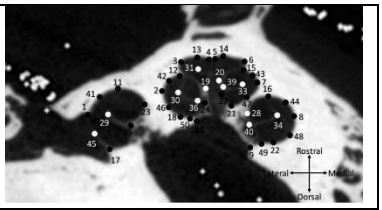
Prediction of the trajectory of obscured cochlear spirals for the development of three-dimensional computational modelling

Example of application of CSRF

In this example, the method to reconstruct the *LSL* for a *rollercoaster* cochlea, using the CSRF from image data for which only the LS, IS and SS can be measured is demonstrated.

Step 1	Measure visible landmarks, e.g. LS, IS and SS on low-resolution data, e.g. CT scans. LS, IS, and SS are the reference spirals for this example. 
Step 2	Fit sixth-order polynomial equations on the radius (R) and height (Z) data for the LS, IS and SS.
Step 3	Normalise the radial polynomial equations by dividing by CL = $R_{LS}(0°) + R_{LS}(180°)$. Normalize the height polynomial equations by dividing by LSH = $Z_{LS}(720°) - Z_{LS}(0°)$.
Step 4	Open the ReconSummary_R.xls file, where _R refers to the rollercoaster dataset. Sheet 4 provides the reconstruction summary for the radius of the LSL. Using the PNMAE ranking in row 7, the ILS is the highest-ranked predictor. However, the ILS was not measured (and will also have to be predicted from the available SL, IS and SS). The second-highest predictor is the IS (which was measured). The sixth-order predictor coefficients for calculating the radius of the LSL from the trajectory of the IS are in column D, rows 5 to 21.
Step 5	Denormalize the predictor coefficients by multiplying with CL as calculated in Step 3.
Step6	Calculate the predicted polynomial coefficients for the radius of the LSL according to equation 3 in the main article.
Step7	Repeat Steps 4 to 6 to calculate the predicted polynomial equation for the height of the LSL from sheet 11 in ReconSummary_R.xls. • The highest-ranked predictor for LSL height is the SS, which is available in this example. • The denormalization factor for the height is LSH as calculated in Step 3. • Use equation 4 of the main article to calculate the predicted polynomial coefficients for the height of the LSL.

The Matlab script UPCochlea, available from doi.org/10.25403/UPresearchdata.12612776.v2 uses the CSRF according to the method described above to automatically reconstruct a full set of cochlear spirals from a subset of reference spirals that was measured from low-resolution data.