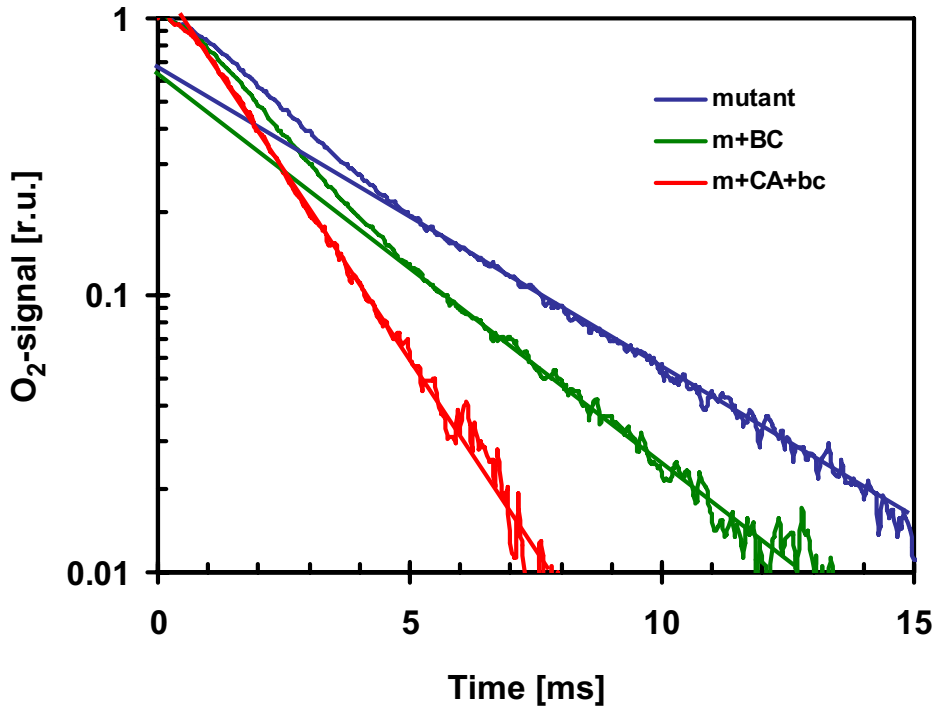
Supplementary Online Material

This figure supplements the discussion of Figure 3 of the article. For further details, see legend of Figure 3 and the related parts of the main body of the manuscript.



A monoexponential decay (time constant of 24 ms), which describes the O_2-signal well for t > 15 ms, was subtracted from the O_2-release signal detected after the third flash. The semi-logarithmic plot shows that the O_2-rise is bi-exponential in the PSII(Cah3-) mutant unless both bicarbonate and Cah3 are provided.

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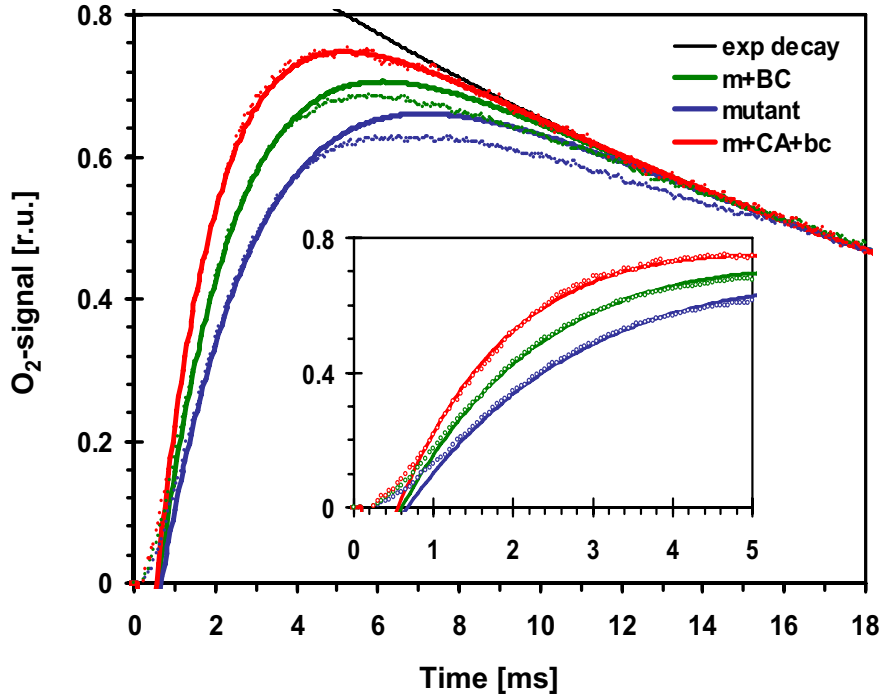

The O_2 rise was simulated by a single exponential term such that a good match of the initial rise (t < 5 ms) and the decay phase (t > 15 ms) was obtained. The need for a second rise component is clearly visible. A mono-exponential rise is sufficient only, if bicarbonate and the carbonic anhydrase are simultaneously added to the medium.

The following function was used for simulating the O_2 transients:

$$R_{ox}(t) = A1 \exp\{-(t-\Delta T)/T1\} + A2 \exp\{-(t-\Delta T)/T2\} + A3 \exp\{-(t-\Delta T)/T3\} \quad \text{for } t > \Delta T$$

An exact modeling of the complex origin of the initial time lag was not approached. Instead we approximated the delayed rise by a shift of the time scale by ΔT (for $t > \Delta T$).

Simulation Parameter	**mutant**	**m+BC**	**m+BC+CA**
ΔT [ms]	0.67	0.60	0.55
A1	-0.971	-0.971	-0.972
T1 [ms]	2.60	2.05	1.59
A2	0	0	0
T2 [ms]	--	--	--
A3	0.971	0.971	0.972
T3 [ms]	23.95	23.95	23.9
fit error	57.17	22.40	3.32

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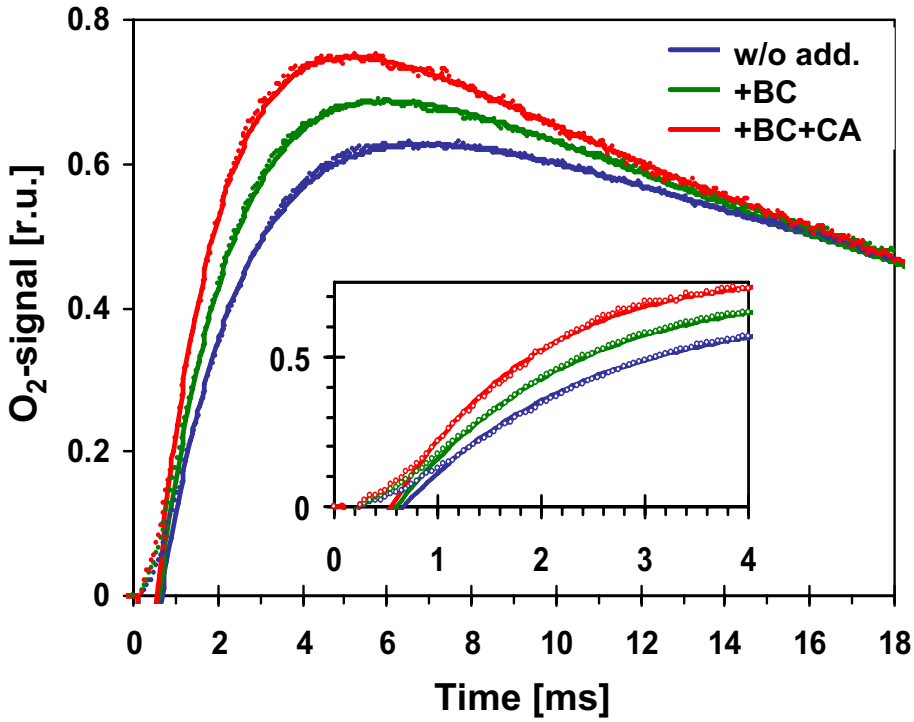

The O_2 rise was simulated by a biexponentially. For addition of both, bicarbonate and the carbonic anhydrase, a monoexponetial simulation was used.

The following function was used for simulating the O_2 transients:

$$R_{ox}(t) = A1 \exp\{-(t-\Delta T)/T1\} + A2 \exp\{-(t-\Delta T)/T2\} + A3 \exp\{-(t-\Delta T)/T3\} \quad \text{for } t > \Delta T$$

An exact modeling of the complex origin of the initial time lag was not approached.
Instead we approximated the delayed rise by a shift of the time scale by ΔT (for $t > \Delta T$).

Simulation Parameter		**mutant**	**m+BC**	**m+BC+CA**
	ΔT [ms]	0.67	0.6	0.55
	A1	-0.65	-0.81	-0.97
	T1 [ms]	1.8	1.8	1.6
	A2	-0.36	-0.15	--
	T2 [ms]	6.0	4.0	--
	A3	1.00	0.96	0.97
	T3 [ms]	23.95	23.95	23.95
	error	1.97	1.79	3.33