

Teacher-to-Teacher

“Biorhythm” is Bio-Nonsense

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A spate of popular articles and advertisements has appeared touting “biorhythm.” This theory proposes that sinusoidal physical (23-day), sensitivity (28-day), and intellectual (33-day) rhythms commence at the moment of birth and modulate feelings and behavior predictably throughout life (Thommen 1964). Dangerous reactions are purported to occur on the “critical days” when the rhythms cross the zero line. “Double critical days” occur when the cycles cross the zero line on the same day; and “triple critical days” occur when all three cycles cross simultaneously.

“Biorhythm” theory was first developed around the turn of the century by Hermann Swoboda of the University of Vienna and by Wilhelm Fleiss, Sigmund Freud’s “analyst.” Poor Freud struggled with Fleiss’s theories for many years before finally rejecting them (Jones 1953).

Because there are true rhythms in the human body that may be usefully estimated with sinusoids (Luce 1970), “biorhythm” has face plausibility. Nevertheless, none of the genuine biological “clocks” such as the heartbeat, the menstrual cycle, or the circadian rhythm is sufficiently precise to be predictive for many years after birth (Pittendrigh and Daan 1976). Even biological clocks synchronized by astronomical events are altered by shift work, transmeridional travel, or variations in latitude (Aschoff 1975;

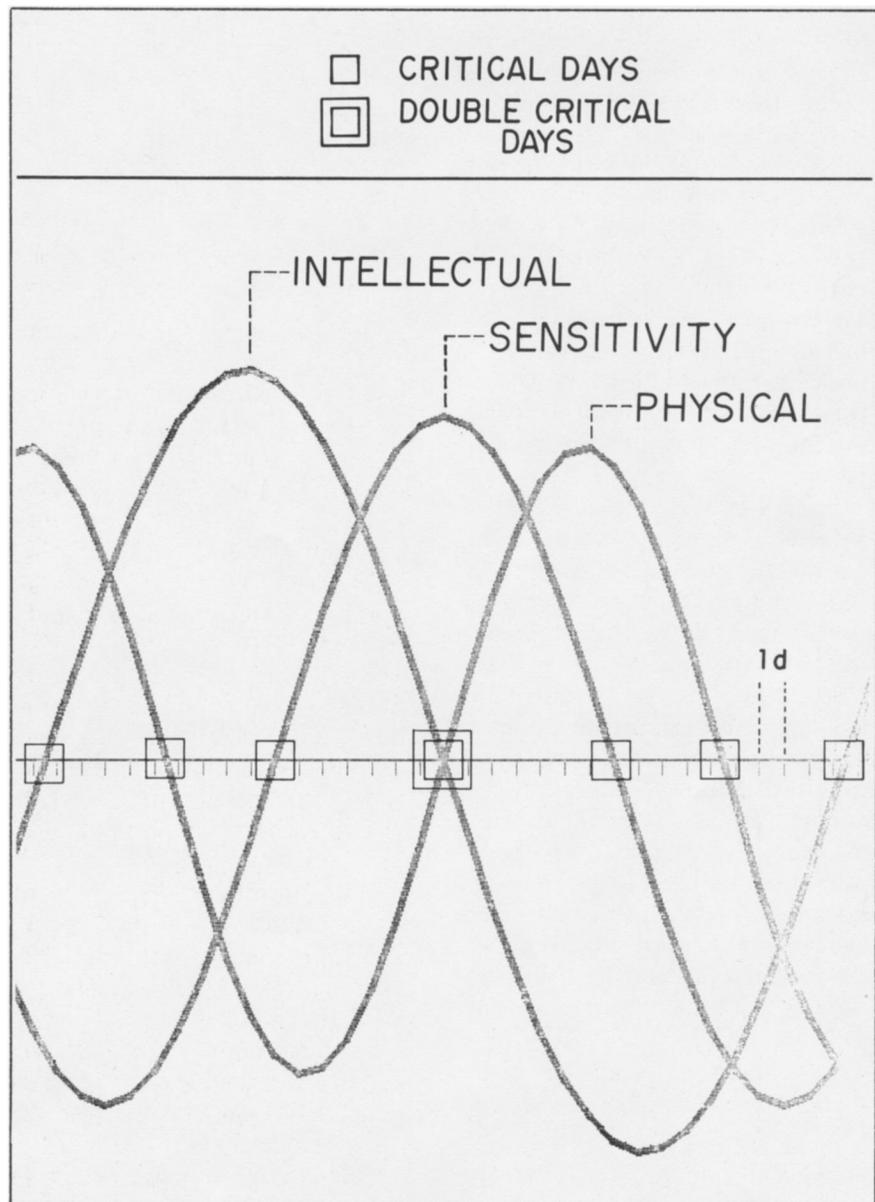


FIGURE 1.

Batschelet, *et al.*, 1973), so "biorhythm" predictions are not consistent with known phenomena. The best empirical tests of the theory have thus far failed to demonstrate any predictive validity (Shaffer, *et al.*, 1978; Ahlgren 1974; Schonholzer, Schilling, and Muller 1972; Wolcott, *et al.*, 1977).

Conducting Our Study

We decided to conduct further tests of the predictivity of the "biorhythm" theory. Thirty staff members of a psychiatry service were asked to graphically rate their "physical" state from best to worse along a 100-mm line. "Emotional" and "intellectual" states were similarly rated. Subjects were blind to the "biorhythm" predictions; that is, they did not know their predicted biorhythm states. Correlations were computed between the subjects' self-ratings and their predicted state determined from birthdate according to "biorhythm." The program provided with a Texas Instruments SR58 calculator was used. Ten days later, a replication was obtained from 30 subjects, including 25 repeaters from the initial group.

In a second experiment, 50 patients who came to a college health center for treatment of accidental injuries over a two-week period were selected without regard to birthdate. From the patients' birthdates, it was determined whether these accidents occurred on "critical days" taken as ± 24 hours from zero crossings of the biorhythm cycles. These 48-hour critical periods were used to avoid uncertainties deriving from the unknown hour of birth. The significance of accidents on critical days were evaluated by chi-square tests.

Results

All of the correlations between the observed and predicted feeling states were low, and most were not statistically significant. As might be

TABLE 1. Predicted Biorhythm States and Observed States of Subjects

| | State | Correlation | Significance |
|---------|--------------|-------------|-----------------|
| Study 1 | Physical | $r = .36$ | $p = .05$ |
| | Emotional | $r = .07$ | Not significant |
| | Intellectual | $r = .30$ | Not significant |
| Study 2 | Physical | $r = -.55$ | $p = .05$ |
| | Emotional | $r = .33$ | Not significant |
| | Intellectual | $r = -.02$ | Not significant |

TABLE 2. Accidents Occurring on "Critical Days" for 50 Subjects.

| | Predicted by Random Variation | Observed |
|-----------------------------|----------------------------------|----------|
| Physical Cycle | 9 | 8* |
| Sensitivity Cycle | 7 | 11* |
| Intellectual Cycle | 6 | 10* |
| Double-Criticals (2 cycles) | 3 | 2* |
| Triple-Criticals (3 cycles) | 1 | 0* |

*Predicted and observed were not significantly different (chi square 3.0)

anticipated when many correlations are computed, one in twenty of individual correlation coefficients might reach "significance" at the .05 level due to chance. However, the overall number of "significant" correlations and the mean correlation were consistent with chance results (table 1). The largest correlation happened to be negative (contrary to prediction). The correlations were inconsistent across replications. The upper-confidence limit of the mean correlation was $r = 0.27$; that is, there is a 95% chance that biorhythm theory accounts for less than 8% of the variability of self-ratings.

The number of accidents occurring on critical days did not vary significantly from the number predicted by random variation for any of the three cycles. Furthermore, the numbers of accidents occurring on double-critical or triple-critical days were slightly less than random expectations (table 2).

Our results confirm that the "biorhythm" theory is worthless for predicting behavior. The commer-

cial popularity of this pseudo-science highlights the persistence of mythical approaches to mental health problems.

Students may wish to test "biorhythm" theory for themselves. Our methods could provide a simple and amusing project in the scientific use of prediction, observation, and statistical analysis in the classroom. Students may then be attracted to the measurement of real biological rhythms, for example, by the methods of Halberg, *et al.* (1972).

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Biorhythms

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Double Helix

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taping such programs or renting the films to be shown at the appropriate class time. I have treasured a *Life* magazine article on James Watson since 1972, and I use it to bring students somewhat up to date on his more recent whereabouts. The November 1977 issue of *BioScience* announced that Francis Crick is establishing residence in this country to begin research here, an event that I brought to the attention of the class.

In spite of the initial reaction to the reading assignment, student response to the study at its

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completion has always been quite positive. They come to appreciate the glimpse into the scientific community, the exposure to the human element in science and its influence on scientific investigation, the opportunity to consider and discuss conflicting points of view on cooperation versus competition in science. In general, they appreciate most of what has been given to them through the reading.

One may be inclined to suggest that this method of teaching be reserved for the English or literature class and that time in a science class is best devoted to laboratory experiences and development of concepts. Such a viewpoint is valid for the most part; however, if you are one who believes that broadening the perspective and increasing the total awareness of your students is an important part of their science education, then you may find, as I have, that guiding them through *The Double Helix* is an excellent way to attain these goals.

Note—The two series mentioned in the text of the article are: NOVA PBS Television Series 1977. *Linus Pauling: Crusading Scientist*, produced by WGBH, Boston, Massachusetts; and NOVA, PBS Television Series 1977. *The Race for the Double Helix*, also produced by WGBH, Boston, Massachusetts.

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Letters

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as rather strange. Never in my life have I seen a chicken bone with webbed feet!

Looking at page 162, figure 9, I wondered had the moth been reclassified into the ranks of the butterfly or had that butterfly undergone a strange metamorphosis, changing it into a moth?

Obviously, one of two situations exists. Either the biology textbooks, supplemented by audiovisual material and the instructors' field work, are in error or the illustrations themselves are valued solely on an aesthetic, rather than a scientific, basis.

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Editor's Note—We expect to run a response from Ms. Karan to Mr. Campbell's letter in a future issue of *ABT*.
