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Supplementary Materials for

3D architecture and a bicellular mechanism of touch detection in mechanosensory corpuscle

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Figs. S1 to S7
Table S1
Legends for movies S1 to S5

Other Supplementary Material for this manuscript includes the following:

Movies S1 to S5

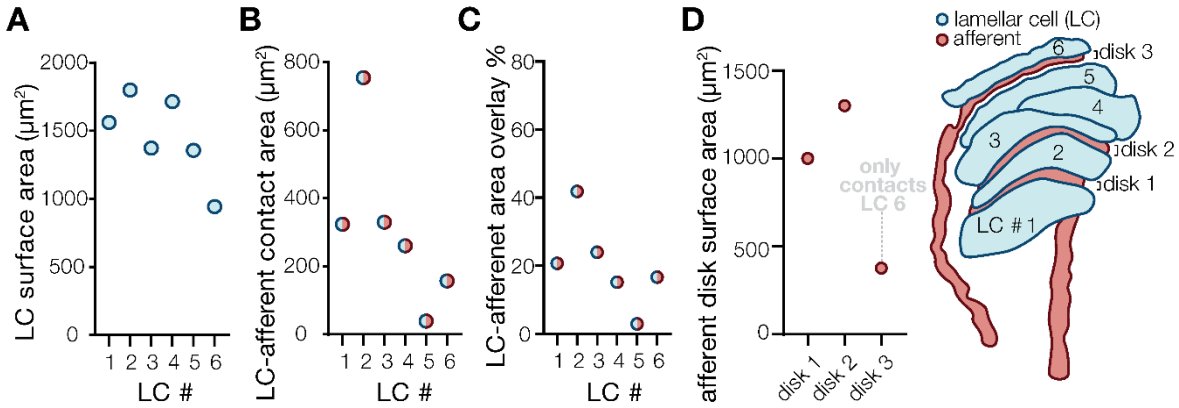

Fig. S1. Quantification of lamellar cell – afferent contact area. (A) Quantification of the surface area of lamellar cells in a reconstituted avian Meissner corpuscle. **(B**) Quantification of LC surface area in contact with the afferent. **(C)** Quantification of the portion of LC surface area in contact with afferents. **(D)** Quantification of afferent disk area in contact with LCs. The cartoon depicts a dually innervated corpsucle.

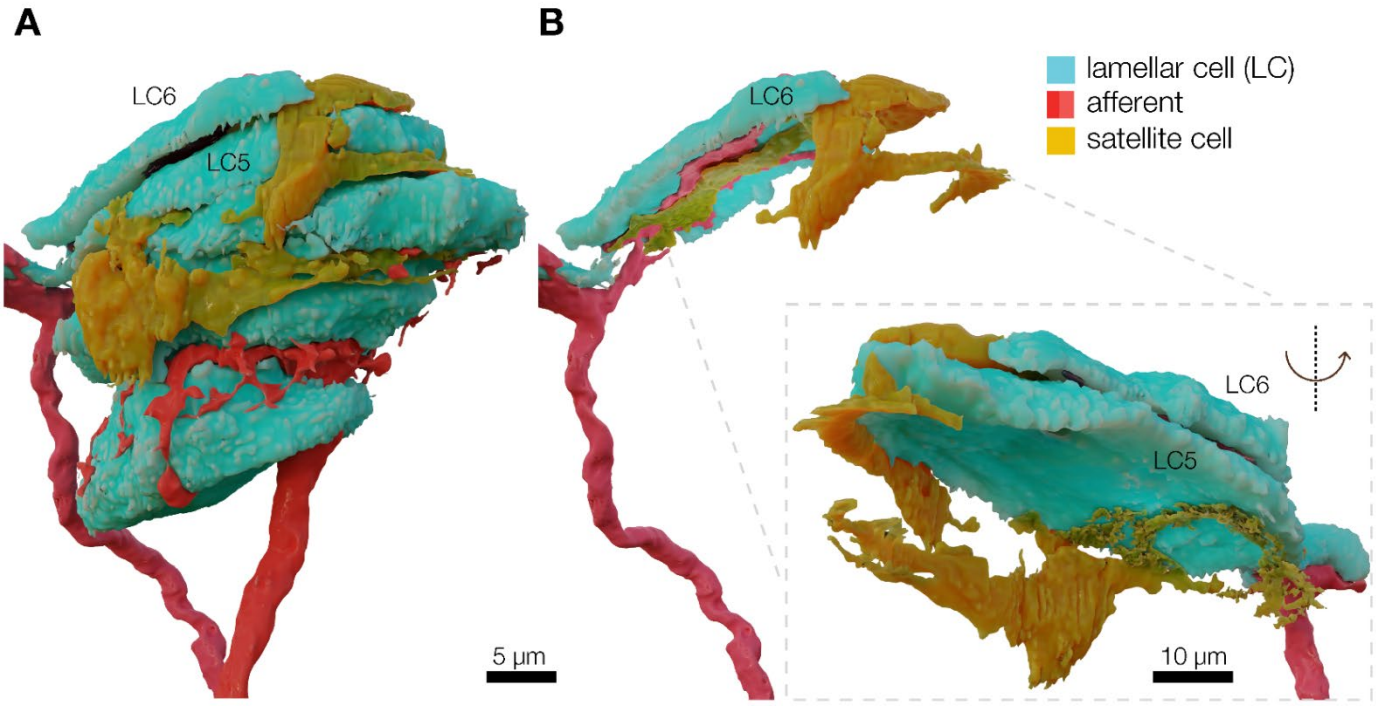

Fig. S2. Three-dimensional image of a satellite cell penetrating the core of avian Meissner corpuscle. (A) 3D reconstitution of the corpuscle core with a satellite cell. **(B)** Isolated 3D images of satellite cell projections relative to LCs and the afferent.

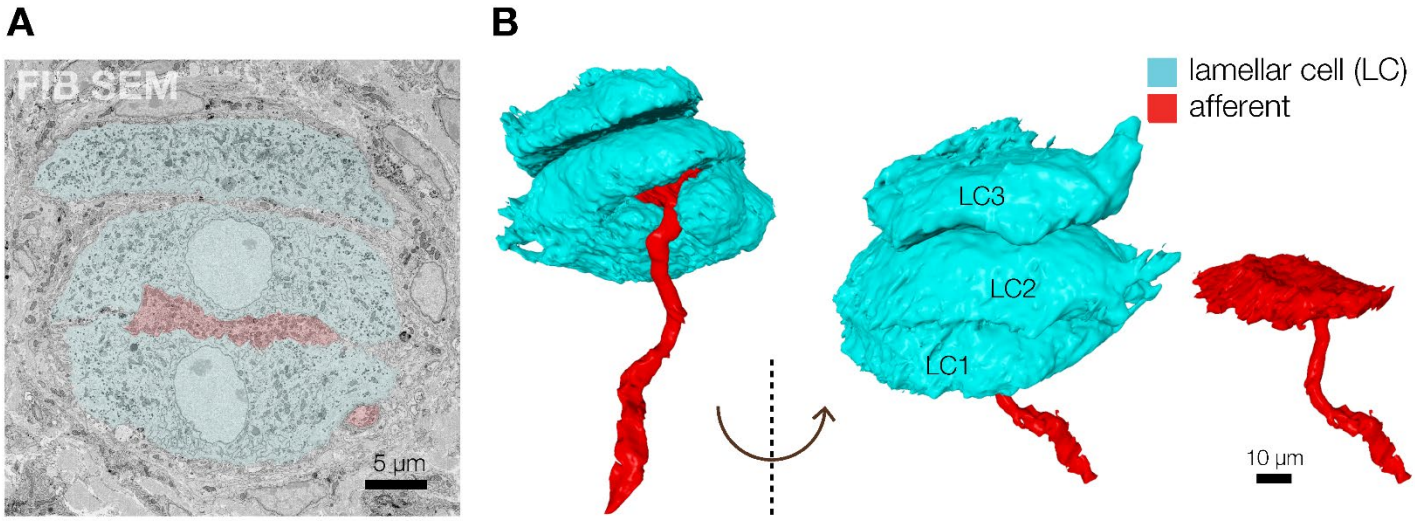

Fig. S3. Three-dimensional image of an avian Meissner corpuscle innervated by a single afferent. (A) A pseudo-colored FIB-SEM image of a section of a Meissner corpuscle in duck bill skin with three LCs (blue) innervated by a single afferent (red). **(B)** Partial 3D reconstruction of a Meissner corpuscle core (without satellite cells) innervated by a single afferent. The afferent (red) forms a single disc positioned between LC1 and LC2 (blue).

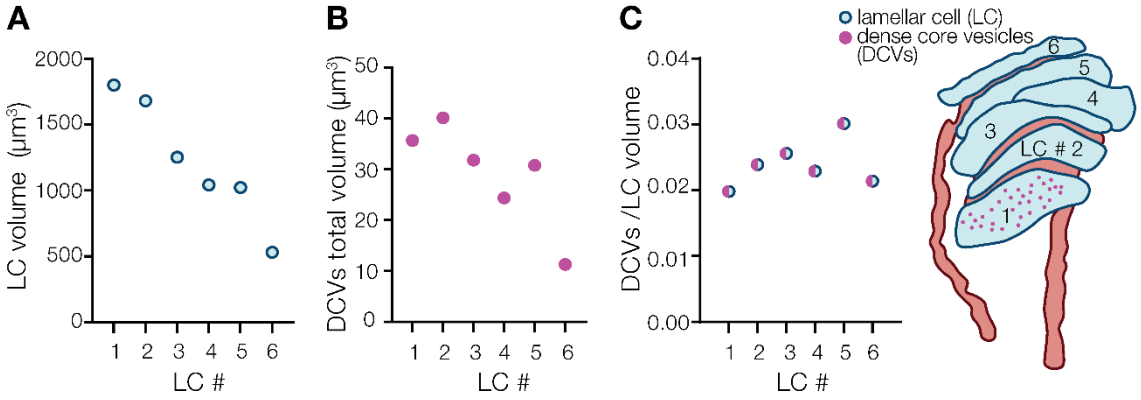

Fig. S4. Quantification of dense core vesicle size and volume. (A) Quantification of the lamellar cell volume. **(B)** Quantification of the volume occupied by dense core vesicles (DCV) in lamellar cells (LC). **(C)** Quantification of total DCV volume per LC. The cartoon depicts a dually innervated corpsucle.

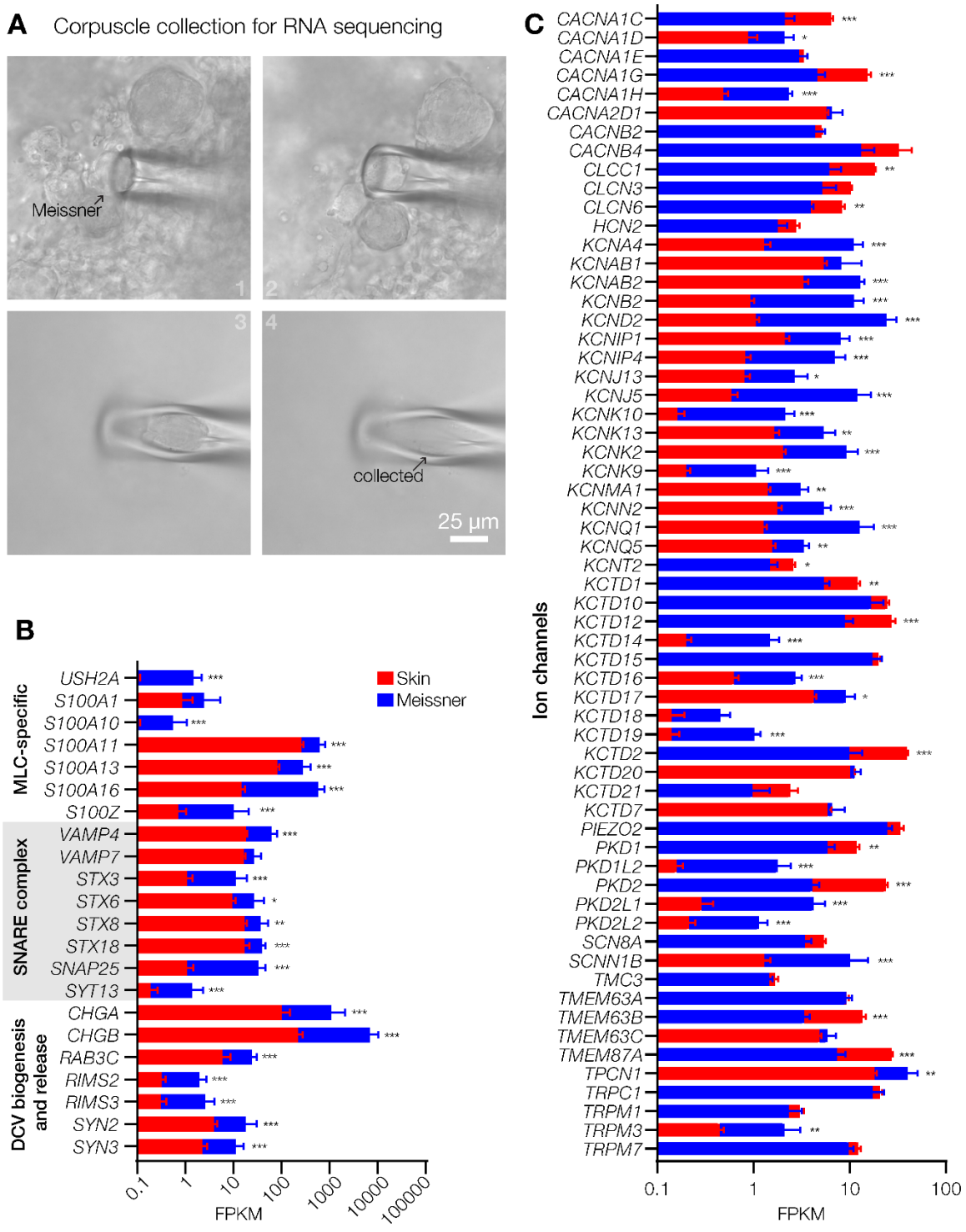

Fig. S5. RNA-sequencing of avian Meissner corpuscles. (A) Images of a Meissner corpuscle in the process of extraction from duck bill skin into a glass pipette for RNA sequencing. **(B, C)** Quantification of transcript levels in Meissner corpuscles and adjacent skin areas. Data are mean ± SEM from 6 corpuscles and 5 skin samples. FPKM, fragments per kilobase of exon per million mapped fragments. Statistics: quasi-likelihood F-test, **P* < 0.05, ***P* < 0.01, ****P* < 0.001.

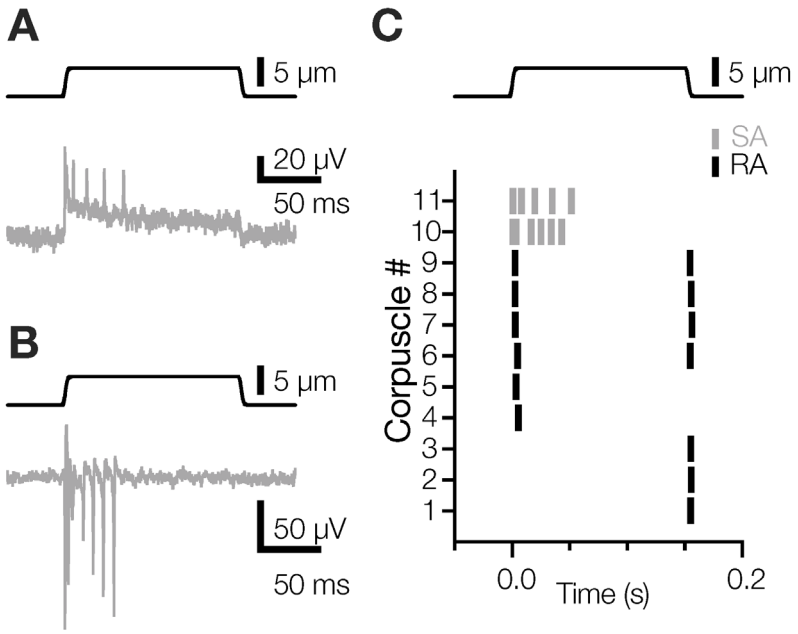

Fig. S6. Slowly and rapidly adapting responses in the afferents from avian Meissner corpuscles. (A, B) Recordings of action potentials in the afferent in response to mechanical stimulation. **(C)** Raster plot of two slowly adapting afferents (SA) and representative rapidly afferents (RA) from different corpuscles in response to mechanical stimulation.

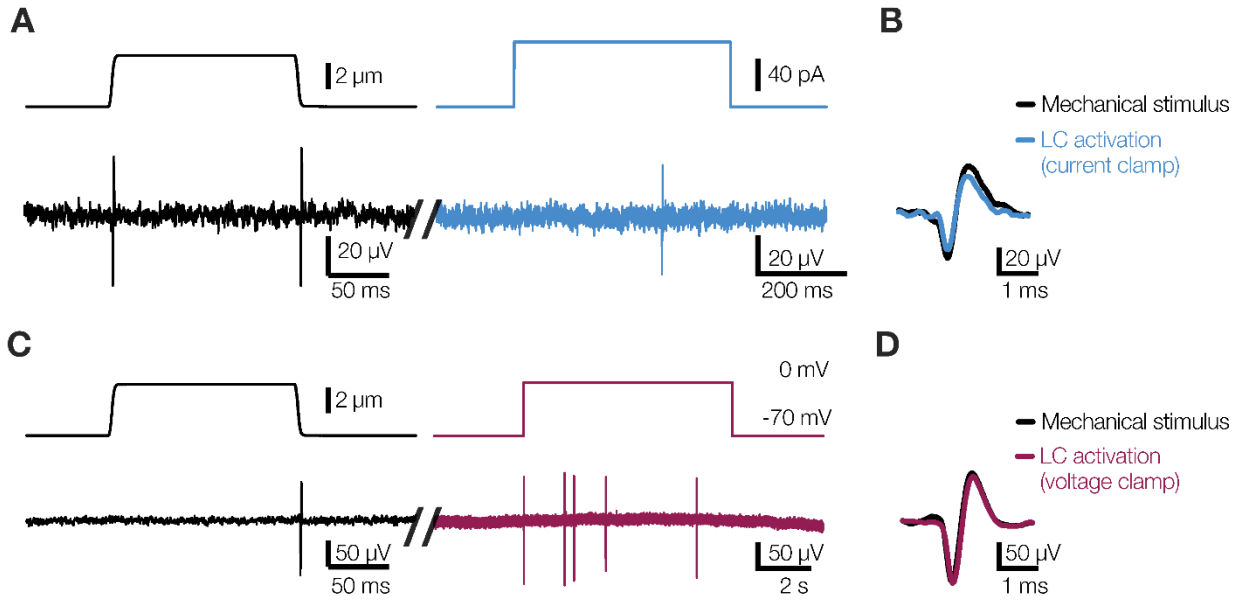

Fig. S7. Action potentials evoked in the afferent by mechanical stimulation or electrical activation of a single LC are indistinguishable. (A) Exemplar traces recorded in a Meissner afferent in response to mechanical stimulation of the corpuscle (left) or LC activation by current injection in the current clamp mode (right). **(B)** Overlay of APs evoked by mechanical stimulation or LC activation by current injection. **(C)** Exemplar traces recorded in a Meissner afferent in response to mechanical stimulation of the corpuscle (left) or LC activation by depolarization in the voltage clamp mode (right). **(D)** Overlay of APs evoked by mechanical stimulation or LC activation by depolarization.

Supplementary Table I. Accuracy statistics of FIB-SEM data segmentation for a Meissner corpuscle innervated by two afferents.

Object	IoU*	F1 score
Afferents	0.67	0.80
DCVs	0.80	0.89
Lamellar cells	0.99	0.99
Satellite cells	0.97	0.98
Collagen	0.94	0.97

**Intersection over Union*

Movie S1. 3D architecture of a duck Meissner corpuscle innervated by two afferents obtained using FIB-SEM.

Movie S2. 3D architecture of a duck Meissner corpuscle innervated by two afferents obtained using FIB-SEM. This is a non-rendered movie version depicting dense core vesicles (dark blue) inside lamellar cells.

Movie S3. An image stack of a fragment of lamellar cell-afferent contact area obtained by transmission electron microscopy tomography. The video shows a cross-section of the afferent disk sandwiched between two dense core vesicle-containing lamellar cells.

Movie S4. 3D reconstruction of a fragment of lamellar cell-afferent contact area obtained by transmission electron microscopy tomography. Shown are mitochondria (yellow), dense core vesicles (red), lamellar cell membrane (dark blue), afferent membrane (purple), clear vesicles (light blue), caveolae (green), membrane densities resembling adherens junctions (orange).

Movie S5. A close-up 3D reconstruction of a fragment of lamellar cell-afferent contact area obtained by transmission electron microscopy tomography, depicting fusing dense core vesicles, a caveolae, and tethers connecting lamellar cell and afferent membranes.