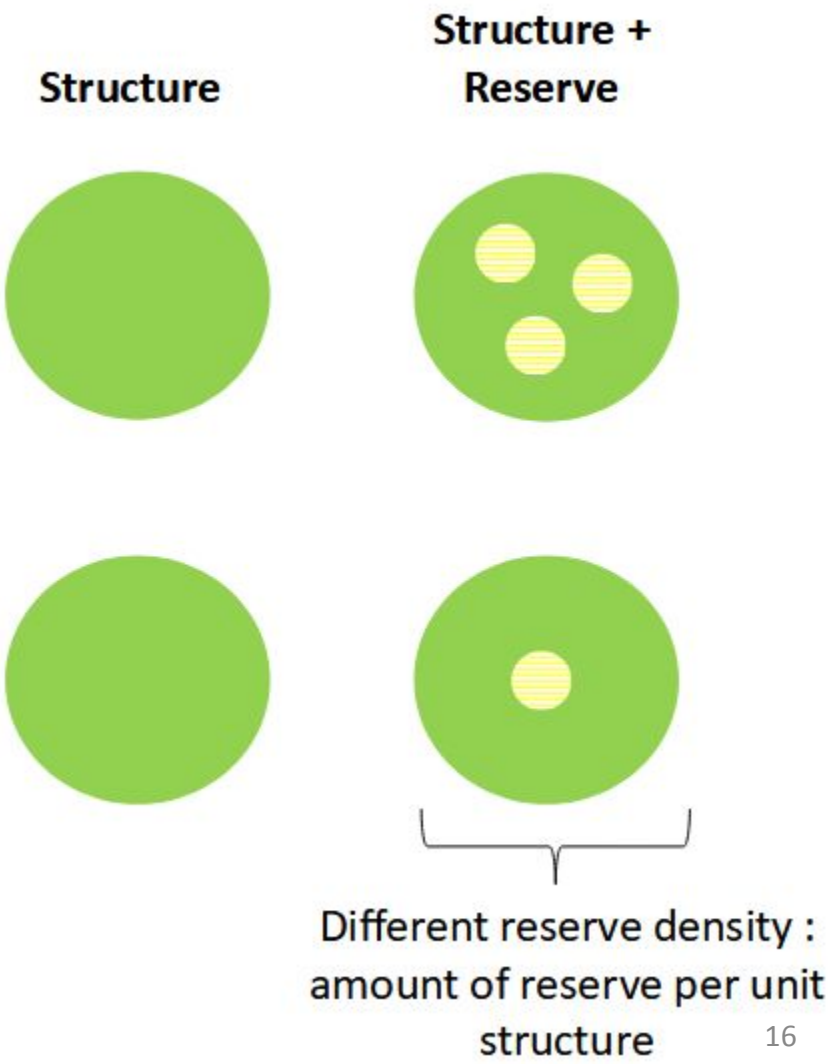


User defined functionin the predict file to include weight of gut content:

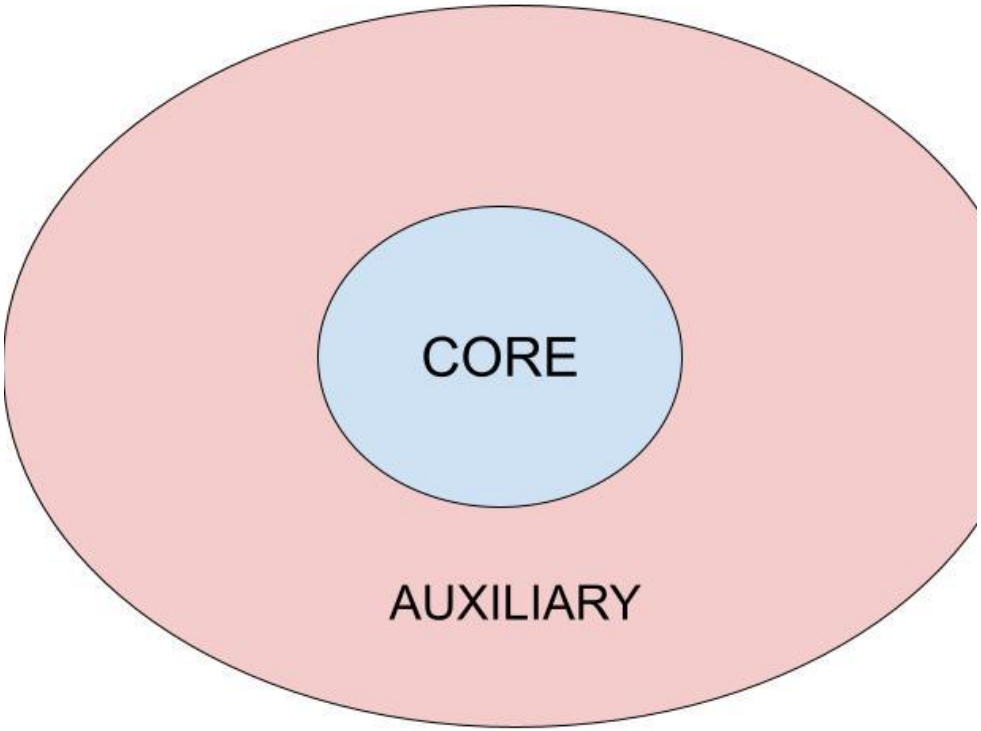
```
function dXeL = dXeL(t,XeL, vT, pT_Am, g, L_m, L_T)
  % routine for predict_Python_regius
  % digestion at max rate

  %unpack state variables
  X = max(0, XeL(1)); e = XeL(2); L = XeL(3);

  dX = - (X > 0) * pT_Am * L^2;
  de = - dX/ L^3 - e * vT/ L;
  r = vT * (e/ L - (1 + L_T/ L)/ L_m)/ (e + g);
  dL = L * r/ 3;

  dXeL = [dX; de; dL];
end
```

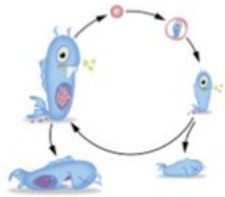
Length as quantifier for structure





Assumptions….

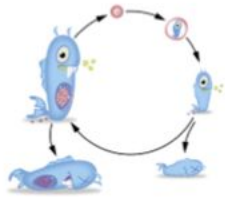




mydata-file

Set the data

- **metadata** - information about: the species, eco-codes, the types of data, the author, etc
- **data** - value, units, labels, references, temperature (for time and rates)
- **pseudo data** - were set automatically, can be modified



Data

(real)data

Empirical observations of physiological processes

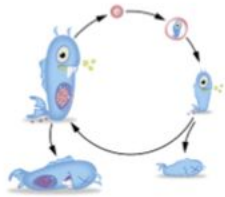
- zero-variate (single measurements)
- uni-variate (lists of values for an independent and an associated dependent variable)
- Read here for more types of data

pseudo-data

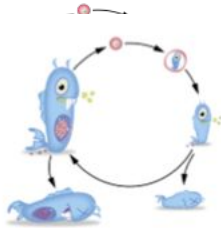
Prior knowledge of a selection of parameter values

Fill possible gaps in information in the real data

mydata-file



```
%% set weights for all real data
weights = setweights(data, []);


%% set pseudodata and respective weights
[data, units, label, weights] = addpseudodata(data, units,
label, weights);


%% pack auxData and txtData for output
auxData.temp = temp;
txtData.units = units;
txtData.label = label;
txtData.bibkey = bibkey;
txtData.comment = comment;
```



pars_init-file

Rename the file and the function: **pars_init_Squalus_acanthias**

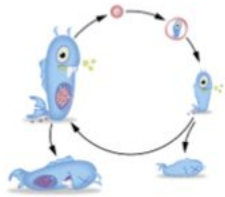
Choose the model

Set the initial parameter values for estimation

including info for units, labels and if it is a free parameter (i.e., parameter that is allowed to change during the estimation procedure)

- Primary
- Auxiliary
- Environmental
- Chemical

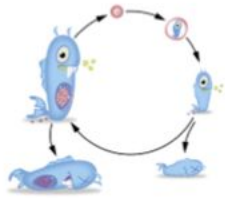
Structures in Matlab



- A **Structure** is a collection of data representing a single idea or "object“
- Inside a structure there is a **list of fields** each being a variable name for some sub-piece of data
- Different type of data for each "field“
- Syntax

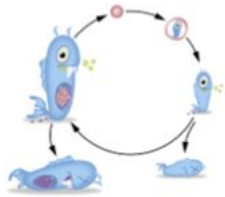
```
VariableName.Field
```

Structure example



A single variable (named `metaData`) which contains many **fields**. Each field has its own **name** and its own **type**.

```
metaData.phylum     = 'Chordata';
metaData.class      = 'Chondrichthyes';
metaData.order      = 'Squaliformes';
metaData.family     = 'Squalidae';
metaData.species    = 'Squalus_acanthias';
metaData.species_en = ‘Spurdog';
```



Structure example

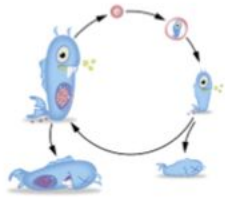
Many variables (named `data, units, label, bibkey, temp`) which contain many **fields** (e.g. zero-variate data, ab, ap).

Variables give different information for a given field.

```
data.ab = 640.5
units.ab = 'd'
label.ab = 'age at birth';
bibkey.ab = 'JoneGeen1977';
temp.ab = T_C + 9
```

```
data.ap = 2190
units.ap = 'd';
label.ap = 'age at puberty';
bibkey.ap = 'Avsa2001'
temp.ap = T_C + 9;
```

Structures in Matlab

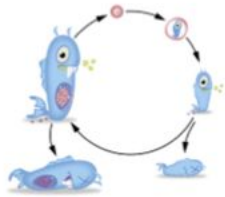


Use function `struct`

```
s = struct(field1,value1,field2,value2)
```

Creates a structure array with multiple fields

Pack/unpack variables



`vars_pull` : pack & unpack variables into & from structures, according to the syntax and inputs.

Example : unpack variables from data

```
vars_pull(data)
```

creates or overwrites variables `ab` and `ap` in the calling function with the contents of the corresponding named fields