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The Impact of Poverty, Waste Management, and Ethics in the Control of Parasitic Infections

Curriculum Unit 99.06.08
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Objectives

After finishing this unit the students should understand the transmission of parasites in general. Focusing on malaria they will investigate the role of several underlying factors affecting it. These will include poverty, availability of health care, and water and waste management systems in both our country and abroad. It is also my hope that students will gain an appreciation of the benefits of life in an industrialized country such as ours and a willingness to look at the role they can play in the global village.

Strategies

Overview

This unit will cover many aspects of parasitic infection. It will look at a variety of parasites that strongly affect many peoples of the globe. It will consider the methods of transmission, possible life cycles, and environmental, physical, medical and pharmacological interventions. Also to be covered in greater depth is the tremendous role of water and sewage management in the control of these diseases and why it can be the quickest and cheapest control that can be implemented. This will be accomplished by a variety of methods. Some of the basic information needs to be covered in a lecture type presentation. The use of data tables will allow students to compare actual numbers related to incidence, prevalence, economics, health care and a variety of other factors. They will create graphs, charts and other visual representations of their data. They will use the Internet, where available, to gather the most up to date information on the spread of parasitic diseases.

A high school students' world is often circumscribed by their limited exposure to cultures outside their immediate geographical areas. One of the tasks we need to assume is that of mentor in helping to expose our charges to the much bigger picture, that of the global village, and of their role in it. So many feel that they can

have no impact on anything beyond their small circle of friends.

Introduction and background material

In most high school biology courses, parasitic diseases are usually covered as individual members in a phylogenetic approach. Some texts give a glancing nod to the role of parasites as a density dependent limiting factor in population growth.

So the first question that is often asked is ‘why study parasitology?’ It doesn’t really affect us, does it? After all, when was the last time that we had an outbreak of malaria?

Well, for one thing, in sheer numbers there are more species of parasites that non-parasites in our environment. The majority of parasitic infections are the province of the tropical zones where the climate favors their life cycle. This tends to make m any people who live in temperate climates such as our very much in the dark as to the toll that these infections can take on a country’s economy, productivity, its morbidity and infant mortality, and the average life expectancy of its inhabitants.

It can also lead to a sense of complacency on our part about the perceived risk to us on our own shores. One needs only to read the newspaper or listen to the news reports to realize that this is far from true. Especially during the warmer months, there are almost daily reports on swimming areas and pools closed due to high bacteria levels. The August 1999 issue of Scientific American recounts the threats posed to people and fish caused by outbreaks of Pfisteria, a dinoflagellate that caused a fishkill of over 1 billion in 1991 and has documented outbreaks from Delaware to Alabama and Florida. It is also suspected of destroying the reproductive capabilities of fish, and it secretes a toxin that can cause nausea, respiratory problems and memory loss so severe it has been mistaken for Alzheimer’s in humans.

Most high school texts only cover malaria briefly in the sections on sporozoans, with a word or two about its’ being one of the most serious infections on earth. Plant biology will often introduce several plant parasites (notably the tobacco mosaic virus) as a major factor in the profitability of many cash crops.

In part, because of this lack of understanding of parasites, there seems to be a prevailing attitude in our country that parasites are shameful. A common reaction among high school students when faced with the facts of parasitic infestations is ‘yechh’ ‘ that’s disgusting’.

For a vast number of mothers, going to the drugstore to fill a prescription for lice shampoo for the family is an occasion of extreme embarrassment. This may be the first time that they have been exposed to a parasitic disease and to their way of thinking, this is a disgusting, dirty secret to be kept within the family, and that is a reflection on their housekeeping habits. Anyone who has taught for any period of time is fully aware that this is not at all true. Once the litter critters get out into the world (lice, that is) they are an equal opportunity opportunist.

Another parasitic infection that is often treated this way is a worm infestation. Yet in some areas of the world, pinworms are a nuisance, difficult to control, but hardly worth noticing when malaria, kala azar, filarial worms, and others are taking center stage.

In most textbooks at some point students learn of the experiments that identified the mosquito as the carrier of malaria and of the incredible success of spraying of DDT in saving innumerable lives in the building of the Panama Canal. They are also becoming increasingly aware of the toxic, hormone-like effects that this

chemical has had on wildlife and will therefore dismiss it as a viable agent in malaria control. But do they realize that the incredible poverty of the areas where malaria is still endemic precludes the use of any of the other 'better' but much more expensive chemicals?

In his book, *Our Children's Toxic Legacy* , John Wargo recounts the battle against malaria from the earliest attempts to control it through the advent of DDT in Chapter 2. It covers the ecology and the life cycle of malaria, early treatment methods, the effects of warfare and use of DDT. Further chapters expand on the resistance of the mosquito to DDT, and of the disease to pharmaceutical interventions. There is a wealth of information in this book. Extensive references allow students an opportunity for further reading or research. They fill over 65 pages at the end of the book and the use of lengthy quotes from referenced material makes it fascinating reading in its own right.

Some of the often-unrealized effects that parasitic infections may have include the following facts:

• Parasites are the causative agents in a variety of diseases ranging from malaria, to the plague, to hookworm, pinworm, Lyme disease and head lice.
• Just one day of acute malarial fever can burn over 5,000 calories. That's the equivalent of 2 days of hard manual labor.
• As a chronic, debilitating disease, malaria has been estimated to take a financial toll on the inhabitants of some countries that can reach billions of dollars annually. This is due to the fact that a large part of the population is too weak and ill to work and therefore fewer products are produced and the whole economy suffers.
• According to published data Ascaritic infections strike over 100 million people annually, and kill around 20,000 of them. The vast majority of those that it doesn't kill are left with a legacy of malnutrition due to the sheer magnitude of the number of worms their body harbors and their effect on the absorption of nutrients in the gut. They can also penetrate tissues such as lung (allowing infections to develop from inhaled bacteria) and intestinal (where they cause bleeding and much anemia)
• Malaria, by comparison, strikes about 489 million people a year but kills up to 2 million of them.
• Leishmania donovani, more commonly known as kala azar or Dum Dum Fever (for the place where it was first isolated) outwits the body's immune system by taking up residence inside the macrophages that should be devouring it.
• As waterborne infections, the role that basic sanitation plays in the control of most parasites is a major one. Access to proper sewage disposal and clean drinking water can have a tremendous effect on controlling the spread of parasitic agents.
The majority of inhabitants of the globe do not have access to basic sanitation controls or potable water.

Research dollars have traditionally gone to the more 'popular' diseases such as hypertension, cancer, diabetes, asthma and the like. While these are all worthy adversaries, all combined they do not equal the devastation caused by parasitic diseases. In order to understand why this is so we must look at the other factors that weigh in the decision making process on what disease we should concentrate our research dollars.

One of these factors is economics. Drug manufacturers are reluctant to pour money into finding a cure or even a treatment for schistosomiasis, when the overwhelming number of patients that would benefit from it would be unable to afford the treatment.

Poverty is not just the plight of the developing countries however. Right here in the USA we still have pockets of incredible poverty and places where running water and efficient sewage treatment are not always a given.

Poverty has never equaled political clout either. Those who are best able to make their voices heard through political action groups and lobbyists often drive politics. This costs a considerable amount of money. Many regulations are written more with an eye towards profitability and 'political pork', than a responsibility to answer a true need.

One ethical question that still remains is whether or not everyone on the globe has the same right to clean air, water, and nutritious food. And if we do believe this to be true, what are our responsibilities to help those who do not have these amenities.

Does it really matter if the teeming masses of poor are in Bombay, Bangladesh, Bolivia or Brazil, or right here in our own back yard? Those people with enough financial means are always more able to pick up and relocate if the area where they currently reside is becoming hostile politically, environmentally, healthwise or other.

When becoming involved in any polarizing situation, students need to become more aware of the 'hidden' agenda of the players, as well as their stated agendas. They need to learn to look beyond the initial obvious facts to examine the possible unspoken motives of those that supplied these facts. Is there more than just money at stakes here? Is human health and welfare on the line? Are these agendas being driven by certain prejudices? Remember hidden does not always equate with subversive. Sometimes these agendas are good, but just not obvious at first glance.

Are there cultural differences at play? What is the lifestyle of the average inhabitant of the area? An excellent reference for comparing lifestyles can be found in a *Material World.* This book is a beautiful graphic presentation of more than just the lifestyles of different peoples. The worldly possessions, cultural mores, and beliefs are as diverse as the conspicuous consumption of a family of four living in Texas in a well-furnished house of 1,600sq.ft. to the 344 sq. ft. dwelling of a family of 6 living in India.

Something worth noting perhaps is that the values of both of these families are remarkably similar. When asked what their most valued possession was the Texas couple both chose their Bible. Asked the same question, the dirt poor Indian couple responded with 'our print of the Hindu gods and sculptures of the gods and goddesses that protect the family and home.

An excellent book for student reading is Robert S. Desowitz' *The Malaria Capers Tales of Parasites and People* . Chapter 2, 'A Child Dies in a Small Village', is short enough to read in (or read to) a class. It is powerful enough in its depiction of a mother desperately trying to save her dying daughters life to touch the heart of most anyone. It throws a spotlight on the basic feelings of love, protectiveness and self-sacrifice that parents often

make routinely without complaint, but the setting is a jarring contrast to what most of us are familiar with.

Rarely is it only a matter of black and white anymore. There is also red, yellow, brown, and mixed ethnicity that is at odds. How do we help one without hurting another? Are there religious beliefs governing the behavior of the indigenous peoples of an area? If an animal is considered sacred by a sect, and has a room of its own inside the dwelling, how do you educate the population to the dangers of disease transmission between it and them?

Students need to become more aware of the interdependent web of all life, and the role that they play as stewards of this legacy.

In addition to the moral and ethical implications of treating, or not treating the diseases that we have the knowledge to control, there is another factor to consider. Often called the parasitologists dilemma it poses the question if we save all of these people from parasitic disease and death, now who is going to clothe them, feed them, house them, educate them, etc.

Thanks to the blessings (?) of a world in which the globe is rapidly shrinking, and computer communications span miles and lives in an instant, we cannot afford to become complacent towards our responsibility to care for this planet. The planet that our children will inherit is only going to be as good as we endeavor to make it.

There is a tendency on the part of humans to judge how others live, based on their own personal experiences. The way we live, what we eat, how we worship what we value, is all a part of which we are. Often we see our choices as affecting only us. But as part of a global family, it is important to understand how our actions impact not only our immediate circle of life, but how these actions have far reaching effects that spread out like ripples on the still water when we toss a pebble in.

History

One of the reasons that the whole topic of parasites can be confusing is that they are often viewed from only one of many possible angles. The most common way that they are presented in basic biology courses is as individual organism within the phylogenetic tree, their placement being dependent on nothing more than their structural similarities.

However they can also be approached from the topic of parasitology. In this setting they are still classified according to phyla, but it is limited to the parasites in each phyla. Unless one is taking a specific course in parasitology, the chances of getting this perspective are usually small.

A third approach is to list them as a major player in widespread devastation, along with viruses like AIDS, bacterial infections like the Spanish Flu, and disasters both manmade and natural such as war, earthquake, floods, ecological destruction, and the like.

Yet another approach, epidemiological, partially categorizes them according to their spread. Endemic is used to denote something normally living in a population of an area or part of an area (the cold virus is one example in the USA, while malaria is endemic in India). An epidemic shows a very sharp increase in the rate of the disease in an area. Finally, a pandemic is an epidemic that is distributed over a very wide area, at times literally ‘sweeping the globe’ in a relatively short period of time. An example of a pandemic is the spread of the bubonic plague (also known as Black Death or Great Dying) in the 14th century. It is believed that it came from China by way of trade routes. In 1347 Sicily and Marseilles experienced an outbreak. By mid 1348 most

of Europe was involved, and everything up through Scotland was stricken. 1351 through 1353 saw it spread over through Russia and back to China where it struck again in 1353. War and famine all along its' route contributed significantly to the quick spread. This was all accomplished by slow moving trade ships and overland caravan. With the travel options that are available to us today a disease could circle the globe in a matter of weeks.

In his book *Biohazard The Hot Zone and Beyond* , Peter Brookesmith refers to the traditional biblical tale of the "Four Horsemen of the Apocalypse". These four horsemen representing war, death, famine and plague were to signal the approach of the end of the world. Although none of them were taken lightly, the one that was most feared was plague. The discovery of microorganisms and their actions is a relatively recent one. Ancient peoples could understand the threat of war. They were familiar with the devastation caused by famine. The plague however, was a mystery. Plagues struck with seeming randomness. Religion offered little in the way of guidance because the good and virtuous were stricken just as often as the wicked sinners were.

Lack of understanding of the methods of transmission led to some seemingly bizarre precautions. In the epidemic of London in 1665 some wore large beak shaped masks to block the 'bad air', while others always carried bouquets of flowers or scented handkerchiefs to help cover the stench of death and hopefully save them from it. The childhood song 'Ring around the rosy, a pocketful of posies, ashes, ashes, we all fall down' was first heard in this setting.

Ethnic cleansing ensued and thousands more were sacrificed in an attempt to control the plague. Drinking of special tonics, sprinkling of vinegar on the extremities, chewing garlic and green walnuts wearing dried toads and sitting indoors with very dense smoky fires were other remedies that were tried without much success.

There are numerous written records of the sweeping devastation of the Black Death, both historical and fiction, to allow students to research easily. Some of the earliest records of plagues are of fossilized organisms, genetically similar to ones found today, existing in the Jurassic era. Historians believe that the plague of Ashdod in 1300 BC was the first recorded account of the bubonic plague. Further records come from the great plague at Constantinople around 540 AD. Often called the Justinian plague it followed close on the heels of the emperor Justinian's attempt to conquer the Roman Empire. It seems likely that he carried this with him on his journeys.

In almost all cases, the death toll from the disease was far higher in the urban centers than it was in the countryside. Close living, substandard housing, no fresh water, no sewage disposal and a poor diet all contributed. In Rome, less than 30% of those living in the cities reached the age of 30. Living in the countryside gave you a 70% chance. There is much literature that demonstrates the effects that poverty, political unrest, lack of potable water, lack of sewage control and ignorance of the disease had on the incredible spread of the bubonic plague. Most of these concepts are directly translatable to the situation with malaria today. The activities at the end of this unit are designed to encourage students to make similar connections with current data. Today it wreaks its devastation over a much smaller area of the globe and present day methods of control are available in industrialized nations.

The most recent catastrophic epidemic to occur in the United States occurred early in this century. It was the great influenza pandemic of 1918 to 1919. One of the reasons that more people don't recall it has nothing to do with the death toll (that rivaled many of the bubonic outbreaks). The difference was that in the case of Black Death, the streets were quite literally covered with bodies, the stench was overpowering, and the disfigurement survivors was great. The Spanish flu was fought behind the closed doors of hospitals. It was out of sight, and now is out of mind of most.

In Laurie Garrett's book *The Coming Plague* , Jonathan Mann writes in the preface

> 'We always want to believe that history happened only to "them," in the "past" and that somehow we are outside history, rather than enmeshed within it. …. Yet in one vital area, the emergence and spread of new infectious diseases, we can already predict the futureand it is threatening and dangerous to all of us.". Laurie Garrett shares with us-that diseases will remain a threat, that disease and human activity are inextricable, and that nature has many hidden places and surprises still in store.

Her book contains a wealth of information on the transmission of diseases including malaria, AIDS, Lassa fever, Ebola, swine flu; Legionnaires' disease, hantaviruses, cholera and much more. She also examines the interactions of poverty, poor housing, and social despair with disease in a chapter titled 'Thirdworldization'

Access to the Internet allows students a wealth of current information on these topics. Outbreak has details of current epidemics of both new and reemerging diseases. The Center for Disease Control has in incredible number of health statistics of all kinds, including the MMWR (Morbidity and Mortality Weekly Report), waterborne disease outbreak definitions and data, and information on the emergence of drug resistant forms of microbes. The World Bank has a site on a 6-year project designed to develop self-sustainable sanitation and water services in rural India. The World Health Organization offers a multitude of pages, among them an excellent section on parasitic diseases. On their site there is also available current information on the availability of basic sanitation and water supplies across the globe. Science News had a recent article describing the benefits of Vitamin A in reducing the number of cases of malaria in children ages 1 to 3. Their online site often has articles on the latest research in disease control.

Basics of Parasitology

Before talking about how parasites affect us, we need to define some terms. Symbiosis is generally used to describe a condition when two organisms are found in close association in nature. Science, however, is a dynamic ever-changing world. Symbionts (the partners in the relationship) can be further defined by the respective benefits of the arrangement for each of the participants. As we become more familiar with organisms we often discover that there are more and different relationships between them that were not apparent at first. In some cases one partner is helped and the other has no readily apparent effect. On further examination it may be revealed that both actually benefit, just not always in an obvious manner.

In mutualism both partners are benefiting, and neither one is harmed. This relationships usually obligatory on the part of the members. That is, if one of the members were removed, the other one would die. A termite is a good example of this. Termites are unable to digest cellulose and turn it into the nutrients that it needs for growth because it lacks the enzyme cellulase. In their gut however, termites play host to a number of flagellates who are capable of producing the needed enzyme and digesting the wood. The termite is then able to use the by-products of the flagellates' digestion for nutrition. If the flagellates were removed from the termite's gut, the termite would continue to eat wood, but it would soon die because it is unable to digest the wood.

Another such relationship is found in the blood-sucking leeches. On their own, they are not capable of digesting the blood that they suck from their prey. That job is left to the bacteria that are found in the leech's gut and this is the only place that those bacteria are found.

Some of the most important mutualisitic relationships involve microorganisms such as bacteria and larger organisms like humans. We harbor, in our gut, a wide range of bacteria. Some of them have the express

purpose of manufacturing vitamins that are needed for out continued health and growth. When humans are on extended antibiotic therapy for a bacterial infection, a large number of these good bacteria are eliminated also, and vitamin deficiencies can ensue.

Scientists have a hypothesis that is widely accepted about the origin of eukaryotic organisms (single or multi-cell with discrete nucleus). They hypothesize that prokaryotes (unicellular organisms without a discrete nucleus) developed a mutualistic relationship with other prokaryotes. For example – ancient forms of mitochondrial matter or chloroplast material formed a symbiotic relationship with other primitive prokaryotes. One of them was then able to produce the energy that the both needed for life from the contents of the others cell. This relationship gradually evolved to the point that neither could survive on their own. They did not just benefit from each other, but were obligated to live as one. Hence, the term obligates symbiont (mutualism).

Another type of interaction between symbiotic organisms is termed commensal. In this relationship one of the members is helped and the other one is not affected. An example of this is the remora, a slender fish whose dorsal fin has evolved into a 'suction cup' of sorts. It has an adhesive disk that can attach itself to the belly of a larger fish, a turtle, and even a submarine (obviously mistaking it for an extremely large fish). It goes along for the ride, and feeds on the scraps that are left by the larger fish, which is not affected by this relationship.

Under some circumstances remoras can be mutualistic organisms. They can take the role of cleaning unwanted parasites off the skin of their host.

When faced with diseases like cancer, psoriasis, or scleroderma, the first concern of many is 'is it contagious'? This is the reference base that most of us are familiar with, reasoning that if we avoid anyone with an active infection, we can be protected from getting that infection.

In parasites however, modes of transmission are usually very different from the bacterial infections that people often use to judge the dangers of an unknown enemy. One must first learn to 'think parasitologically' – that is, life cycles involving two or more very different hosts and possessing an uncanny ability to exist for long periods of time virtually undetected. Therefore taking pains to avoid infected people will not protect us from parasitic infections.

Most parasites have a primary and at least one secondary host (see Fig 1) and unless we are aware of the entire chain of transmission for a given parasite, we can be overly complacent about our chances of contracting it. In the case of trichnella spp., humans are NOT reservoirs of the disease. We get it from eating infected meat (usually pork) which is the main carrier of the worm. The pig is a scavenger and can get it from eating the carcass of an infected animal such as a dead pig, dead rat, or even a live rat. In frigid climates the bear is the main carrier, and in the Torrid Zone, the hyena does the honors. Humans are only incidental to the process and the worms could not survive if they had to depend on the hospitality of humans as a host. Therefore, avoiding a person who is infected with it has no benefit.

We should not kid ourselves however. Parasites exact their proverbial 'pound of flesh' in our country also. A study by Flores EC, Plumb MC and McNeese in 1983, showed an incidence of over 49.5% positive for ova or parasites in a pool of 321 pediatric patients. There was a high correlation between infection and recent travel to Mexico by the patient or a close family member.

A retrospective study done by state diagnostic laboratories in 1994 examined the results of 216,275 stool specimens taken in 1987. There was an incidence of parasites in 20. % of the cases. Giardia had the highest incidence (7.2 %) that year. In similar data for 1991, parasites were found in 19.7 % of 178,786 specimens.

Giardia was reported at 5.6 % and an appearance of Cryptosporidia was noted. Both of these parasitic organisms are presently viewed as a growing problem in the United States.

There are a number of other parasitic diseases that live in our own backyard. These include EEE (Eastern Equine Encephalitis), Lyme Disease, Hantavirus, head lice, Cryptosporidium, and Giardia.

Treatment of Parasitic Infections

Many of the pharmaceuticals used to treat infections of all kinds (not just parasitic) are becoming increasingly less effective. The emergence of resistant strains has moved along more rapidly than sciences' ability to synthesize new drugs. Even when there are new drugs available, their use can be seriously restricted, especially in developing (third world) nations due to their expense.

Fortunately, some of the cheapest and most effective treatments for malaria and other parasitic diseases are relatively easy to obtain. Among these is education, development of self-sustainable sanitation and water controls, vector control, awareness of changing global weather patterns, awareness of global warming effects on changing endemic areas.

Limited, thoughtful and careful applications of DDT, provision of mosquito netting, drainage of standing water (including fresh rainwater) are other possible methods of attack.

(figure available in print form)

AN EXAMPLE OF A PERFORMANCE BASED ACTIVITY

Background Information

Your are a consultant to the World Health Organization (WHO). They have recently been granted a million dollars to try to eradicate malaria in third world countries. It is your job to gather information on the effects of malaria and investigate various methods of controlling its spread. This will include (but may not be limited to) the access to waste and sewage management and clean water in these areas, availability of primary health care and the ability to access it, educational, political, and any other considerations you feel important.

You must then decide where to direct this money in order to get the most benefit and save the most lives. You will present you findings to the WHO along with the graphs and data that you used to determine this, in an oral presentation.

Outline

Using Internet resources and World Resources book, locate information on the incidence of malaria in Zambia and the United States

Graph results of this

Repeat this task, comparing economic levels, health care resources and water management resources for both areas.

Graph the results of all of these using different graphs for each parameter.

Compare and contrast the four graphs making notes of similarities and differences.

Interpret data and draw conclusion as to the best option.

Prepare an oral presentation using whatever method you desire. Use graphs and graphics along with your written report.

(figure available in print form)

Figure 3

If you are working with a basic group and your primary objective is to have them learn how to draw a graph and label it properly you could supply them with the numerical values to use and adjust the assessment so that the most points are in the area of number 2 and 3. Ex. You could further divide 'are graphs done correctly' into subcategories such as 'are the axis labeled properly, is a scale included, is the graph titled, etc. When you are sure that students know what is necessary for a well done graph you can then go back to the original 'is the graph done correctly' on future assessments. The assessment list is provided along with the assigning of the task. It serves as a guide as to what parts of the project are the most important based on the points assigned to it.

The students use the last column to grade themselves before turning it in. I usually fold this under until I have given my grade so that I won't be influenced by it.

QUESTIONS FOR CLASS DISCUSSION OR DEBATE

Students will be assigned randomly to either a 'rich' family in an industrialized county or a 'poor' family in a developing nation. Using available resources they will endeavor to figure out answers to various questions based on their assigned background, in relation to the control of malaria. Have students construct dioramas or posters illustrating the differences in lifestyles between a location in the United States and one in India or Mauritania.

Using a world map, and colored pins, have students mark the number of cases of malaria that the different regions reported in the most recent data. Encourage students to repeat this type of analysis using 2 different locations within our borders, but with greatly opposing incomes and lifestyles. Use Cryptosporidia, or Giardia or some parasite that has appeared recently in the news media.

What is the problem?
Whose problem is it?
What are the causes of this problem?
Are they always the same?
Does it affect everyone the same?
What can I do about the problem?
Am I my brother's keeper?
What if I do help solve the problem?
Will that create other problems?
With people living longer, how will they eat? Where will they live?
Do I have a role in the solution if the problem only exists 'out of my sight'?
Is it a 'popular' disease?

What is the controversial role of DDT in its control?
Is there a difference between being just and being fair? (Fair often means that everyone gets exactly the same. Justice can mean that everyone gets what he or she needs.)

Figure 4

These topics can be done as an individual research project or as a class forum to discuss the different sides and hopefully make some ethical judgements.

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July 26, 1999

Kathy Doucette

I am a teacher in the New Haven Public Schools, and through the Yale-New Haven Teachers Institute I am preparing a curriculum unit for my own and my colleagues' use in school courses. I want to include in my unit several data tables that appear in World Resources, 1998-1999, A Guide to the Global Environment.

My unit, containing this material, will be compiled with other Curriculum units which the Institute will

reproduce and distribute free of charge to teachers in New Haven schools and to some other teachers on request. The units are intended to suggest appropriate materials which teachers may decide to use in their own classrooms. Teachers in the Institute assemble this material under grants from various private and public funders.

Because of the limited non-profit distribution for teaching purposes, we request that no royalties be charged. I request your written (e-mail) permission to reproduce this material in the reproduced compiled units.

Because units must be available to teachers at the beginning of the school year, your prompt consideration and reply will be greatly appreciated.

Sincerely,

Connie Florio Welton, Institute Fellow

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(tables available in print form)

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Drug database with extensive information on effectiveness of available pharmaceuticals used to treat infection (HYPERLINK http://helix.com/member/news/medtribune http://helix.com/member/news/medtribune)

Bad Bug Book FDA Prime Connection on-line computer network

notes

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