Supplementary Information for

Universal scaling of maximum speed with body mass - Why the largest animals are not the fastest

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Supplementary Table 1

Distribution of data across movement types and taxa.

movement mode	taxonomic group	n data points
running	arthropods	44
	birds	3
	mammals	262
	reptiles	144
flying	arthropods	19
	birds	29
	mammals	7
swimming	arthropods	1
	birds	5
	fish	81
	mammals	16
	mollusks	5
	reptiles	1

Supplementary Table 2

Distribution of data across study and publication types.

study type	nbr. of data points
field study	34
laboratory study	113
meta-study	404
unclear	66

Supplementary Table 3

ΔBIC values for comparing the seven speed models. Taxonomic groups comprise arthropods, birds, fish, mammals, mollusks, reptiles.

models	Δ BIC		
	flying	running	swimming
time-dependent model	0	0	0
polynomial	6.79	118.20	19.51
polynomial (* taxon)	17.96	15.97	24.90
polynomial (+ taxon)	8.03	78.60	18.81
power law (* taxon)	12.90	122.57	8.82
power law (+ taxon)	13.52	112.38	25.55
power law	11.95	191.66	46.48

Note that for the time-dependent model, taxon could not be directly included because of the complexity of fitting a non-linear model with four free parameters. Therefore, we conducted a residual analysis (see main text).

Supplementary Table 4

Fitted values of the time-dependent maximum speed model: parameters a, b, c and d (from Eq. 5) with standard errors and resulting equations for the different movement modes (flying, running, swimming). Body mass M in kg and speed v in km h^{-1}.

movement mode	a	b	h	i	equation
flying	144 ± 17.05	0.24 ± 0.01	2.31 ± 1.28	0.72 ± 0.25	$v_{real} = 144\, M^{0.24}(1 - e^{-2.31\, M^{0.72}})$
running	25.78 ± 0.88	0.27 ± 0.01	19.36 ± 6.33	0.6 ± 0.05	$v_{real} = 25.78\, M^{0.27}(1 - e^{-19.36\, M^{0.6}})$
swimming	10.71 ± 0.84	0.36 ± 0.02	21.2 ± 15.17	0.56 ± 0.07	$v_{real} = 10.71\, M^{0.36}(1 - e^{-21.2\, M^{0.56}})$

Supplementary Table 5

References for the masses and speed predictions of Table 1 in the main text.

species	mass	power law	reference morphological model	time-dependent model
Dromaius	(23)	*	(23)	+
Struthio	(23)	*	(23)	+
Patagornis	(23)	*	(31)	+
Velociraptor	(23)	*	(23)	+
Allosaurus	(23)	*	(23)	+
Tyrannosaurus	(23)	*	(23)	+
Triceratops	(24)	*	(24)	+
Apatosaurus	(24)	*	(24)	+
Brachiosaurus	(24)	*	(24)	+

* prediction from a power law (equ. 1)

[+] prediction from our model (equ. 5)