Basics of Programming (Thurs. / Fri.; Springer)

- Reading a line of code
- Variables – x=2
  - Entering
  - Retrieving
  - Mathematical Operations + - * / ^
  - Order of Operations
- Arrays
  - Loading
  - Visualizing
  - Retrieving Values
  - Altering Values
- Basic Functions – Analyzing a dataset
  - Length, size
  - Mean, median, standard deviation
  - Sort
- Functions of 2D arrays
- Entering Arrays
  - Bracket operator
  - Colon operator
  - Comma semicolon
- Conditional Retrieval
  - >
  - find
- Ploting
  - 2D: colors, lines, labels
  - 3D
- Scripts
- Conditional States and Control Flow
  - For loops
  - If, Elseif, Else
  - !, ==, >, <, >=
  - Or and And (| || & &&)
  - While
  - Counters
- Cell Arrays
  - Entering
  - Retrieving
  - fieldnames
- Function
  - Simple functions
  - Scope
- Data Structures
- Strings – dealing with text and mixed data
- Parsing data

Statistics with MATLAB (Monday, AM; Born)

- *Rattus binomialis*: When is he guessing?
  - all you need is 'rand'
  - simulations and probability
  - 'for' loops
  - tricky indexing into arrays
  - 'tic' and 'toc' to time code execution
  - binomial distribution
  - pdf's and cdf's

- Bootstrap Bill: Statistics for the common man
  - operations along columns of 2D matrix
  - use of 'repmat'
  - simple descriptive statistics: mean, median, standard error
  - plotting functions: 'plot', 'errorbar', 'polar'
  - handle graphics
  - bootstrapping: null hypothesis; permutation test; confidence intervals

- Sorting spikes: The joys of dimensionality reduction
  - thresholding to find peaks in data
  - using 'diff' to find events in continuous data
  - PCA/SVD to reduce dimensionality of data
  - 3D plotting
  - ISI histograms

Image Processing I: Computer Processing (Monday, PM; Springer)

- Visualizing an image in MATLAB
  - loading images – imread and dragging
  - displaying images –imshow, imagesc, surf
  - data types – double, mat2gray
- Manipulating Pixels
  - Background Subtraction
  - Rescaling
  - Transform – e.g. log

- Manipulating Field of pixels – Filters
  - Intensity Preserving
    - Smoothing Filters
  - Non-Intensity Preserving
    - Contrast
    - Vertical Lines
    - Horizontal Lines
    - Edges
    - Contrast – Laplacian
    - Laplacian of Gaussian (LoG)

Image Processing II: Images and Your Brain
(Tuesday, AM; **Born**)

- Horace Barlow: Image Statistics and "Suspicious Coincidences"
  - loading and displaying images
  - histograms and probability density functions
  - nearby pixels are similar: correlation with 'corrcoef'
  - center-surround: LoG and 'imfilter'
  - orientation selectivity: finding "suspicious coincidences with 'colfilt'

- David Marr: Where's Abe?
  - image manipulation: blkproc
  - edge detection: LoG and thresholding
  - image filtering in the frequency domain: 'fft2', 'ifft2'
  - band-rejection filters
  - zero-crossings and the "raw primal sketch"
  - better recognition through subtraction

Image Processing III: Segmentation

- Finding cells or features
  - Thresholding
  - Bwlabel
  - Cleaning up the features – imopen, imclose, imerode imdialate
- Quantitating Cell
  - Regionprops
  - Extracting values from pixels

Modeling with SIMBIOLOGY
(Tuesday, PM; **Springer**)

- Launching simulink
  - The hydrogen model – mRNA synthesis and decay
    - Drawing a model
    - Setting the rate equations
    - Running a simulation
    - Running a parameter scan
    - Extract the data into MATLAB to manipulate
- Models
  - Enzymatic reactions
  - Binding unbinding reaction
  - Ligand Receptor with Sink/Drug pharmacology with Sink
  - Competitive Inhibition
  - Multisite Phosphorylation