

Greening Up the Lab – Part 3

Five Opportunities to Differentiate with Environmentally Friendly Value Propositions—A Quantitative Survey

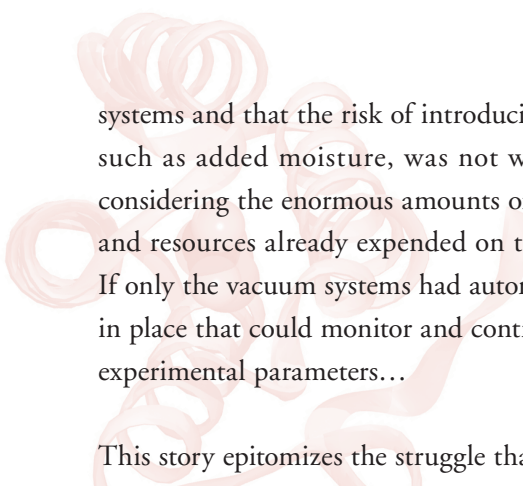
By Leah Nichols, Ph.D.; Hamid Ghanadan; Renée Shediak, Ph.D.; and Martin Brown

Many companies are using environmentally friendly—or green—messages to differentiate their products and services in response to consumer attitudes toward environmentalism. Marketers in science and engineering industries may be tempted by such strategies, and not without reason. In the last two issues of *Linus Report*, we have drawn on a set of in-depth interviews to suggest that scientists seem to have a strong, and sometimes extraordinary, interest in the environmental aspects of their personal lives that is not being matched at work. In other words, there may be an unfulfilled desire for green products and services for the laboratory. This installment of *Linus Report* approaches the subject quantitatively, reporting the findings from a survey of 583 scientists on attitudes and behaviors at home and in the lab. Our data suggest that the interest in green products for the lab is high. Scientists already incorporate some environmental concerns into their decision-making, are interested in hearing more about green laboratory practices and products, and are willing to consider specific compromises—in price point and in efficiency of lab operations, but not in quality of scientific results—in order to minimize the environmental impact of their work. We conclude with five specific respondent-generated ideas for green features of lab products and services.

Introduction

A principal investigator at a prominent U.S. national laboratory recounted to one of the authors (Ghanadan) a recent debate that she had with her laboratory manager. The manager wanted to implement a policy of shutting off vacuum pumps

overnight in order to conserve energy, arguing that the pressure levels required for experiments could easily be reached within a few minutes after turning the systems back on the following day. The scientist disagreed, arguing that this would perturb the



systems and that the risk of introducing variables, such as added moisture, was not worth taking considering the enormous amounts of time, money, and resources already expended on the research. If only the vacuum systems had automatic sensors in place that could monitor and control important experimental parameters...

This story epitomizes the struggle that is occurring in laboratories everywhere: Scientists desire to reduce their ecological footprint, but without compromising their science. Our earlier conversations with scientists (see the November/December 2007 and Volume 1, 2008 issues of *Linus Report*) suggest that this conflict manifests itself on multiple levels, from the strategic choice of research questions to the design of whole facilities and to more detailed choices about lab equipment and techniques.

Given the right opportunities, laboratories might substantially reduce their environmental impact. One 1996 study of California's electricity consumption estimated that laboratory-type facilities consumed over 3.5 times the amount of electricity per square foot than the state's average.¹ The report further states, "In end-user categories representing Standard Industrial Codes (SIC) 2700-8734 (253 categories), laboratory-type energy use represents 35% of total energy (38% of total electricity and 27% of total natural gas). In the absence of energy-efficiency improvements, these shares are projected to grow to 40%, 43%, and 29%, respectively, by the year 2015. The most important segments are cleanrooms, healthcare, universities, and national laboratories." It takes little effort to extrapolate the magnitude of energy usage when we consider every laboratory facility around the world.

In our earlier qualitative work, in-depth interviews with scientists indicated that practically all of our respondents act on environmental concerns at home, but find it difficult to be green in their

laboratories. This research left us with the impression that scientists would welcome opportunities to reduce the ecological footprint of their laboratories. Before that observation can be translated into marketing, it seems necessary to understand the psychology of scientists with regard to environmentalism—which is a set of human values and priorities, not a part of the scientific method. Our interviews suggested that, like every other citizen and media consumer, scientists feel pressure from society, the mass media, and often themselves to be greener. This work also suggested that the formal training and natural skepticism of scientists often make them dubious judges of marketing messages and less likely to be swayed by overt appeals to sentiment. Scientists need objective facts in order to evaluate claims, and are quick to dismiss associative environmental claims as green-washing (for more information on this topic, see the Volume 1, 2008 issue of *Linus Report*).

In this issue of *Linus Report*, we conclude our series on environmentalism and green marketing in the sciences by presenting the results of a quantitative survey of hundreds of scientists that sought to elucidate the role that environmental concerns play in their decisions at home and in the laboratory. We list five areas where laboratory suppliers could address environmental concerns with environmentally friendly alternative products and services, thereby providing insight to science marketers about how environment-based marketing messages can be effectively used.

Methods

We developed and distributed an online survey designed to answer the following four questions:

1. Is there a measurable difference between the actions scientists take in their personal vs. their

professional lives in order to minimize their environmental impact?

2. Do scientists feel that environmental concerns should play a role in their laboratories? Do they want to reduce the environmental impact of their science?
3. Are there barriers that keep scientists from being as environmentally active in their labs as they would like to be?
4. What opportunities exist for suppliers of scientific laboratory products to make the lab more environmentally friendly?

Although science is done in a wide variety of settings, we chose to focus our research on laboratories. We defined the laboratory as “a facility that provides controlled conditions in which scientific research, experiments, analysis, or measurements are performed.” This intentionally broad definition encompasses all laboratory types, including basic research, applied research, clinical, diagnostic, and production laboratories.

In close collaboration with the American Association for the Advancement of Science (AAAS) and *Science* magazine, we e-mailed an invitation to participate in this survey to a randomly selected list of scientists on June 12, 2008. As an incentive to participate, all respondents were given the opportunity to enroll in a drawing to win a US\$500 American Express card. While this incentive was discussed in the body of the email invitation, we purposely did not include it in the subject line of the message. The email invitation was transmitted to 23,096 recipients, was opened by almost one-third of all recipients, and generated a 7.6% click-through rate. We received 1,028 responses to our initial, qualifying questions, and screened out those who did not work in, manage, or make decisions for a laboratory, leaving us with 583 scientists who completed the entire survey.

Since the survey was associated with a sweepstakes, regulations prohibited us from forcing responses. Therefore, respondents were free to skip questions and the number of responses we received to each question, or the N value, varied from question to question. We have normalized our results throughout our analyses and have reported the N value for each analysis in this report. Overall, we received responses from 62 different countries and all 6 of the populated continents, 59% of which were from North America (USA, Canada, and Mexico) (N = 654). Additionally, our respondents were:

- 62% academic researchers, 16% industrial scientists, 10% government employees, and 7% hospital workers (N = 653);
- 46% life scientists, 25% health scientists / medical researchers, 9% chemists, and 7% environmental scientists (N = 657); and
- 57% basic scientists, 30% applied scientists, 8% diagnosticians, and 2% production scientists (N = 655).

Since we did not mask the purpose of this survey in our email invitation, we must assume that most of the scientists who took the time to respond to our survey care about the environment to some degree. We do not find this potential bias troubling because concern for the environment is entering the mainstream of social consciousness and popular culture. For example, 84% of Americans surveyed in 2007 believe that global warming is real and occurring, and “94% are willing to make changes in their lives in order to help the environment generally; 80% say so even if it means some personal inconvenience. In one key area, nearly three-quarters (73%) say they’re already making efforts to reduce energy consumption in their homes.”ⁱⁱ Although environmental concern may not be absolutely universal, the segment of the population who would be interested in our survey is not marginal by any means.

Environmental Action at Home Versus in the Lab

Based on the findings from our previous qualitative study, we hypothesized that *scientists generally take more action to reduce their environmental impact at home than they do in their laboratories.*

To test this hypothesis, we devised a series of parallel questions that asked scientists about the purchases they make for their home and for their lab. The first set of questions asked respondents to indicate how frequently they purchased various types of environmentally friendly products for their home. For example, one question asked, “when purchasing products for your home that use electricity, what percent of the time do you

purchase energy efficient products?” We then asked a second, parallel set of questions about their purchases for the lab, allowing us to directly compare our respondents’ environmental activity at home versus in the lab.

Figure A displays the aggregate responses we received for these parallel sets of questions. Each bar indicates the average percentage of the total purchases made by our respondents that are green purchases. The blue bars represent purchases made for their homes, while the red bars represent purchases made for their laboratories. Take, for example, the first pair of bars labeled ‘environmentally friendly chemicals:’ On average, 57% of the all the chemicals purchased by our respondents for their homes are environmentally friendly chemicals,

FIGURE A: GREEN PURCHASES FOR THE HOME VERSUS THE LAB

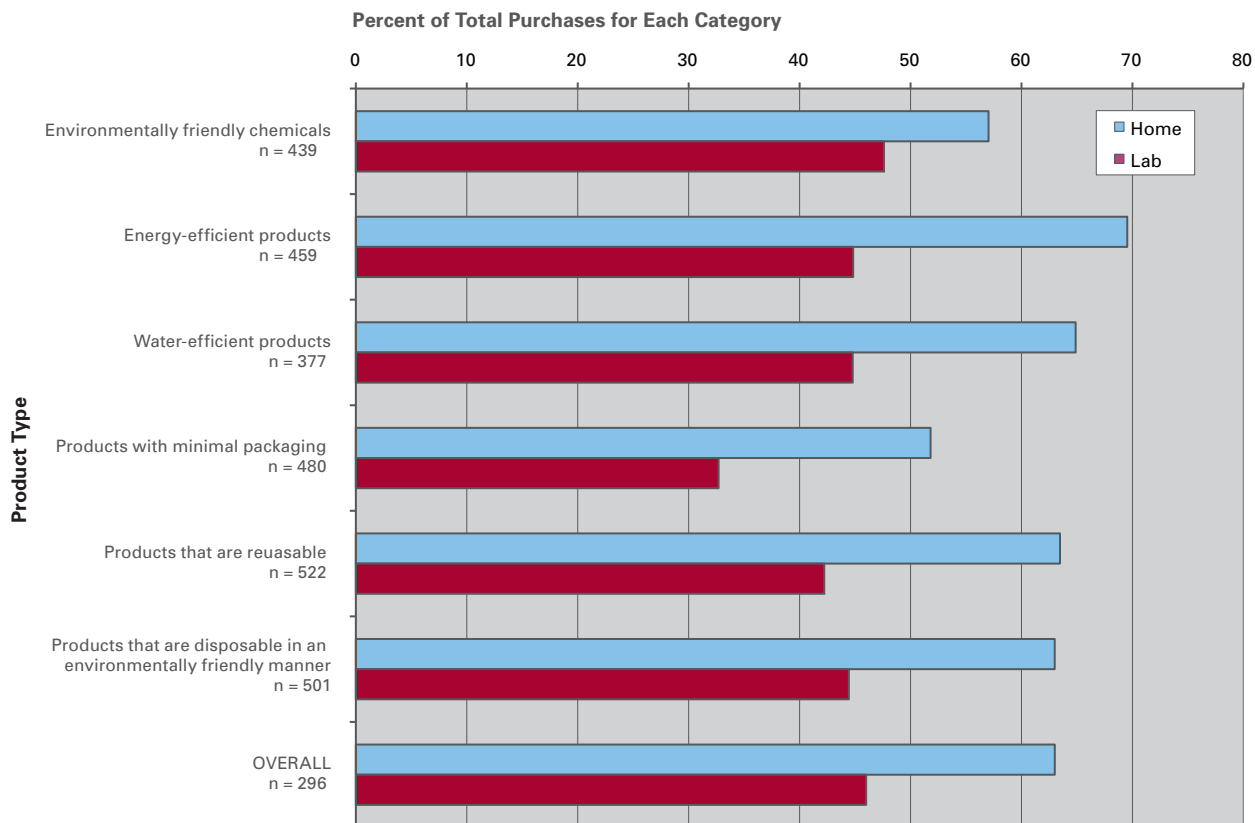


Figure A: Scientists make more environmentally conscious decisions for their homes than their labs. All differences are statistically significant. ($p < 0.0001$)

while only 48% of all the chemicals purchased by our respondents for their laboratories are environmentally friendly.

This graph clearly reveals a significant gap between the extent to which our respondents purchased green products for their homes versus the extent to which they purchased green products for their

Scientists generally take more action to reduce their environmental impact at home than they do in their laboratories.

laboratories. In all categories, our respondents purchased green products more than 50% of the time for their homes, while this number never surpassed 50% when they made purchases for their laboratories. This difference between green purchases for the home versus for the lab ranges from 9 percentage points in the case of chemical purchases to 25 percentage points for purchases of energy-efficient products. The average size of this gap is 19 percentage points.

We also noted that green products already comprise a sizeable portion of scientists' purchases for their laboratories, even though few products on the market are positioned as green alternatives. In fact, we have found several web resources that serve as green laboratory product guides, published by

FIGURE B: GREEN PURCHASES FOR THE HOME VERSUS THE LAB BY ULTRA-CONCERNED SCIENTISTS

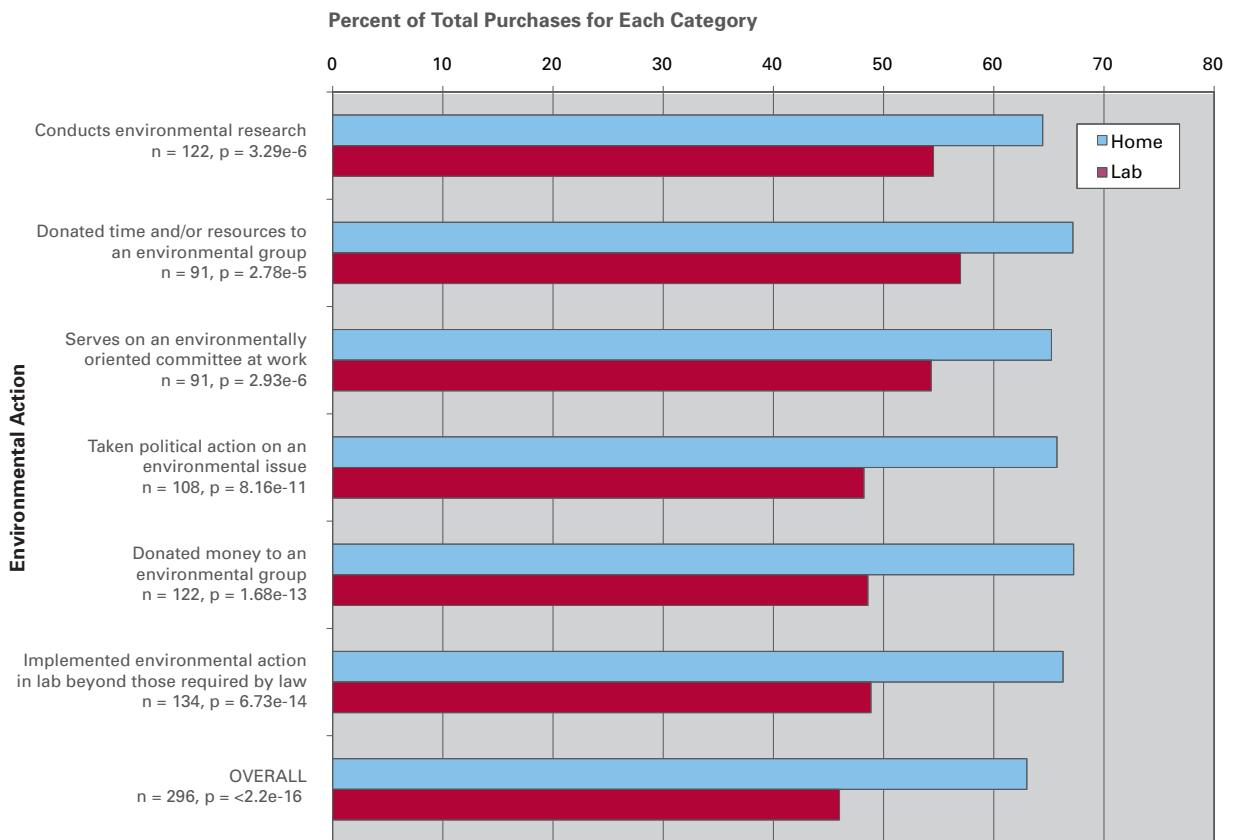


Figure B: The home versus lab purchasing habits of ultra-concerned scientists demonstrates that, on average, they buy more green products for their homes and laboratories than the overall average, but even this group demonstrates an average gap of 14 percentage points between their purchases for their homes versus their labs.

multiple academic institutions^{iii,iv,v}, suggesting that the market for green laboratory products is ripe for growth.

To further explore this gap, we decided to examine the purchasing habits of the segment of our respondents that we consider to be the most environmentally active. These scientists have taken environmental actions beyond reducing their personal environmental impact, such as volunteering time or donating money to environmental causes. We speculated that such “ultra-concerned” scientists are most likely to actively and deliberately pursue environmental action in their laboratories.

Figure B reveals the purchasing habits of these ultra-concerned scientists. Our data confirm that

the ultra-concerned scientists purchase more green products, both for the home and for the lab, than the average respondent. However, the gap between the extent of green purchasing for the home and for the lab is still visible across the board.

Quality and performance are undisputed drivers in purchase decisions for the laboratory because scientists are unwilling to compromise on data quality for their experiments. Even price, which is a third driver, does not garner the level of influence that value-based attributes such as quality and performance achieve.

FIGURE C: TOP 6 FACTORS THAT INFLUENCE PURCHASING DECISIONS FOR THE HOME

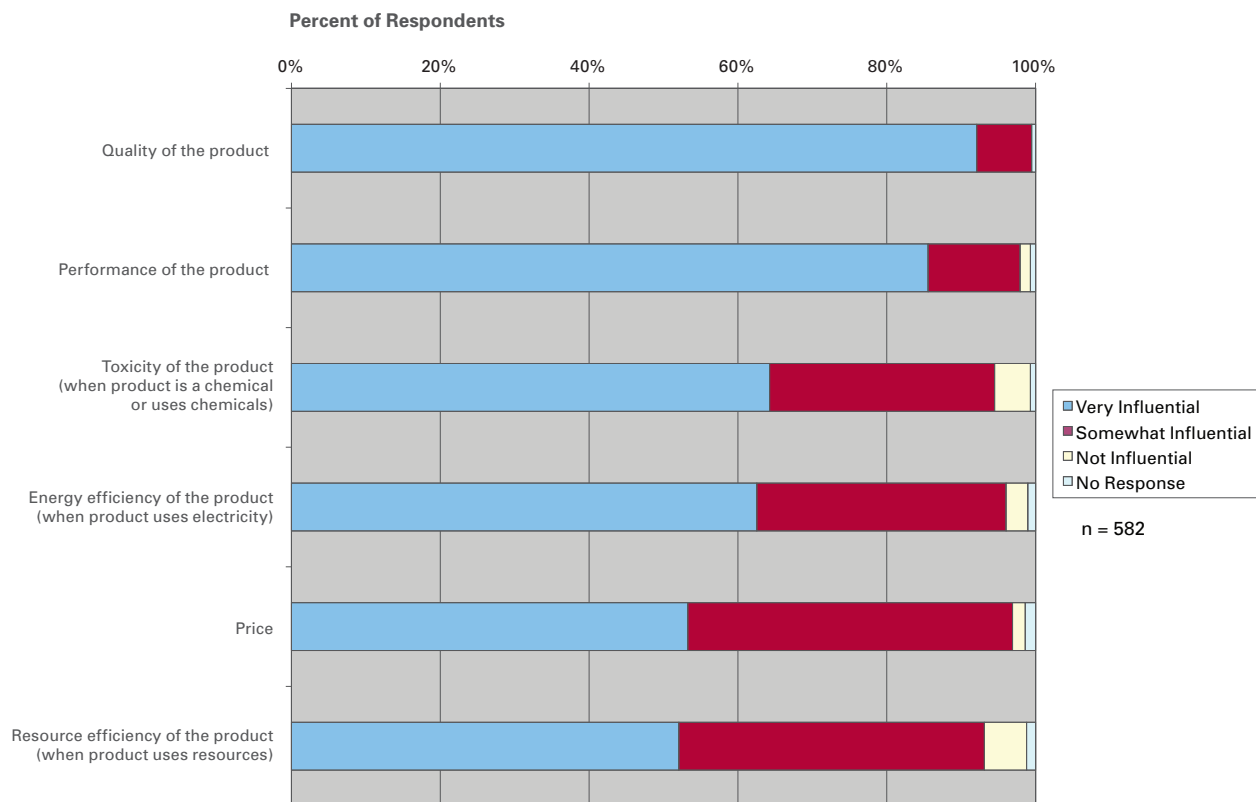


Figure C: Our respondents are more environmentally conscious than price conscious in their home purchase calculus.

We hypothesize that this group is most likely to find innovative ways to reduce the environmental impact of their laboratories, and that its inability to close the gap between home purchases and lab purchases suggests that significant hurdles exist in greening up the laboratory.

Making Decisions for the Home Versus for the Lab

Why does such a gap exist between scientists' green purchasing for the home versus the lab? To answer this question, we examined the purchasing decision-making processes of scientists by asking a series of questions that identify the degree to which various factors influence their decision to purchase a specific

product. We listed a variety of factors, such as 'price' and 'toxicity of the product,' and asked our respondents to indicate how much each factor typically influences their decision to purchase a product.

We found important differences in the calculus that scientists employ when evaluating products for their homes versus their labs. **Figures C and D** reveal the top six factors that most influence purchasing decisions for the home and for the lab, respectively. Quality and performance of products ranked highest both at home and in the lab. However, two environmental concerns, toxicity and energy efficiency, trump price considerations for home purchases for our respondents. In fact, three of the top six considerations for home purchases are environmentally oriented, while only one of the

FIGURE D: TOP 6 FACTORS THAT INFLUENCE PURCHASING DECISIONS FOR THE LABORATORY

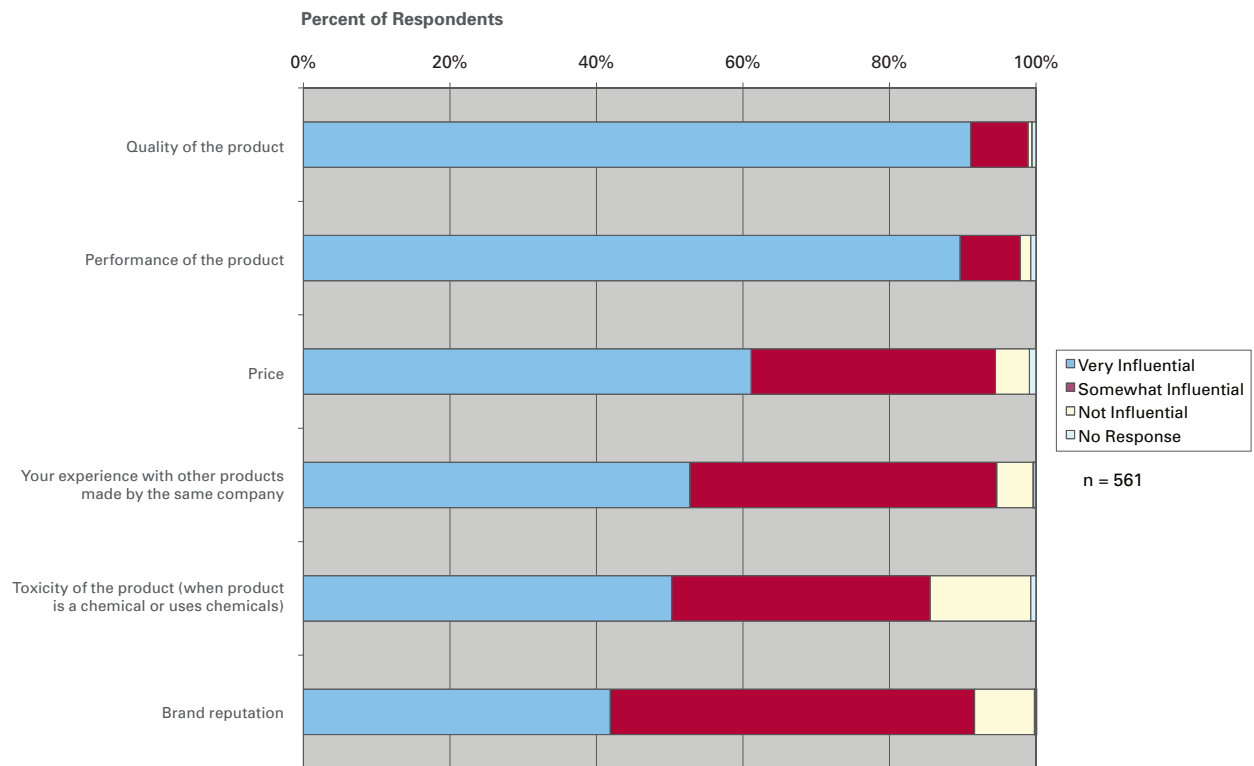


Figure D: Quality and performance are undisputed drivers in purchase decisions for the laboratory because scientists are unwilling to compromise on data quality for their experiments. Even price, which is a third driver, does not garner the level of influence that value-based attributes such as quality and performance achieve.

top six considerations for lab purchases is an environmental concern.

Perhaps the most telling view of the factors behind how scientists make purchasing decisions for home and laboratory products is our “factor index,” depicted in **Figure E**. Positive values (the bars on this graph that lie to the right of the zero point) indicate the factors that more of our respondents consider ‘very influential’ when evaluating purchases for their home than for their lab, while negative values (the bars that lie to the left of the zero point) indicate the factors that our respondents considered more influential when making purchases for their labs than for their homes. Values that are close to zero are important in both home and lab purchases.

We see these factors falling into three categories:

- A. Environmental factors (first five factors, with values >5) are more influential in purchasing decisions for the home
- B. Intrinsic product-based factors (middle four factors, with values between -5 and 5) are universal in purchasing decisions
- C. Marketing factors (bottom four factors, all with values < -5) are more influential in purchasing decisions for the lab

One could interpret these data to indicate that scientists simply do not prioritize the environment

FIGURE E: FACTOR INDEX DEPICTING THE DIFFERENCE BETWEEN ‘VERY INFLUENTIAL’ FACTORS FOR HOME AND LAB PURCHASES

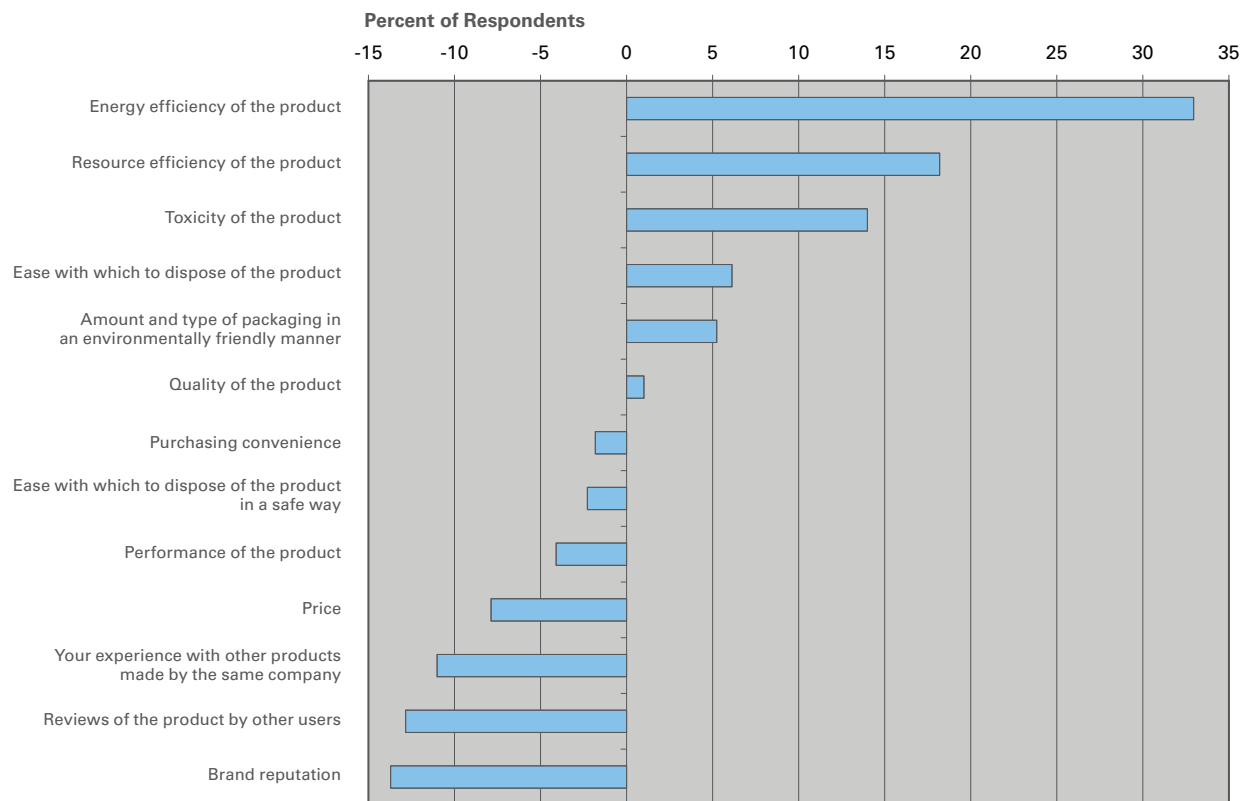


Figure E: To construct this graph, we subtracted the percent of respondents who marked each factor as ‘very influential’ for evaluating lab products from the percent of respondents who marked the corresponding factor as ‘very influential’ in their evaluations of products for the home. Essentially, we subtracted the blue bars in Figure D from the corresponding blue bars in Figure C.

when making purchases for their labs. However, to do so would be oversimplifying the picture. These data reveal only that scientists do not consider the environment in their laboratories as much as they do at home. It says nothing about whether or not scientists want to prioritize the environment in their laboratories.

On the one hand, scientists are often more financially constrained in their professional lives than they are in their personal lives. In their laboratories, scientists must also answer to the people who fund them or to their shareholders. Therefore, scientists may understandably need to prioritize price, quality, and performance above any environmental concern. On the other hand, as we

will discuss in the next section, scientists are also deeply concerned about the environment, and many would like to prioritize environmental concerns in the purchasing decisions for their labs but are prevented from doing so by a variety of factors.

An overwhelming number of our respondents (932 out of 1,028) indicated that they believe environmental concern should play a role in the material operations of scientific laboratories.

FIGURE F: REASONS WHY SCIENTISTS PURCHASE GREEN PRODUCTS (FOR THEIR HOMES AND LABS)

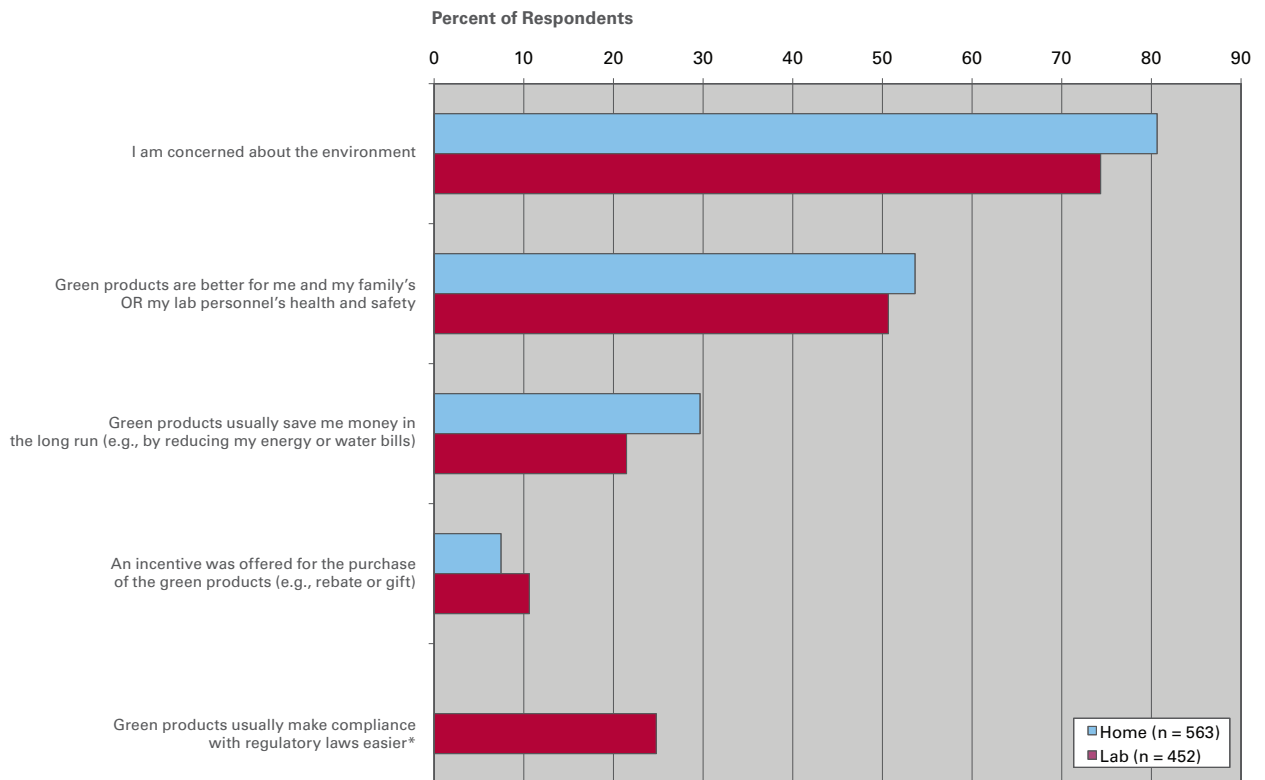


Figure F: Concern about the environment, followed by health and safety concerns, are the top reasons why scientists seek green laboratory products. Regulatory compliance is the third most common motivation behind making green purchases for the laboratory.

*Since regulatory laws are not as prevalent in the home as they are in the lab, we did not ask people whether or not regulatory compliance was a reason for purchasing green products at home.

Environmentalism in the Laboratory

An overwhelming number of our respondents (932 out of 1,028) indicated that they believe environmental concern should play a role in the material operations of scientific laboratories. Many respondents indicated that they feel an obligation to do all that they can to protect the environment. This sense of obligation appears to stem from several aspects of these scientists' lives. First, as human beings, many feel that they have a moral responsibility to protect society, future generations, and the planet itself. Second, as scientists, many see themselves as role models for the rest of society. Third, as scientists who actively study natural systems, many feel that not acting on their concerns for the environment in both their home and work lives is hypocritical. The following

response from an open-ended question in our survey illustrates these aspects:

“To put it rhetorically, what is special about the vocation of scientists that exempts them from considerations of how their activities impact the environment in material and energetic ways? All people should be aware of how their daily activities impact the larger world, and should try to make choices that are environmentally responsible.”

When asked, “In the instances you purchased green products for your laboratory, why did you choose to do so?”, 74% of the respondents indicated their concern about the environment. Further, 51% felt that greener products were better for their health and safety. These results are comparable to their

FIGURE G: DEGREES TO WHICH SCIENTISTS WILL COMPROMISE TO ADOPT GREENER LABORATORY PRODUCTS

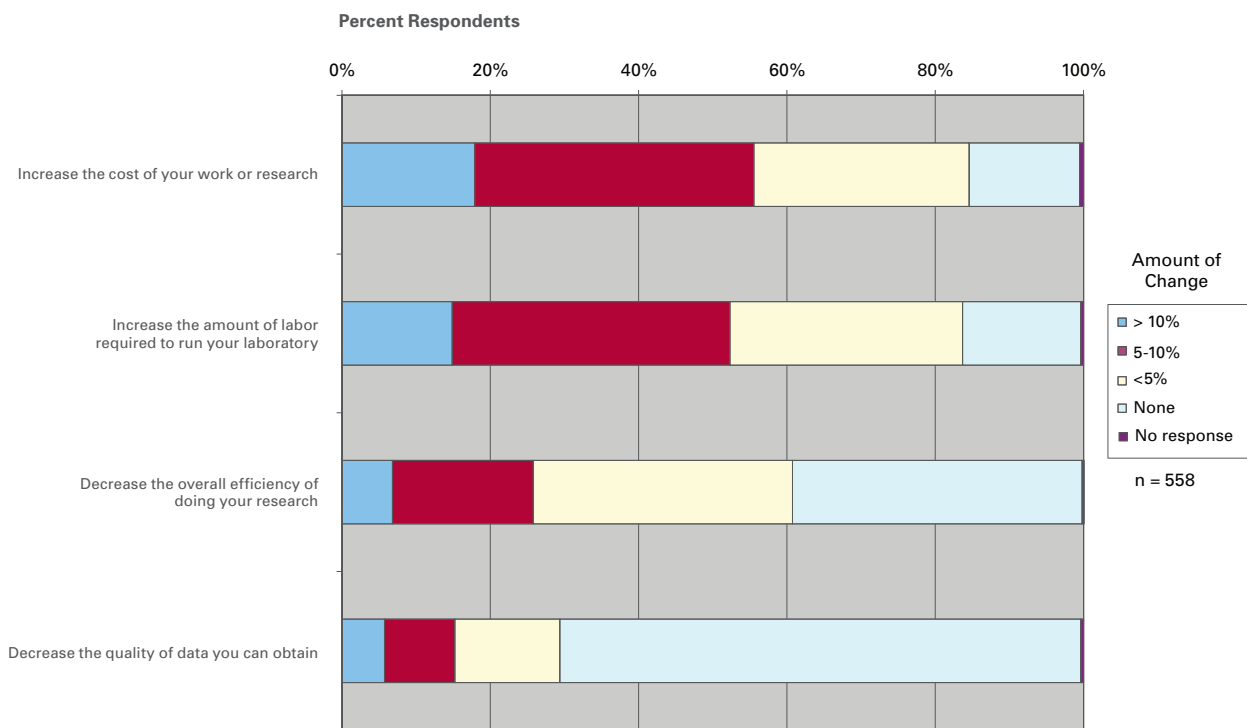


Figure G: Scientists will not make concessions on data quality. But our respondents claim that they would be willing to pay more, work more, and to some extent, be less efficient in order to be green. For example, approximately 18% of our respondents said that they would be willing to incur additional costs of >10% in order to make their labs more green. Would they actually make such compromises in practice?

reasons for making green purchases for their homes (see **Figure F**).

Our respondents were also substantially willing to compromise various aspects of their work in order to adopt greener practices in their laboratory (see **Figure G**). Over 80% of our respondents were willing to increase the costs and labor requirements of their research to some degree in order to make their work more environmentally friendly. This is particularly significant in light of the constant financial constraints on almost all laboratories, especially academic laboratories. However, scientists are unwilling to compromise the quality of their data. Exactly 70% of our respondents were unwilling to implement greener laboratory practices if it meant decreasing the quality of the data they could obtain. Of the remaining 30% who indicated some

An essential tension exists between scientists' desire to protect the environment and their need to preserve the quality of their science.

tolerance to compromising data quality, a larger percentage was ultra-concerned scientists (45%) than the overall respondents (38%). We did not find any other demographic shifts in the scientists who are willing to compromise data quality.

This is indicative of an essential tension that exists between scientists' desire to protect the environment and their need to preserve the quality of their science.

FIGURE H: REASONS WHY SCIENTISTS DO NOT PURCHASE GREEN PRODUCTS FOR THEIR LABS

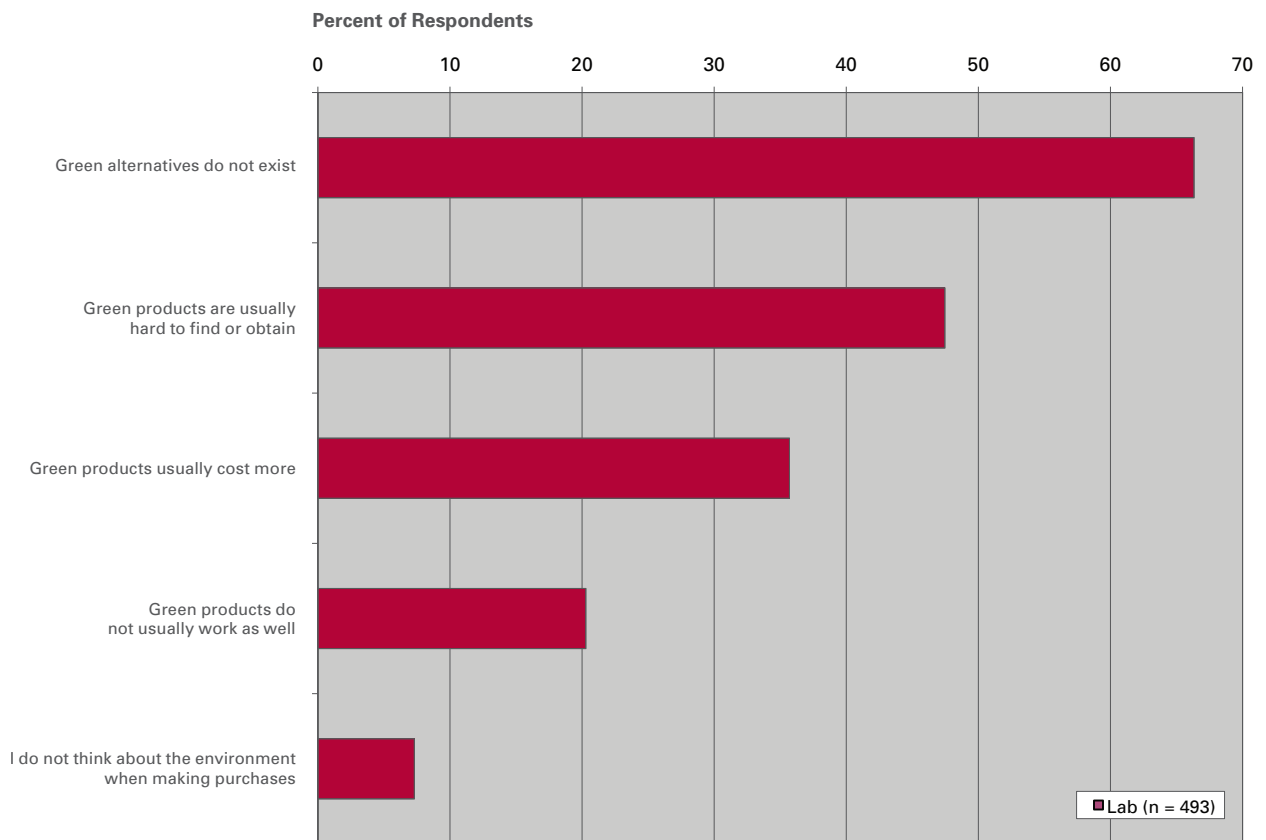


Figure H: Every single one of the barriers that scientists face in being green can be addressed by marketing.

On the one hand, scientists are acutely aware of the resources they consume and the waste they produce. In response to an open-ended question, many claimed that they are concerned, for example, about the tendency toward single-use disposable laboratory tools (e.g., disposable pipette tips and test tubes), the amount of electrical energy they consume, and the toxicity of the chemicals they regularly use in their research. On the other hand, they believe in the scientific process as a means of improving the human condition. Therefore, while scientists take environmental responsibility very seriously, they will neither sacrifice their ability to do their science nor jeopardize the quality of their data. One respondent conveyed this constant negotiation in the following quote:

“There is no excuse for not trying to be as environmentally friendly as possible when carrying out research. However, this should not compromise the problems that are being addressed with research.”

Barriers to Green Purchasing for the Lab

Out of 1,023 respondents, 39% indicated that they are not able to be as environmentally active in their laboratories as they would like, and cited several impediments. As one respondent stated, the primary

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obstacle to reducing the environmental impact of laboratories is the lack of “high-quality, inexpensive, and readily available” environmentally friendly products. In fact, 66% of our respondents claimed that they sometimes do not buy green laboratory products because such products do not exist, while 47% indicated that the green products that do exist are sometimes hard to find or obtain (see **Figure H**).

In open-ended responses, several scientists also said that their efforts to be green in their laboratories are often stymied by the lack of available information about the green aspects of existing products. Many suppliers do not advertise, emphasize, or even publish the environmental aspects of their products, and scientists do not have the time or resources to research and compare environmental attributes of products.

Scientists also hesitate to switch to greener products because the performances of these new products are not adequately demonstrated. Since scientists are unwilling to compromise their data, any alteration to their protocols or methods requires verification that the replacement products will not lower the quality of their data. The more that laboratory product suppliers can demonstrate the equivalence of green alternative products to existing products, the more willing scientists will be to switch to such environmental products.

Five Suggestions for Greening Up the Lab

Our respondents have identified a number of ways in which they feel suppliers can help laboratories become greener without threatening their data or research. These include the following:

- **Provide Information.**

Many of our respondents indicated that they do not purchase environmentally friendly products because they do not know or cannot validate which products are better for the environment. Several respondents suggested that suppliers should emphasize the green aspects of their products in their marketing campaigns. They would also like to see the relevant environmental information (e.g., energy use or toxicity) clearly identified and easily located in the “short” description of the products.

- **Address Packaging.**

Excessive and wasteful packaging is one of the most frequently cited frustrations for scientists wishing to implement greener strategies in their laboratories. According to our respondents, suppliers should pack products in bulk format when possible, minimize the amount of packaging materials used, use recycled materials for packaging, and/or use packaging materials that can easily be recycled through standard municipal recycling programs.

- **Reuse and Recycle.**

Our respondents also suggest that suppliers develop take-back programs for used products and packaging materials. Many laboratory instruments and products cannot easily be disposed. Electronic equipment and other large-scale appliances can be collected, refurbished, and resold or donated (e.g., to schools), recycled, or properly discarded. Many consumer electronic companies have already implemented similar programs.

Scientists would also like to recycle more single-use disposable products that account for a significant amount of their laboratories’ waste. Products, such

as pipette tips, test tubes, and sample vials, that have not been contaminated with controlled biological substances or toxic chemicals could be collected and recycled. Along these lines, a few respondents suggested developing tools to facilitate the benchtop separation of recyclable wastes from biological and toxic wastes. Glass tubes, micropipettes, and microscope slides, for example, can easily be recycled in municipal facilities. However, the majority of this recyclable waste is discarded into the same containers as waste contaminated with biological substances and therefore cannot be recycled.

Scientists hesitate to switch to greener products because the performances of these new products are not adequately demonstrated.

- **Reduce Chemical Waste.**

One respondent indicated that chemicals are often sold in quantities that are inappropriate for laboratories that conduct experimental research. Academic and other forms of basic research labs typically only need small quantities of chemicals, but are often forced to buy much more than they need since smaller volumes are not sold. The extra material often ends up being discarded. Eliminating this waste is a simple way of making laboratories greener.

- **Reduce Energy Consumption.**

Energy-efficient laboratory tools, such as freezers, incubators, fume hoods, centrifuges, and instruments, with better power-saving standby modes, along with tools that facilitate the shut-

down (and start-up) of equipment when not in use, such as automatic shut-off capability and instant-on functionality, may also be popular with environmentally conscious scientists.

A Closing Note to Marketers of Scientific Products and Services

As the laboratory products and instrumentation markets mature and face heavier competition, smart marketers must look for ways to differentiate their offerings in order to force the market to view their products as having a competitive advantage. Environmental concern in the laboratory is a growing issue and is here to stay for the foreseeable future; it may therefore provide an excellent opportunity for companies to create meaningful relationships with their customers. However, our in-depth interviews and open-ended responses suggest against appealing directly to the emotional sentiments of scientists. Instead of reacting to this trend in the short term with marketing campaigns, suppliers should develop products and services that measurably reduce scientists' environmental impact as well as engage in dialogue with their market in order to enable scientists to evaluate the environmental aspects of product offerings on their own terms.

Summary

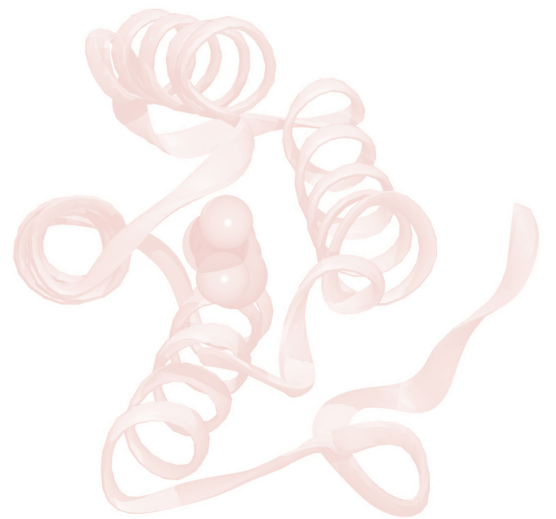
Our omnibus research study has demonstrated the following: Scientists are interested in reducing the environmental impact of their laboratories; significant gaps exist between the environmentally motivated actions scientists take at home versus the actions they take in their laboratories as well as the factors that influence their decisions in either case; scientists have the desire to close this gap and bring their professional lives more in line with their personal values; and they will not compromise the quality of their data or research.

ABOUT THE DATA

This research was conducted as an independent survey. If you are interested in accessing the full survey questionnaire along with the responses in aggregate, please contact us by sending an email to surveys@thelinusgroup.com.

ABOUT THE AAAS

This research was made possible by generous support from AAAS, which provided an email blast for us to invite scientists to participate in our survey. A global, nonprofit organization, AAAS is committed to advancing science for the benefit of all people by fostering a global community to provide support, information, and tools for scientists, educators, policymakers, and society at large. Also, as the publisher of *Science*, AAAS provides an effective channel for companies to communicate with scientists around the world. To learn more about advertising with AAAS and *Science*, visit <http://www.sciencemag.org/help/advertisers/rep.dtl>



End Notes

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- ^{iv} University of Melbourne Green Laboratory Program. Seen at http://www.pb.unimelb.edu.au/ehs/ehs/environmentprogram/green_lab/ on July 10, 2008.
- ^v Massachusetts Institute of Technology's "Working Green at MIT" Program. Seen at <http://web.mit.edu/workinggreen/buy/lab.html> on July 14, 2008.
- ^{vi} P value is a statistical measure of calculating the chance that the results observed by the data are created by random chance. In other words, a p value of $9.45e-9$ is a 0.000000945% chance that the results are purely by chance. This is literally less than 1 in a million chance. For a rigorous definition of p value, please visit Wikipedia (http://en.wikipedia.org/wiki/P_value).

THE LINUS GROUP

About the Authors

Leah Nichols, Ph.D., is a researcher who recently received her doctorate from the University of California, Berkeley. She specializes in the sociology of biological science and science and technology studies.

Renée Shediak, Ph.D., is a senior analyst and Hamid Ghanadan is the president of The Linus Group, a marketing and communications firm specializing in the life science industry. They can be reached at (510) 547-7100 or at info@theLinusGroup.com for questions and comments.

Martin John Brown is a researcher and writer specializing in environment and history. His research and writing has appeared in academic and popular publications, including *The Journal of Ecology*, *American Naturalist*, *MAKE*, *Sierra*, and *Air & Space/Smithsonian*.

Editor

Hamid Ghanadan
hamid@theLinusGroup.com

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