

Supplementary information

The neural mechanisms of manual dexterity

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SUPPLEMENTARY INFORMATION

Table 1. Muscles important for actuating wrist joint^{1,2}. Extrinsic: 11 (12 MTUs), intrinsic: 1 (1).

Name	Notes
<i>Flexor Carpi Ulnaris</i>	Flexion and ulnar deviation (adduction, towards pinky).
<i>Flexor Carpi Radialis</i>	Flexion and radial deviation (abduction, towards index).
<i>Extensor Carpi Ulnaris</i>	Extension and ulnar deviation.
<i>Extensor Carpi Radialis Longus</i>	Extension and radial deviation.
<i>Extensor Carpi Radialis Brevis</i>	Extension and radial deviation.
<i>Palmaris Longus</i>	Flexor, lacks in 5-64% of population depending on nationality, lies outside of carpal tunnel ^{3,4} .
<i>Palmaris Brevis</i>	Located in hand, protects ulnar nerve and artery from compression.
<i>Biceps Brachii</i>	Elbow-crossing strongest supinator with two heads, does not cross carpus.
<i>Brachioradialis</i>	Elbow-crossing, rotates the wrist to neutral from pronated and supinated positions.
<i>Supinator</i>	Proximal on forearm, does not cross carpus.
<i>Pronator Teres</i>	Proximal on forearm, does not cross carpus.
<i>Pronator Quadratis</i>	Distal on forearm, does not cross carpus.

Table 2. Muscles mainly actuating fingers 2-5^{1,2}. Pinky finger muscles ODM, FDM and ADM form hypothenar eminence. Extrinsic: 5 (14), intrinsic: 14 (14).

Name	Notes
<i>Flexor Digitorum Superficialis</i>	Extrinsic, head for each finger, attaches at middle phalanx. Two proximal heads, attaching to radius on one side and ulna with humerus on the other.
<i>Flexor Digitorum Profundus</i>	Extrinsic, head for each finger, attaches at distal phalanx.
<i>Extensor Digitorum</i>	Extrinsic, heads for each finger with interconnected tendons.
<i>Extensor Digiti Minimi</i>	Extrinsic, extends pinky finger.
<i>Extensor Indicis</i>	Extrinsic, extends index finger.
4 <i>Lumbricales</i>	Intrinsic, 4 muscles on the palmar side. Connect 2 tendons: FDP tendon and extensor expansion sheath.
4 <i>Dorsal Interossei</i>	Intrinsic, 4 muscles. Attach to metacarpal, proximal phalanx and extensor expansion sheath. Abduct fingers (away from middle finger).
3 <i>Palmar Interossei</i>	Intrinsic, 3 muscles, attach to extensor expansion sheath of 2 nd , 4 th

	and 5 th fingers. Adduct fingers (towards middle finger).
<i>Opponens Digiti Minimi</i>	Intrinsic, actuates pinky finger.
<i>Flexor Digiti Minimi</i>	Intrinsic, actuates pinky finger.
<i>Abductor Digiti Minimi</i>	Intrinsic, actuates pinky finger.

Table 3. Muscles mainly actuating thumb^{1,2}. FPB, FBP2, APB, OP, AP and APA form thenar eminence. Extrinsic: 4 (4), intrinsic: 6 (7).

Name	Notes
<i>Extensor Pollicis Longus</i>	Extrinsic.
<i>Extensor Pollicis Brevis</i>	Extrinsic, present in humans, gibbons, and bonobos.
<i>Flexor Pollicis Longus</i>	Extrinsic, present in humans, gibbons, and bonobos.
<i>Abductor Pollicis Longus</i>	Extrinsic.
<i>Flexor Pollicis Brevis</i>	Intrinsic.
<i>Flexor Brevis Profundus 2</i>	Intrinsic, deep head of <i>flexor pollicis brevis</i> .
<i>Abductor Pollicis Brevis</i>	Intrinsic.
<i>Opponens Pollicis</i>	Intrinsic.
<i>Adductor Pollicis</i>	Intrinsic, two heads: transverse and oblique.
<i>Adductor Pollicis Accessorius</i>	Intrinsic, first <i>palmar interosseus</i> , also called <i>interosseus volaris primus of Henle</i> . Absent in some people ^{5,6} .

REFERENCES

1. Diogo, R. & Wood, B. A. *Comparative Anatomy and Phylogeny of Primate Muscles and Human Evolution*. (Oxford: Taylor and Francis, 2012).
2. Lemelin, P. & Diogo, R. Anatomy, Function, and Evolution of the Primate Hand Musculature. in *The Evolution of the Primate Hand* (eds. Kivell, T. L., Lemelin, P., Richmond, B. G. & Schmitt, D.) (2016).
3. Sebastin, S. J., Lim, A. Y. T., Bee, W. H., Wong, T. C. M. & Methil, B. V. Does the absence of the palmaris longus affect grip and pinch strength? *Journal of Hand Surgery* **30**, 406–408 (2005).
4. Sebastin, S. J., Puhaindran, M. E., Lim, A. Y. T., Lim, I. J. & Bee, W. H. The prevalence of absence of the palmaris longus - A study in a Chinese population and a review of the literature. *Journal of Hand Surgery* **30**, 525–527 (2005).
5. Susman, R. S., Nyati, L. & Jassal, M. S. Observations on the pollical palmar interosseous muscle (of Henle). *The Anatomical Record* **254**, 159–165 (1999).
6. Bello-Hellegouarch, G. *et al.* “Pollical palmar interosseous muscle” (musculus adductor pollicis accessorius): Attachments, innervation, variations, phylogeny, and implications for human evolution and medicine. *Journal of Morphology* **274**, 275–293 (2013).