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Universal elastic mechanism for stinger design

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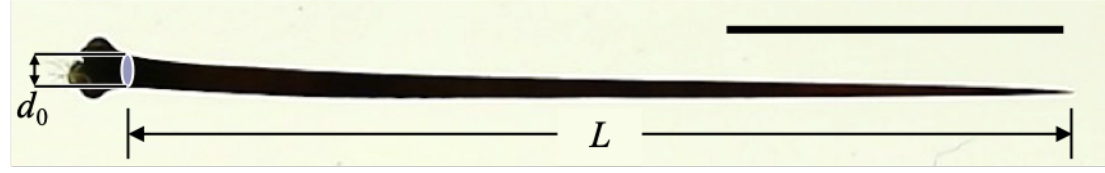


Figure S1: Micrograph of a *Stetsonia coryne* cactus spine (No. 111). Arrows indicate measured values of the length L and base diameter d_0 . Scale bar 100 μm .

Table S1: Length L , base diameter d_0 , and elastic modulus E of the stinger data presented in Fig. 1(b) and 3. The length and base diameter was obtained from (1; 2; 3; 4; 5; 6; 7; 8; 9; 10; 11; 12; 13; 14; 15; 16; 17; 18; 19; 20; 21; 22; 23; 24; 25; 26; 27; 28; 29; 30; 31; 32; 33; 34; 35; 36; 37; 38; 39; 40; 41; 42; 43; 44; 45; 46) and our experiments (*), while Young's modulus was acquired from (18; 27; 30; 35; 47; 48; 49; 50; 51)

No.	Category	Species / Object (Common name)	L [m]	d_0 [m]	E [Pa]	Ref.
001	Viruses	<i>Enterbacteria</i> phage T4 (Fiber)	7.50E-08	5.00E-09	2.00E+07	(1)
002	Viruses	<i>Enterobacteria</i> phage lambda (Side tail fiber)	3.87E-08	3.23E-09	2.00E+07	(1)
003	Viruses	<i>Enterobacteria</i> phage lambda (Tail tip)	4.19E-08	6.45E-09	2.00E+07	(1)
004	Algae	<i>Arctyocha</i> sp.	1.56E-05	2.22E-06	2.24E+10	(2)
005	Algae	<i>Arctyocha bukryi</i>	3.23E-05	6.15E-06	2.24E+10	(2)
006	Algae	<i>Arctyocha mesocena</i>	1.00E-05	4.44E-06	2.24E+10	(2)
007	Algae	<i>Cannopilus depressus</i>	1.14E-05	3.88E-06	2.24E+10	(3)
008	Algae	<i>Cannopilus hemisphaericus</i>	1.87E-05	5.15E-06	2.24E+10	(3)
009	Algae	<i>Corbisema apiculata</i>	1.00E-05	2.42E-06	2.24E+10	(4)
010	Algae	<i>Corbisema triacantha</i>	1.55E-05	2.79E-06	2.24E+10	(3)
011	Algae	<i>Cornua deflandrei</i>	3.38E-05	6.25E-06	2.24E+10	(4)
012	Algae	<i>Cornua tapiae</i>	1.81E-06	4.38E-07	2.24E+10	(2)
013	Algae	<i>Cornua tapiae</i>	1.56E-05	3.33E-06	2.24E+10	(2)
014	Algae	<i>Cornua trifurcata</i>	4.00E-05	7.69E-06	2.24E+10	(2)
015	Algae	<i>Cornua trifurcata</i>	3.45E-06	6.36E-07	2.24E+10	(2)
016	Algae	<i>Dictyocha</i> cf. <i>explicata</i>	1.88E-05	2.93E-06	2.24E+10	(4)
017	Algae	<i>Dictyocha</i> sp.	1.25E-05	2.64E-06	2.24E+10	(4)
018	Algae	<i>Dictyocha arctios</i>	2.33E-05	4.42E-06	2.24E+10	(4)
019	Algae	<i>Dictyocha ausonia</i>	7.82E-06	2.74E-06	2.24E+10	(3)

No.	Category	Species / Object (Common name)	L [m]	d_0 [m]	E [Pa]	Ref.
020	Algae	<i>Dictyocha deflandrei</i>	1.01E-05	2.77E-06	2.24E+10	(4)
021	Algae	<i>Dictyocha fibula</i>	1.28E-05	1.61E-06	2.24E+10	(3)
022	Algae	<i>Dictyocha fibula</i> sp.	1.04E-05	2.78E-06	2.24E+10	(5)
023	Algae	<i>Dictyocha fibula</i> sp.	8.19E-06	2.79E-06	2.24E+10	(5)
024	Algae	<i>Dictyocha fibula</i> sp.	8.93E-06	2.68E-06	2.24E+10	(5)
025	Algae	<i>Distephanus crux</i>	1.44E-05	5.00E-06	2.24E+10	(6)
026	Algae	<i>Distephanus speculum</i>	1.63E-05	2.50E-06	2.24E+10	(6)
027	Algae	<i>Gleserocha tapiae</i>	2.54E-05	3.85E-06	2.24E+10	(4)
028	Algae	<i>Gleserocha wisei</i>	1.17E-05	2.95E-06	2.24E+10	(4)
029	Algae	<i>Lynamula deflandrei</i>	2.79E-06	4.21E-07	2.24E+10	(2)
030	Algae	<i>Lynamula furcula</i>	1.54E-05	3.08E-06	2.24E+10	(2)
031	Algae	<i>Lynamula minor</i>	1.09E-06	4.55E-07	2.24E+10	(2)
032	Algae	<i>Mallomonas porifera</i>	2.09E-05	1.28E-06	2.24E+10	(7)
033	Algae	<i>Mesocena circulus</i>	4.52E-06	2.72E-06	2.24E+10	(3)
034	Algae	<i>Mesocena diodon</i>	6.73E-06	3.44E-06	2.24E+10	(3)
035	Algae	<i>Mesocena elliptica</i>	5.39E-06	3.49E-06	2.24E+10	(3)
036	Algae	<i>Naviculopsis biapiculata</i>	2.91E-05	4.45E-06	2.24E+10	(3)
037	Algae	<i>Naviculopsis</i> sp.	3.67E-05	4.79E-06	2.24E+10	(4)
038	Algae	<i>Schulzyocha loperi</i>	2.31E-05	4.62E-06	2.24E+10	(2)
039	Algae	<i>Schulzyocha loperi</i>	3.27E-06	4.00E-07	2.24E+10	(2)
040	Algae	<i>Umpiocha umpiana</i>	1.08E-05	3.08E-06	2.24E+10	(2)
041	Algae	<i>Umpiocha umpiana</i>	1.50E-06	2.92E-07	2.24E+10	(2)
042	Algae	<i>Vallacerta hannai</i>	1.34E-05	3.10E-06	2.24E+10	(2)
043	Algae	<i>Vallacerta hortonii</i>	1.11E-05	3.26E-06	2.24E+10	(3)
044	Algae	<i>Vallacerta hortonii</i>	1.15E-06	3.46E-07	2.24E+10	(2)
045	Algae	<i>Vallacerta quadrata</i>	1.32E-06	4.19E-07	2.24E+10	(2)
046	Algae	<i>Vallacerta siderea</i>	2.15E-05	4.62E-06	2.24E+10	(2)
047	Algae	<i>Vallacerta siderea</i>	8.14E-06	1.43E-06	2.24E+10	(2)
048	Algae	<i>Variramus aculeifera</i>	9.23E-06	4.62E-06	2.24E+10	(2)
049	Algae	<i>Variramus wisei</i>	1.25E-05	3.75E-06	2.24E+10	(2)
050	Marine invertebrates	<i>Sponge spicule</i> (Acanthoxea)	2.09E-04	2.30E-05	1.37E+10	(9)
051	Marine invertebrates	<i>Sponge spicule</i> (Acantoxea)	1.48E-04	1.60E-05	1.37E+10	(9)
052	Marine invertebrates	<i>Sponge spicule</i> (Calthrop)	3.53E-04	4.80E-05	1.37E+10	(9)
053	Marine invertebrates	<i>Sponge spicule</i> (Diaene)	7.29E-04	2.00E-05	1.37E+10	(9)

No.	Category	Species / Object (Common name)	L [m]	d_0 [m]	E [Pa]	Ref.
054	Marine invertebrates	<i>Sponge spicule</i> (Oxea type I.)	2.62E-04	3.40E-05	1.37E+10	(9)
055	Marine invertebrates	<i>Sponge spicule</i> (Oxea type I.)	1.88E-04	3.10E-05	1.37E+10	(9)
056	Marine invertebrates	<i>Sponge spicule</i> (Oxea type II.)	2.45E-04	3.60E-05	1.37E+10	(9)
057	Marine invertebrates	<i>Sponge spicule</i> (Oxea type II.)	8.15E-05	8.40E-06	1.37E+10	(9)
058	Marine invertebrates	<i>Sponge spicule</i> (Oxea type III.)	5.07E-04	2.40E-05	1.37E+10	(9)
059	Marine invertebrates	<i>Sponge spicule</i> (Oxea type III.)	2.11E-03	6.70E-05	1.37E+10	(9)
060	Marine invertebrates	<i>Sponge spicule</i> (Strongyle)	2.38E-04	3.00E-05	1.37E+10	(9)
061	Marine invertebrates	<i>Sponge spicule</i> (Style type I.)	1.68E-04	1.90E-05	1.37E+10	(9)
062	Marine invertebrates	<i>Sponge spicule</i> (Style type II.)	1.96E-04	1.50E-05	1.37E+10	(9)
063	Marine invertebrates	<i>Sponge spicule</i> (Style)	1.70E-04	2.80E-05	1.37E+10	(9)
064	Marine invertebrates	<i>Sponge spicule</i> (Triaene type I.)	5.76E-04	1.30E-05	1.37E+10	(9)
065	Marine invertebrates	<i>Sponge spicule</i> (Triaene type II.)	7.62E-04	5.10E-05	1.37E+10	(9)
066	Marine invertebrates	<i>Sponge spicule</i> (Tylostyle type I.)	1.48E-04	7.00E-06	1.37E+10	(9)
067	Marine invertebrates	<i>Sponge spicule</i> (Tylostyle type I.)	3.00E-04	2.00E-05	1.37E+10	(9)
068	Marine invertebrates	<i>Sponge spicule</i> (Tylostyle type II.)	3.13E-04	4.16E-05	1.37E+10	(9)
069	Marine invertebrates	<i>Sponge spicule</i> (Tylostyle type II.)	1.89E-04	1.50E-05	1.37E+10	(9)
070	Marine invertebrates	<i>Sponge spicule</i> (Tylostyle type III.)	2.52E-04	3.00E-05	1.37E+10	(9)
071	Terrestrial invertebrates	<i>Aedes aegypti</i> (Mosquito)	1.75E-03	4.00E-05	1.00E+10	(12)
072	Terrestrial invertebrates	<i>Aedes aegypti</i> (Mosquito)	1.80E-03	2.20E-05	1.00E+10	(13)
073	Terrestrial invertebrates	<i>Aedes togoi</i> (Mosquito)	1.59E-03	7.09E-05	1.00E+10	(14)
074	Terrestrial invertebrates	<i>Apis cerana</i> (Honey bee)	1.77E-03	2.00E-04	1.00E+10	(15)
075	Terrestrial invertebrates	<i>Apis cerana Fabricius</i> (Mosquito)	1.40E-03	1.13E-04	1.00E+10	(16)
076	Terrestrial invertebrates	<i>Apis dorsata</i> (Mosquito)	2.50E-03	3.10E-04	1.00E+10	(15)
077	Terrestrial invertebrates	<i>Apis florea</i> (Mosquito)	1.25E-03	1.80E-04	1.00E+10	(15)
078	Terrestrial invertebrates	<i>Apis mellifera</i> (Mosquito)	2.26E-03	2.80E-04	1.00E+10	(15)
079	Terrestrial invertebrates	<i>Apocrypta</i> sp. (Wasps)	2.63E-03	1.00E-04	1.00E+10	(46)
080	Terrestrial invertebrates	<i>Apocrypta bakeri</i> (Wasps)	5.20E-03	1.00E-04	1.00E+10	(46)
081	Terrestrial invertebrates	<i>Apocrypta westwoodi</i> (Wasps)	5.45E-03	1.00E-04	1.00E+10	(46)
082	Terrestrial invertebrates	<i>Bombus</i> sp. (Bumblebee)	3.55E-03	7.98E-04	1.00E+10	(17)
083	Terrestrial invertebrates	<i>Climex lectularis</i> (Bed bugs)	1.20E-03	1.60E-05	1.00E+10	(13)
084	Terrestrial invertebrates	<i>Clistopyga teresitae</i> (Wasps)	4.64E-03	1.32E-04	1.00E+10	(45)
085	Terrestrial invertebrates	<i>Clistopyga carinata</i> (Wasps)	4.62E-03	1.26E-04	1.00E+10	(45)
086	Terrestrial invertebrates	<i>Clistopyga henryi</i> (Wasps)	5.00E-03	1.00E-04	1.00E+10	(45)
087	Terrestrial invertebrates	<i>Diachasmimorpha longicaudata</i> (Wasps)	5.27E-03	8.43E-05	1.00E+10	(44)

No.	Category	Species / Object (Common name)	L [m]	d_0 [m]	E [Pa]	Ref.
088	Terrestrial invertebrates	<i>Doryctobracon areolatus</i> (Wasps)	3.77E-03	8.43E-05	1.00E+10	(44)
089	Terrestrial invertebrates	<i>Doryctobracon crawfordi</i> (Wasps)	5.39E-03	8.43E-05	1.00E+10	(44)
090	Terrestrial invertebrates	<i>Euglossa piliventris</i> (Orchid bee)	3.37E-03	3.59E-04	1.00E+10	(17)
091	Terrestrial invertebrates	<i>Opius hirtus</i> (Wasps)	2.20E-03	8.43E-05	1.00E+10	(44)
092	Terrestrial invertebrates	<i>Parasa consocia</i> (Moth larva)	6.00E-04	3.30E-05	5.00E+09	(18)
093	Terrestrial invertebrates	<i>Pediculus humanus</i> (Head louse)	4.00E-04	7.20E-06	1.00E+10	(13)
094	Terrestrial invertebrates	<i>Polistes</i> sp. (Wasps)	1.68E-03	1.88E-04	1.00E+10	(16)
095	Terrestrial invertebrates	<i>Utetes anastrephae</i> (Wasps)	1.57E-03	8.43E-05	1.00E+10	(44)
096	Plants	<i>Asparagus falcatus</i>	4.38E-03	2.00E-03	1.13E+09	(19)
097	Plants	<i>Cereus peruvianus</i>	1.77E-02	7.74E-04	1.13E+09	(*)
098	Plants	<i>Colletia hystrix</i>	3.95E-02	1.40E-03	1.13E+09	(*)
099	Plants	<i>Euphorbia splendens</i>	1.60E-02	1.57E-03	1.13E+09	(*)
100	Plants	<i>Mamillaria appalanta</i> (Cactus)	9.65E-03	3.02E-04	1.13E+09	(*)
101	Plants	<i>Mamillaria pringlei</i> (Cactus)	1.09E-02	5.95E-04	1.13E+09	(*)
102	Plants	<i>Mamillaria pringlei</i> (Cactus)	7.97E-03	4.83E-04	1.13E+09	(*)
103	Plants	<i>Mamillaria spinosissima</i> (Cactus)	8.40E-03	2.65E-04	1.13E+09	(*)
104	Plants	<i>Mamillaria spinosissima</i> (Cactus)	8.50E-03	2.70E-04	1.13E+09	(*)
105	Plants	<i>Opuntia</i> sp. (Cactus)	1.06E-02	4.11E-04	1.13E+09	(*)
106	Plants	<i>Opuntia</i> sp. (Cactus)	3.50E-02	9.58E-04	1.13E+09	(*)
107	Plants	<i>Pilosocereus azureus</i> (Cactus)	1.33E-02	3.52E-04	1.13E+09	(*)
108	Plants	<i>Pilosocereus azureus</i> (Cactus)	1.06E-02	2.60E-04	1.13E+09	(*)
109	Plants	<i>Pilosocereus azureus</i> (Cactus)	1.05E-02	2.65E-04	1.13E+09	(*)
110	Plants	<i>Sideroxylon thornei</i>	2.17E-02	1.85E-03	1.00E+10	(20)
111	Plants	<i>Stetsonia coryne</i> (Cactus)	2.80E-02	9.50E-04	1.13E+09	(*)
112	Plants	<i>Stetsonia coryne</i> (Cactus)	1.42E-02	8.60E-04	1.13E+09	(*)
113	Plants	<i>Stetsonia coryne</i> (Cactus)	2.69E-02	7.70E-04	1.13E+09	(*)
114	Plants	<i>Stetsonia coryne</i> (Cactus)	1.26E-02	6.00E-04	1.13E+09	(*)
115	Plants	<i>Urtica dioica</i> (Nettle)	1.22E-03	8.93E-05	8.70E+10	(*)
116	Nails/needles	Diamond microneedle	1.44E-06	2.15E-07	1.10E+12	(21)
117	Nails/needles	Hypodermic needle (brand: Agani)	4.00E-02	2.10E-03	2.00E+11	(22)
118	Nails/needles	Hypodermic needle (brand: Agani)	6.00E-02	2.10E-03	2.00E+11	(22)
119	Nails/needles	Hypodermic needle (brand: Agani)	8.00E-02	2.10E-03	2.00E+11	(22)
120	Nails/needles	Hypodermic needle (brand: Agani)	6.00E-02	2.10E-03	2.00E+11	(22)
121	Nails/needles	Hypodermic needle (brand: Agani)	4.00E-02	1.80E-03	2.00E+11	(22)

No.	Category	<i>Species</i> / Object (Common name)	L [m]	d_0 [m]	E [Pa]	Ref.
122	Nails/needles	Hypodermic needle (brand: Agani)	5.00E-02	1.80E-03	2.00E+11	(22)
123	Nails/needles	Hypodermic needle (brand: Agani)	2.50E-02	1.60E-03	2.00E+11	(22)
124	Nails/needles	Hypodermic needle (brand: Agani)	4.00E-02	1.60E-03	2.00E+11	(22)
125	Nails/needles	Hypodermic needle (brand: Agani)	5.00E-02	1.50E-03	2.00E+11	(22)
126	Nails/needles	Hypodermic needle (brand: Agani)	1.20E-02	1.20E-03	2.00E+11	(22)
127	Nails/needles	Hypodermic needle (brand: Agani)	2.50E-02	1.20E-03	2.00E+11	(22)
128	Nails/needles	Hypodermic needle (brand: Agani)	4.00E-02	1.20E-03	2.00E+11	(22)
129	Nails/needles	Hypodermic needle (brand: Agani)	5.00E-02	1.20E-03	2.00E+11	(22)
130	Nails/needles	Hypodermic needle (brand: Agani)	6.00E-03	1.20E-03	2.00E+11	(22)
131	Nails/needles	Hypodermic needle (brand: Agani)	2.50E-02	1.10E-03	2.00E+11	(22)
132	Nails/needles	Hypodermic needle (brand: Agani)	3.00E-02	1.10E-03	2.00E+11	(22)
133	Nails/needles	Hypodermic needle (brand: Agani)	4.00E-02	1.10E-03	2.00E+11	(22)
134	Nails/needles	Hypodermic needle (brand: Agani)	5.00E-02	1.10E-03	2.00E+11	(22)
135	Nails/needles	Hypodermic needle (brand: Agani)	1.20E-02	9.00E-04	2.00E+11	(22)
136	Nails/needles	Hypodermic needle (brand: Agani)	2.50E-02	9.00E-04	2.00E+11	(22)
137	Nails/needles	Hypodermic needle (brand: Agani)	4.00E-02	9.00E-04	2.00E+11	(22)
138	Nails/needles	Hypodermic needle (brand: Agani)	5.00E-02	9.00E-04	2.00E+11	(22)
139	Nails/needles	Hypodermic needle (brand: Agani)	1.60E-02	8.00E-04	2.00E+11	(22)
140	Nails/needles	Hypodermic needle (brand: Agani)	2.50E-02	8.00E-04	2.00E+11	(22)
141	Nails/needles	Hypodermic needle (brand: Agani)	4.00E-02	8.00E-04	2.00E+11	(22)
142	Nails/needles	Hypodermic needle (brand: Agani)	5.00E-02	8.00E-04	2.00E+11	(22)
143	Nails/needles	Hypodermic needle (brand: Agani)	2.50E-02	7.00E-04	2.00E+11	(22)
144	Nails/needles	Hypodermic needle (brand: Agani)	3.00E-02	7.00E-04	2.00E+11	(22)
145	Nails/needles	Hypodermic needle (brand: Agani)	4.00E-02	7.00E-04	2.00E+11	(22)
146	Nails/needles	Hypodermic needle (brand: Agani)	5.00E-02	7.00E-04	2.00E+11	(22)
147	Nails/needles	Hypodermic needle (brand: Agani)	2.50E-02	6.00E-04	2.00E+11	(22)
148	Nails/needles	Hypodermic needle (brand: Agani)	3.00E-02	6.00E-04	2.00E+11	(22)
149	Nails/needles	Hypodermic needle (brand: Agani)	2.50E-02	5.50E-04	2.00E+11	(22)
150	Nails/needles	Hypodermic needle (brand: Agani)	1.60E-02	5.00E-04	2.00E+11	(22)
151	Nails/needles	Hypodermic needle (brand: Agani)	2.50E-02	5.00E-04	2.00E+11	(22)
152	Nails/needles	Hypodermic needle (brand: Agani)	1.20E-02	4.50E-04	2.00E+11	(22)
153	Nails/needles	Hypodermic needle (brand: Agani)	2.30E-02	4.50E-04	2.00E+11	(22)
154	Nails/needles	Hypodermic needle (brand: Agani)	2.50E-02	4.50E-04	2.00E+11	(22)
155	Nails/needles	Hypodermic needle (brand: Agani)	1.20E-02	4.00E-04	2.00E+11	(22)

No.	Category	Species / Object (Common name)	L [m]	d_0 [m]	E [Pa]	Ref.
156	Nails/needles	Hypodermic needle (brand: Agani)	2.00E-02	4.00E-04	2.00E+11	(22)
157	Nails/needles	Hypodermic needle (brand: Agani)	1.20E-02	3.00E-04	2.00E+11	(22)
158	Nails/needles	Hypodermic needle (brand: Terumo Neolus)	4.00E-02	1.20E-03	2.00E+11	(23)
159	Nails/needles	Hypodermic needle (brand: Terumo Neolus)	2.50E-02	1.10E-03	2.00E+11	(23)
160	Nails/needles	Hypodermic needle (brand: Terumo Neolus)	4.00E-02	1.10E-03	2.00E+11	(23)
161	Nails/needles	Hypodermic needle (brand: Terumo Neolus)	2.50E-02	9.00E-04	2.00E+11	(23)
162	Nails/needles	Hypodermic needle (brand: Terumo Neolus)	4.00E-02	9.00E-04	2.00E+11	(23)
163	Nails/needles	Hypodermic needle (brand: Terumo Neolus)	1.60E-02	8.00E-04	2.00E+11	(23)
164	Nails/needles	Hypodermic needle (brand: Terumo Neolus)	2.50E-02	8.00E-04	2.00E+11	(23)
165	Nails/needles	Hypodermic needle (brand: Terumo Neolus)	4.00E-02	8.00E-04	2.00E+11	(23)
166	Nails/needles	Hypodermic needle (brand: Terumo Neolus)	1.60E-02	6.00E-04	2.00E+11	(23)
167	Nails/needles	Hypodermic needle (brand: Terumo Neolus)	2.50E-02	6.00E-04	2.00E+11	(23)
168	Nails/needles	Hypodermic needle (brand: Terumo Neolus)	3.00E-02	6.00E-04	2.00E+11	(23)
169	Nails/needles	Hypodermic needle (brand: Terumo Neolus)	1.60E-02	5.00E-04	2.00E+11	(23)
170	Nails/needles	Hypodermic needle (brand: Terumo Neolus)	2.50E-02	5.00E-04	2.00E+11	(23)
171	Nails/needles	Hypodermic needle (brand: Terumo Neolus)	1.20E-02	4.50E-04	2.00E+11	(23)
172	Nails/needles	Hypodermic needle (brand: Terumo Neolus)	2.00E-02	4.00E-04	2.00E+11	(23)
173	Nails/needles	Nail	2.54E-02	1.83E-03	2.00E+11	(24)
174	Nails/needles	Nail	3.18E-02	1.98E-03	2.00E+11	(24)
175	Nails/needles	Nail	3.81E-02	2.54E-03	2.00E+11	(24)
176	Nails/needles	Nail	4.45E-02	2.49E-03	2.00E+11	(24)
177	Nails/needles	Nail	5.08E-02	2.82E-03	2.00E+11	(24)
178	Nails/needles	Nail	6.35E-02	2.79E-03	2.00E+11	(24)
179	Nails/needles	Nail	6.48E-02	3.33E-03	2.00E+11	(24)
180	Nails/needles	Nail	6.99E-02	3.30E-03	2.00E+11	(24)
181	Nails/needles	Nail	7.62E-02	3.71E-03	2.00E+11	(24)
182	Nails/needles	Nail	8.26E-02	3.68E-03	2.00E+11	(24)
183	Nails/needles	Nail	8.89E-02	4.09E-03	2.00E+11	(24)
184	Nails/needles	Nail	1.02E-01	4.80E-03	2.00E+11	(24)
185	Nails/needles	Nail	1.14E-01	5.21E-03	2.00E+11	(24)
186	Nails/needles	Nail	1.27E-01	5.92E-03	2.00E+11	(24)
187	Nails/needles	Nail	1.40E-01	6.35E-03	2.00E+11	(24)
188	Nails/needles	Nail	1.52E-01	6.81E-03	2.00E+11	(24)
189	Nails/needles	Nail	1.78E-01	8.00E-03	2.00E+11	(24)

No.	Category	Species / Object (Common name)	L [m]	d_0 [m]	E [Pa]	Ref.
190	Nails/needles	Nail	2.16E-01	8.00E-03	2.00E+11	(24)
191	Nails/needles	Nail	2.16E-01	9.35E-03	2.00E+11	(24)
192	Nails/needles	Nail	2.29E-01	7.67E-03	2.00E+11	(24)
193	Nails/needles	Nail	2.54E-01	9.35E-03	2.00E+11	(24)
194	Nails/needles	Hypodermic needle (30 gauge)	8.00E-03	3.00E-04	2.00E+11	(25)
195	Nails/needles	Hypodermic needle (32 gauge)	5.00E-03	2.30E-04	2.00E+11	(25)
196	Nails/needles	Hypodermic needle (34 gauge)	3.00E-03	3.00E-04	2.00E+11	(25)
197	Nails/needles	Toothpick, Longerinc	6.50E-02	2.20E-03	1.00E+10	(26)
198	Terrestrial vertebrates	Melanerpes carolinus	2.60E-02	6.00E-03	3.00E+07	(52)
199	Terrestrial vertebrates	Triceratops horn	5.80E-01	2.20E-01	1.00E+10	(53)
200	Terrestrial vertebrates	<i>Coendou prehensilis</i> (Brazilian porcupine)	4.72E-02	1.93E-03	5.60E+09	(27)
201	Terrestrial vertebrates	<i>Erinaceus europaeus</i> (European hedgehog)	2.07E-02	1.17E-03	1.16E+10	(27)
202	Terrestrial vertebrates	<i>Hystrix indica x cristata</i> (Porcupine)	1.44E-01	4.81E-03	6.00E+09	(27)
203	Terrestrial vertebrates	<i>Oryx gazella</i> (Gemsbok)	8.24E-01	5.89E-02	5.00E+09	(54)
204	Terrestrial vertebrates	<i>Oryx leucoryx</i> (Arabian Oryx)	6.29E-01	3.64E-02	5.00E+09	(55)
205	Marine vertebrates	<i>Tachypleus tridentatus</i> (Horseshoe crab)	3.05E-01	1.70E-02	1.00E+10	(36)
206	Marine vertebrates	<i>Tetrapturus pfluegeri</i> (Horseshoe crab)	2.43E-01	1.94E-02	1.80E+10	(31)
207	Marine vertebrates	<i>Paracentrotus lividus</i> (Horseshoe crab)	5.06E-02	2.65E-03	2.20E+10	(35)
208	Marine vertebrates	<i>Paracentrotus lividus</i> (Horseshoe crab)	1.10E-02	2.00E-03	5.00E+10	(34)
209	Marine vertebrates	<i>Tetrapturus angustirostris</i> (Horseshoe crab)	7.67E-02	1.50E-02	9.07E+09	(31)
210	Marine vertebrates	<i>Tetrapturus audax</i> (Horseshoe crab)	3.31E-01	2.48E-02	1.80E+10	(31)
211	Marine vertebrates	<i>Tetrapturus albidus</i> (Horseshoe crab)	2.79E-01	2.09E-02	1.80E+10	(31)
212	Marine vertebrates	<i>Acanthaster planci</i> (Seastar)	4.24E-03	7.61E-04	1.00E+10	(28)
213	Marine vertebrates	<i>Amphiura complanata</i> <i>Amphiura complanata</i>	2.70E-04	5.97E-05	3.00E+08	(29)
214	Marine vertebrates	<i>Diodon Holocanthus</i> (Long-spine porcupinefish)	1.00E-02	1.00E-03	1.00E+10	(30)
215	Marine vertebrates	<i>Istiophorus platypterus</i> (Indo-Pacific sailfish)	3.21E-01	1.93E-02	1.80E+10	(31)
216	Marine vertebrates	<i>Makaira indica</i> (Black marlin)	2.96E-01	2.82E-02	1.80E+10	(31)
217	Marine vertebrates	<i>Makaira nigricans</i> (Atlantic blue marlin)	5.01E-01	4.26E-02	1.80E+10	(31)
218	Marine vertebrates	<i>Monodon monoceros</i> (Narwhal)	1.70E+00	4.25E-02	1.00E+10	(32)
219	Marine vertebrates	<i>Monodon monoceros</i> (Narwhal)	2.20E+00	6.20E-02	1.00E+10	(33)
220	Marine vertebrates	<i>Ophiacantha pentacrinus</i>	1.00E-03	1.91E-04	3.00E+08	(29)
221	Weapons	15th century lance	3.47E+00	8.00E-02	2.00E+11	(37)
222	Weapons	Atlatl dart	6.10E-01	1.27E-02	1.00E+10	(38)
223	Weapons	Atlatl dart	6.92E-01	1.75E-02	1.00E+10	(38)

No.	Category	<i>Species</i> / Object (Common name)	L [m]	d_0 [m]	E [Pa]	Ref.
224	Weapons	Gestech lance	4.53E+00	1.27E-01	2.00E+11	(37)
225	Weapons	Lance	3.73E+00	7.00E-02	1.00E+10	(41)
226	Weapons	Medival crossbow bolt	3.00E-01	1.25E-02	1.00E+10	(39)
227	Weapons	Modern arrow	6.99E-01	7.94E-02	1.00E+10	(38)
228	Weapons	Pilum shank	2.50E-01	2.00E-02	1.00E+10	(42)
229	Weapons	Pilum shank	2.32E-01	2.00E-02	1.00E+10	(42)
230	Weapons	Quarrel	3.00E-01	1.25E-02	2.00E+11	(39)
231	Weapons	Rennen lance	3.79E+00	7.32E-02	2.00E+11	(37)
232	Weapons	Sarissa	2.26E+00	3.81E-02	2.00E+11	(43)
233	Weapons	Tartar war arrow	9.65E-01	1.27E-02	1.00E+10	(38)

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