# Dataset for the Article "Predicting vessel diameter changes to up-regulate biphasic blood flow during activation in realistic microvascular networks"

# Dataset for the Article "Predicting vessel diameter changes to up-regulate biphasic blood flow during activation in realistic microvascular networks"

Robert Epp, Franca Schmid, Bruno Weber, Patrick Jenny

## Research article

Epp, R., Schmid, F., Weber, B., and Jenny, P. (2020). Predicting vessel diameter changes to up-regulate biphasic blood flow during activation in realistic microvascular networks. Front. Physiol. doi:10.3389/fphys.2020.566303

## Accessing the result files

The result files of the realistic microvascular networks are saved as compressed **Python pickled formats** and can be easily accessed with the Python module python-igraph (https://igraph.org/python/, tested with Python 2.7.17 and python-igraph 0.7.1)

*Example: Import the network including the results from file (here for Scenario I with the activated region being the most central barrel of the MVN):*
*g = igraph.Graph.Read_Picklez('Barrel_1/Scenario_I/full_graph.pkl')*

Additionally, the same results are also given as **csv-files** to ensure long-term accessibility. For each scenario, the three files “edgedata.csv”, “nodedata.csv” and “graphdata.csv” contain the same information as the corresponding igraph-pkl-file (adjacency edge list is included in “graphdata.csv”). For the artificial hexagonal network, the results are only included in the csv-files.

The realistic microvascular networks are from the mouse parietal cortex and were first published in Blinder et al., 2013, Nature Neuroscience (https://doi.org/10.1038/nn.3426).

All results are time averaged values as described in the corresponding research article.

## Attributes of realistic MVNs

### Node attributes

| Attribute name | Description | Unit | Remark |
|---|---|---|---|
| p_tav_base_si | Pressure (baseline) | Pa | |
| p_tav_opt_si | Pressure (activation) | Pa | |
| r | xyz coordinate of vertex | µm | |
| pBC | Prescribed fixed boundary pressure at boundary nodes | mmHg | A pressure value is given if the current node is a boundary node (None, if it is not a boundary node) |

*Examples:*

*- g.vs['p_tav_base_si'][99] returns the baseline pressure (in Pascal) in the node with index 99.*

*- g.vs['r'][99] returns the x, y and z coordinates (in micro meters) of the node with index 99.*

## Edge attributes

| Attribute name | Description | Unit | Remark |
|---|---|---|---|
| activated_region | Indicates if current edge is in the activated region | - | 1 if edge is in activated barrel; 0 otherwise |
| vessel_type | Vessel type | - | 0: Pial arteriole; 1: Pial venule; 2: Descending arteriole; 3: Ascending venule; 4: Capillary |
| d_base_si | Edge diameter (baseline) | m | |
| d_opt_si | Edge diameter (activation) | m | |
| fplasma_tav_base_si | Blood flow rate (baseline) | $m^3$/sec | |
| fplasma_tav_opt_si | Blood flow rate (activation) | $m^3$/sec | |
| ht_tav_base_si | Tube haematocrit (baseline) | - | |
| ht_tav_opt_si | Tube haematocrit (activation) | - | |
| rbc_flux_base_si | RBC flux (baseline) | $m^3$/sec | |
| rbc_flux_opt_si | RBC flux (activation) | $m^3$/sec | |
| urbc_tav_base_si | RBC velocity (baseline) | m/sec | |
| urbc_tav_opt_si | RBC velocity (activation) | m/sec | |
| length | Edge length | µm | |
| httBC | Prescribed fixed tube haematocrit at boundary edges | - | A value is given if the current edge is a boundary edge (None, if it is not a boundary edge) |

*Examples:*

*- g.es['d_base_si'][99] returns the baseline diameter (in micro meters) of the edge with index 99.*

*- g.es['rbc_flux_opt_si'][99] returns the RBC flux (in $m^3$/sec) during activation in the edge with index 99.*

## Graph attributes

| Attribute name | Description | Unit | Remark |
|---|---|---|---|
| activation_center_coords_si | xyz coordinate of activation centre | m | |
| activation_radius_si | Radius of activated barrel | m | |

*Example: g['activation_center_coords_si'] returns the x, y and z coordinates (in meters) of the activation centre.*