the next 1200 years, long enough for the farthest signals in the neighborhood to reach us? The combined chances need to be better than about 1 in 30 million. If the stars are too big or too small, if the planets' orbit or obliquity are wrong, their sizes or chemical compositions unsuited, their surfaces ill equipped, their geologic and meteoritic history too inauspicious, then we are alone. Then add in the biological uncertainties, which are much less well understood: If the chemistry needed to generate life is too intricate or too slow, if evolution from proteins to intelligence is too often aborted or misdirected, or if civilizations die off quickly, then, too, we are alone.

I support the search for extraterrestrial intelligence. If we don't look, we won't find them. But it is a risky endeavor, and nonprofessionals should keep in mind the complex and contingent evolutionary history of intelligence on Earth and the enormous limitations imposed by the finite speed of light. Livio and Silk end their discussion by asking, "Are we alone? The answer may affect nothing less than our claim for being special in the cosmos. . . . We shall never know unless we search!" That search, however, could very likely last an astronomically long time.

I think my own community of scientists has hopped aboard an optimistic science fiction bandwagon while being insufficiently honest in highlighting the many cautions. Percival Lowell, famous for his search for Pluto and his studies of the canals of Mars, wrote in 1908, "From all we have learned of its constitution on the one hand, or of its distribution on the other, we know life to be as inevitable a phase of planetary evolution as is quartz or feldspar or nitrogenous soil. Each and all of them are only manifestations of chemical affinity."[2]

No one believes that today. Every schoolchild knows that Mars has no artificial canals and no Martians either. Lowell's confident assumption was wishful thinking, and we should beware of making similar assumptions.

A companion issue is not nearly as ambiguous: the ethical one. If the human race might be alone, with no one to talk with, then we face the possibility that neither we nor our planet are commonplace; we might even be rare. The implications are that Earth and its life have cosmic value, that we have concomitant responsibilities, and that we will have to solve our problems without advice from superintelligent beings from space. The prospect brings great urgency to the cause of protecting our rare planet and its precious inhabitants.

References

1. H. A. Smith, *Am. Sci.* **99**, 320 (2011).
2. P. Lowell, *Mars as the Abode of Life*, Macmillan (1908), p. 37.

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Calling computers names in Swedish

I very much enjoyed reading Jim Fleming's article on Carl-Gustaf Rossby and the seminal contributions Rossby made to meteorology (PHYSICS TODAY, January 2017, page 50). However, the oth-

erwise excellent article has two errors.

Something must have gotten lost in translation to cause Fleming to claim that "Rossby pursued numerical weather prediction in Sweden in an era in which there was no Swedish word for digital computer." With applied mathematician Germund Dahlquist, Rossby developed a weather model for the Binär Elektronisk Sekvens Kalkylator (BESK; Binary Electronic Sequence Calculator). Designed and built in Sweden, BESK was the world's fastest computer when it became operational in 1953. From September 1954, BESK weather simulations enabled routine 24-hour national forecasts.

The funding agency for the BESK project, Matematikmaskinnämnden (the Swedish Board for Computing Machinery), has a Swedish word for digital computer, *matematikmaskin* (literally, mathematics machine) in its name! Other contemporary Swedish terms for computer were *siffermaskin* (numbers machine), *datamaskin* (data machine), *kalkylator* (calculator), and the more fanciful *elektronhjärna* (electron brain), favored by the media. *Dator*, the now predominant term, was not introduced until 1968. Also, the correct abbreviation for Sveriges Meteorologiska och Hydrologiska Institut (Swedish Meteorological and Hydrological Institute) is SMHI.

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▶ **Fleming replies:** I thank Johan Carlsson for his comments. My statement about "an era in which there was no Swedish word for digital computer" was based on a 1946 report by Stig Ekelöf, a technician at Chalmers Institute of Technology.[1] I could have said there was no widely used term in *any* language for the new machines.

According to the digital archives of Sweden's two leading newspapers, *Dagens Nyheter* and *Svenska Dagbladet*, the term *elektronhjärna* appeared as early as 1946. *Matematikmaskin* became established in 1947. *Siffermaskin* was mentioned in 1907 and reappeared in 1948. *Datamaskin* was in frequent use by 1956.

By the early 1950s, BESK (Binary Electronic Sequence Calculator) was the best machine of its kind in the world. Sweden used it to issue the world's first real-time operational numerical forecast on 23–24 March 1953; it beat the actual weather events by some 90 minutes. In 1955 Joanne Malkus and Georg Witt used BESK to generate the first digital cloud models.

When Carl-Gustaf Rossby entered meteorological service in 1922, the Swedish Meteorological and Hydrological Institute was called Statens Meteorologisk-Hydrografiska Anstalt. The name change occurred in 1945. The confusion of the abbreviations SMHA and SMHI on page 53 of my article is an editorial glitch.

Reference

1. A. Persson, *Meteorol. Appl.* **12**, 135 (2005), p. 143.

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Correction

September 2017, page 31—The amount of annual US hydrogen production is around 11 million tons, not 10 tons as stated. PT