

## CHAPTER 3

### Knowing Biology

#### Is Blood Type Related to One's Character?

In contemporary Japan, knowing a person's blood type is not just considered important during blood transfusions, it is also used to predict an individual's personality and the nature of his or her social interactions (Sakurai, 1997). Young people who go out on a first date typically try to learn each other's blood type—or, ask their own matchmaker to screen out the undesired types in advance. Employers in Tokyo may seek to hire only employees who have a particular blood type—one socially compatible with the employees they already have. People who read the Japanese tabloids hope to discover what blood types their favorite TV and film stars have. Women's magazines even publish diets said to be suitable for particular blood types. In Japan, the subject of blood types is as popular a topic of general conversation as the weather.

From the history of biology, we know that many so-called common sense ideas have turned out to be erroneous when subjected to the light of careful scientific scrutiny. Human blood, for example, has been attributed with having extraordinary powers far beyond the role we ascribe to it today as a *physiological fluid in the form of a liquid tissue* – with past claims including that it acts as the seat of the soul, as the prime determinant of human inheritance, and as the controlling agent of human personality.

With respect to the latter, Hippocrates promoted blood-letting methods to adjust human personality characteristics using the doctrine of the four humors (Gardner, 1972, p. 58). Thomas Bartholin (1616–1680) “reported that he had examined a young girl who displayed feline characteristics after drinking the blood of a cat” (Magner, 1979, p. 116). Even that giant of biological thought, Charles Darwin, proposed a blood-borne theory of inheritance in which tiny gemmules that were given off by every body cell were carried to the reproductive organs and assembled into eggs or sperm (Magner, 1979, pp. 409–410). Darwin thought that, at conception, blood-borne gemmules arising from both parents formed the new human embryo – with gemmules for particular traits coming from either the maternal or paternal line.

While the possibility always exists that blood-based explanations of human personality may someday prevail in science, their future looks bleak at this juncture. From what we know about inheritance of personality today, claiming linkage patterns between ABO blood type genes and personality-influencing genes seems far-fetched as a comprehensive explanation. Some proponents claim that the very fact that today's science rejects their views only substantiates how progressive their views really are. However, as the popular scientist Carl Sagan (1979, p. 64) pointed out in

his writings about borderline science, while it is true that people sometimes laugh at those whose thinking is actually far more advanced than their own, such laughing alone is not convincing validation – since people also laugh at Bozo the Clown, and rightly so.

The arbiter in science is convincing and replicable evidence. Until it exists, speculation must be treated as speculation. The big contribution which a scientific theory makes is bringing order out of chaotic facts and observations; while the ABO blood-type theory of personality does that to some extent – it must also fit with the biological knowledge we currently have about human blood and about human personality's heritable and environmental components. Social science tells us that personality differences go well beyond biologically defined temperaments. Prevailing moods may reflect long-term positive or negative experiences – they may derive from each individual's personal and social learning history within particular familial or cultural contexts (Snow, Corno, & Jackson, 1996, p. 258). In short, human personality determination is apparently quite complex and has multiple causes. Perhaps it is well to recall Alfred North Whitehead's oft-quoted aphorism, "Seek simplicity, but distrust it."

The idea that ABO blood type influences personality dates back to 1930 when, during Japan's Asian military invasions, the Japanese military commissioned a study of how blood type affects personality — in an attempt to create better soldiers. Some proponents have sought anthropological data to support these claims. Yet there seems to be little scientific evidence to support the conclusion that ABO blood type influences personality and few other cultures share this belief. Is it fact or fantasy?

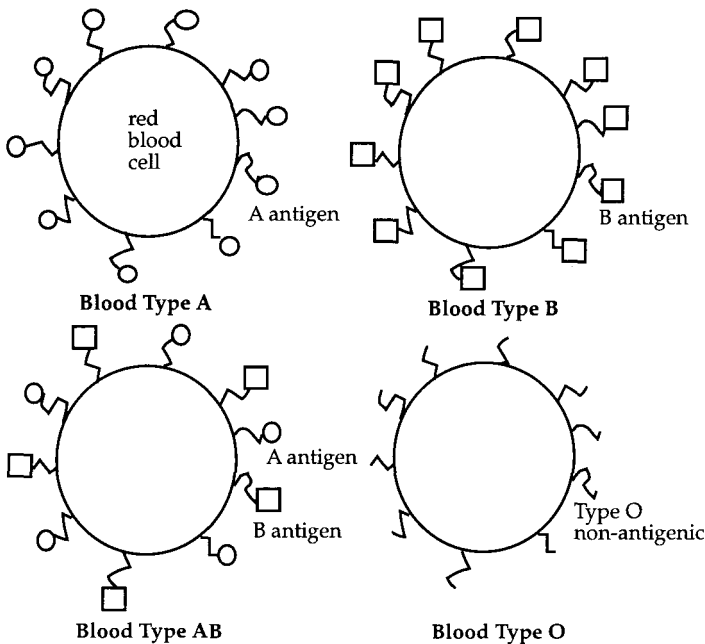
The idea still persists in Japan today – across all age segments of the population. The Japanese believe that type A blood (the "farmers" type) produces nervous, detail-oriented, honest, loyal, careful accommodators; type B blood (the "hunters" type) produces noisy, proud, aggressive, optimistic, adventurous people; type AB blood (the "humanists" type) produces creative, critical but useful people who are full of contradictions; and type O blood (the "warriors" type) produces highly motivated, workaholic, emotional people who seek to control any group they join.

What can we learn about blood types from biology? In 1901, Karl Landsteiner reported that there were types of human blood that together constituted the ABO blood system, and that the incompatibility of certain blood types could explain the rapid intravascular hemolysis that occurs during some blood transfusions. In 1930, he received the Nobel Prize in medicine for his discovery of human blood groups. The ABO blood types are produced by a single gene for which there are three different alleles (variations of the gene) in the population. These alleles produce enzymes that modify carbohydrates attached to the surface of red blood cells. The carbohydrates are antigenic — that is, they can stimulate production of antibodies and will react with antibodies that are specific to them. Today, we know that there are many other blood group antigens on red blood cells, the most important of the others being the Rhesus (Rh) system. There is also a complex set of antigens (the HLO antigens) on white blood cells and many other body cells.

As for the ABO system, we now know that the A, B, and O factors are carbohydrates (oligosaccharides) that attach to the ceramide lipids of the red blood

cell's plasma membrane, but that can also attach to proteins. Type O cells are marked with a saccharide sequence — fucose-galactose-n-acetylglucosamine-galactose-glucose — attached to the ceramide membrane lipid. The A antigen is produced when N-acetylglucosamine is attached to the outer galactose in this sugar, while the B antigen is produced when an extra galactose is attached to that outer galactose. Thus, what humans inherit is either 1) an allele coding for an enzyme that attaches N-acetylglucosamine to the O saccharide (type A), 2) an allele coding for an enzyme that attaches an extra galactose to the O saccharide (type B), 3) both of these alleles (type AB), or 4) two alleles that do not alter the basic saccharide (type O) — see Figure 3.1.

Humans produce antibodies that circulate in the blood and that react with type A and type B antigens. A type A person will have anti-B antibodies, a type B person has anti-A antibodies, and a type O person has both kinds of antibodies. Interestingly, these antibodies are produced in response to antigens found on intestinal bacteria, but react with type A and type B red blood cells due to cross-reactivity. The antibodies are not produced if an antigen is part of “self.” Most people do not make antibodies that react with the type O saccharide. Recently, however, some rare individuals have been discovered who do produce antibodies that react with the O saccharide — the Bombay phenotype.



*Figure 3.1. Schematic diagram of glycolipids on the surface of red blood cells that are produced by ABO alleles and give rise to the ABO blood types. Drawing by Laura Becvar.*

What does this ABO cell biology have to do, if anything, with human character determination? Seemingly nothing. Science is mute on this point, and there is virtually no scientific evidence to support an “ABO personality hypothesis.” It is interesting to note that the Japanese blood type study was mandated in the same year that Karl Landsteiner won the Nobel prize, which may be why this particular red blood cell system (ABO) was selected as the scientific tool to use for human personality prediction. Yet while blood typing *is* scientific, such simplistic and unwarranted leaps of application definitely are not.

Humans seem to have strong desire to predict personality — it is part of their future orientation. In the US astrology serves this purpose, while in Japan the ABO blood system is used. Science cannot support either approach because there is no theoretical basis, no known mechanism, and questionable empirical data.

On the other hand, scientists must always reserve final judgment. Consider the recent National Institutes of Health findings showing success in treating certain medical conditions using the traditional Chinese therapeutic technique of acupuncture, or the recent Baylor College of Medicine pilot study showing that magnetic therapy (using small, 300- to 500-gauss magnets fitted to the anatomic area where the pain is centered) successfully reduces pain in patients suffering from post-polio syndrome (Altman, 1997). Both therapies initially seemed dubious to scientists, and unfortunately they still don’t understand the scientific basis for these therapeutic effects. Right now, two leading hypotheses for the magnetic therapy include the following: the magnets may increase blood flow to a painful area of the body — reducing inflammation and pain, or, the magnetic field may effectively block pain receptors in the painful area (Fremerman, 1998, p. 56). These therapies contrast with many other popular remedies for medical conditions that have been shown to be ineffective.

Such topics are not typically the foci of scientific research because scientists are more likely to make progress via studies that are supported by and have the potential to advance sound scientific theories. Scientists are justifiably reluctant to work on investigations in the so-called *borderline* or *fringe areas* of science. They are willing to pass on studies with a low probability (albeit, potentially high yield) for success, those that require hypotheses which cannot be supported by current scientific theory. The Japanese blood type theory of character determination and the popular astrological approaches to forecasting human events fall into this category. Today the scientific research topics being pursued are determined mostly by where the funding is available, but since scientists are involved in establishing the funding programs, the same biases still apply, albeit indirectly.

#### HUMANS SEEK TO INTEGRATE THEIR KNOWLEDGE FOR FUTURE USE

The foregoing story illustrates that advanced societies expect science to be able to explain everything—even social behavior. But, science has its limits (both as to what constitutes a legitimate scientific question and as to what is currently explainable scientifically). Science doesn’t have all the answers and never will. It is likely that individual human behavior will always remain unpredictable to some degree. The

leap from basic biology to behavior is enormously challenging, in that it entails many levels of biological organization, environmental factors, and the effects of learning from experience.

In spite of these reservations, we agree with psychoanalyst George Kelly (1955, p. 48) who maintains that humans ultimately seek to anticipate real events. Such anticipation is crucial for survival of the individual and the species. Humankind is future-focused. In fact, Kelly says that humans are “tantalized” by the future and this is why we argue that humans’ knowledge structures reflect this bias.

People search for recurrent events and the conditions under which they occur. The relations humans use to connect the concepts that they have already learned serve primarily to represent reality for future reference and application; relations make possible the conceptual hierarchies that serve to “rank-order” and integrate what we know for efficient use later. Dennett (1996, p. 57) puts it this way, “A mind is fundamentally an anticipator, an expectation-generator.” The process of knowledge mapping is useful in this regard in that it helps us to make our relations explicit and to streamline our knowledge structures for ease of retrieval.

### THE IMPORTANCE OF THE “NEED TO KNOW” PRINCIPLE

It appears that some organisms have little need to know things in advance. The amoeba does not seem to have a plan or even a focused “search image” of what it must seek out or avoid. It responds to selected stimuli “on the fly.” An economy-of-information rule seemingly applies across the kingdoms of life—although the quality and quantity of what needs to be known in advance varies with the species. Thus, each extant species of organism has, over time, developed perceptual and representational limits adequate for its survival to date.

This is not necessarily so for contemporary humans. As “informavores,” we have, quite recently in our history, been led to think that more information is always better than less. Unfortunately, such a superabundant stimulus flux can also lead to what has been called “information overload” and “paralysis of analysis.”

We suggest that in biology teaching and learning, students’ knowledge structures should be optimized primarily for efficiency and effectiveness in making anticipatory decisions. Many complex details that probably will not be used frequently in the near future can be “off-loaded” to external memory devices (e.g., books, computer storage devices, or visual media). Dennett (1996, p. 134) points out that such off-loading can free us from the processing limitations of our brain—which is far from the largest in the animal kingdom — thus, streamlining our thinking.

Biology teachers have traditionally foisted high volume/high conceptual density memorization tasks upon their students—claiming these to be a requirement for “understanding” biology and an indicator of their courses’ high academic rigor. (We think that knowledge-mapping tasks would be a better alternative to such assignments—more on this later.) And while these fact-laden assignments are usually not solely rote-memorization tasks, they do tend to induce a high level of rote memorization. Few instructors would want to ask a former graduate to retake her final exam five years hence in, for instance, plant physiology, to see what course-

based knowledge is still accessible today. While many students, especially biology majors, are able to memorize and reconstruct selected biology topics in great detail within the context of a particular biology course, biology teachers are generally aware how little of that information each student stores in long-term memory. And the quantity of long-term understanding declines precipitously with nonmajors.

#### SPURIOUS CRITICISM OF STUDENTS' UNDERSTANDING

Craig (1997, p. 23), in a short essay on how woefully inadequate today's University of Michigan students' knowledge of American historical and political knowledge is, exemplifies the carping of those university professors who apparently have not thought through which knowledge in their field is of greatest worth.

He relates that every semester for the past 10 years, he has given his undergraduate classes on public opinion, consisting mostly of upper class students, a "brief quiz of assorted historical facts." Later he dubs these facts to be "basic historical and political knowledge."

What is this foundational knowledge the "bright, inquisitive individuals" in his class lack? Here are the examples Professor Craig (1997, p. 23) gives. Who are Michigan's two current senators? When did World War II begin and end? Who is the current US Secretary of State? Who was Joseph Stalin? These are factoids—informational tidbits that can be easily off-loaded and retrieved on a need-to-know basis. He does not include a single general principle such as "What conditions generally lead to instability in a country?" or "What are the biggest threats to democracy?"

Craig says he was dismayed to find out that his students were not embarrassed by their performance on his quiz, telling him (Craig, 1997, p. 23) that "they wouldn't need the information in their future jobs" and asking, "When is any of this stuff going to matter in my career?" On the basis of his short quiz and the students' subsequent defensive reaction to being told they had performed poorly on it, he then concludes that these students "see no need to understand why democracy needs to be preserved," closing with a dire warning: "...If our most promising young people have no appreciation for why democracy is worth preserving, how will they know when it is threatened?"

From the information presented in the essay, we side with the students. While a well-read, up-to-date person may have little trouble answering such specific and relatively trivial questions, college students are typically so busy with ample, challenging course work, jobs to pay for their education, and other college-related activities that most must virtually abandon public life during their college career. All of the questions cited have arguably little relevance to the students' immediate future, nor are their answers necessarily representative of the quality of their future citizenship, or even of their overall understanding of American history. While ignorance of dates and surnames is claimed by Craig (1997) to augur the demise of American democracy, we think it actually indicates college students' aversion to courses driven by obsolete views on what constitutes good instruction, and their rejection of educational practices that overvalue memorization and mindless learning.



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