rized data on more than 100 "men of eminence" and praised Gauss for the richness of his convolutions and sutures. In an outrageous example of nonrandom selection, he arranged a sequence of Gauss, a bushwoman, and a gorilla, and wrote: "The brain of a first-class genius like Friedrich Gauss is as far removed from that of the savage Bushman as that of the latter is removed from the brain of the nearest related ape" (*4*). Data can always be twisted and misused if expectations are sufficiently powerful. The conviction that black and female inferiority would be located in brain structure led "men of eminence" to know themselves and proclaim their innately higher worth in the face of ambiguous and contrary evidence. Wade cites Gauss's tale in a modern perspective, but the story between Wagner and Wade needs to be told as well, if only to temper current humor with a reminder that the same information can be nonsense or profundity in different social contexts.

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The brief article on Albert Einstein's brain recalled to me the fact that several of the great Swiss and German neuroanatomists in the period between the two World Wars were passionately interested in the study of brains of people of outstanding talent. One publication even carried the unusual title "How shall we study the brains of the elite?" These studies grew out of the discovery during this period that there were differences in the configuration of the cortex on the two sides of the brain and that, in addition, there were marked individual differences in this pattern of asymmetries. Even with this solid scientific basis, however, no firm conclusions could be drawn because the number of brains of distinguished people was too small. In the present state of study of the asymmetries of the brain, it is possible that differences would be found between the people who were highly verbal on the one hand and highly spatial on the other, but it is very doubtful that one could pick out the brains of geniuses.

There is a story, perhaps apocryphal, concerning the brain of another remarkable figure which was removed for study. One distinguished German anatomist is said to have reported at a medical meeting that the brain of Lenin was exceptional because on microscopic study it was found to have seven layers in the cerebral cortex instead of the usual six. At this point, one of his right-wing colleagues is supposed to have shouted angrily, "Would you consider a baby born with six fingers to be a superior specimen?"

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Alfredics

While William J. Broad's squib (News and Comment, 29 Sept., p. 1195) on my predictions of the 1978 Nobel Prize winners (in *Omni*, October 1978) is accurate in every other respect, he errs by suggesting that my method includes "hocus-pocus." No magic whatsoever was involved. Indeed, the predictions were derived from the 17 quantifidamncations which undergird low energy alfredics, alfred being the first name of the Nobel Prize. Alfredics of any energy level is a social science and, as you well know, there is no magic in a social science. Unfortunately, the entire 17-part formula upon which the predictions were based—plus the original title of the paper, "How to bet the Nobel Prize"—were snipped away by referees to discourage unwholesome elements from setting up in Stockholm. In the event that my prognostications are reasonably correct—I would consider one winner out of ten candidates to be reasonable—I will prepare a second paper outlining the complete system. It is my belief that the only way to democratize the secretive and elite Nobel operation is to make it possible for every fool to make money out of it.

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Eavesdropping on Galactic Civilizations

The possibility (*1*) that our present radio technology could be used to eavesdrop on the internal radio communications of a civilization on a planet of a nearby star has been known for some time; it is accordingly instructive to see just how the earth's television and radar transmissions might be viewed over the

vantage point of some light years (27 Jan., p. 377). However, the possibility of such eavesdropping is not necessarily an argument for skewing radio search programs and the development of radio astronomical instrumentation toward an eavesdropping mode. Extensive microwave transmitting systems on the earth are at most 30 years old. Present trends are toward cable and tight beam transmission for television, and it seems likely that at least in the matter of television the high-intensity radio power spectrum of the earth has a lifetime of less than a century. This implies that the intensity-time curve of radio emission from the earth is approximately a delta function centered around the last quarter of the 20th century, with a half-width of about a century in a total lifetime of 4.6×10^9 years. If this experience is typical of emerging planetary civilizations, the probability that a given civilization is wastefully leaking radio power to space as we are has a probability of $\sim 10^{-8}$. As even optimistic estimates of the number of advanced technical civilizations in the galaxy (*2*) are less than 10^8, it follows that there is no civilization in the entire Milky Way Galaxy which should be preferentially detectable through radio eavesdropping. It is, of course, conceivable that advanced technical civilizations could have very high intensity space surveillance radar systems, for astronomical or military contingencies (and if such systems were spaceborne they need not have the awkward intermittency problem of a radar based on a rotating planetary surface). But this is quite a different situation from the television eavesdropping context and one less easy to understand by analogy with current terrestrial trends (*3*).

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3. Supported by NASA grant NGR 33-010-101.

Sagan's concern appears to be over the possibility that our article about eavesdropping on extraterrestrial civilizations might influence some researchers to alter their search strategies from conventional ideas put forward over the past 20 years. Indeed, we do believe that some efforts should be directed toward the eavesdropping mode, but nowhere in our article do we argue that searches for purposeful signals should take second

priority or be abandoned. In many cases virtually the same observational strategy can be employed for either type of search—it is the "decoding" of any received signals which is very different when acting on one hypothesis or the other. Sagan's arguments about the longevity of television leakage from earth are possibly correct, but the point is that we do not and cannot know how applicable they are to even the future of *this* planet, not to speak of the typical experience on other planets. The cable television people have by now been telling us for decades about their imminent dominance of the industry, and yet it has not happened and may well never happen. In any case, even if Sagan's probability of 10^{-8} for *television* leakage is correct, we do not imagine that any leakage signals we might detect would be at all related to television. In order for the principles of our article to apply, they need be only narrow-band, periodic, electromagnetic signals not intended for our reception. Our focus on the earth was only because it was the only example of a technical civilization which we had at hand.

As an addendum I note that in our article we concluded that the Ballistic Missile Early Warning System radars were probably detectable at the greatest distance of any that our civilization continuously emits into a reasonable fraction of the sky. I have now, however, learned of a more powerful transmitter, namely that of the U.S. Naval Space Surveillance System (*1*) located at Archer City, Texas.

The effective radiated power of this antenna is 1.4×10^{10} watts into a bandwidth of only ~ 0.1 hertz. Its beam is such that any eavesdropper in the declination range of 0° to 33° (28 percent of the sky) will be daily illuminated for a period of $\gtrsim 7$ seconds. This antenna then significantly extends the range of detectability of leaking terrestrial signals: to ~ 60 light years for an Arecibo-type (300-meter) antenna at the receiving end, or ~ 600 light years for a Cyclops array (1000 100-meter dishes). While this latter distance encompasses $\sim 10^6$ stars, it should be noted that the transmitter has only been on the air since A.D. 1967. Thus only a fraction of these stars have to date had a chance to be bathed in this radiation, although they all will have by the 26th century.

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