Alchemy

CMS NOTES

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A little while ago I was reading a book about the history of alchemy. What I found most surprising was how single-minded the alchemists were: for centuries, almost all their research efforts were dedicated to one or two goals: transmutation of base metals into gold or silver usually via the Philosopher's Stone, which could also grant immortality. Some useful techniques (notably the distillation of alcohol) were developed along the way, but overall alchemy had few spinoffs, given the labor and time involved. One major impediment was undoubtedly the backward-looking nature of the alchemical tradition: most alchemists believed that they were rediscovering an already-known secret. The vague outlines of this secret were generally agreed upon: there was little point looking elsewhere!

After a while, I got to wondering about what the corresponding episode, if any, in the history of mathematics might be. Astronomy spent a long time held back by the Ptolemaic system; biology was impeded by the Four Humors and various other theories. Aristotle's views on mechanics did little to aid the progress of physics. What of our own subject?

If you look back far enough, math simply wasn't studied much. When did people start? It's hard to tell – it's probable that the vast majority of Babylonian mathematical writings have been lost forever. We do know, however, that they had some idea of trigonometry and algebra, and applied it to astronomy. As far as I can find out, we don't know of anything that they (as a culture) got wrong mathematically.

And then (runs the oversimplified popular account) along came Pythagoras, around 500 BCE, and suddenly we had number theory and geometry. Well, it wasn't quite that simple: but there's little evidence that the splash of mysticism that the Pythagoreans flavored their math with actually did much harm. Calling odd numbers "male" and even numbers "female" seems unproductive and pointless, but it doesn't seem to have got in the way of their math. Euclid, working around 300 BCE, had the occasional lapse in rigor, but his results, interpreted with a little charity, are almost unfailingly correct.

So has mathematics ever gone off the rails? One might think of the "problems of antiquity" – trisecting the angle, duplicating the cube, and squaring the circle using compass and straightedge. These were once considered respectable but difficult, much as we consider the Riemann conjecture or the "P=NP" problem. Over the years, the suspicion grew that they were actually impossible, and that those attempting to solve them were wasting their time. In 1837 Wantzel proved that this was indeed the case. Needless to say, that didn't stop the trisectors! A good analogy in the natural sciences might be the dream of building a perpetual motion machine, which went through a similar evolution from plausible idea, to eccentricity, to "outsider science" attempted only by those unable to understand why it couldn't be done. It's worth noting that neither perpetual motion nor the "problems of antiquity" ever dominated the research efforts of their respective communities.

The point, of course, is not that early mathematicians were less error-prone than their counterparts in other fields. Rather, they were (and we are) fortunate in that mathematics only has to be self-consistent; this is much easier than being consistent with reality.