Supplementary information

In vivo imaging of coral tissue and skeleton with optical coherence tomography

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Supplementary figures

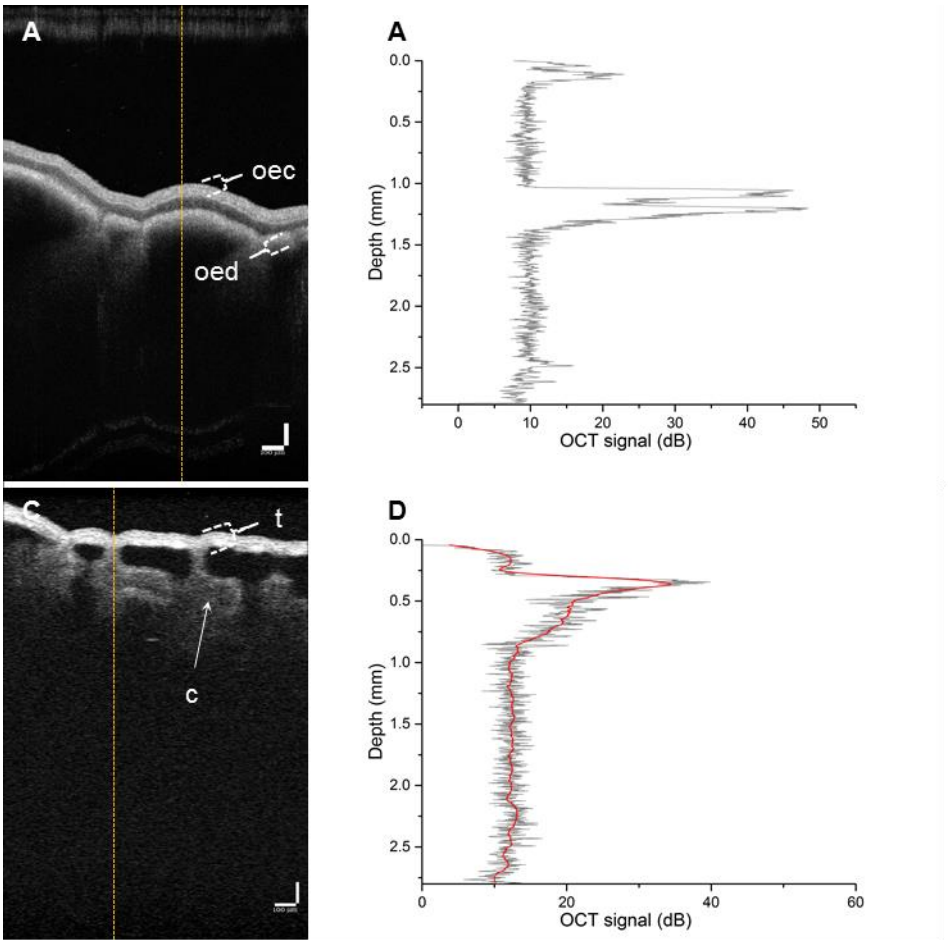


Fig. S1: OCT B-scan and corresponding axial depth profile (A-scan) of the thick tissued coral *Favites abita* (**A, B**) and the thin-tissued *Acropora aspera* (c,d). The vertical orange dotted line in panel **A** and **C** correspond to the axial scan in panel b and d, respectively. The B-scan visualizes the oral ectoderm (oec) and the oral endoderm (oed) of *Favites abita*. Data for *Acropora aspera* was smoothed

(solid red line) in Origin 9.1 (Originlab, Northhampton, USA) using the Savitzky-Golay smoothing function with a 62 point window. The B-scan identifies the entire tissue (t) and skeletal channels (c).

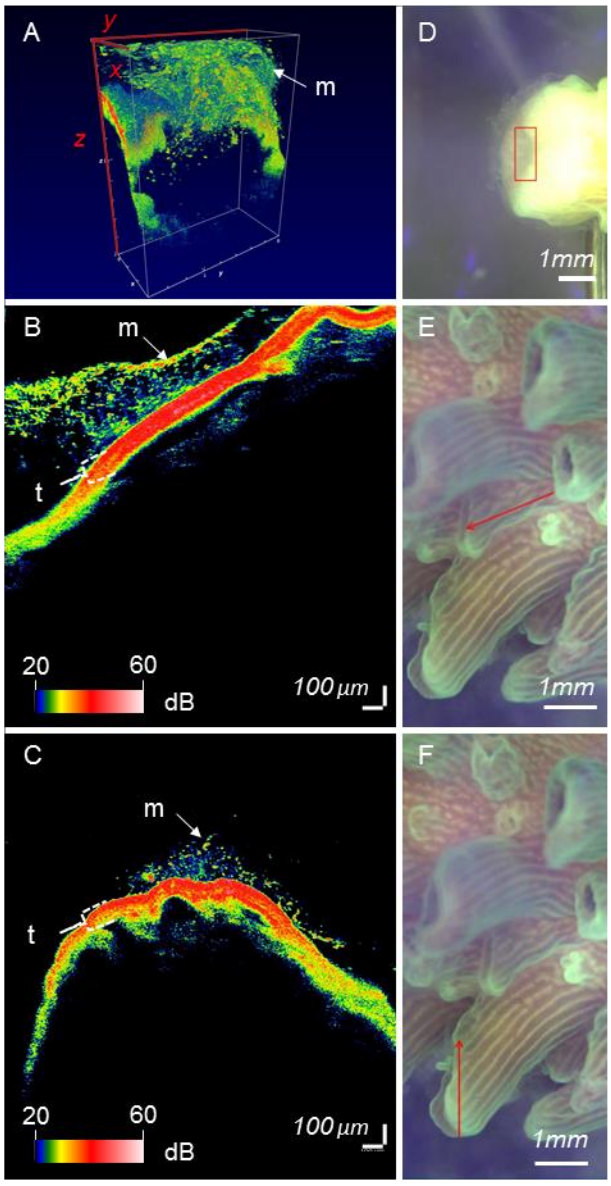


Fig. S2: Additional examples of mucus release by the coral *Acropora aspera*. OCT scans shown in A,B,C correspond to imaged areas and sections shown in D,E,F as indicated by red frame/arrows. The field of view of the 3D scan was x=0.7 mm , y=1.6 mm and z=2.8 mm. Note that any light scattering

particles trapped within the mucus will also be imaged by OCT, and might thus affect the quantification of mucus secretion.

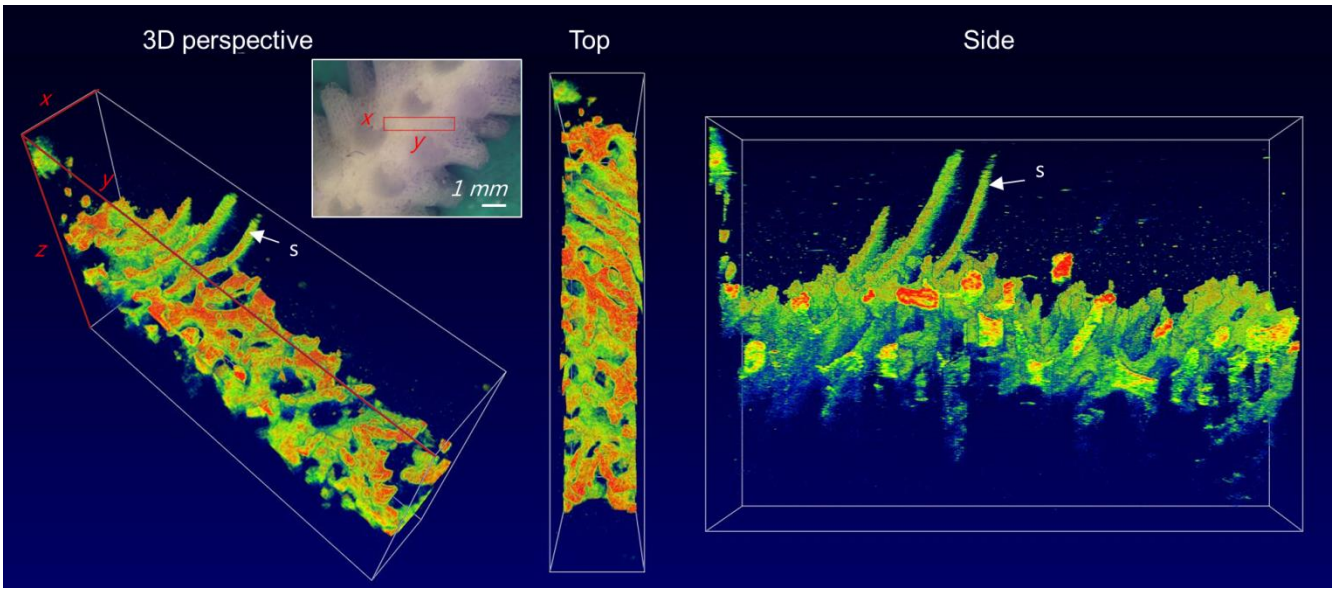
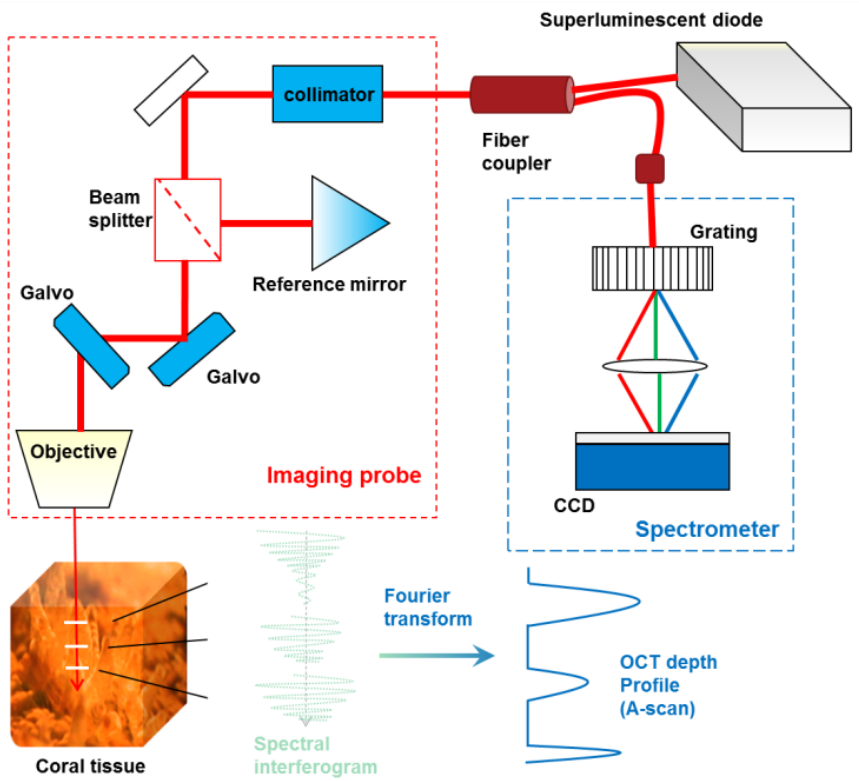


Fig. S3: Three-dimensional OCT imaging of exposed naked skeleton of the coral *Acropora pulchra*. The scanned dimension were *x*= 0.6mm, *y*= 3.1mm and *z*= 2.8 mm. The scan covers the coenosteum of a single branch and visualizes spinules (s) extruding as digitate structures from the branchlet.



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42 **Fig. S4. Principle of spectral-domain optical coherence tomography.** The super luminescent diode
43 provides broadband low coherent near infrared radiation (930 nm). Light is emitted through the fiber
44 and send to the imaging probe, which works like a modified Michelson interferometer. The beam
45 splitter sends light to the retro-reflecting prism (reference mirror) and the sample beam which is
46 focused by the scanning objective before it interacts with the coral tissue. Reflective boundaries within
47 the coral tissue (white lines) scatter light back to the imaging probe where, reference light and sample
48 light are combined and send to the spectrometer. A diffraction grating creates a characteristic spectral
49 interferogram (Fourier-domain signal), which is converted to an OCT depth profile of reflectivity along
50 the z-axis (A-scan) via Fourier transform. Two-dimensional (OCT B-scan) and three-dimensional
51 (OCT C-scan) tomographs are sampled by moving the sample beam within the imaging probe along the
52 *x* and *y* axis by a galvanometer system.

Supplementary Movie 1. Video animation of 3D optical coherence tomography rendering of a single coral polyp (*Favites abdita*). The rendering visualizes the convoluted surface topograph. The false color coding represents the intensity of the uncalibrated OCT signal, which was manually adjusted for to optimize visualization of structural features. The red areas identify the GFP granule containing chromatophore system. (https://www.youtube.com/watch?v=P1IpCwjzZOc)

Supplementary Movie 2. Video animation of 2D optical coherence tomography scanning of the release of coral mucus. Slight water movement in the experimental aquarium allowed for visualizing the movement of sheath like mucus structures adjacent to the surface of the coral *Acropora aspera*. **(**https://www.youtube.com/watch?v=NR2GdiFsA-0**)**

Supplementary Movie 3: Video animation of 2D optical coherence tomography scanning revealing coral tissue contraction following high light stimulation. The video shows the tissue of a *Favites abdita* polyp in cross-sectional view (monochrome mode). The white circle added in surface detection and subsequent linear velocity estimates of coral tissue (playback speed: 3x). https://www.youtube.com/watch?v=ABRb8wk68n0

Additional movies can be found online:

https://www.youtube.com/channel/UCRXl_vkyIpG45SKgm79ff2w