**Supporting Information S5**

# Tracheal branching in ants is area-decreasing, violating a central assumption of network transport models

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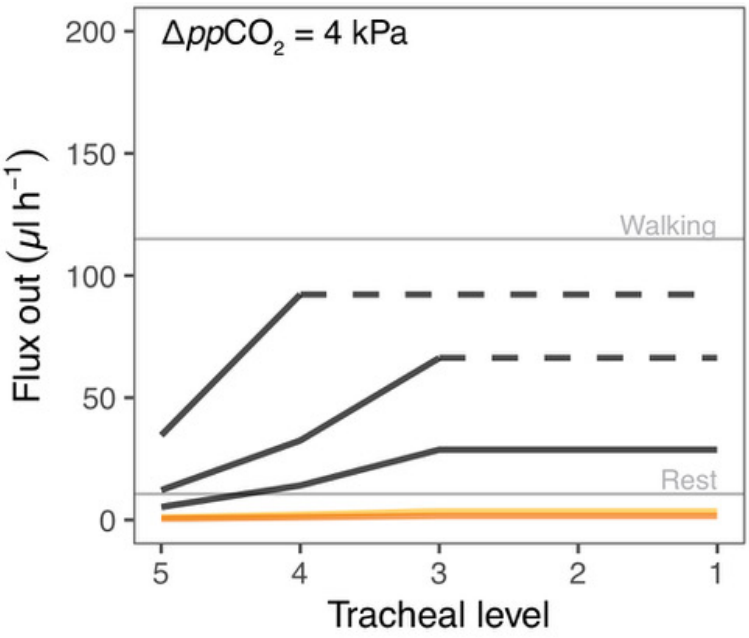
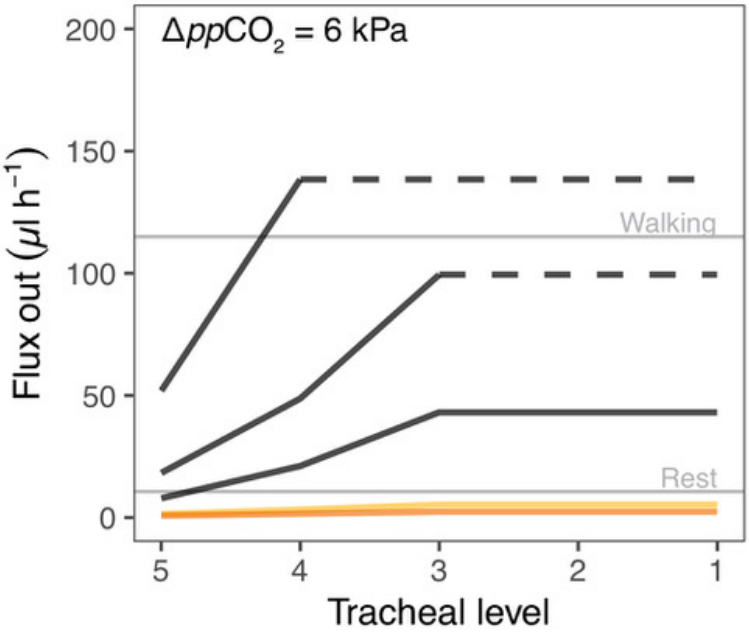
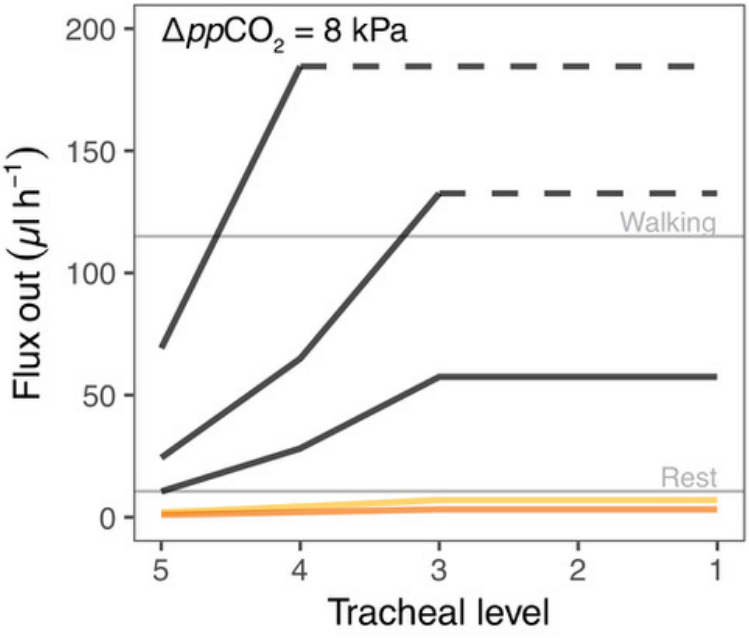
**S5. Effect of altered *pp*$CO_2$ gradient on modelled whole-organism $CO_2$ flux.** Results for area-conserving (yellow line), area-increasing (orange line), or area-reducing (black lines) transport networks shown. Each of the three black lines represents a model system with either no air sac (continuous solid line) or an air sac at either the 3$^{rd}$ or 4$^{th}$ level (indicated by the dashed line-segment). Tracheal branch lengths of the modelled system ranged from 211 µm at the deepest level (level 5) to 1569 µm at level 1 (levels 4, 3, 2 had branch lengths of 352, 586, and 976 µm, respectively). The tracheal radius of level 5 was set at 3 µm. Whole organism flux was modelled with a partial pressure difference of 4, 6, or 10 kPa and assuming 6 pairs of abdominal spiracles. Horizontal grey lines indicate the flux needed to meet the metabolic requirements of an average ant at rest or walking (Supporting Information S9).


ΔppCO2 = 4 kPa
Flux out (μl h−1)
200
150
100
50
0
Walking
Rest
5
4
3
2
1
Tracheal level


ΔppCO2 = 6 kPa
Flux out (μl h−1)
200
150
100
50
0
Walking
Rest
5
4
3
2
1
Tracheal level


ΔppCO2 = 8 kPa
Flux out (μl h−1)
200
150
100
50
0
Walking
Rest
5
4
3
2
1
Tracheal level