Stretching of capsules in an elongation flow, a route to constitutive law
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Supplementary material 1:
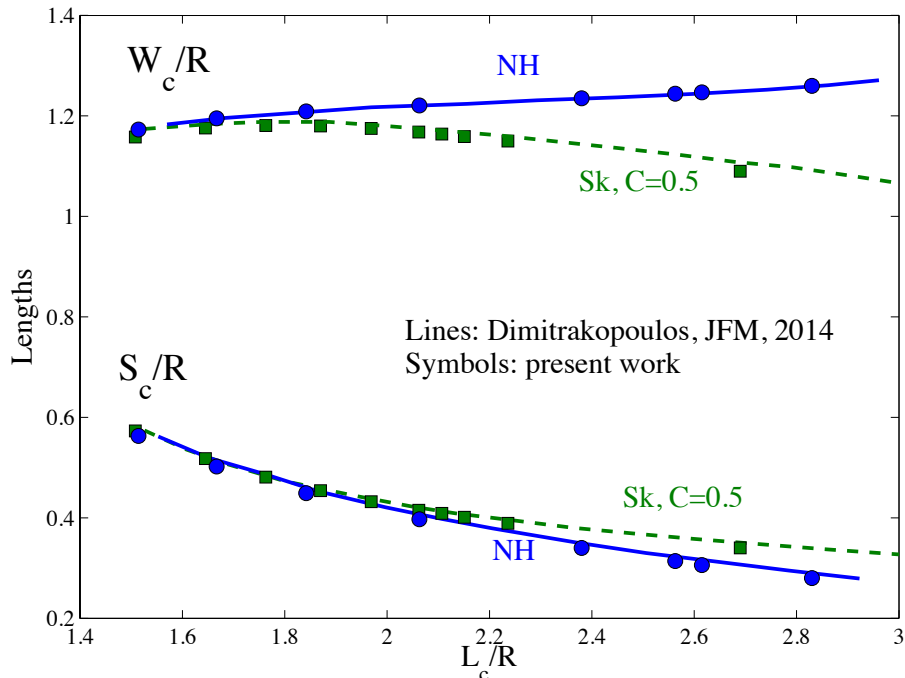**Numerical comparisons with previous works**

Figure S1: Variations of S_c/R and W_c/R as a function of L_c/R for neo-Hookean (NH) and Skalak (Sk, C=0.5) models. Our numerical results (squares for Sk, circles for NH) are compared with the curves (dashed line for Sk, continuous line for NH) of Dimitrakopoulos (2014). Lengths are calculated from the tensor of inertia (subscript c).
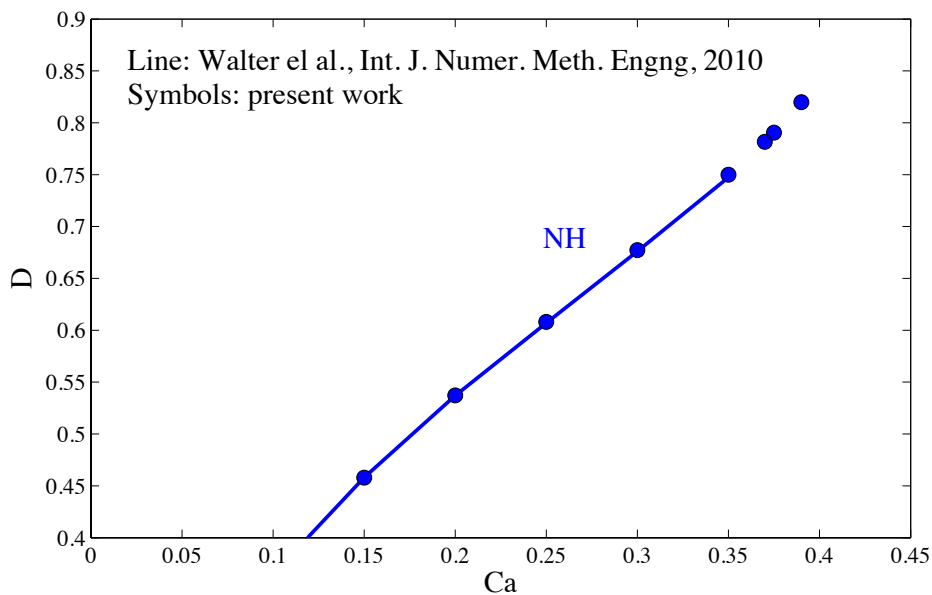

Figure S2: Variations of D as a function of Ca for the neo-Hookean (NH) model. Our numerical results (circles) are compared with the curve of Walter *et al.* (2010).

Supplementary material 2:
Numerical simulations of the deformation for a capsule
in a planar elongational flow for various constitutive laws

Geometrical characteristics of the capsule :
R :   Radius of the capsule
L, S, W :   Real semi-lengths of the ellipsoid
L_c, S_c, W_c :   Semi-lengths of the ellipsoid calculated from the tensor of inertia

Capillary number Ca :
Ca $= \eta * \varepsilon * R / G_s$
with η the viscosity, ε the rate of the elongation flow and G_s the surface elastic shear modulus of the capsule

Numerical simulations :
In the following arrays, the characteristic lengths of the capsule are provided as a function of the capillary number Ca. These values are used in the figures S1 and S2 of the supplementary material 1.

Neo-Hookean model

Ca	L_c/R	S_c/R	W_c/R	L/R	S/R	W/R
0.15	1.514	0.563	1.173	1.527	0.574	1.187
0.2	1.667	0.502	1.195	1.681	0.511	1.205
0.25	1.842	0.449	1.209	1.857	0.455	1.218
0.3	2.063	0.397	1.221	2.078	0.402	1.229
0.35	2.38	0.34	1.235	2.395	0.344	1.242
0.37	2.563	0.314	1.244	2.579	0.317	1.251
0.375	2.615	0.306	1.247	2.633	0.31	1.254
0.39	2.83	0.28	1.26	2.845	0.283	1.266

Skalak model, C=0.25

Ca	L_c/R	S_c/R	W_c/R	L/R	S/R	W/R
0.25	1.624	0.509	1.21	1.632	0.516	1.229
0.3	1.695	0.483	1.223	1.703	0.49	1.241
0.35	1.76	0.461	1.233	1.769	0.467	1.249
0.4	1.822	0.443	1.241	1.831	0.449	1.256
0.45	1.88	0.427	1.247	1.89	0.433	1.26
0.5	1.935	0.415	1.25	1.95	0.42	1.265
0.55	1.99	0.401	1.254	2.002	0.407	1.266
0.6	2.043	0.39	1.256	2.055	0.396	1.268
0.7	2.143	0.372	1.257	2.157	0.377	1.268
0.8	2.238	0.356	1.255	2.254	0.361	1.266
0.9	2.329	0.343	1.252	2.348	0.348	1.263
1	2.41	0.33	1.25	2.44	0.34	1.26
1.5	2.8	0.29	1.22	2.85	0.3	1.23

Skalak model, C=0.5

Ca	L_c/R	S_c/R	W_c/R	L/R	S/R	W/R
0.2	1.508	0.573	1.158	1.515	0.579	1.17
0.3	1.645	0.518	1.176	1.655	0.524	1.185
0.4	1.763	0.481	1.181	1.776	0.486	1.19
0.5	1.87	0.454	1.18	1.886	0.459	1.188
0.6	1.969	0.432	1.175	1.989	0.437	1.183
0.7	2.062	0.415	1.168	2.087	0.42	1.176
0.75	2.107	0.409	1.164	2.135	0.414	1.172
0.8	2.151	0.401	1.159	2.181	0.406	1.168
0.9	2.236	0.389	1.15	2.271	0.394	1.159
1.5	2.69	0.34	1.09	2.77	0.35	1.1

Generalized Hooke model, ν_s=0.3

Ca	L_c/R	S_c/R	W_c/R	L/R	S/R	W/R
0.25	1.584	0.536	1.179	1.586	0.541	1.196
0.3	1.651	0.507	1.196	1.653	0.512	1.212
0.35	1.713	0.483	1.21	1.716	0.488	1.226
0.4	1.773	0.462	1.223	1.775	0.468	1.238
0.45	1.829	0.444	1.234	1.831	0.45	1.249
0.5	1.883	0.428	1.245	1.885	0.433	1.26
0.55	1.936	0.413	1.255	1.937	0.418	1.269
0.6	1.987	0.4	1.265	1.987	0.405	1.278
0.75	2.131	0.365	1.291	2.133	0.37	1.304
1	2.362	0.321	1.332	2.355	0.325	1.342

Generalized Hooke model, ν_s = 0.4

Ca	L_c/R	S_c/R	W_c/R	L/R	S/R	W/R
0.2	1.473	0.601	1.131	1.473	0.603	1.141
0.3	1.6	0.54	1.158	1.602	0.544	1.167
0.4	1.709	0.497	1.177	1.711	0.502	1.186
0.5	1.807	0.464	1.192	1.811	0.469	1.201
0.6	1.899	0.438	1.205	1.902	0.442	1.213
0.7	1.985	0.415	1.216	1.987	0.419	1.225
0.75	2.026	0.404	1.221	2.031	0.408	1.23
0.8	2.068	0.396	1.227	2.069	0.4	1.234
0.9	2.148	0.378	1.236	2.148	0.382	1.243
1	2.222	0.362	1.245	2.227	0.366	1.252
1.25	2.405	0.329	1.265	2.41	0.333	1.271
1.5	2.581	0.303	1.284	2.584	0.306	1.289

Generalized Hooke model, $\nu_s = 0.5$

Ca	L_c/R	S_c/R	W_c/R	L/R	S/R	W/R
0.175	1.403	0.649	1.098	1.403	0.65	1.103
0.25	1.496	0.599	1.115	1.497	0.602	1.121
0.375	1.624	0.543	1.134	1.627	0.546	1.139
0.5	1.735	0.503	1.147	1.739	0.506	1.152
0.75	1.926	0.446	1.164	1.932	0.45	1.169
1	2.096	0.406	1.177	2.103	0.409	1.181
1.25	2.252	0.374	1.188	2.26	0.377	1.191
1.5	2.4	0.35	1.2	2.41	0.35	1.2
1.75	2.54	0.33	1.21	2.55	0.33	1.21
2	2.68	0.31	1.22	2.69	0.31	1.22

Supplementary material 3 (fig. 5-right high resolution):
Experimental profiles of a capsule of radius 47 μm deformed in a planar elongation flow
i) the experimental shape in the two perpendicular fields of view (grey)
ii) the 3D numerical shape (red triangles of the mesh):