Advancing Biocultural Models by Working with Communities: A Partnership Approach

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ABSTRACT Culture and human behavior are recognized today as major forces acting on human biological variation around the world. Studies of the relationships between biology and processes, such as modernization, urbanization, and social stratification, are prominent in our journals and meetings. An ongoing study of the interrelationships between toxicant exposure (organochlorines, lead, and mercury), health, and culture among youth of the Mohawk Nation at Akwesasne is located within this context and is used to analyze the strengths and challenges of a partnership approach to biocultural research. To assist in modeling the complex relationships between health, behavior, and culture, we have employed concepts from contemporary social theory, integrated qualitative and quantitative research, and implemented community-based research principles to develop a partnership approach to research in human biology. The community is directly involved in identifying research goals, developing research protocols appropriate for local cultural sensitivities and complexities, implementing the protocols in the field, and collaborating in the analysis and publication of results. We show the utility of this approach for understanding the relationships of toxicants to behavior and biological outcomes (adolescent growth, sexual maturation, and endocrine system alteration); as well as how it facilitates the agency of participants and communities involved in research, and brings greater social engagement to the development of the new human biology. Am. J. Hum. Biol. 19:511–524, 2007.

Human biologists and biocultural anthropologists have sought to develop models that integrate culture and biology in order to gain a greater understanding of adaptation, evolution, and variation. The project of modeling culture is vital because of its omnipresence in human–environment interactions.

Human biologists utilize anthropology’s holistic approach to create biocultural models that integrate qualitative and quantitative data in order to better understand interactions between biology and culture in the context of real world political and economic forces (Armelagos et al., 1992). Over the last 25 years within human biology, culture has been viewed as a buffer, a stressor, an allocator of resources and risks (Dressler, 1995; Goodman, 1988; Greene, 1977; Montagu, 1968; Rappaport, 1967; Schell, 1992, 1997; Singer, 1989; Wiley, 1992) as well as covarying with outcomes of interest (for example, when indoor cooking influences respiratory function assessed in studies of high altitude hypoxia). Such biocultural models have advanced our knowledge regarding a wide range of research issues including reproduction, growth and development, health and well-being, and morbidity and mortality across the lifespan.

As we continue to explore the biocultural interface a question emerges: how can we improve and refine our research models to the benefit of both human biology research and the communities with which we work? The purpose of this paper is to describe how the contemporary anthropological critique of the relation between researchers and human subjects is relevant to work in human biology and
explore its implications for research in human biology. To do so, we will compare two studies our research team has conducted—a top-down research project and a project employing a partnership approach—and present results from the partnership research project as evidence of the usefulness of this approach. Finally, we discuss the benefits to the community of a partnership research project.

A CONTRIBUTION FROM POSTMODERN ANTHROPOLOGY

Human biologists have often looked to cultural anthropology and ethnography to inform our biocultural models, at both the methodological and theoretical level. Since the mid 1980s, cultural anthropology/ethnography, initially propelled by the work of Marcus and Fischer (1986), Clifford and Marcus (1986), and Geertz (1973, 1983), has been engaged in an epistemological crisis concerning the politics of representation, a component of the larger ongoing postmodern critique of how knowledge is produced within the humanities and social sciences. The postmodern critique constitutes a diverse and amorphous body of cultural criticism that is not always fully accessible to those outside the debate. One clear and relevant theme running through postmodernism, though, is its critique of the essentialized and disempowered research subject. This critique reconceptualizes the people who we study, or the researched, from passive objects/subjects of our research to one of active agents, or participants in research who have their own interests, priorities, and agendas.

This article describes the significant and beneficial implications for research design and results that this shift from research “subject” to research “participant” has for the field of human biology and biocultural studies in general. Moving from passive subjects to active participants in research promotes a more level playing field. This is the premise of the partnership approach or the community-based participatory research (CBPR) approach (Cornwall and Jewkes, 1995; Israel et al., 1998; Minkler and Wallerstein, 2003; O’Fallon and Dearry, 2002; Wallerstein and Duran, 2003). Although CBPR can take many forms (Harrison, 2001; Holkup et al., 2004; Israel et al., 1998; Schulz et al., 2005; Stevens and Hall, 1998), fundamental to this approach is breaking down barriers between the researcher and researched and the sharing of power, with an emphasis on colearning and dialogue (Wallerstein, 1999). Biggs (1989) identified four levels of potential community participation in research (Table 1). Human biologists have tended to employ the first of these models, but are moving toward increasing community involvement and reconceptualizing research design in human biology from a traditional model to more collaborative and collegial models.

AN EXAMPLE OF THE TRADITIONAL RESEARCH MODEL: THE ALBANY PREGNANCY INFANCY LEAD STUDY

The benefits and challenges of a shift in the role of the researched are evident through a comparison of two studies conducted by our group that investigated the relationship of children’s environments to their growth and health. An example of a traditional approach is the Albany Pregnancy Infancy Lead Study. The study followed pregnant women through delivery, measuring changes in blood lead level during pregnancy; and followed infants through 12 months of age to investigate (1) impact of diet on lead levels, and (2) the relationship of maternal gestational lead level and the infant’s own lead level to infant physical and cognitive development. Several characteristics of the study are typical of the traditional approach. Subjects were recruited into the study through their participation in prenatal medical care. Informed consent was obtained from each pregnant woman. The study design and protocols were reviewed both by the sponsor prior to funding and by the Institutional Review Boards of all collaborating institutions (three in this case). After data were collected, laboratory test results were conveyed to physicians, and investigators analyzed data to test hypotheses. Results were disseminated through journal publication and reports of cli-
cally relevant information to the participant’s physician.

Although this project was productive by the traditional metric employed by funding agencies, that is, papers published (Czerwinski, 1999; Denham et al., 2001; Nolan et al., 2002; Schell et al., 1997a,b, 2000, 2003a), in hindsight, this research process disempowered participants. The prenatal clinic was a medical bottleneck that drew potential subjects to one place for the purpose of prenatal care, but which passively brought gravidae into contact with a study recruiter. Pregnant women were approached as individuals, rather than through any community organization that drew power as a group from its members. Certainly, individuals had full right of refusing participation, but at no time did a group representing the pregnant women from a lead-impacted area of the city consider whether or not the project was beneficial for the community as a whole. Community participation was nonexistent in other areas of potential partnership. The scientific team determined the research questions in conjunction with the funding agency, and the community members had no input, and so the research goals did not necessarily address any community concerns. Community members were not involved in creating the data collection protocols, and data collection techniques were determined by scientific practice. Community members were not consulted in the analysis and interpretation of data, including data on the roles of sociocultural factors such as marital status and employment. Finally, research results were not disseminated directly to participants or to community groups, as none had been involved.

In the future, it seems likely that community willingness to participate in research may not be assumed. Many communities and populations that human biologists want to work with (e.g. minority communities facing health disparities, a local community dealing with environmental pollution, villages facing issues of modernization and a global market economy) are politically galvanized and expect more from research that is conducted in their backyards. Increasingly, communities are asking for research that is relevant and meaningful in that it addresses local concerns, not necessarily academic interests. Consequently, incorporating a more reflexive approach, where all participants lay their goals and agendas “on the table” can provide a solid foundation for building a research partnership. Both sides then have the opportunity to articulate their goals, acknowledge awareness of the partner’s aims, and agree to a working relationship (or agree to part ways) before the actual research commences.

**AN EXAMPLE OF A COLLABORATIVE RESEARCH MODEL: THE MOHAWK WELL-BEING STUDY**

The study “PCBs and the well-being of Mohawk Youth: Growth, development and cognitive-behavioral functioning” (MAWBs) was conducted in partnership with the community at Akwesasne between 1995 and 2000, and funded by the NIEHS Superfund Basic Research Program (SBRP). The goal of the SBRP is to conduct basic research, including epidemiological, engineering, and ecological studies, in a broad range of areas related to understanding the potential health effects resulting from exposures to hazardous substances and how to remediate sources of exposure (Anderson et al., 2002). MAWBs is an example of a research project that employed the collaborative and collegiate approaches to research as described by Biggs (1989).

The Mohawk Nation at Akwesasne is a Native American community of nearly 13,000 people located on both sides of the St. Lawrence River. Approximately 40 years ago, the St. Lawrence Seaway was constructed, and the river became an attractive site for industry. Abutting the western border of Akwesasne, actually less than 100 feet from its edge, is the General Motors Corporation Central Foundry Division. From 1959 until 1974, the plant used a PCB-containing hydraulic fluid during manufacturing that leaked into the wastewater treatment system and into the surrounding environment. The site is on the U.S. Environmental Protection Agency (EPA) National Priority List and it is a designated U.S. Superfund site (A Superfund site is any land in the United States that has been contaminated by hazardous waste and identified by the EPA. The U.S. EPA National Priority List contains those Superfund sites identified to pose significant risks to human health and eligible for clean-up using Superfund Trust Fund monies (Anderson et al., 2002)). Additionally, there are two other aluminum plants nearby, the Reynolds Metals and ALCOA. The New York State Department of Environmental Conservation has declared both these to be inactive hazardous waste sites and designated them New York State Superfund sites.
In the mid 1980s, a community health practitioner, midwife Katsi Cook, approached scientists at the University at Albany about the safety of breastfeeding at Akwesasne, given increasing knowledge of the environmental contamination there. Community concern grew into questions about the health and well-being of all residents of Akwesasne, particularly children and adolescents. Despite the strong interest in answers to these questions, there was concern about seeking help from scientists outside the community. Mohawk experience with researchers, both anthropologists and most recently with public health researchers, had not been beneficial to the community, although it appeared to produce benefits to the scientists (Arquette et al., 2002; Ransom and Ettinger, 2001; Schell and Tarbell, 1998). Community members had little opportunity for input, research questions were dictated by the researchers, and the participants and community very rarely learned about the study results or findings from those who conducted the research (Schell and Tarbell, 1998). If the community learned about research results at all, it was often through various outside media sources that community members often perceived as misrepresenting the issues of concern to the community.

In response to this history and the pressing need to understand the risks of toxicant exposure at Akwesasne, a Research Advisory Committee (RAC) was established in 1995 by the Akwesasne Task Force for the Environment (ATFE), a community-based organization founded to conserve, preserve, protect, and restore the environment, natural, and cultural resources within Akwesasne (Akwesasne Task Force on the Environment, 1996). The RAC’s role is to review and comment on all proposals for intended research at Akwesasne. Following guidelines outlined by the RAC (Akwesasne Task Force on the Environment, 1996; Akwesasne Task Force on the Environment and Research Advisory Committee, 1997) and principles of community-based research, a collaborative research partnership developed between the Mohawk Nation at Akwesasne and the University at Albany.

A partnership approach to research

The initial phase of our partnership relationship involved identifying the mutual and individual goals of the partners (Cornwall and Jewkes, 1995; Israel et al., 1998; O’Fallon and Dearry, 2002). This candid discussion meant recognizing that each partner has their individual goals and agendas, acknowledging the existence of these distinct interests, and where possible, agreeing to a joint effort to help each partner fulfill their goals (Minkler and Wallerstein, 2003).

This approach borrows from contemporary anthropological theory and is an application of the “reflective perspective” that emerged as a point of debate during the crisis of representation in ethnography during the 1980s and 1990s. At the heart of this debate was the question of the role of the researcher in research, and how researchers/anthropologists through their own biases, research agendas, and theoretical leanings come to conclusions regarding the researched. This type of self-awareness or positionality is not yet part of the cannon of methodological approaches in human biology, but may become increasingly useful and necessary.

Gaining community consent and planning research

In a community-partnership study, investigators often work with an organized, self-identified group rather than with individuals, and consent comes on two levels: from the individual participants and from the community. Gaining community consent at Akwesasne required numerous meeting with community leaders, members of the ATFE, local health providers, and community residents.

To create an application for federal funding, the Akwesasne and academic partners had to consider each other’s interests, agendas, and priorities, and the interests and public health priorities of the potential funding agency. This process allowed the partners to identify research questions that were important to the community, within the realm of the researcher’s expertise, and might be supported by sponsors. The overlap among these sets is what can be done realistically (Fig. 1). During such discussions, it was realized that not all of the community’s concerns and interests could be addressed, although they had much importance and merit. Specific types of cancers and congenital birth defects, for example, could not be rigorously investigated in a small population and were therefore unlikely to be funded on methodological grounds. Likewise, researchers learned that not all the questions they wished to investigate could be supported by the community or the funding agency. Though a difficult process, community mem-
bers developed a clearer idea of the proposed research questions and the types of findings or “answers” they could expect if the grant application was funded.

The study outcomes (Table 2) reflect the coincident interests of both the local community and the scientists, as well as the availability of measurement methods that were both scientifically rigorous and acceptable to the community’s values. The academic partners made presentations to community members and organizations outlining the types of data that would need to be collected and the methodological options for collecting such data, including the pros and cons for each. Incorporating community input at this point helped ensure that the data collection methods would be culturally appropriate, and not problematic for participants, once the research began. Since some of the data needed to explore specific research questions were considered culturally sensitive and potentially damaging to the community if misrepresented (such as measures of cognitive ability or cultural identity), frank discussions ensued about research instruments and how such data would be presented in publication format. Such conversations with research communities are valuable, because collecting the appropriate type of data in a manner that encourages cooperation is crucial in studies seeking to uncover subtle biocultural interactions.

Additionally, the amount of data needed to address the identified research questions was large and required significant effort on the part of the study participants and local school districts (who provided school records and behavioral assessments by teachers). Without the investment by the community it would have been impossible to collect the amount and types of data (e.g., blood specimens, assessments of sexual maturation) that were needed.

**Community partners as active agents in research**

Becoming “active agents in research” also means involving community members in the activity of research itself. One of the complaints about past research at Akwesasne was that previous researchers had hired all their staff from outside the community and the community had gained nothing in terms of economic benefits or in raising the education and skill levels of community members. For our project, community members were trained in anthropometry, phlebotomy, cognitive assessment, nutritional surveys, and interview skills rather than hiring trained personnel from outside the community. Multiple 2- and 3-day training sessions were conducted at both the University at Albany and Akwesasne for 6 months prior to the start of data collection. The use of local personnel conveys benefits to the community, as it helps build the local economy, build local leadership, and increase knowledge of environmental health problems (Israel et al., 2001). Building community capacity to conduct research and ultimately transition to the role of colleagues in research begins with positioning the community as partners rather than subjects.

Having a vested interest and a stake in the research project makes research more rele-

![Fig. 1. Overlapping interests: where community-based research happens?](image)

**TABLE 2. Outcomes of interest identified by community and academic partners in the Mohawk Adolescent Well-Being Study at Akwesasne**

<table>
<thead>
<tr>
<th>Toxicant levels</th>
<th>PCBs</th>
<th>DDE</th>
<th>Mercury</th>
<th>Mirex</th>
<th>HCB</th>
<th>Lead</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth</td>
<td>Height, weight</td>
<td>Measures of body fat, bone and muscle</td>
<td>Tanner stages (self-staged)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Endocrine assessment</td>
<td>Thyroid related: thyroxin (free thyroxine); triiodothyronine; thyretropin</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Behavioral and cognitive development</td>
<td>Woodcock Johnson-revised</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ravens</td>
<td>Tonal</td>
<td>Addes</td>
<td>Conners</td>
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</tbody>
</table>

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vant and meaningful to communities, because it investigates specific research questions and identifies concerns rather than questions of interest to science and academia only. This increases the likelihood that recruitment and retention of participants will be successful. However, involvement in research also places those community members who are primary contacts or “point people” at risk; if the study fails in the community’s view, their reputations will be forever tainted. The vested interest of the community translates into a heavy expectation for answers and results at the end of the research process. This makes the interests of community staff to control or affect research processes and outcomes more understandable.

**Sustaining the partnership**

Once the research is underway, sustaining the partnership requires each side to keep communication open and flowing in both directions (Holkup et al., 2004). For the academic partners this means frequent visits to the research site and budgeting in the grant proposal for a local office equipped with communication technology (telephone, fax, computer, internet service, etc). Local staff may need to be trained to effectively use computer software programs and e-mail. The project Principal Investigator should be in frequent contact with local data collection staff to receive information as well as to send it, but also must recognize that community partners often prefer face-to-face interactions.

Community partners expect to be updated at regular intervals on the progress of the research: the sample size so far, number of participant refusals, laboratory tests completed, results from data analysis thus far, etc. As the project progresses, local staff, community partners, and academic researchers can assess and reassess whether the original research protocols are effectively collecting the needed data and whether the instruments remain acceptable to participants. Frequent communication between the partners allows adjustments to data collection procedures and helps ensure good quality data. Collecting data that is credible in the eyes of the community and scientifically valid is tantamount.

**Communication of research results to participants and community residents**

In addition to communication between partners, ongoing results from the project should be shared with the study participants and community members at large (O’Fallon and Dearly, 2002). For the Akwesasne project, participants received results from individual testing (toxicant profiles, hormone levels, cognitive assessments, and growth assessment). Each participant received several letters relaying these results back to him or her as they became available. The letters were carefully crafted in tandem with the community partners, and in accord with community values and concerns. Special attention was paid to translating results into layperson’s terms and providing an explanation of the available toxicant standards, so that participants could better understand their individual results. This may be one of the most significant steps in the research process from the community’s perspective, as it represents the delivery of “product from research” back to the community (McCauley et al., 2001; O’Fallon and Dearly, 2002).

Participants also received results of the scientific investigation and data analysis. Prior to disseminating results to the participants though, all analytic results, including those that might later be published or presented at a conference, were shared with our community partners. At these meetings, the academic partners received feedback regarding interpretation of analyses and strategies to effectively communicate results to the study participants. As the data set was large and the research questions were many, community partners also provided input concerning a roadmap and priorities for future data analysis. Presentations of new analytic findings were made to participants during lunch or dinner meetings that allowed enough time for extended question and answer periods. Such meetings were “closed door,” and for participants and their families only. The press, industry representatives, and other interested parties were not invited, as our community partners felt it was important for study participants to learn of the project results privately, before the information was accessible to the general public or media. This was a strong community concern and the legacy of past research at Akwesasne, when participants had learned of study results secondhand, “from other people” (the media), rather than directly from the researchers themselves.

Study results were not only conveyed to the participants but also to the community at large. With our community partners taking the lead, we organized and conducted public
meetings to present results. Health practitioners, local leaders, local press, and other community organizations as well as residents of Akwesasne were invited to these meetings. Question and answer sessions followed the presentations, which often provided feedback to the researchers regarding the community’s ongoing concerns and perceptions of the research process.

Our community partners took the lead in the dissemination of results to both participants and the community in general. Organization, publicity, set-up, and invitations for presentations were all coordinated by local project staff members and our community partners. If possible, a formalized community outreach and education program or dissemination plan with a local staff person specifically employed in this role facilitates the release of results (Israel et al., 1998). For the Akwesasne project, one half-time local staff member is exclusively dedicated to community outreach, dissemination of results, and community education activities. Additionally, time was spent to educate and familiarize all staff members with project results, so that they were able to represent the study to community members and the local media. Budgetarily, this means factoring-in staff time and salary for this important task as well as more resources to host the requisite community meetings.

**Publishing as partners**

Empowering the community, fostering community leadership development, and contributing to community capacity for future research means publishing in partnership with the community, including sharing authorship (Israel et al., 2001; Stevens and Hall, 1998; Wallerstein, 1999). During the publication process, we have had to balance the sometimes lengthy peer-review process with the community’s need for timely research results. With our community partners from the ATFE’s RAC, we jointly developed a publication protocol that incorporates community feedback and participation, but also returns scientifically validated results to the community as quickly as possible (Schell et al., 2005). While results of individual tests (e.g., toxicology tests or growth assessments) are returned to participants and to their physicians if relevant, as soon as they are available, results of the hypothesized relationships involving the community are reported back when they are final and peer-reviewed. We did not wish to offer preliminary results that might have to be retracted or altered later. The result is a multi-step publication protocol that enables communication of accurate results, peer review publication, community input, and reporting of results to participants before other audiences (Table 3).

Since there are adverse effects related to one’s community being known as a site where research on an environmental hazard is taking place, we obtained feedback from community partners to avoid misrepresenting the community or somehow presenting data in a manner that could be hurtful to the community. This was an important concern for Akwesasne, as litigation with industry regarding remediation and clean-up is ongoing. Although it was not always possible for our community partners to contribute professional writing at the drafting stages of papers intended for publication, they always provided comments, suggestions for further analyses, and rewrites in the review stage before papers were submitted for publication. Editor’s and reviewer’s comments were shared with the community partners and were addressed jointly by the academic partners and those community members serving on the ATFE RAC if a manuscript revision was needed. The RAC also reviewed and provided feedback on abstracts describing analytic results to be submitted for presentation at scientific conferences. To ensure that the community perspective and contributions were not an afterthought, we sought the input of community research partners at the outset, in the preparation stage, rather than right before publication when input and meaningful rewrites are impossible.

**RESEARCH RESULTS FROM THE PARTNERSHIP**

The ability of the partnership research model to produce new knowledge is one major

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**TABLE 3. Steps in the Albany-Akwesasne publication protocol**

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Draft research report, with community partners if possible.</td>
</tr>
<tr>
<td>2.</td>
<td>Present research results to community partners and obtain their input.</td>
</tr>
<tr>
<td>3.</td>
<td>Redraft with community partners and submit to peer-review journal.</td>
</tr>
<tr>
<td>4.</td>
<td>Editor’s comments shared with community partners.</td>
</tr>
<tr>
<td>5.</td>
<td>Redraft for journal.</td>
</tr>
<tr>
<td>6.</td>
<td>Acceptance by journal.</td>
</tr>
<tr>
<td>7.</td>
<td>Communicate peer-review validated findings to study participants and community.</td>
</tr>
<tr>
<td></td>
<td>Publication appears.</td>
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</table>
consideration in assessing its benefits over the traditional subjects-as-objects model. Several sets of results from our research partnership with the Akwesasne community have been published and additional publications are forthcoming.

Levels of PCBs, lead, and other pollutants in Akwesasne youth are not as high, as has been reported following incidents of poisoning in Japan and Taiwan, or among several other populations (Schell et al., 2003b). Although measurement methods vary, comparison of levels of the same PCB congeners across several studies, in persons of roughly comparable ages, shows that Akwesasne youth have lower levels. The expectation from the scientific community was, therefore, that effects on human biology parameters would be few or none at all. However, age at menarche in girls and thyroid hormone levels in both boys and girls were significantly related to specific toxicants. One of the advantages of the current study is the capacity to measure several toxicants, including many different forms of PCBs. Previous studies focused on single toxicants in relation to health outcomes, essentially borrowing the one variable model common in laboratory science and applying it to human populations. However, the simultaneous consideration of multiple toxicants is both consistent with community concerns and more accurately reflects human pollution exposure.

The timing of menarche has social and health implications during adolescence and beyond. Earlier puberty in teenage girls has been associated with earlier onset of sexual activity (Rosenthal et al., 2001; Wellings and Field, 1996), higher rates of depression (Hayward et al., 1997), and body image and dieting concerns (Striegel-Moore et al., 2001). Later in life, earlier age at menarche has been associated with increased risk of breast (Sakorafas et al., 2002), endometrial (Purdie and Green, 2001), and ovarian (Riman et al., 2004) cancers. The timing of menarche has also, but less consistently, been associated with several factors related to fertility, including endometriosis (Berube et al., 1998; Missmer et al., 2004), anovulation (Hegab et al., 1987), polycystic ovaries (Sadrzadeh et al., 2003), and spontaneous abortion (Helm et al., 1995).

Age at menarche among Akwesasne girls is significantly delayed in relation to lead levels, and is advanced in relation to the level of a specific group of PCBs as shown by multiple logistic regression analysis (Denham et al., 2005). PCBs can take a variety of forms, or congeners, and these vary in toxicity, similarity to naturally occurring hormones, and resistance to metabolism. A group of four PCB congeners identified as estrogenic (IUPAC no. 52, 70, 101+[90], 187; (Wolff and Tonio, 1995; Wolff et al., 1997)) are predictors of earlier menarche, while other nonestrogenic groups of PCB congeners having different properties in toxicological testing were not related to age at menarche. On the basis of a multivariate model controlling for age, socioeconomic status, and other toxicant levels, we estimate the median age at menarche for the population at different levels of lead and estrogenic PCBs while holding all other variables constant at their respective means (Fig. 2).

A second finding from our research partnership with the Akwesasne community addresses the relationship between PCB levels and hormones related to thyroid function (Schell et al., 2004). The 16 PCB congeners found in the majority of study participants were grouped together. That PCB group is significantly related to lower levels of thyroxine and higher levels of thyroid stimulating hormone. The latter is a clinical marker of low thyroid output and hypothyroidism. These relationships were apparent in both bivariate tests and multivariate models controlling for age, sex, lipid levels, time of blood collection,
and several other pollutants (mirex; a pesticide; hexachlorobenzene; DDE, a metabolite of DDT; mercury; lead). Further analysis indicated that much of the relationship was produced by the more highly chlorinated congeners that tend to be more persistent, resisting metabolism and excretion.

Although these health effects had not been demonstrated in the mid 1980s, community concerns coupled with the presence of PCBs in local fish prompted the Akwesasne and New York State health agencies to issue advisories against the consumption of local fish. These advisories ultimately reduced the community’s consumption of locally caught fish (Fitzgerald et al., 1995, 1999). The loss of local fish as a dietary component may be related to increased intakes of other foods, particularly protein sources and nutrient-dense foods high in fat and calories (Ravenscroft et al., 2003). How much of this dietary shift is the result of the fish advisories or is from the rapid influx of fast food providers and grocery stores in the vicinity of the Nation territory, or the interaction of both, is not known, and there is much concern on the part of health providers at Akwesasne about the issues of overweight/obesity and their attendant risks for diabetes, cardiovascular disease, and cancer.

Our investigation of adolescent growth in relation to toxicant exposure began with a description of the heights, weights, and BMI among the 10–16.9-year-old Akwesasne youth (Gallo et al., 2005). Although heights of each age group are little different from the NCHS reference values, mean weights of males and females are significantly greater than the 50th percentile of the reference values at every age (Fig. 3). Mean weights of males, at all ages, are at or above 90th percentile and females’ weight means exceed the 75th percentile of the reference population until age 15, when they surpass the 90th percentile. Furthermore, the prevalence of overweight, as defined as a BMI at or above the 95th percentile of the sex-specific BMI-for-age growth chart, was high; 26% of Akwesasne youth were found to be at risk of overweight and 33% were overweight. This high prevalence is evident in the youngest age groups studied and may begin even before adolescence. Compared to results of a national survey of Native Americans (Jackson, 1993), Akwesasne youth exhibit greater weight at every age (Figs. 4 and 5).

While it is not possible to establish a causal relationship between the fish advisories and high prevalence of overweight, comparison with previous studies of the Akwesasne and closely related groups show that contemporary Akwesasne youth are heavier at most ages than Mohawk youth measured earlier (Figs. 4 and 5). Although pollutants remain a community concern, the high prevalence of overweight has spurred community health workers to increase efforts to control the growth of obesity and its related disease risks.

To date, the results generated by our research partnership with the Akwesasne com-
munity suggest that lead and PCB levels that are often considered background or safe have meaningful biological effects. The impact of environmental pollutants on reproductive health and the growth and development of children are longstanding concerns within the Akwesasne community, as they directly affect the future existence of the Mohawk Nation.

CHALLENGES: WORKING WITH COMMUNITIES

Although benefits of collaborative and collegial partnership research may accrue to both the researchers and the community, there are specific challenges to collaboration. One of the most difficult has been the identification of

Fig. 4. Comparison of mean weight of Akwesasne males to other Native American data.

Fig. 5. Comparison of mean weight of Akwesasne females to other Native American data.
community groups to represent the community. Communities may not have representative government, and can be divided along religious or political lines or according to a specific issue. Building a relationship with several community groups is a viable strategy, although it is one that takes considerable investment. In reality, expectations for widespread, representative community support may not be reached, as there are usually larger issues of community cohesion and even existence.

Another hurdle concerns the “ownership of data.” A consistent early complaint of speakers for the Akwesasne community was researchers taking data out of the community and preventing community interests from using it for community purposes. From a university perspective, data used without Institutional Review Board approval violates Federal rules governing research, particularly health data, and such violations can end a university’s ability to conduct sponsored research. If research is conducted in the United States, it may be possible to formally collaborate with a community health agency already involved in maintaining health records, and this agency could be a safe repository for community data. Community partners hired as researchers were trained in university and federal programs for the protection of confidential data. This training introduced the community to information on research ethics as defined by university partners and the sponsor.

Community-based research may be more expensive than research conducted via a more traditional rubric. The costs associated with training personnel, maintaining community research office, as well as the costs associated with community outreach and translation activities, might increase the budgetary bottom line. Some federal funding agencies are allowing or even requiring that a certain proportion of the direct research costs be intended for formal community outreach and education efforts. Also, some application requests specifically encourage community-based approaches to research. This is especially true of research issues that may place burdensome data collection protocols on participants or an institutional interest in communities/populations that have experienced longstanding disparities or disenfranchisement from research. The costs associated with a community-based approach can be strongly justified. For instance, a partnership approach to a research project may allow research to go forward that might not be possible at all, unless there is significant vested interest of the community. Additionally, a community-based approach serves to build community capacity as skills, resources, and training are left in the community increasing the likelihood of future and perhaps larger projects.

A further challenge is reconciling the sometimes different products of research sought by researchers and community groups. Publication is an academic goal, but other goals are often far more important to community. Before beginning MAWBs we discussed the product of the research, and we agreed that peer-reviewed publication would be of value to the community. A part of the community’s interest focused on the utility of such publications in furthering legal attempts to redress the impact of pollutants in the community.

Each of these challenges may be amplified in a community with previous negative research experiences, especially so in heavily studied communities. For example, earlier studies at Akwesasne by other researchers have been very slow to report results, if they were reported at all, and this experience made establishing trust and upfront discussions of community expectations and the kind of results to be generated from the proposed research, of utmost importance.

**CHALLENGES: FITTING PARTNERSHIPS INTO THE ACADEMIC CAREER**

Meeting the specific challenges of collaborative research requires a significant time investment for both the community and academic partners. Developing the relationships essential in partnership research can affect a junior researcher’s career progress, as it may take time away from producing credentials typically assessed for tenure and promotion. Two factors should be considered. First, academic institutions are becoming more sensitive to serving surrounding communities. Many now value research that is relevant to communities, and teaching that puts students in communities and involved with practical, real-world issues. Partnership research and service learning may enhance academic career advancement when balanced with academic products. Second, partnership research can be more efficient over the long run. Partnerships of trust are fundamental to enduring research relationships and can enhance the likelihood that research projects will be long lasting and ultimately more productive than a series of short-term relationships that have to be built.
Repeatedly, in addition, academics can develop strategies to ameliorate detrimental effects of extra effort involved in starting partnership relationships. Junior researchers can partner with more senior ones to share the work, and they can leverage those relationships to create an appreciation of partnership research among colleagues. Certainly, junior researchers can assure the most support for partnership research by being careful to select an initial academic position that shows some appreciation for partnering with communities.

BENEFITS OF A PARTNERSHIP APPROACH

There are benefits to partnership research whether typed as collaborative or collegial that may outweigh the considerable challenges and the investment needed to overcome them. For the researcher, a chief benefit is greater cooperation in the study that usually translates into a larger sample of participants than would be obtained otherwise or one that is obtained faster and with less expense. Another is the improved measurement of relevant cultural variables. For example, human biologists are interested in effects of socioeconomic status either as a causal variable or a covariate, but this concept is difficult to measure as its meaning is remarkably variable across communities and cultures. Local knowledge of the components of socioeconomic status can help produce a more nuanced interpretation of this and other cultural concepts. This leads to enhanced modeling of complex biocultural systems.

In the follow-up study to MAWBs, we seek to determine which behaviors related to maintaining Mohawk values and identity are related to toxicant exposure and effects. This investigation would be impossible without local expert knowledge. In general, studies linking behaviors to biology are better informed by information about those behaviors from community members.

From the community perspective, the benefits of a partnership research model can be both educational and economic. Research project purchasing and employment brings direct economic benefits to the community, especially, as dollars usually remain in local circulation. As we trained research partners in data collection and management, they became better informed about specific research methodologies and, more importantly, about the conduct of a logistically complex operation. Direction of day-to-day operations by community employ-ees produced important experience in leadership and administration. With their involvement, community partners became stakeholders in the research process, committed to producing the best research possible.

Overall, partnership research projects, although requiring substantial investment by researchers and community partners to implement, can improve university/community relations, which is valuable in its own right. In addition, such partnerships can produce a more civically relevant human biology and a more sustainable one.

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LITERATURE CITED


