Underwater air rings. Left, three rings rising vertically; right, top rings become linked.

limited to studying vortices that travel in parallel planes, it does show that vortex linking is easy to demonstrate experimentally.

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AREF REPLIES — I had previously seen pictures of these 'air-rings' (usually called 'vortex ring bubbles' in the fluid mechanics literature) that divers can produce. There is a recent paper by Lundgren and Mansour³ where such bubbles are studied and these authors mention a photograph in *National Geographic Magazine*⁴. Apparently, whales and dolphins also blow the rings.

I am not sure that what Rivest saw is the same process of linking that we reported in our paper¹. In our study, the intermediate state of interest consists of two rings connected as successive links in a chain, whereas he reports the formation of 'a single large ring of irregular shape'. The linking that we were interested in is a variant of the more general phenomenon of reconnection, where two rings can, indeed, form a single, irregular ring for a while. I think what Rivest is seeing (see right-hand photo) is more closely related to the type of intermediate state that we have in our Fig. 1d-e rather than the linked state in our Fig. 4d. We actually believe that the ellipticity of the initial rings is essential for the process. In our simulations we did not succeed in producing linking starting from two circular rings.

I am not sure how one would blow elliptical vortex ring bubbles, but if it were possible, it would make a spectacular

real-world analogue of the numerical solutions.

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Neanderthal dates debated

SIR — We cannot agree with some of Stringer and Grün's speculations¹ stemming from the redating of the late Neanderthal from Saint-Césaire. We wonder why a thermoluminescence date of 36,300 years before present (BP), several thousand years older than previously thought, can justify the contention that "Neanderthals probably went out with a whimper, not a bang"¹.

The new date means that 12,500 years or more may separate Saint-Césaire from Cro-Magnon, the site of the earliest definitive 'modern' human crania from western Europe², if these burials are Upper Perigordian and not Aurignacian, as has been suggested³. How can this new, expanded timespan show an ancestor-descendant relationship to be chronologically untenable in western Europe? We believe that the western European dates may provide the best evidence for a region where there was a transition to modern populations with significant local genetic input from Neanderthals, in that there is now more than enough time for the process of

evolution due to natural selection to proceed at a reasonable rate. For instance, the rates of change between Neanderthals and early 'modern' Europeans for a truly diagnostic feature such as anterior tooth size are small relative to other recent evolutionary changes. These rates are one-half those between early and late Upper Palaeolithic samples and one-tenth the rate of change between Europeans of the Mesolithic and Neolithic who are only 3,500 years apart (D.W.F., manuscript in preparation).

There is also no evidence that indicates a "gradual displacement [of Neanderthals] to more marginal and less favorable environments, where their dwindling numbers would have suffered greater attrition from the vagaries of fluctuating climates and food supplies as well as disease"¹. Earlier, from the same evidence Stringer argued just the opposite², that Neanderthals persisted into the Upper Palaeolithic "... not just in backward or isolated areas either. Saint-Césaire is, in fact, situated in a region densely occupied during the Middle and Upper Palaeolithic." The marginalization interpretation would not seem to apply to the Neanderthals of western Europe, any more that it applies to the Neanderthals of western Asia, where Neanderthals and their so-called 'modern' contemporaries lived for a period estimated to be as long as 60,000 years, manufacturing identical industries and using the same technology to do so, applying their tools in similar ways (the microwear is identical), burying their dead with the same customs, hunting the same game species and butchering them the same way. Here, these two supposed human species are known to coexist with archaeologically indistinguishable adaptations for a very long time and there is no evidence of banging or whimpering. There simply are no data to support the assertion of a cultural, biological or ecological marginalization of Neanderthals.

Stringer and Grün suppose that Neanderthals may have been a different species, but then they assert that the species "were probably sufficiently closely related to allow hybridization", saying that "mitochondrial DNA studies have been used to suggest that there is no trace of a genetic input from Neanderthal females in recent European samples". (We know of no discovery of Neanderthal mitochondrial DNA.) To make sense of these contradictory claims one would have to assume that this new understanding of species is not based on reproductive isolation, and that the "hybridization" was between Neanderthal men and the women of the "anatomically modern" humans who (presumably) replaced them.