

## GLOSSARY

## Ecological perspectives in health research

Lindsay McLaren, Penelope Hawe

*J Epidemiol Community Health* 2005;59:6–14. doi: 10.1136/jech.2003.018044

An ecological perspective on health emphasises both individual and contextual systems and the interdependent relations between the two. Origins of this approach have emanated from multiple disciplines over the past century or more. This article provides a glossary of perspectives, processes, and settings that pertain to an ecological approach in health research.

I ncreasingly in the public health and health promotion literatures, authors refer to the need for an ecological perspective on research and intervention.<sup>1–5</sup> Although reference to ecology in these health arenas is a comparatively recent phenomenon, giving it the appearance of a “new” perspective, the ecological approach has roots in several disciplines dating back more than a century.<sup>6</sup> Scholars argue that ecology has always been a heterogeneous field, which has not one, but many histories corresponding to diverse scientific, philosophical, and socio-political contexts.<sup>7</sup> In light of this historical heterogeneity, the purpose of this glossary is to outline key terms pertaining to an ecological approach to health, to help researchers navigate and apply this complicated and somewhat disparate literature.

The heart of ecological thinking is the natural ecosystem. By analogy, concepts from natural systems are used to help understand human systems and environments.<sup>8–9</sup> The use of metaphors, as in this case, occurs when people seek to explain phenomena in unfamiliar contexts by evoking images from familiar contexts.<sup>10</sup> This is potentially problematic in science, because the more complex the phenomena being observed, the greater is scientists’ dependency on the use of metaphoric language to describe it.<sup>11</sup> So while metaphors are seen as necessary to communication, the danger is that the careless or partial application of metaphor invites misrepresentation,<sup>12</sup> as illustrated in the following paragraph.

Ecological language and thinking was introduced to urban studies by sociologists associated with the Chicago School after the first world war. But the popularity of these ideas declined. There was an overall souring of interest in using ecology to understand human social worlds, because various ideas from biology such as “competition” and “survival of the fittest” became unpalatable when they were used in association with morally unacceptable actions and policies. A chief example was the Nazi regime’s use of various terms from evolutionary biology to justify their particular interpretation of the theory of natural selection (for a brief

overview see Institute for Social Ecology web site ([http://www.social-ecology.org/learn/library/staudenmaier/fascist\\_ecology.html](http://www.social-ecology.org/learn/library/staudenmaier/fascist_ecology.html))). As Beatty<sup>7</sup> observed, Darwinian theories of evolution can provide “a convenient, plausible explanation and justification for all the aggressive, selfish behaviour of which man is possible” (page 255). As a consequence, the ecological metaphor itself fell into disfavour. Critical interrogation of the appropriate role of the biological sciences to understanding society continues,<sup>7 13 14</sup> as does critical interrogation of metaphorical understandings in science.<sup>11 12 15 16</sup>

Renewed interest in and use of ecological language and thinking in public health at the present time may possibly be attributable to a range of factors. These include increasing acknowledgement of the complexity of public health problems (including our increasing capacity to investigate gene-environment interactions), frustration with individualism and linear and mechanistic ways of construing causality,<sup>3 17</sup> and the rediscovery of the inextricable link between social inequality and health inequality.<sup>18</sup> A further impetus comes from evidence of the independent effect of place of residence on health,<sup>19</sup> with the consequent search for explanation that requires analysis of context. An ecological perspective encompasses context in the broadest sense of the word, to include physical, social, cultural, and historical aspects of context (including trends at the local and global level such as globalisation, urbanisation, and large scale environmental change) as well as attributes and behaviours of persons within.<sup>20</sup> Moreover, primary themes of an ecological analysis include interdependence and mutual interaction among persons/organisms and settings, as well as an emphasis on studying behaviour in natural (non-experimental) circumstances.<sup>21</sup>

There are a number of primary contributors to an ecological way of thinking in public health, including Roger Barker, Jim Kelly, Urie Brofenbrenner, and Rudolph Moos, among others.<sup>9 21–25</sup> In compiling this glossary, we have endeavoured to provide a balance of references between these original sources and more recent contributors to the ecological health literature, such as Nancy Krieger<sup>26</sup> and Daniel Stokols.<sup>27</sup> And, although a concise definition of ecology (in the plant/animal sense) is provided, most time and effort was spent consulting sources obtained through disciplines of human ecology, social ecology, ecological psychology, environmental psychology, and ecological community psychology. Within these disciplines, we aimed to achieve a similar depth of coverage for relevant terms.

See end of article for authors’ affiliations

Correspondence to:  
Dr L McLaren, Centre for Health and Policy Studies, G230, Health Sciences Centre, University of Calgary, 3330 Hospital Dr NW, Calgary AB, Canada; [lmclaren@ucalgary.ca](mailto:lmclaren@ucalgary.ca)

Accepted for publication  
26 February 2004

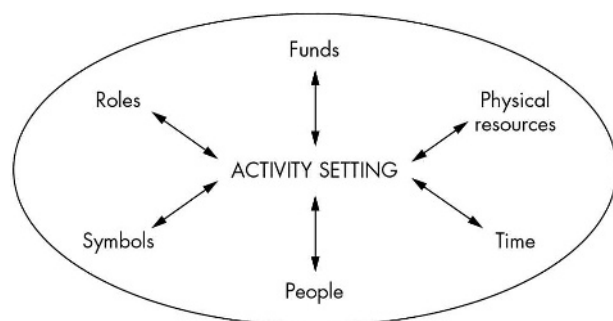
In compiling this work, we encountered conceptual overlap among some terms from different theoretical perspectives, reflecting the fact that the terms originated in disciplines that developed in parallel. In other instances, conceptual differences between perspectives on terms were evident. In still other instances, certain terms were used frequently and interchangeably (for example, context, setting, environment), and we were not always able to detect a concise definition for each. As this is a glossary rather than a synthesis, we consciously resisted the temptation to resolve definitional ambiguity, recognising that differing perspectives constitute a real part of this literature, and that covering up or superficially resolving such differences may hinder rather than facilitate their application in health research.

### ACTIVITY SETTING

The places, events, routines, and patterns that structure the experience of everyday life; for example, a basketball game, a classroom, a school playground, a neighbourhood resident meeting, a commuter train, family meals, or a waiting room in a doctor's office. Activity settings are considered to be the unit by which culture and community are propagated across time.<sup>28</sup> Activity setting theory refers to aspects of a setting (such as the people, the symbols, and the physical infrastructure) and how the interrelations among these aspects create particular types of experiences for the people in the setting (see fig 1). For example, alienation is experienced if there are more people than there are meaningful roles to share around.<sup>29</sup> <sup>30</sup> The theory thus has consequences for intervention design. See also BEHAVIOUR SETTING.

### ADAPTATION

On an individual level, adaptation refers to the ways in which people may change aspects of their behaviour, language, routine, and lifestyle to fit new situations. Migrants, for example, might adapt their eating patterns to reflect the food and culture of a new country. In ecology, adaptation is regarded as a collective, SYSTEM level process rather than an individual process, which is thought to be achieved when a population is sufficiently organised that it is able to act as a unit in interrelation with the environment.<sup>8</sup> In an illustration of system level adaptation, Smith<sup>31</sup> used ecological theory to describe the way hospitals across the USA, in order to retain federal funding in accordance with civil rights legislation, had to abandon previous policies that placed African Americans in separate hospitals and wards. In this example, the imperative to adapt to the changing environment overcame any structural inertia within organisations. In ECOLOGICAL COMMUNITY PSYCHOLOGY, the principle of adaptation is typically used with reference to the way new programmes "fit" aspects of a setting.<sup>23</sup> <sup>25</sup> For example, a "pre-packaged" school health promotion programme might need to adapt its



**Figure 1** Components of an activity setting (adapted from O'Donnell *et al*<sup>29</sup> by Hawe<sup>30</sup>).

language, timing, and modes of delivery to suit features of a particular school, such as its timetable, the presentation style of teachers, and other programmes competing for space in the curriculum.

### BEHAVIOUR SETTING

A behaviour setting refers to the place where a pattern or sequence of behaviour regularly occurs, and includes the ordinary events of daily life. Behaviour settings originated in the 1940s and 1950s in behaviourist psychology where the emphasis was only on what was observable and measurable. It is a forerunner of the concept of ACTIVITY SETTING and, in practical terms, differs now only in how the setting is studied. That is, behaviour settings researchers rely on observations of behaviour in environments, while activity settings researchers extend their domain to what the people in the setting say about their experience of the setting. Behaviour settings theory sees behaviour and environment as occurring in inseparable units. Rather than looking inward and studying personal motivations or properties of individuals, it was reasoned that knowledge of the setting in which behaviour occurs was the best predictor of a person's behaviour. Behaviour settings draw out a particular range and type of behaviour (roles) that conform to certain principles (see MANNING THEORY). The range and diversity of behaviour settings in a given locality might be indicative of the satisfaction or quality of life of people living there.<sup>21</sup> <sup>22</sup> <sup>32</sup> <sup>33</sup> Early research on behaviour settings entailed compiling complete censuses of behaviour settings in towns, in order to refine and develop the observational methods and to track changes over time.

### COMMUNITY

Biologically speaking, a community is a territorially organised population that is rooted in the soil it occupies, and its individual units live in a relationship of mutual INTERDEPENDENCE; a community has a more or less definite structure and a life history in which successive developmental phases can be observed.<sup>34</sup> Although this definition<sup>34</sup> is viewed as appropriate to plant, animal, and HUMAN COMMUNITIES, it is arguable to what extent it pertains to the latter.

### Human community

Pertinent elements of and definitions for human communities are currently contested issues. A comprehensive viewpoint is provided by McLeroy *et al*,<sup>35</sup> who suggest three distinct definitions for a human community: firstly, a collection of primary interpersonal groups (for example, families, friendship networks, neighbours); secondly, a collection of relationships among organisations and groups within a defined area; and thirdly, a geographical and political unit characterised by a population with one or more power structures. Furthermore, as distinct from non-human communities, human communities can encompass elements of culture and identity.

### CONTEXT

In linguistics, context refers to the text surrounding a word, which allows a reader to gain a better understanding of what the word means. In art, contextualism refers to the way a work of art may only be understood by knowing the historical, political, or cultural circumstances during which it was produced.<sup>36</sup> In health research, context also refers to the wider situation surrounding something (usually a variable under investigation) and how this wider situation confers meaning. Appreciation of context is central to qualitative inquiry. In quantitative analysis the investigation of context has been formalised through multilevel analysis.

So “context level” variables, such as characteristics of the places in which people live or work, or the characteristics of the groups to which they belong, can be factored into analyses of health behaviours and health outcomes alongside variables operating at the individual level.<sup>19</sup>

### CYCLING OF RESOURCES

Principle drawn from biological ecology that pertains to the ways in which a COMMUNITY develops, distributes, and uses resources. In a human community, resources may take a variety of forms, including people (who may possess knowledge, skills, or external contacts), settings (which can provide venues for interaction or policy enactment), and events (which may help to build identity and foster group values).<sup>25–37</sup> Cycling refers specifically to processes by which resources are transferred from one part of the system to another. For example, staff who are trained as part of a new health promotion intervention in one organisation, may then go on to take up employment in other community organisations after the intervention period is over. Anticipating this flow in advance might change the focus or scope of the training to maximise benefits and SUSTAIN the effect of the intervention.

### DOMINANCE

Argued to be an inherent component of any COMMUNITY, dominance is a concept from biological and urban ecology describing how one group or species has more influence or control than the others. Dominance is established through a process of competition; for example, in a plant community the dominant species is established through competition for light, whereas in an urban community, dominance may be related to competition over strategic geographical location and land value. In the urban setting, the various parts of a metropolitan community (for example, business district, shopping district, industrial areas) thus owe their existence—in part—to the process of competition for dominance. Dominance in human communities can be self-perpetuating; for example, the areas of highest land value become the predominant location for shopping and business; these areas may then become more accessible from outlying areas through transit development, and in turn the land value and desirability (and dominance) of these areas is reinforced. Because dominance tends to stabilise a community, it is indirectly responsible for the phenomenon of SUCCESSION.<sup>34</sup>

### ECOBHAVIOURAL PERSPECTIVE

A perspective that aims to analyse and understand behaviour within context, by considering environmental influences and constraints on behaviour. This perspective thus contrasts with the dominant psychological paradigm of the contextless person. An ecobehavioural perspective does not neglect intra-individual factors; rather it assumes that the impact of any environmental influence is mediated by (operates through the pathway of) a range of interactive, intra-individual genetic, biological, cognitive, and behavioural variables. Environmental influences on health considered from this perspective include social connections, the organisation and structure of work, home, and community environments, availability of health information, and the economic and political climate. This perspective is said to overlap with fields of public health, medical sociology, and other ecological perspectives.<sup>38</sup>

### ECO-EPIDEMIOLOGY

A paradigm for epidemiology that encompasses multiple, interactive SYSTEMS at different levels ranging from the molecular to the societal. Eco-epidemiology is grounded in

the principle of ecologism, which emphasises localisation (that is, understanding phenomena in relation to the boundaries of context) over universalism (that is, the seeking of universal explanations that may be context free).<sup>39</sup> Other researchers<sup>40–41</sup> concur with this view,<sup>39</sup> stating that eco-epidemiology is a perspective that balances traditional biomedical concepts of risk with the broader social and environmental context and community ownership principles; in this way, eco-epidemiology rests on an understanding of a universe in which nothing exists as a thing by itself, but only has existence in relation to everything else.

### ECOLOGICAL COMMUNITY PSYCHOLOGY

Branch of psychology that places explicit emphasis on the importance of developing theory, research, and interventions that situate individuals, settings, and communities within culture and context, and focuses on the INTERDEPENDENCE of these things. Perhaps to a greater extent than other branches of psychology, ecological community psychology acknowledges multiple levels of influence on behaviour and appreciates human diversity on dimensions of culture and resources. To understand behaviour in context, the context needs to be understood in terms of how different people experience it, including researchers. To this end, diversity of methods is encouraged.<sup>23–24–42</sup>

### ECOLOGICAL DEPTH

A criterion that may be used for assessing the penetration of an intervention into the local system; it encompasses an evaluation of intervention scope (number of levels) and duration of effect. A programme with high ecological depth yields an effect at multiple levels (for example, individual, environment) that endures over extended periods of time. Thus, a short range or personal range programme may have an impact on individual behaviour; whereas a medium or community range programme may additionally have an impact on local environment, which in turn can affect personal health in the longer term. It has been suggested that a judgement about the ecological depth of an intervention should be made alongside an evaluation of scientific validity (methodological rigour and theoretical adequacy) and social validity (societal value and practical significance).<sup>4</sup> This gives decision makers information that will help them appreciate how long changes brought about a programme might last; or in other words, how easily the “footprint” of a programme will be eroded.

### ECOLOGICAL FALLACY

The fallacy that sometimes arises when an inference of individual level relations is made based on aggregate (ecological level) data. In a well known paper on this topic, Robinson<sup>43</sup> showed that the correlation between skin colour and illiteracy in the United States was much lower when based on individual data, than when based on exactly the same data aggregated to the state level. The fallacy may be especially likely to occur when the conceptual model for the research, and the corresponding data, pertain to different levels; for example, when the conceptual model pertains to individuals, but the data are available only at a group level. One must be cognisant that a variable measured at one level may tap into a different construct at a different level, as in the instance of group compared with individual level processes for the same variable.<sup>44</sup> When speaking of the ecological fallacy, it should be noted that ecological refers to the level of analysis (for example, aggregate level data such as a mean or proportion), and should not be confused with ecological as a metaphor or theoretical framework.

### ECOLOGICAL PERSPECTIVE (HEALTH PROMOTION)

A conceptual framework designed to draw attention to individual and environmental determinants of behaviour. The visual metaphor is a series of concentric or nested circles (similar to the diagram in figure 2), each of which represents a level of influence on behaviour (for example, intrapersonal factors, interpersonal processes, organisations, community, and public policy). Central to the ecological perspective is the assumption of INTERACTION and reciprocal causation among levels. Thus, improvement in behaviour requires that various levels be targeted for intervention, and that the effect of intervention be evaluated at the different levels. The perspective assumes that appropriate changes in the environment will lead to changes in individuals, but the support of individuals is required to implement environmental change.<sup>35</sup>

### ECOLOGICAL PSYCHOLOGY

The branch of psychology concerned with how people's behaviour and experiences are related to their everyday environment. One of the first ecological psychologists, Kurt Lewin, argued that a first step in understanding the behaviour of individuals or groups is to study the opportunities and constraints in their environment; particularly people's perceptions of them. A key principle of ecological psychology is mutuality, the reciprocal relationship between people and their environments. In contrast with the tendency in the dominant psychological paradigm to adhere to the principles of experimental design, ecological psychology promotes the study of behaviour within the complex real life settings in which it occurs. The BEHAVIOUR SETTING is a central unit in ecological psychology.<sup>21 33</sup>

### ECOLOGICAL PUBLIC HEALTH

A way of characterising the "new public health", which emerged in response to a shift in risk patterns of industrialised societies. Because contemporary risk patterns and health consequences do not fit within simple models of causality and intervention, there is a need to consider interdependence between humans, health, and their physical and social environments. Notions of INTERACTION and INTERDEPENDENCE are central to this approach. Key features of an ecological public health include understanding health as a pattern of relations rather than as a quantitative outcome (that is, viewing health as a process nested in contexts rather than as a static attribute of individuals), and a new type of dialogue between the natural and social sciences that enables the explanation of both physical and social processes contributing to health.<sup>46</sup>

### ECOLOGICAL TRANSITION

Within a framework of human development, ecological transitions refer to shifts in roles or settings that occur across the life course. Examples include the arrival of a new sibling, entering a new school, graduating, finding a job, getting married, moving house, and retiring. These transitions usually entail a change in a person's role or behavioural expectations, and in terms of understanding the ecology of human development, these events offer much research potential. Although the transition refers to an event experienced by a person, an ecological perspective treats the elements of the transition as a SYSTEM. Thus, the relations between the individual and other individuals (for example, family, friends, neighbours; MICROSYSYEM) and the relations between the relevant settings (for example, home, school, work; MESOSYSYEM and EXOSYSYEM) are viewed as dynamic systems that are interrelated along various dimensions such as support, participation, communication, and information.<sup>9</sup> Ecological transitions differ from EPIDEMIOLOGICAL TRANSITIONS and from SUCCESSION in that the latter two pertain specifically

to collective or population level processes, whereas the ecological transition pertains to individuals whose situation (transition) is understood as a system.

### ECOLOGY

The comprehensive science of the relation of the organism to the environment; or, the study of variation in the earth's biosphere, to understand why plants and animals are found in certain areas and what controls their numbers.<sup>47</sup> See HUMAN ECOLOGY.

### ECOSOCIAL THEORY

A theory proposed by Krieger that sets out to answer the central question, "who and what is responsible for population patterns of health, disease and well-being, as manifested in present, past and changing social inequalities in health?"<sup>48</sup> This theory is contrasted against other ways of understanding health patterning in epidemiology such as the "web of causation". The theory draws together cellular and societal level processes. EMBODIMENT is a key concept within an ecosocial perspective.

### ECOSYSTEM

A comparatively stable, enduring arrangement of a population with mutual dependencies, which includes all living (that is, people and other organisms) and non-living (for example, rocks, water, climate) elements within an area. The arrangement is such that the population operates collectively as a unit in ways that maintain a viable relationship with the environment. The ecosystem thus encompasses the process of ADAPTATION. The unit-like character of an ecosystem suggests that it has boundaries; however, as edges of ecosystems are unlikely to be clearly defined, it is usually necessary to develop operational definitions. An example is to assign boundaries around a social SYSTEM that encompasses all interactions that recur on a regular basis.<sup>8</sup>

### EMBODIMENT

Within public health and epidemiology, embodiment is the means by which humans biologically incorporate the physical and social environment in which they live, throughout the life course. An implication of embodiment is that one's biology cannot be fully understood without attention to psychosocial and sociocultural aspects of individual development and societal history.<sup>26 48</sup> An example of embodiment may be found in research on discrimination and health, such as that which reports differential health status between socially defined dominant and subordinate groups. This research provides indirect evidence for the embodiment of discrimination; that is, the process whereby the adverse effects of discrimination "get under the skin".<sup>49</sup> From an anthropological perspective, embodiment is relevant to the distinction between disease (abnormalities in structure and function of bodily systems and organs) and the lived experience of sickness<sup>50 51</sup>; the latter goes far beyond organic pathology to include the ways in which illness and illness labels are interpreted and experienced, and acquire social significance, among populations nested within particular social, cultural, historical, and political contexts. In sociology, the term is viewed broadly as pertaining to how we experience the world, which includes perception and apprehension of stimuli, as well as physical engagement with our surroundings. Language (both speech and body gestures) is a vehicle through which our experience of the world is made possible.<sup>52</sup>

### ENVIRONMENT

An open-ended concept that includes all that is external to and potentially or actually influential upon an object of

investigation. Strictly speaking, an environment must therefore be defined separately for each separate object.<sup>8</sup> This definition contrasts with common (pragmatic) practice in research on neighbourhoods and health, in which an environment defined by administrative boundaries is presumed to apply to all persons living within.<sup>53</sup> It follows from the above definition<sup>8</sup> that environment must include CONTEXT.

### ENVIRONMENTAL EPIDEMIOLOGY

The study of aspects of the physical environment and their implications for the distribution of human disease. Traditionally, the concerns of environmental epidemiology included the contamination of air, water, and food. However the focus now includes climate change, and other large scale environmental change related to globalisation and urbanisation. Such environmental changes, particularly as they coincide with particular demographic shifts (for example, shifts in birth rate) have implications for a number of adverse health outcomes including cancers, reproductive problems, and infectious diseases.<sup>21 54 55</sup>

### ENVIRONMENTAL PSYCHOLOGY

The study of the relation between individuals (primarily their behaviour and psychological characteristics) and their physical environment. Aspects of the social environment are not ignored in environmental psychology, but are viewed as mediating the effects of the physical environment, on health. For example, the impact of noise at the workplace on blood pressure levels may be magnified or reduced by factors such as work satisfaction, social support, and work shift.<sup>56</sup> In measuring or characterising an environment, a distinction is made between assessments—referring to objective measurements of physical environment properties, and appraisals—referring to subjective assessments of the environment by individuals. The discrepancy between assessments and appraisals is of interest, as this may help to understand the processes mediating the effect of the physical environment on health.<sup>57</sup>

### EPIDEMIOLOGICAL TRANSITION

Term used to describe the changes in morbidity and mortality that occur as societies change their demographic, social, and economic structure. The transition from a pattern dominated by infectious disease with high mortality that mainly occurs at younger ages, to one dominated by chronic disease and injury with lower overall mortality that mainly occurs at older ages, is one example. The transition may also refer to changes in patterns of illness within a population—such as changes in the social distribution. An example is the transition whereby chronic disease in industrialised countries went from being “illnesses of affluence” during the early 20th century, to subsequently showing higher prevalence among lower income people in these wealthy societies.<sup>58 59</sup>

### EQUILIBRIUM

Describes a balance between a population and the natural resources of the habitat. An early view of equilibrium held that, when equilibrium is disturbed, competition arises in the system to restore it.<sup>34</sup> However, more recent discussion<sup>60</sup> suggests that ecological scholars no longer regard ecosystems as closed, self regulating entities that mature to reach equilibriums. The newer paradigm is one of open, dynamic, and highly unpredictable multi-equilibriums, in which SUCCESSION is highly dependent on environmental and historical context. Furthermore, ecosystems are seen as being often regulated by external forces rather than internal mechanisms such as competition.

### EXOSYSTEM

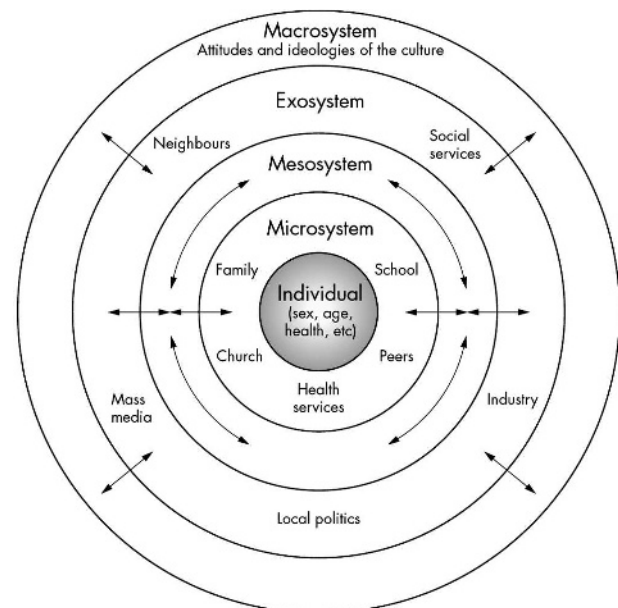
An aspect of the ecological environment as described by Brofenbrenner<sup>9</sup> in his framework of human development (see fig 2), which refers to linkages between settings that a person may or may not directly participate in, but that are none the less relevant because of their impact on his or her immediate environment. Examples include local politics or industry. See also MACROSYSTEM, MESOSYSTEM, and MICROSYSTEM.

### HOST-AGENT-ENVIRONMENT MODEL

An early public health framework that may be viewed as adhering to an ecological perspective.<sup>35 61</sup> This model holds that changes in population levels of a disease (usually infectious disease) may result from changes in the host (for example, decreased resistance to disease), the agent (for example, increased virility of agent), or the environment (for example, change in structure or climate that modifies opportunity for exposure).<sup>62</sup> Cassel<sup>63</sup> argued that epidemiologists traditionally focused on agents (for example, environmental pathogens). He called for an increased focus on host resistance because for many diseases of modern society, agents are ubiquitous and host resistance may be the primary element that varies and therefore explains disease distribution. Because of its emphasis on exposure and vulnerability, the host-agent-environment model encompasses what is thought of as gene-environment interactions.

### HUMAN ECOLOGY

A macrolevel, holistic approach to the study of human organisation. Human ecology holds that behaviour is an activity patterned by a structure of relationships, and is subject to changes in that structure. Human ecology shares several assumptions with biological (plant/animal) ecology; for example, organisms cannot be considered to exist or act in isolation—every organism is linked with other organisms in a complex network of relationships; all organisms are affected by forces both within (for example, genes, hunger) and external to themselves (for example, climate, behaviours of other members); and, living organisms ADAPT—that is, they act in a way that promotes the achievement of a harmonious working relationship with their environment.<sup>6 21</sup> Despite



**Figure 2** Bronfenbrenner's ecological theory of development (adapted from Santrock *et al*<sup>45</sup>).

these shared assumptions, however, human ecology shows important differences from plant/animal ecology including a less direct dependence on the physical environment, a greater capacity to react to and modify the environment (by virtue of technology and other inventions), and the added complexity of institutional structure that is intertwined with custom and tradition.<sup>34</sup> Stokols<sup>64</sup> describes five sub-paradigms of human ecology: firstly, the Chicago school, which emphasised economic processes underlying urban pathologies; secondly, the neo-orthodox school, which emphasised the biological principles of ADAPTATION, natural selection, and SUCCESSION as they apply to the development of HUMAN COMMUNITIES; thirdly, social area analysis, which implicated data on population density, ethnic composition, illness, and deviance rates of neighbourhoods (census tracts); fourthly, the sociocultural school, which highlighted sentiment and environmental symbolism as ecological forces that could influence economic development; and fifthly, intersystem congruence, which focused on the interrelations among economic, geographical, architectural, sociocultural, and psychological processes in order to understand human behaviour in relation to environmental contexts.

### INDIVIDUAL

From an ecological perspective, the individual is both a postulate (a basic entity whose existence is taken for granted) and a unit of measurement. As a postulate, an individual has several characteristics: firstly, requires access to an environment, upon which he/she is dependent for nourishment and knowledge; secondly, is interdependent with other humans; that is, is always part of a population, and cannot exist otherwise; thirdly, is time bound, or has a finite life cycle; fourthly, has an innate tendency to preserve and expand life; and fifthly, has an indeterminate (but not limitless) capacity for behavioural variability.<sup>8</sup>

### INTEGRATION

In general, integration refers to the organising or bringing together of elements to form a coherent whole or SYSTEM.<sup>65</sup> In psychology this might entail understanding the organisation of traits and attributes that make up a personality; whereas a sociologist might be interested in the various elements that hold a society together.<sup>32</sup> In the context of prevention and health promotion, the term integrated is currently used to refer to interventions that target multiple risk factors and the use of multiple strategies at various levels of influence (for example, policy support and informational resources), and that require collaboration and intersectoral action.<sup>66–67</sup> Thus, integration entails both multiplicity (more than one of something—risk factor, level, sector, etc), and synergy resulting from multiplicity.<sup>68</sup>

### INTERACTION

In general, interaction may be used to describe the mutual or reciprocal action between elements in a SYSTEM (for example, individuals interact with each other, and with their environment). In statistics, interaction pertains to the nature of the relation between variables in an analysis, such when the association between two variables depends upon, or differs at different levels of, a third variable.<sup>69</sup> For example, the finding that socioeconomic position is more strongly related to obesity in women than in men<sup>70</sup> suggests a gender by socioeconomic status interaction. Theories and analyses that include interaction effects can thus be used to understand the complexities of the determinants of health, to a greater extent than univariate analyses. A statistical interaction is also known as a moderator effect.<sup>71</sup>

### INTERDEPENDENCE

A principle of biological ecology that pertains to the interactive nature of component parts within a community. The interdependence principle pertains to, for example, how change in one aspect of a setting may incite changes in other aspects. From the perspective of a health intervention, adherence to the interdependence principle requires that the range of potential but unintended effects of a programme be considered.<sup>25–37</sup>

### MACROINTERVENTION

Used to describe health promotion programmes at the community level that are based on a SYSTEMS approach. Macrointerventions generally include the following elements: involvement of a complex group of structures and resources; use of integrated actions across multiple levels; and a decentralised decision process. In a health context, the intervention generally consists of a combination of educational, organisational, regulatory, and economic components aimed at achieving specific health objectives for a given population.<sup>6</sup>

### MACROSYSTEM

Along with EXOSYSTEM, MESOSYSTEM, and MICROSYSTEM, the macrosystem is one aspect of the ecological environment described by Bronfenbrenner<sup>9</sup> in his ecological framework for human development (see fig 2). The macrosystem is the most overarching concept in this framework, and includes the entire network of nested, interconnected systems within a setting (that is, inclusive of microsystem, mesosystem, and exosystem). The macrosystem refers to the overall patterns of ideology and organisation that characterise a given society or social group, and may thus be used to describe the culture or social context of various societal groups such as social classes, ethnic groups, or religious affiliates. Because of the overarching nature of macrosystems, the microsystems, mesosystems, and exosystems tend to be more similar within, than between, macrosystems.

### MANNING THEORY (SIC)

Within ECOLOGICAL PSYCHOLOGY, manning theory refers to the filling of essential positions within a BEHAVIOUR SETTING. In the case of optimal manning, the number of participants present is equal to the number of roles required to operate and maintain a setting optimally. With undermanning, there is an insufficient number of people to ensure smooth running of actions within the setting, and with overmanning, a setting contains more people than it can accommodate meaningfully.<sup>21</sup> In psychology, manning theory was used to justify alternative ways of handling “problem students” in schools. Originally, psychologists would “help” or counsel individual students who were delinquent or acting out in class. But after receiving help, it was observed that the poor behaviour would recur once the students were sent back to the classroom. Using manning theory, one can reason that students act out because there are more students in an activity setting than there are meaningful roles to share around. In other words, the ratio of people to roles is not optimum (fig 1). To solve the problem, one can simply reduce the number of people in the setting; that is, the size of the class or school.<sup>72</sup> More recently, manning theory has come to be referred to as “staffing theory”.

### MESOSYSTEM

Along with EXOSYSTEM, MACROSYSTEM, and MICROSYSTEM, the mesosystem is one aspect of the ecological environment described by Bronfenbrenner<sup>9</sup> (see fig 2). Within an environment, the mesosystem refers to linkages or overlap between settings of which the individual is a participant (for example, family, workplace, community). Examples

include parent-teacher interviews (which link the family and school microsystems), and working overtime (where the work setting overlaps with the home setting, temporally). These interconnections between settings are seen as equally important to health and wellbeing, as the interconnections between persons within a microsystem.

### MICROSYSTEM

Along with EXOSYSTEM, MACROSYSTEM, and MESOSYSTEM, the microsystem is one aspect of the ecological environment described by Bronfenbrenner<sup>9</sup> (see fig 2). The microsystem includes a person's immediate situation (that is, other persons with whom he/she interacts in a face to face manner), the connections between other persons within the setting, the nature of these connections, and the influence of all these (direct or indirect) on the person at hand.

### NATURAL EXPERIMENT

A natural event or phenomenon whose effects or consequences can be studied because it has some features of an experiment. That is, if an ecologist happens to realise at the right time that a particular event has occurred, he or she may be able to study the effects of the event as if it had been a deliberate research study. As an example, an ecologist could study the SUCCESSION of a community by tracking changes in that community after a disaster such as a flood or fire. Natural experiments are often the only means of studying the effects of particular phenomena, because of logistic or ethical impracticalities of manipulating the event in question. It has been argued that natural experiments differ from accidental experiments in that the event of interest is a natural rather than human initiated action,<sup>73</sup> although in practice this distinction is not always clear. For example, a so called "natural event" such as a fire may well be started by humans, making the distinction between natural and accidental difficult to determine.

### POLITICAL ECOLOGY

The interdisciplinary study of the political and economic principles controlling the relations of human beings to one another and to the environment. It thereby represents an interaction between political economy and ecology (see Political Ecology Society web site <http://www.library.arizona.edu/ej/jpe/eco~1.htm>). Also refers to the position advocating the insertion of ecological thinking into political debate, so that political decisions take into account the impact of human activity on the global environment (see Campaign for Political Ecology web site <http://eco.gn.apc.org/>).

### SOCIAL CLIMATE

Umbrella term that includes factors that may mediate the effects of structural aspects of setting (for example, socioeconomic status, population size, physical environment) on human health, in various contexts (for example, family, school, community). Moos, a pioneer in this field suggested that a way of describing the social climate is in terms of three sets of dimensions that emphasise human experiences within settings: (a) relationship dimensions (for example, the amount and quality of social interaction, the extent to which relationships are cohesive and supportive, and the openness with which feelings are expressed), (b) opportunities for personal growth (for example, the extent to which a family environment encourages independence, achievement, participation, and various attitudes and values; the extent to which the workplace environment encourages autonomy and task orientation; the extent to which a neighbourhood supports diversity), and (c) system maintenance and change dimensions (for example, the extent to which a setting is orderly, organised, and clear in its expectations; and the

extent to which a setting is responsive to changes among individuals).<sup>24</sup>

### SOCIAL ECOLOGY

A framework or set of theoretical principles for understanding the dynamic interrelations among various personal and environmental factors in health. Social ecology pays explicit attention to the social, institutional, and cultural contexts of people-environment relations; and draws on both large scale preventive strategies of public health and individual level strategies of behavioural sciences and medicine. This perspective emphasises the multiple dimensions (for example, physical environment, social and cultural environment, personal attributes), multiple levels (for example, individuals, groups, organisations), and complexity of human situations (for example, objective and subjective qualities, various scales of immediacy, cumulative impact of events over time). It also incorporates concepts from systems theory such as interdependence and homeostasis, to characterise reciprocal and dynamic person-environment transactions. According to the social ecological perspective, the congruence or "fit" between people and their environment is considered an important predictor of wellbeing.<sup>4 27</sup>

### SOCIAL ENVIRONMENT

Within the HOST-AGENT-ENVIRONMENT MODEL, the social environment is one category of environmental factors that is capable of changing host susceptibility to environmental influences on disease. As an example, the nature of a person's social network (size, affiliative level) may in part dictate whether exposure to an environmental agent results in disease.<sup>63</sup> The word is often used interchangeably with SOCIAL CLIMATE; this is common in the literature on school health.<sup>74</sup> As a broader conceptualisation, the social environment can be viewed as one of multiple levels of influence on health, referring to societal conditions that affect health and that may be amenable to social and health policy interventions. These may include social institutions (for example, cultural and religious institutions, economic systems, and political structures), surroundings (for example, neighbourhoods, workplaces, cities, built environments), and social relationships (for example, social networks, social groups, and position in social hierarchy).<sup>75</sup>

### SOCIAL EPIDEMIOLOGY

A branch of epidemiology that is concerned with the socio-environmental factors associated with patterns of disease in populations. Within this framework, social experiences such as social support/isolation, social status and status (in)consistency, work conditions, society and social organisation are viewed as direct influences on health. An early pioneer in this field, Cassel<sup>63</sup> pointed out how similar circumstances may promote or facilitate the development of a variety of illnesses (rather than corresponding to single clinical entities); a position that corresponds to the current social epidemiological emphasis on social forces that create and maintain social inequalities in health. Another primary contributor to social epidemiology, Syme,<sup>76</sup> suggests that it is this consideration of group or community level attributes as influences on health that distinguishes social epidemiology from traditional epidemiology.

### SUCCESSION

The orderly sequence of changes through which a community passes in the course of its development from a comparatively unstable to a comparatively stable stage. It is not just the individual organisms within the communal habitat that grow; rather, the community itself (that is, the system of relations between species and with the environment) is also

involved in an orderly process of change and development. At every stage in the process of succession, a more or less stable EQUILIBRIUM is achieved, which undermines the equilibrium of previous stages. Stages of succession for a biological community might include grassland to forest; whereas a human community might see a repeated sequence of events in which refugees inhabit a particular community, only to move out when they acquire the means to do so, and are replaced at this time by a new influx of refugees. The nature of succession, and the characteristics of each phase of equilibriums, are a function of the life course or history of the setting.<sup>21 25 34</sup> Importantly, stages of succession should not be taken to imply hierarchy.

## SUSTAINABILITY

Sustainability is principally concerned with how gains or benefits are maintained relative to resource use. In urban planning, for example, sustainable development refers to a city or town that is designed and built with a concern for energy efficiency and water conservation. In health promotion, sustainability refers to the continuation or durability of an effect once initial programme resources are reduced or withdrawn.<sup>77</sup>

## SYSTEM

A comparatively bounded structure consisting of interacting, interrelated, or interdependent elements forming a whole, which can be described in terms of a coherent structure or function.<sup>39</sup> Thus we have health systems, education systems, food systems, and so on. Systems thinking is central to ecological analysis. More recently in the health literature we are seeing acknowledgement of a differentiation between simple systems (those that can be decomposed into their component parts) and complex systems, those that cannot be decomposed in this way without losing an understanding of the system itself.<sup>78</sup>

## TERRITORIALITY

Within ECOLOGICAL PSYCHOLOGY, territoriality describes the system of attitudes, sentiments, and behaviours toward discrete environmental spaces. This system of attitudes, sentiments, and behaviours concerns who has access to the area and what activities occur there. Territorial functioning is place specific, and thus dependent on the actual physical attributes of the location as well as the perceived characteristics or meaning of the place. One important function of territoriality is informal social control—a means of ensuring compliance with norms. This function varies with proximity to the centrality of a person's daily life; for example, a person's territoriality might be high around his/her house because he/she feels more responsible for what occurs there, and can more easily determine who does and does not belong.<sup>79</sup>

## ACKNOWLEDGEMENTS

Lindsay McLaren is a Postdoctoral Fellow supported by the Canadian Institutes of Health Research and the Alberta Heritage Foundation for Medical Research. Penelope Hawe is a Senior Scholar of the Alberta Heritage Foundation for Medical Research, Markin Chair in Health and Society and Visiting Professor at the VicHealth Centre for the Promotion of Mental Health and Social Wellbeing, School of Population Health, University of Melbourne, Australia. We thank Alan Shiell and Ed Trickett for helpful comments on an earlier draft of this paper. We also thank four reviewers for many very helpful comments and insights.

## Authors' affiliations

L McLaren, Centre for Health and Policy Studies, Department of Community Health Sciences, University of Calgary, Canada

P Hawe, International Collaborative Centre for the Study of Social and Physical Environment and Health, Canadian Institutes of Health Research, University of Calgary, Canada

## REFERENCES

- Porta M, Alvarez-Dardet C. Epidemiology: bridges over (and across) roaring levels. *J Epidemiol Community Health* 1998;**52**:605.
- Susser M. Does risk factor epidemiology put epidemiology at risk? Peering into the future. *J Epidemiol Community Health* 1998;**52**:608–11.
- Koopman JS. Comment: emerging objectives and methods in epidemiology. *Am J Public Health* 1996;**86**:630–2.
- Stokols D. Translating social ecological theory into guidelines for community health promotion. *Am J Health Promot* 1996;**10**:282–98.
- Colwell RR, Epstein PR, Gubler D, et al. Climate change and human health. *Science* 1998;**279**:968–9.
- Green LW, Richard L, Potvin L. Ecological foundations of health promotion. *Am J Health Promot* 1996;**10**:270–81.
- Beatty J. Ecology and evolutionary biology in the war and post war years: questions and comments. *J Hist Biol* 1988;**21**:245–63.
- Hawley AH. *Human ecology: a theoretical essay*. Chicago: University of Chicago Press, 1986.
- Brofenbrenner U. *The ecology of human development: experiments by nature and design*. Cambridge, MA: Harvard University Press, 1979.
- Lakoff G, Johnson M. *Metaphors we live by*. Chicago: University of Chicago Press, 1980.
- Chew MK, Laubichler MD. Natural enemies—metaphor or misconception? *Science* 2003;**301**:52–3.
- Chew MK, Laubichler MD. Metaphors, misuse and misconceptions. *Science* 2003;**301**:1481–2.
- Futyma DJ. Reflection on reflections: ecology and evolutionary biology. *J Hist Biol* 1986;**19**:303–12.
- Kingsland SE. Essay review: the history of ecology. *J Hist Biol* 1994;**27**:349–57.
- Brummer J. Metaphors, misuse and misconceptions. *Science* 2003;**301**:1480.
- Perry G, Schueler FW. Metaphors, misuse and misconceptions. *Science* 2003;**301**:1480–1.
- Koopman JS, Longini IM. The ecological effects of individual exposures and nonlinear disease dynamics in populations. *Am J Public Health* 1994;**84**:836–42.
- Krieger N. Historical roots of social epidemiology: socioeconomic gradients in health and contextual analysis. *Int J Epidemiol* 2001;**30**:899–900.
- Diez Roux AV. Investigating neighborhood and area effects on health. *Am J Public Health* 2001;**91**:1783–9.
- McMichael AJ. Population, environment, disease, and survival: past patterns, uncertain futures. *Lancet* 2002;**359**:1145–8.
- Wicker AW. *An introduction to ecological psychology*. Belmont, CA: Wadsworth, 1979.
- Barker RG, Wright HF. Psychological ecology and the problem of psychosocial development. *Child Dev* 1949;**20**:131–43.
- Kelly J. Naturalistic observations and theory confirmation: an example. *Hum Dev* 1967;**10**:212–22.
- Moos R. The mystery of human context and coping: an unraveling of clues. *Am J Community Psychol* 2002;**30**:67–88.
- Trickett EJ, Birman D. Taking ecology seriously: a community development approach to individually based preventive interventions in schools. In: Bond LA, Compas BE, eds. *Primary prevention and promotion in schools*. Newbury Park, CA: Sage, 1989:361–90.
- Krieger N. Theories for social epidemiology in the 21st century: an ecosocial perspective. *Int J Epidemiol* 2001;**30**:668–77.
- Stokols D. Establishing and maintaining healthy environments: toward a social ecology of health promotion. *Am Psychol* 1992;**47**:6–22.
- O'Donnell CR, Tharp RG. Community intervention guided by theoretical development. In: Bellack AS, Hersen M, Kazkin AE, eds. *International handbook of behavior modification and therapy*. 2nd ed. New York: Plenum Press, 1990:251–66.
- O'Donnell CR, Tharp RG, Wilson K. Activity settings as the unit of analysis: a theoretical basis for community intervention and development. *Am J Community Psychol* 1993;**21**:501–20.
- Hawe P. Making sense of context-level influences on health. *Health Educ Res* 1998;**13**:1–4.
- Smith DB. Population ecology and racial integration of hospitals and nursing homes in the United States. *Milbank Q* 1990;**68**:561–96.
- Bechtel RB. Ecological psychology. In: Bechtel RB, Marenz RW, Michelson W, eds. *Methods of environmental and behavioral research*. New York: Van Nostrand Reinhold, 1987:191–215.
- Schoggen P. *Behavior settings: a revision and extension of Roger C Barker's ecological psychology*. Stanford: Stanford University Press, 1989.
- Park RE. Human ecology. *Am J Sociology* 1936;**42**:1–15.
- McLeroy KR, Bibeau D, Steckler A, et al. An ecological perspective on health promotion programs. *Health Educ Q* 1988;**15**:351–78.
- Blackburn S. *Oxford dictionary of philosophy*. New York: Oxford University Press, 1994.
- Kelly J. Ecological constraints on mental health services. *Am Psychol* 1966;**21**:535–9.
- Winett RA. Ecobehavioral assessment in health life-styles: concepts and methods. In: Karoly P, ed. *Measurement strategies in health psychology*. New York: Wiley, 1985:147–81.
- Susser M, Susser E. Choosing a future for epidemiology: II. From black box to Chinese boxes and eco-epidemiology. *Am J Public Health* 1996;**86**:674–7.



- 40 **Smith MH.** Community-based epidemiology: community involvement in defining social risk. *J Health Soc Policy* 1998;**9**:51–65.
- 41 **Babor TF.** Comments on Smart and Mann's "The impact of programs for high-risk drinkers on population levels of alcohol problems". *Addiction* 2000;**95**:53–64.
- 42 **Trickett EJ.** A future for community psychology: the contexts of diversity and the diversity of contexts. *Am J Community Psychol* 1996;**24**:209–33.
- 43 **Robinson WS.** Ecological correlations and the behavior of individuals. *Am Sociol Rev* 1950;**15**:351–7.
- 44 **Diez Roux AV.** A glossary for multilevel analysis. *J Epidemiol Community Health* 2002;**56**:588–94.
- 45 **Sanrock JW, Yussen SR.** *Child development: an introduction*. 5th ed. Dubuque, IA: Wm C Brown Publishers, 1992.
- 46 **Kickbusch I.** Approaches to an ecological base for public health. *Health Promot* 1989;**4**:265–8.
- 47 **Stiling PD.** *Ecology: theories and applications*. 2nd ed. Upper Saddle River, NJ: Prentice Hall, 1996.
- 48 **Krieger N.** A glossary for social epidemiology. *J Epidemiol Community Health* 2001;**55**:693–700.
- 49 **Krieger N.** Discrimination and health. In: Berkman LF, Kawachi I, eds. *Social epidemiology*. New York: Oxford University Press, 2000:36–75.
- 50 **Kleinman A, Eisenberg L, Good B.** Culture, illness, and care: clinical lessons from anthropologic and cross-sectional research. *Ann Intern Med* 1978;**88**:251–8.
- 51 **Rock M.** Sweet blood and social suffering: rethinking cause-effect relationships in diabetes, distress, and duress. *Med Anthropol* 2003;**22**:131–74.
- 52 **Abercrombie N, Hill S, Turner BS.** *The Penguin dictionary of sociology*. 4th ed. London: Penguin Books, 2000.
- 53 **Sampson RJ, Morenoff JD, Gannon-Rowley T.** Assessing "neighborhood effects": social processes and new directions in research. *Annu Rev Sociol* 2002;**28**:443–78.
- 54 **Hertz-Picciotto I, Brunekreef B.** Environmental epidemiology: where we've been and where we're going. *Epidemiology* 2001;**12**:479–81.
- 55 **Patz JA, Hulme M, Rosenzweig C, et al.** Regional warming and malaria resurgence. *Nature* 2002;**420**:627–8.
- 56 **Lercher P, Hortnagl J, Kofler WW.** Work noise annoyance and blood pressure: combined effects with stressful working conditions. *Int Arch Occup Environ Health* 1993;**65**:23–8.
- 57 **Garling T.** Introduction—conceptualizations of human environments. *J Environ Psychol* 1998;**18**:69–73.
- 58 **Beaglehole R, Bonita R.** *Public health at the crossroads: achievements and prospects*. Cambridge: Cambridge University Press, 1997.
- 59 **Wilkinson RG.** *Unhealthy societies: the afflictions of inequality*. London: Routledge, 1996.
- 60 **Alberti M, Marzluff JM, Shulenberg E, et al.** Integrating humans into ecology: opportunities and challenges for studying urban ecosystems. *BioScience* 2003;**12**:1169–79.
- 61 **Susser M.** *Causal thinking in the health sciences: concepts and strategies of epidemiology*. New York: Oxford University Press, 1973:26–40.
- 62 **Frost WH.** Some conceptions of epidemics in general. *Am J Epidemiol* 1967;**103**:141–51.
- 63 **Cassel J.** The contribution of the social environment to host resistance. *Am J Epidemiol* 1976;**104**:107–23.
- 64 **Stokols D.** Environmental psychology (<http://eee.uci.edu/03w/50690/>).
- 65 **Pickett JP, ed.** *American heritage dictionary of the English language*. 4th ed. Boston: Houghton Mifflin Company, 2000.
- 66 **World Health Organisation.** Noncommunicable disease prevention and health promotion. Integrated noncommunicable disease prevention, 2003. (<http://www.who.int/hpr/globalforum/integrated.ncd.prevention.shtml>).
- 67 **Alberta Healthy Living Network Framework Development Working Group.** *Alberta healthy living framework: an integrated approach*. Alberta: Alberta Healthy Living Network Framework Development Working Group, 2003.
- 68 **McLaren L.** Integrated approaches to the prevention of obesity and chronic disease: a policy-oriented synthesis research. [Abstract]. First conference of the Canadian Association for Health Services and Policy Research, Montreal, May, 2004.
- 69 **Tabachnick BG, Fidell LS.** *Using multivariate statistics*. 3rd ed. New York: HarperCollins College Publishers, 1996.
- 70 **Zhang Q, Wang Y.** Socioeconomic inequality of obesity in the United States: do gender, age, and ethnicity matter? *Soc Sci Med* 2004;**58**:1171–80.
- 71 **Baron RM, Kenny DA.** The moderator-mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations. *J Pers Soc Psychol* 1986;**51**:1173–82.
- 72 **Barker RG, Gump PV.** *Big school small school*. Stanford: Stanford University Press, 1964.
- 73 **Cotgreave P, Forseth I.** *Introductory ecology*. Oxford: Blackwell Sciences, 2002.
- 74 **Anderson CS.** The search for school climate: a review of the research. *Rev Educ Res* 1982;**52**:368–420.
- 75 **Task Force on Community Preventive Services.** Guide to Community Preventive Services Systematic Reviews and Recommendations. Social environment and health. (<http://www.thecommunityguide.org/social/Default.htm>).
- 76 **Syme SL.** Foreword. In: Berkman LF, Kawachi I, eds. *Social epidemiology*. New York: Oxford University Press, 2000:ix–xii.
- 77 **Shediac-Rizzkallah MC, Bone LR.** Planning for the sustainability of community-based health programs: conceptual frameworks and future directions for research, practice and policy. *Health Educ Res* 1998;**13**:87–108.
- 78 **Caspi JL.** *Would-be worlds: how simulation is changing the frontiers of science*. New York: Wiley, 1997.
- 79 **Taylor RB.** Toward an environmental psychology of disorder: delinquency, crime, and fear of crime. In: Stokols D, Altman I, eds. *Handbook of environmental psychology*. Vol 2. New York: Wiley, 1987:951–86.

## APHORISM OF THE MONTH .....

**"Cost benefit analysis consists of weak definitions on both sides of the equation."  
(Lowell Levin)**

JRA