**Table S1**. The meaning of columns in Dataset-S1-75 (see Figure 1 from the main text for the convention we used to name the microscopic rate constants). Rows in the Dataset are arranged from the highest to the lowest dissipation for enzyme-catalyzed reactions.

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| --- | --- | --- |
| *Column* | *Title* | *Explanation* |
| A | kcat/KM (Ms)-1 | Specificity constant (enzyme catalytic efficiency) |
| B | kcat (s-1) | Catalytic constant (turnover number) |
| C | Dissipation/(RT) (s-1) | Dissipation in RT units |
| D | E+S↔ES Dissipation/(RT) (s-1) | Dissipation in substrate capture-release step |
| E | EP↔E+P Dissipation/(RT) (s-1) | Dissipation in product release-capture step |
| F | KM (M-1) | Michaelis-Menten constant |
| G | Enzyme Abbreviation | Yellow background highlights engineered enzymes |
| H | Specialized**/**Generalist Enzymes | Wild-type enzymes are specialized or generalist |
| I | Enzyme Class | “Eff” or “Tur” type enzyme reactions |
| J | Full Name and EC number | Full title and EC number for each enzyme |
| K | Conformational states number | No. functionally important states in the model |
| L | Substrate Concentration (M) | Substrate name and concentration in moles |
| M | Substrate**/**Product Ratio | Product concentration from the substrate**/**product ratio |
| N | Microscopic rate constant k1 (s-1) | The second-order constant k1 multiplied with [S] |
| O | Microscopic rate constant k2 (s-1) | Rate constant for backward first transition |
| P | Microscopic rate constant k3 (s-1) | Rate constant for forward second transition |
| Q | Microscopic rate constant k4 (s-1) | Rate constant for backward second transition |
| R | Microscopic rate constant k5 (s-1) | Rate constant for forward third transition |
| S | Microscopic rate constant k6 (s-1) | Rate constant for backward third transition |
| T | Microscopic rate constant k7 (s-1) | Rate constant for forward fourth transition |
| U | Microscopic rate constant k8 (s-1) | Rate constant for backward fourth transition |
| V | Temperature (oC) | The temperature used in experiments |
| W | Force/(RT) | Force (affinity) in the RT units |
| X | J (s-1) | Net flux as a response to force |
| Y | Source Code Title | The FORTRAN program name for the reaction |
| Z | Species (organ)**/**Domain | Species name and the domain of life |
| AA | Reference | Full reference for a complete set of rate constants |
| AB | Doi Number | Green background highlights additional 5 references |
| AC | Reference citation | Authors and publication year |
| AD | Number of Identical References | Associated with the last row where reference is cited |