

## Notes on Granville Sewell's essay, "On 'compensating' entropy decreases"

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The above essay appeared in *Physics Essays* **30**, 70–74 (January 2017). It incorporates most of the errors present in Professor Sewell's earlier work, which I have already described in "Remarks on Granville Sewell's treatment of 'Entropy and Evolution'" (27 August 2015). But there are also some new blunders worth noting.

- Sewell's first sentence is "The idea that 'entropy' is a single quantity which measures disorder of all types is widely believed." This belief is erroneous, as scientists have pointed out<sup>1</sup> repeatedly. Entropy does not measure disorder, yet Sewell's entire essay is founded upon this misconception.
- Sewell claims that if  $^{16}\text{O}$  and  $^{18}\text{O}$  were mixed (presumably he means  $^{16}\text{O}_2$  and  $^{18}\text{O}_2$ ), then there would be no entropy increase. This claim is false: there is a measurable<sup>2</sup> entropy increase even due to the mixing of orthohydrogen and parahydrogen, which are considerably more similar than  $^{16}\text{O}$  and  $^{18}\text{O}$ .
- About one third of the essay is devoted to an appendix showing that, when "nothing is going on but diffusion", then at equilibrium the diffusing quantity is homogeneous. This fact is obvious. . . no one needs to demonstrate it using a three-dimensional integration by parts. The only correct conclusion to be drawn is that in nature, there are things going on in addition to diffusion.
- Sewell attempts to denigrate entropy by calling it "a rather abstract quantity". Yet the number two is also a rather abstract quantity: You've seen two hands, you've seen two eyes, you've seen two balls, you've seen the numeral 2 (which is made up of ink), but you've never seen the number 2 (which is made up of pure, abstract thought). There are many abstract quantities: beauty, happiness, justice, freedom, love. People pay good money for abstract quantities; people fight and die for abstract quantities. It is no insult to a quantity to call it abstract.

Sewell is wrong about entropy. But if he were right, then all creationist claims that evolution violates the second law of thermodynamics would be fallacious. Why is Professor Sewell so vociferous in pointing out that if he were right then Dan Styer would be wrong, yet silent upon the consequence that if he were right then Henry Morris would be wrong?

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<sup>1</sup>H. Dingle, "Turning Points in Physics (review)," *Bulletin of the Institute of Physics and the Physical Society* **10**, 218–219 (1959). P.G. Wright, "Entropy and disorder," *Contemporary Physics* **11**, 581–588 (1970). D.F. Styer, "Insight into entropy," *Am. J. Phys.* **68**, 1090–1096 (2000). F.L. Lambert, "Disorder — A cracked crutch for supporting entropy discussions," *Journal of Chemical Education* **79**, 187–192 (2002). F.L. Lambert, "Entropy is simple, qualitatively," *Journal of Chemical Education* **79**, 1241–1246 (2002). D.F. Styer, "Entropy and evolution," *Am. J. Phys.* **76**, 1031–1033 (2008); erratum: **82**, 706 (2014). D.F. Styer, "Entropy and rust," *Am. J. Phys.* **78**, 1077 (2010). D.F. Styer, "Equilibrium versus homogeneity," *Am. J. Phys.* **83**, 749–750 (2015). J. Haglund, S. Andersson, and M. Elmgren, "Chemical engineering students' ideas of entropy," *Chemistry Education Research and Practice* **16**, 537–551 (2015). Jeffrey A. Phillips, "The macro and micro of it is that entropy is the spread of energy," *The Physics Teacher* **54**, 344–347 (2016).

<sup>2</sup>W.F. Giaque, "The entropy of hydrogen and the third law of thermodynamics: The free energy and dissociation of hydrogen," *J. Am. Chem. Soc.* **52**, 4816–4831 (1930). J. Bevan Ott and Juliana Boerio-Goates, *Chemical Thermodynamics: Principles and Applications* (Academic Press, San Diego, 2000) pages 175–176.