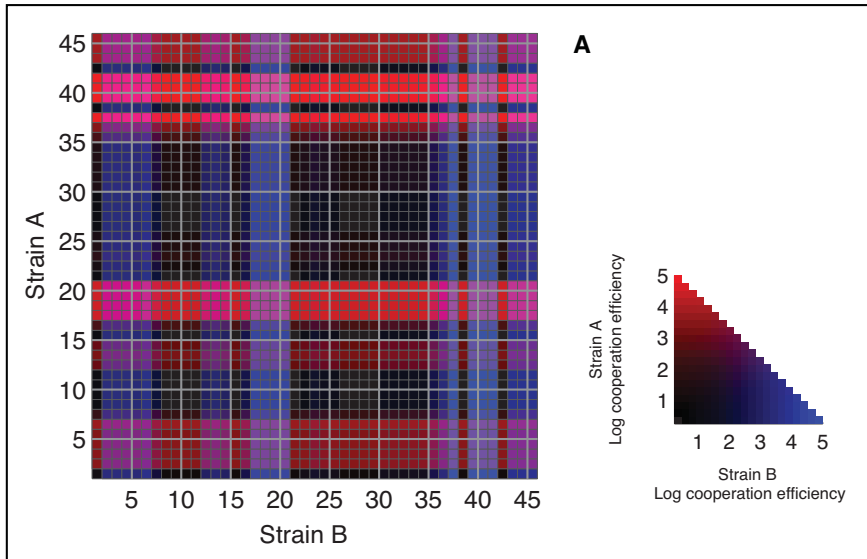


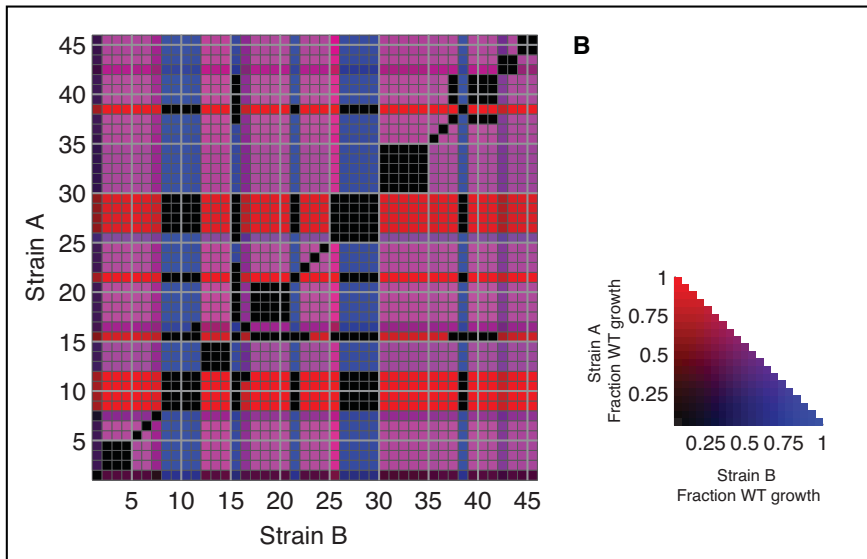
#	Mutation	#	Mutation	#	Mutation
1	<i>ppc</i>	17	<i>hisB</i>	33	<i>pyrE</i>
2	<i>argB</i>	18	<i>hisC</i>	34	<i>pyrF</i>
3	<i>argC</i>	19	<i>hisD</i>	35	<i>lysA</i>
4	<i>argE</i>	20	<i>hisI</i>	36	<i>tyrA</i>
5	<i>argH</i>	21	<i>metA</i>	37	<i>trpA</i>
6	<i>proC</i>	22	<i>guaA</i>	38	<i>trpB</i>
7	<i>icd</i>	23	<i>guaB</i>	39	<i>trpC</i>
8	<i>nadC</i>	24	<i>purA</i>	40	<i>trpD</i>
9	<i>panB</i>	25	<i>purC</i>	41	<i>trpE</i>
10	<i>panD</i>	26	<i>purD</i>	42	<i>ilvC</i>
11	<i>serC</i>	27	<i>purF</i>	43	<i>ilvE</i>
12	<i>cysC</i>	28	<i>purL</i>	44	<i>leuB</i>
13	<i>cysE</i>	29	<i>purM</i>	45	<i>leuD</i>
14	<i>cysH</i>	30	<i>pyrB</i>	46	<i>leuC</i>
15	<i>glnA</i>	31	<i>pyrC</i>		
16	<i>serA</i>	32	<i>pyrD</i>		

**Supplementary figure 1** Mutants in shared pathways have similar cooperation profiles. Red intensity corresponds to growth of the labelled row strain, blue intensity indicates growth of the numbered column strain. Fold growth is reported relative to the initial inoculation density. In most cases, correlated cooperation profiles are evident.



**Supplementary figure 2** Model predictions reflect measured synergistic growth.

**(A)** The cooperation efficiency is the ratio of the fitness benefit a strain receives from a given metabolite to the fitness cost for the conjugate partner in producing that metabolite. Cooperation efficiencies of zero are shown as black on the log scale. **(B)** Growth rates, as calculated from the joint flux model applying a MOMA-type objective function. Predicted growth rates are normalized to the FBA prediction for the wild type growth rate. Note the gaps along the diagonal reflecting the general failure of mutants in shared metabolic pathways to complement growth. The derivation of model predictions is detailed in Materials and Methods.



#	Mutation	#	Mutation	#	Mutation
1	<i>ppc</i>	17	<i>hisB</i>	33	<i>pyrE</i>
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3	<i>argC</i>	19	<i>hisD</i>	35	<i>lysA</i>
4	<i>argE</i>	20	<i>hisI</i>	36	<i>tyrA</i>
5	<i>argH</i>	21	<i>metA</i>	37	<i>trpA</i>
6	<i>proC</i>	22	<i>guaA</i>	38	<i>trpB</i>
7	<i>icd</i>	23	<i>guaB</i>	39	<i>trpC</i>
8	<i>nadC</i>	24	<i>purA</i>	40	<i>trpD</i>
9	<i>panB</i>	25	<i>purC</i>	41	<i>trpE</i>
10	<i>panD</i>	26	<i>purD</i>	42	<i>ilvC</i>
11	<i>serC</i>	27	<i>purF</i>	43	<i>ilvE</i>
12	<i>cysC</i>	28	<i>purL</i>	44	<i>leuB</i>
13	<i>cysE</i>	29	<i>purM</i>	45	<i>leuD</i>
14	<i>cysH</i>	30	<i>pyrB</i>	46	<i>leuC</i>
15	<i>glnA</i>	31	<i>pyrC</i>		
16	<i>serA</i>	32	<i>pyrD</i>		