S1: Composition of the test media according to DIN EN ISO 6341:2013-01 protocol.

pH adjusted to 7.00 ± 0.2. Salinity did not exceed 0.585 ppt.

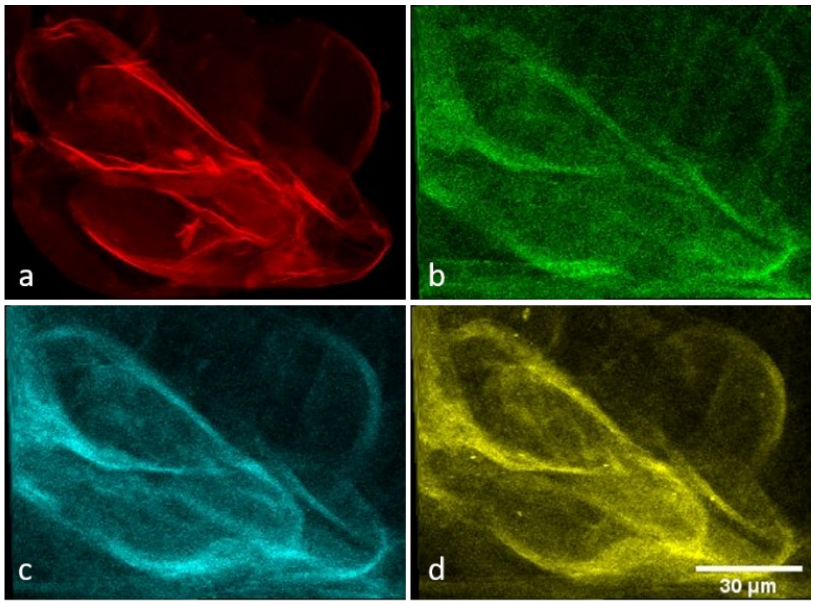
Cations	Ligands
Ca^{2+} = 79,38 mg L^{-1}	SO_4^{2-} = 48 mg L^{-1}
Mg^{2+} = 12 mg L^{-1}	Cl^{-1} = 313 mg L^{-1}
Na^{+} = 17,48 mg L^{-1}	
K^{+} = 2,99 mg L^{-1}	

S2: La and Gd forms (mg L^{-1}) after equilibrium according Visual MINTEQ speciation modelling.

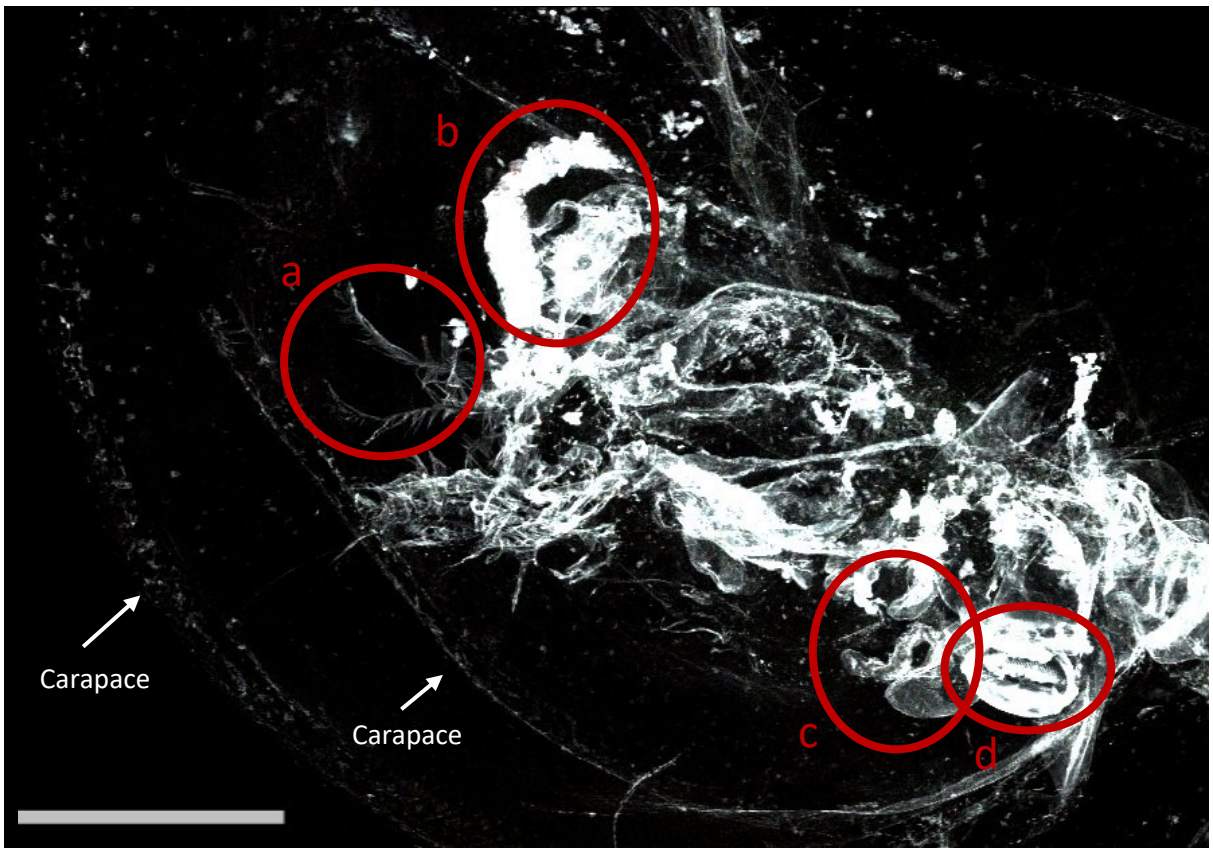
Nominal concentrations (mg L^{-1})		5	10	15	20	25	30
La	**% dissolved**	**17.10**	**8.55**	**5.70**	**4.27**	**3.42**	**2.85**
La dissolved forms (mg L^{-1})	$La(CO_3)_2^-$	6.00E-05	6.00E-05	6.00E-05	6.00E-05	6.00E-05	6.00E-05
	$La(SO_4)_2^-$	0.01	0.01	0.01	0.01	0.01	0.01
	La^{+3}	0.55	0.55	0.55	0.55	0.55	0.55
	$LaCl^{+2}$	0.01	0.01	0.01	0.01	0.01	0.01
	$LaCO_3^+$	0.05	0.05	0.05	0.05	0.05	0.05
	$LaHCO_3^{+2}$	0.01	0.01	0.01	0.01	0.01	0.01
	$LaOH^{+2}$	0.01	0.01	0.01	0.01	0.01	0.01
	$LaSO_4^+$	0.42	0.42	0.42	0.42	0.42	0.42
La solid form (mg L^{-1})	$La_2(CO_3)_{3(s)}$	6.83	15.07	23.31	31.55	39.79	48.03

Nominal concentrations (mg L^{-1})		5	10	15	20	25	30
Gd	**% dissolved**	**100**	**100**	**96.17**	**72.13**	**57.70**	**38.39**
Gd dissolved forms (mg L^{-1})	$Gd(CO_3)_2^-$	4.22E-03	0.01	0.01	0.01	0.01	0.01
	$Gd(SO_4)_2^-$	0.02	0.05	0.07	0.07	0.07	0.07
	Gd^{+3}	2.73	5.48	7.94	7.94	7.94	7.94
	$GdCl^{+2}$	0.03	0.06	0.09	0.09	0.09	0.09
	$GdCO_3^+$	1.00	2.00	2.89	2.89	2.89	2.89
	$GdHCO_3^{+2}$	0.03	0.06	0.08	0.08	0.08	0.08
	$GdOH^{+2}$	0.25	0.51	0.73	0.73	0.73	0.73
	$GdSO_4^+$	2.04	4.02	5.73	5.73	5.73	5.73
Gd solid form (mg L^{-1})	$Gd_2(CO_3)_{3(s)}$	0.00	0.00	0.90	8.76	16.63	24.49

S3: Element map detail of internal structure (circle in Figure 2c) in D. magna exposed to 15 mg L-1 of La for 72 h. Beamline: NANOSCOPIUM. Incident energy of 17.02 keV, pixel size of 0.4 μm and integration time of 100 ms. (a) La (b) S (c) Zn (d) Fe.



S4: Distribution of Gd in organism of figure 2e (exposed to 15mg L^{-1} of Gd for 48h). Area selected: a. Filtering setae, b. intestine, c. shell gland, d. articulation of the antenna. Scale: 200 µm. Beamline: NANOSCOPIUM. Incident energy of 17.02 keV, pixel size of 1 µm, integration time of 20 ms.

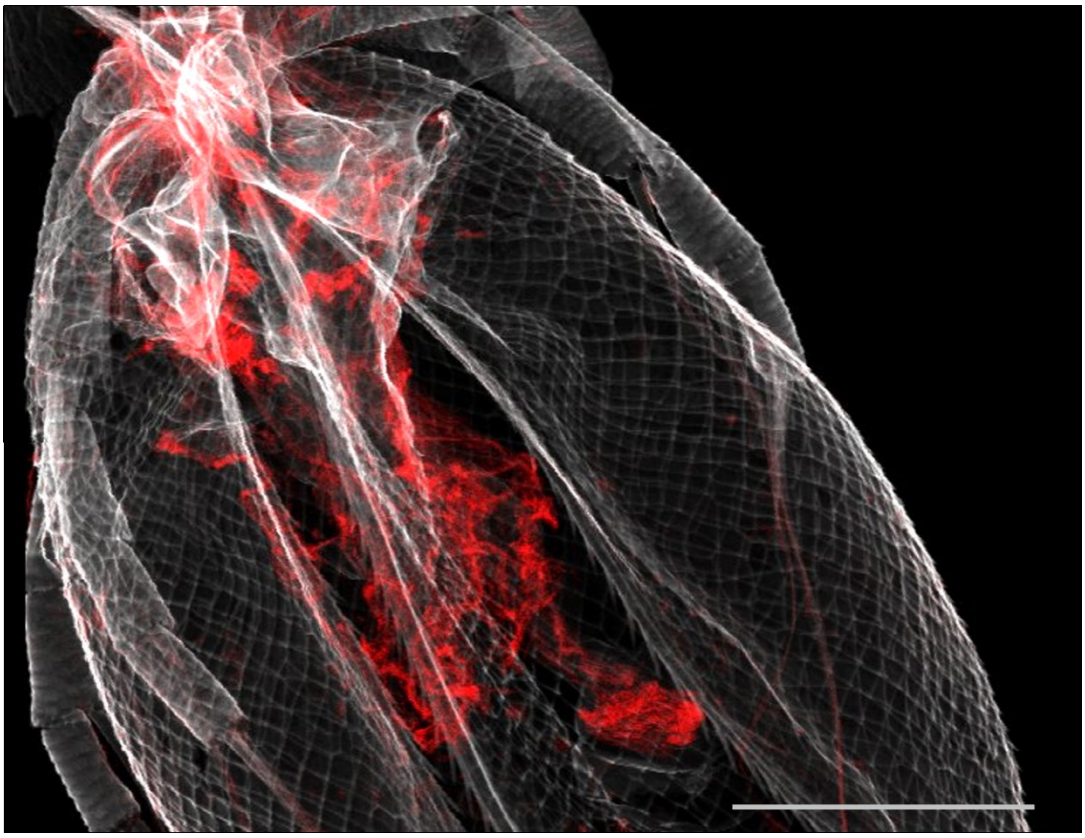


S5: Visualization of the intestinal tract with Compton images. Scale: 200 µm. Beamline: NANOSCOPIUM. Incident energy of 17.02 keV, pixel size of 1 µm, integration time of 20 ms.

S6: Normalized intensity of La and Gd measured in the total organisms and in the intestinal tract. Beamline: NANOSCOPIUM. Incident energy of 17.02 keV. N.A. : not available

	Total intensity	Intensity in the intestinal tract
15 mg L^{-1} La for 48 h (Figure 2a)	1897	1399
15 mg L^{-1} La for 72 h (Figure 2b)	1783	1396
15 mg L^{-1} La for 72 h (Figure 2c)	1671	1359
15 mg L^{-1} Gd for 48 h (Figure 2d)	290	N.A.
15 mg L^{-1} Gd for 48 h (Figure 2e)	233	N.A.
15 mg L^{-1} Gd for 72 h (Figure 2f)	1379	N.A.

S7: Distribution of Gd in organism of figure 2d viewed from the front. Grey: calcium and red: gadolinium. Scale: 200 µm. Beamline: NANOSCOPIUM. Incident energy of 17.02 keV, pixel size of 1 µm, integration time of 20 ms.



S8: Ratio between Ln and Ca intensity for different organisms at 48 and 72h. Beamline: LUCIA. Incident energy of 7.25 keV.

Organisms		La/Ca	Gd/Ca
Control	48 h	1.07E-06	2.55E-03
Control	48 h	1.92E-04	4.35E-04
Control	48 h	2.95E-04	3.93E-04
Control	48 h	2.68E-05	5.75E-05
Control	72 h	4.56E-04	1.48E-05
Control	72 h	8.76E-06	3.17E-04
Control	72 h	2.76E-07	9.18E-05
Control	72 h	3.03E-05	1.10E-04
Gd	48 h	1.07E-06	**4.59E-01**
Gd	48 h	1.92E-04	**9.71E-01**
Gd	72 h	4.56E-04	**1.41E+01**
La	48 h	**6.17E-02**	2.55E-03
La	48 h	**1.62E-01**	4.35E-04
La	72 h	**2.29E-01**	1.48E-05