Upon Further Reflection: View from the Other Side of “Windows on the 21st Century”

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Published online: 10 July 2014

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Abstract Three points discussed in Glenn (1993) are reviewed in the context of current events: the discipline of behavior analysis as a cultural system, the importance of that discipline in the training and regulation of behavior analytic practitioners, and Association for Behavior Analysis International (ABAI) as a cultural subsystem that links to all the other parts and therefore links the other parts to one another. Noting similarities between behavior analysis and biology, I consider the growth of biological sciences as a model for behavior analysis. Of particular importance for biology has been the role of basic biological sciences in the practice of medicine and the resulting feedback loops that have developed among its basic sciences, applied sciences, and medical practice. I suggest that behavior analysis explicitly follow this model and that ABAI has a critical role to play in leading the field to developing the feedback loops that have integrated the biological sciences and medicine.

Keywords Science · Practice · Biology · Medicine · Association for Behavior Analysis · Feedback loops

In the published version of my 1993 presidential address for the Association for Behavior Analysis (ABA before

it was International), I offered something of a “state of the union” message—the “union” being behavior analysis as a cultural level entity or system and ABA being one of its parts or subsystems (Glenn 1993). I likened the association’s role in the larger cultural system of behavior analysis to the role of the central nervous system in organisms because it seemed that ABA was the only subsystem that linked to all the other parts and therefore linked the other parts to one another.

Matt Normand (Editor of *The Behavior Analyst*) invited me to write a brief commentary on my 1993 article “in the context of current events,” which provided an opportunity to think further about behavior analysis as a cultural system and about the Association for Behavior Analysis International (ABAI, nee ABA) as an integrative subsystem. Two points that I made in the 1993 paper, on which I will expand here, pertain to the disciplinary character of behavior analysis and the importance to that discipline of the training and regulation of behavior analytic practitioners.

Noting that behavior analysis is closest to biological science in both scientific content and disciplinary structure, I begin below by considering similarities in those two disciplines. Next, I discuss the twentieth century growth in biology and discuss what appear to be three drivers of that growth. Then, I suggest how behavior analysis might grow by following the path established by biology. Last, I examine ABAI’s historical role in the growth of behavior analysis and consider its path along the razor’s edge into the future.

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Similarities in Disciplines of Biology and Behavior Analysis—and a Difference

Biology is a scientific discipline comprising many different subdisciplines focusing on a variety of content areas that include, for example, botany, anatomy, ecology, genetics, paleontology, physiology, and bacteriology. The coherence of these biological subdisciplines rests on two critical features: First, a small number of key concepts are foundational for all of the subdisciplines; second, an overarching conceptual framework to which they all subscribe unifies the subdisciplines.

Foundational concepts for all biological sciences include cells as the basic units of life, genes as units of inheritance, and environments as comprising the parts or features of the physical world that exist outside of and affect the biological units of interest (i.e., organisms, cells, genes, colonies, and so on). The conceptual framework that unifies the biological subdisciplines is the theory of evolution and its processes, which currently include natural selection, gene flow, mutation, and genetic drift. One might say, then, that the biological sciences share a foundation and a roof.

Behavior analysis also comprises a number of subdisciplines having a small number of unifying concepts that form their foundation. Those concepts include operant and classical conditioning, habituation, stimulus control, and motivating operations, which are the foundation of nascent subdisciplines such as behavioral economics, instructional design, relational frame theory, behavioral pharmacology, and so on. As in biology, subdisciplines elaborate on the unifying concepts with additional concepts specific to the subdiscipline's subject matter. Also less well developed than in biology is a conceptual framework that unifies the discipline. That framework is often viewed as having parallels with the evolutionary framework of evolutionary biology (e.g., Donahoe 2003; Glenn and Madden 1995; Hull, Langman and Glenn, 2001).

A significant difference between biology and behavior analysis concerns the relations between their basic sciences and practices based on the findings of those sciences. Another difference is that biology has many more subdisciplines, more scientists, more funding, and more public interest. Given that modern biology began some 200 years before behavior analysis, that may not be surprising, but a longer history does not necessarily translate to cumulative growth and expansion.

Of particular interest here is the explosion of growth in the biological sciences that occurred during the twentieth century, extending to the present. During this same time period, modern medicine advanced exponentially in diagnosis, treatment, and prevention—first with respect to infectious diseases and more recently with respect to chronic conditions. Although it is obvious that advances in biological science are major contributions to advances in medicine, it may not be so obvious how medicine has contributed to the growth of biology. In the next section, I consider those relations.

Biological Theory and Research and the Practice of Medicine

A significant contribution to the growth of the biological sciences in the twentieth century was the “synthetic theory” of evolution. This theory resulted from the marriage of the experimental science of genetics to Darwin's theory of evolution by natural selection (Mayr and Provine 1980). The synthetic theory erected a roof for all biological sciences, which has been elaborated and renovated in numerous ways. Punctuated equilibrium was offered as an alternative to Darwin's view of constant slow and steady evolution (Eldridge and Gould 1972). The mechanisms of inheritance have expanded to include environmental contributions to inheritance and the ongoing gene/environment partnership during ontogeny (Moore 2001). Evolutionary theory is increasingly applied to biological research on the causes of cancer, antibiotic resistance, and other medical conditions (e.g., Merio et al. 2006). The scientific power of evolutionary theory, then, is that it connects biological sciences to one another and opens the possibility that any of them can, in principle, contribute to medicine.

A second contribution to the growth of biology in the twentieth century is the linking of standard medical training to training in the biological sciences themselves. Although medicine and experimental biology had been intertwined for over 200 years, medical training at the end of the nineteenth century was quite haphazard in the USA. During the latter half of the nineteenth century, an expanding population resulted in a plethora of medical colleges where “it was easy for a man of no particular training to attend lectures for one winter and to emerge a full-fledged doctor” (Shryock 1936/1974, p. 258). Public confidence in medicine was at low ebb after a succession of “panaceas” from

purgatives through hydrotherapy swept the country even as scientifically trained practitioners decried them.

In 1901, the American Medical Association initiated efforts to improve training standards. A report in 1908 to the Carnegie Foundation on Advancement of Teaching focused upon the inadequacy of much medical training; this resulted in the closing of dozens of inferior medical schools by 1929 (Shryock 1936/1974). The resulting standardized medical training was firmly based on scientific findings of bacteriology, medical entomology, immunology, toxicology, and other basic sciences. Since at least the mid-twentieth century, medical school has begun with 2 years of didactic courses in basic biological sciences.

A third contribution to the growth of biology in the twentieth century has been the systematic feedback loops that have developed between the practice of medicine and the several biological sciences. Both medicine and basic sciences have benefitted enormously from these relations. When physicians confront problems for which there are no known solutions, biological researchers in one or more subdisciplines seek to understand the source and nature of those problems. Many of the researchers participating in these feedback loops are applied scientists trained as medical doctors who go into research positions after completing the medical degree. Their general training in biology in conjunction with their medical training may render them particularly useful as links between the basic research of Ph.D. biologists and medical practitioners.

Theory, Research, and Practice in Behavior Analysis

If the three features of twentieth century biology suggested above have contributed significantly to its growth, might behavior analysis use the biology model to guide its growth in the coming century? Let us consider the situation and what that could mean.

As might be expected given its more recent beginnings, ontogenetic selection theory is not nearly as well developed as evolutionary theory in biology. However, behavior analytic theory has been advancing, somewhat haltingly, beyond Skinner's initial insight of reinforcement as the causal nexus of ontogenetic behavior change. Sporadic attention has been given to the evolutionary path of behavioral relations in human repertoires, some examples being Rosales-Ruiz and Baer (1997) on behavioral cusps, Donahoe and Palmer

(1994) on complex repertoires, Sidman on equivalence relations (Sidman 1994), and Hayes and colleagues on relational responding (Hayes et al. 2001). Neuringer (1993) has addressed variability as a factor in the ontogenetic evolution of behavior. There have even been challenges to the primacy of reinforcement in behavior change (e.g., Baum 2012) that are not unlike challenges to the primacy of selection in the evolution of species. Alas, nothing comparable to the synthetic theory has emerged to link some or all of these efforts into a common framework.

Moving on to basic research and the practice of behavior analysis, there appears to be a chasm between the two. It has been noted that support of basic research in behavior analysis may be lacking because that research “does not focus sufficiently on problems relevant to the general population” (Neuringer 2011, p. 27). What seems to be missing is something like the feedback loops that exist between basic biological research and unresolved problems that beset practitioners. Those two ends of the continuum might be bridged by specifically training applied researchers in both the basic subdisciplines and the problems faced by practitioners.

As for the training of practitioners, there currently is little in behavior analysis that approaches the training of medical practitioners. Because in behavior analysis both researchers and practitioners are trained as graduate students in universities, training of both can be considered together. If the linkage between basic science and practice that characterizes biology/medicine was to be used as a model, graduate training (both of basic scientists and practitioners) would begin with two full years of basic and translational behavioral science. The first year might focus on historical and current research in classical and operant conditioning;¹ the second year might focus on basic and applied research in several subdisciplines.² This coursework would be less about doing science than about the knowledge base that currently exists and the frontiers where problems currently have no answers. However, all students

¹ A handbook by McSweeney and Murphy (2014) offers an overview of what is known about operant and classical conditioning. Introduction to these fundamental concepts could be followed up in first year courses that cover, in depth, the basic research cited.

² The recent *APA Handbook of Behavior Analysis* (Madden 2013) provides overviews of many areas of behavior analysis that could be used to initiate second year studies. Coursework in several of these areas could then provide in-depth coverage of areas where faculty at a given institution had specific expertise.

would participate in doing science through laboratory experience. Scientist trainees would then move on to 2 or more years of research training. For practitioners, a year of clinical rotations would provide opportunities for relating practice to the scientific findings and lay the foundation for problem solving in more than one specialty area. Finally, an internship would allow practitioners to develop the skills and knowledge pertinent to a particular area of practice. Although current training of basic researchers in behavior analysis does not seem dramatically different from these suggestions, practitioner training differs greatly. Why should that change?

If medicine is a reasonable model, some approximation of the practitioner training suggested above would provide practitioners with the general knowledge needed for expert problem solving making good use of both basic and applied research findings. This would benefit the recipients of their services, and it would also foster the development of feedback loops between practice and basic research. And that brings us to the topic of applied researchers having the basic research foundations as well as the clinical experience gained from rotations in their third year of graduate school. In their fourth year, when practitioners proceed to internships, these research-oriented practitioners (call them applied behavior analysts) would do research in preparation for a postdoc in their specialty area. Their clinical counterparts would be doing a residency in their specialty area.³

ABAI and the Future of Behavior Analysis

The website of ABAI (<http://www.abainternational.org/abai.aspx>) states its mission as being to “contribute to the well-being of society by developing, enhancing and supporting the growth and vitality of the science of

behavior analysis through research, education, and practice.” The mission statement assumes that a growing and vital science of behavior analysis will contribute to the well-being of society and that such growth of the science can be realized through the activities of research, education, and practice. ABAI’s interest in research, education, and practice, then, lies in their function of supporting the science of behavior analysis, which will in turn contribute to the well-being of society. If the feedback loops that exist among research, education, and practice in biology have contributed to the growth and vitality of biology, such feedback loops might similarly support the growth and vitality of the science of behavior analysis. Given its stated mission, then, ABAI appears the ideal organization to foster those feedback loops systematically and consistently.

In addition to its mission, there are other reasons that ABAI is in the best position to lead behavior analysis along the path that was taken by biology. As the oldest and largest membership organization in behavior analysis, its conventions bring together scientists, scholars, and practitioners working in many areas of application. When the organization was smaller, many attendees sampled research presentations in a variety of subdisciplines and practice areas. Due to increasing size of the various areas, attendees find it more and more difficult to get to papers in their own areas, to say nothing of those outside it. One way that ABAI might encourage the kind of feedback loops now institutionalized in biological research and medical practice would be to include at every convention symposia that bring together papers in a basic science, an applied science, practice of one kind or another, and perhaps even theory, whose work is related—maybe only peripherally. Ideally, these presenters would come from different institutions. To encourage such people “to find each other,” ABAI could offer free registration and possibly hotel accommodations to participants in these symposia. Such an initiative could begin with only two or three such symposia and increase in number over time.

Another program initiative that might be considered involves symposia comprising applied researchers in several different areas to promote cross-fertilization of research methods, especially when research problems call for new methods. For example, when researchers in one area find it necessary to devise new methods to address previously unasked research questions, researchers in other areas might make use of those new methods as well as becoming bolder in asking questions

³ If this educational structure sounds familiar to readers trained as clinical psychologists—such as myself—I would point out a critical difference. Although clinical psychologists typically must take “core courses” in various fields of academic psychology, there are no unifying key concepts that underpin all of them nor is there even a nascent theoretical framework that ties those mini-disciplines together. Thus, students often consider the core courses irrelevant to practice (Scott 1991), which they probably are. When the students begin rotations, they have only a hodge-podge of theories, data, concepts, and procedures to draw on. Unless they are fortunate enough to have had a few courses in behavior analysis, a coherent perspective based on the various scientific findings would appear impossible.

not easily answered by current methods. Practitioners interested in research issues, *per se*, might benefit from the broader perspective as well. Such integrative sessions would be most effective if one or more blocks of time featured only such sessions in order to counteract tendencies to stay in familiar grooves where familiar faces abound.

ABAI's role in accrediting academic programs is another avenue for creating feedback loops linking basic research and practice. The revised accreditation standards already provide more systematic guidance, and more scientific requirements, than earlier standards. Let us consider a first approximation to the medical school training that requires 2 years of science courses before beginning clinical rotations across several areas of practice. For the terminal master's programs, even one year dedicated to coursework in behavior analytic basic sciences (including laboratory experience) would provide a scientific foundation for integrating applications with scientific knowledge. A year of rotations in at least two specialty areas would also support cross-field integration. Finally, a third year internship in a setting that included applied researchers as well as clinical supervisors would allow students the opportunity to continue integrating science and practice.

In doctoral programs, all students planning research careers and all planning to practice in any area would have 2 years of basic science courses. Students planning careers as basic researchers would continue in their chosen research area. Those planning careers both in applied research and in practice would have 1 year of clinical rotations. Practitioners would then proceed to their second year of rotations and their internship, as is typical of medical school. Applied researchers would proceed after their year of rotations to applied research, also characteristic of medical doctors planning careers in science. In the ideal case, these applied researchers would maintain contact both with advances in basic sciences and in clinical problems in need of research answers.

As always, changes such as those suggested here are bootstrapping operations. Programs currently having faculty resources to implement an approximation of medical training would necessarily take the lead. Less well-staffed programs would reasonably use those programs as benchmarks to support the hiring of the full complement of basic and applied researchers as well as clinical supervisors. The seamless integration of these

three areas of behavior analytic work may be even easier in behavior analysis than in biology/medicine because properly implemented, behavior analytic applications follow the logic of scientific experimentation, with ongoing data gathering providing the basis for evaluation of outcomes and informing adjustments of procedure. Hence, to a notable degree, the training in basic science is directly relevant to effective application.

Conclusion

As of 2014, behavior analysis is still an academic orphan but the possibility is greater than it has ever been that it will break through the academic barriers faced by new disciplines. The disciplinary character of behavior analysis offers an opportunity to follow the path of biology in its training of practitioners and in the feedback loops among basic sciences, applied sciences, and practice. The alternative is to follow the path of psychology, where basic science and clinical science are, with rare exceptions, essentially unrelated, and the basic sciences are generally treated as irrelevant to clinical practice and vice versa.

If it is to thrive as a discipline, behavior analysis must remain a "scientific whole" until the basic science sub-disciplines become so large that they regularly have their own conferences, journals, and the like. Further, and of critical importance, the education of practitioners must include courses in basic science, especially as regards research underpinning the key concepts of behavior analysis as well as current knowledge in those subdisciplines.

In summary, behavior analysis appears to be at a crossroads. One path is toward disciplinary cohesion and the integration of science and practice through feedback mechanisms and, possibly, theoretical development. This is the path that was taken by biology. The other path is easier to take and may be the one that behavior analysis is currently on. It is the path that psychology appears to have taken. Biological science and medical practice were formally wed in the USA when action of the American Medical Association and a report to the Carnegie Foundation resulted in universal standards for scientific training in medicine. Subsequent feedback loops between basic and applied science and medical practice benefit all three. Society, in turn, has been the chief beneficiary. In behavior analysis, the organization best positioned to develop and strengthen

feedback loops among research, education, and practice is ABAI. May it contribute to the wellbeing of society by developing, enhancing, and supporting the growth and vitality of the science of behavior analysis through research, education, and practice.

Acknowledgment I thank Matt Normand for the invitation to ponder again these topics and for his patience while I sorted out what I had to say. I also thank Philip N. Hineline for encouraging me actually to submit it; his astute comments and editorial suggestions are gratefully acknowledged.

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