Medical Ecology: the link between public health and the ecological sciences

Project Summary

The term *Medical Ecology* was first coined by Rene Dubos to describe a new way of viewing the human condition in context with the environment. Slow to take hold in the mainstream of public health, this paradigm has rarely been applied in the last two decades, though the urgency to do so has dramatically increased, mainly due to the dramatic increase in the human population, and the emergence and re-emergence of a wide variety of infectious diseases. The scientific community-at-large now realizes the extensiveness of the relationship between human health and a damaged environment.

Medical Ecology is still considered an emerging hybrid science striving to supply the missing connections between the health and the ecological and earth sciences, enabling a more complete understanding of human health in the context of ecosystem services. Despite widespread acknowledgement among practicing physicians as to the overall impact of the environment on health, much of their efforts are focused on treatment of individuals rather than in the prevention of diseases for which there are major environmental components. Most public health practitioners at the local and state level are similarly drawn to definable small-scale issues, and rarely get the opportunity to become involved with global concerns such as climate change and stratospheric ozone depletion. Ecologists have generally focused their studies on ecosystem functions in light of natural events and ecosystem inhabitants—with the common glaring exception of

concern for the human component of each. A coherent understanding of the method and the degree to which disturbance in ecosystems causes ill health in humans (in cases such as malaria, encephalitis, including the West Nile virus, cholera, etc.), has the potential to significantly transform the ways health agencies, doctors, researchers, and even historians approach these problems.

Given the significant potential benefit of the **Medical Ecology** paradigm to human health, the **Medical Ecology** Website will serve as an online center and resource for the documentation and dissemination of work in this growing interdisciplinary field. **Medical Ecology** will be a widely accessible, clearly organized, and extensive home for research, curriculum models, integrated data sets, discussion, and scholarly information as it develops in the field, and in fields that now contribute to **Medical Ecology**.

The **Medical Ecology** Website will be the linchpin connecting the ecological and earth sciences with those of public health. It will serve as the repository for databases relevant to diseases with strong environmental components; it will hold resources pertinent to scholarship in and application of the ideas of **Medical Ecology**; and it will be relied upon by health professionals and scholars to identify current health problems, research causes and possible solutions, and interact with peers toward the common goals of scholarship and improved human health.

1. Background

a. The Public Health Paradigm

The influence of the environment on the outcome of human health is complex, and at best, poorly understood. Despite the general acceptance of this concept, public health practitioners, for the most part, discharge their duties without due consideration for the ecological impact of anthropogenically-induced alterations in the very environment in which public health is forced to operate.

Global climate change, stratospheric ozone depletion, air and water pollutions, the over use and mis-use of fertilizers, herbicides, and insecticides, numerous arthropod-borne infectious diseases, and contaminated food supplies represent current hazards to the well-being of vast numbers of people living throughout the world.

All of these problems have major environmental components associated with them. Most of those who carefully study these issues would admit that global climate change, alone, raises grave doubts as to whether standard public health practices could be implemented in a world in which the rise of the oceans, if unchecked, would likely overwhelm whole cities and rearrange the coastlines of all land masses, both large and small. Several recent Environmental Protection Agency-sponsored symposia address solutions to this urgent world-wide problem.

It is a given that environmental disturbances which result in alterations of essential ecosystem components at the global level, and often place large numbers of humans at

risk to acquiring infectious and non-infectious diseases. Awareness of such global issues usually begins in the high school or college classroom. Concern for these issues among young people is high. But, ironically, at the graduate school level, it is not the norm in most health sciences curricula throughout the United States to embrace, and then include, ecologically relevant information and their data sets into the base of knowledge required for advanced training in any health-related specialty track. As the result, practicing physicians and public health professionals, alike, are deprived of gaining even an elementary level appreciation for the influences that environmental change can have on the health status of each and every one of us.

The science of environmental health, a required specialty subject at all accredited schools of public health, has attempted to define some external factors that influence the outcome of a given disease process, and incorporate them into their research programs. But as currently configured, this interdisciplinary science has evolved into a set of narrowly focused laboratory-based areas, addressing for the most part, local rather than global issues.

b. The Ecological Paradigm

In contrast to medicine and the public health sectors, ecologists tend to concentrate on large-scale, field-based areas, particularly those dealing with the ways in which the physical aspects of nature (air and sea surface temperatures, climate, and weather) combine to influence behavior of most life forms on earth (population dynamics, factors that determine the geographic distributions of plants and animals, parasitism, energy

flow, trophic relationships, etc.). They have until very recently, largely excluded the human element and their activities from their studies, focusing instead more on gathering basic information related to ecosystem functions than on practical, health-related issues and ecosystem services.

Yet, ecologists for many years have advocated that constant oversight and careful management of the life forms that contribute to the functioning of a given ecosystem are essential to being able to maintain those functions. It is widely accepted that wherever this knowledge has been applied, a better, healthier life style was achieved for humans living within that zone, as well as for the rest of the life forms there.

The scientific community-at-large has only recently come to realize the degree of intimacy and connectedness that humans have with most of the places we inhabit. Conversely, disturbing segments of a given ecosystem that are not perceived as posing a health risk have often turned out to be just that, witness the increase in the transmission of many arthropod-borne diseases (malaria, Lyme disease, West Nile virus, and other encephalitis viruses), cholera, stratospheric ozone depletion, and the indiscriminate discarding of a wide variety of highly toxic wastes, to name but a few of the more high profile problem areas confronting humankind.

One concrete example will serve to illustrate some of these points. The relationship between climate and weather, two related ecological factors, to the transmission of various infectious diseases is an area of great concern and active research among some

teams of researchers. These teams are typically composed of climatologists, geologists, plant and animal ecologists, infectious disease biologists, physicians, biostatisticians, and epidemiologists. As a result of their efforts, we have come to appreciate that knowing what the patterns of rainfall and temperature profiles were for a given region one year allows for accurate predictions for the coming year regarding the population dynamics of those plants and animals living there that could take advantage of those short term pattern changes. This is particularly true for arid and semi-arid ecozones, where heavy rain events are rare, and their impact on wildlife is profound. Some of these kinds of plants and animals play major roles in the transmission of the above-mentioned diseases; relationships that have just recently emerged from those research units into the scientific literature. Outbreaks of plague, hantavirus, Lassa virus, and encephalitis viruses, including the West Nile virus, wherever they occur, fall into this category of diseases that wax and wane at perturbations in local patterns of weather.

Conveying that kind of knowledge efficiently to the public health sector in a standard format will allow local, state, and federal health agencies to better prepare for them once those patterns become understood and incorporated into disease control strategies.

Never before has the urgency for acquiring and implementing this kind of information been so much in demand as it has at this moment in our history, for several reasons. Human populations are increasing in many regions, and therefore encroaching more and more into natural systems. Civil unrest and war help to exaggerate already deteriorating environmental conditions due to the mass movement of people into places that never had

them before. Crowding allows for more efficient transmission of infectious diseases, especially those that are vector-borne, witness the resurgence of African sleeping sickness throughout the sub-Sahran regions of that continent. Climate changes continue to re-arrange the distribution of plants and animals, many of which play a role in disease transmission.

Exceptions to the first two paradigms abound, but the total effort represents but a small number of scientists who have "crossed over" from both the basic and applied sciences. None of the majority of the work force in either group is trained to deal with health problems confronting human populations requiring multi-disciplinary approaches to: 1. describing in biological terms the failure of a given ecosystem service to provide us with that service; 2. perform health risk assessments of having to live within a damaged portion of a given ecosystem, and most importantly; 3. generate practical, cost-effective strategies for remediation of a given ecosystem, thereby improving the health of those living within it.

c. The Medical Ecology Paradigm

Medical Ecology is a hybrid science which brings the principles of ecology, earth sciences, and public health together for the purpose of analyzing problems of the environment as they impact on human health. In doing so, it is expected that the information contained therein will serve to encourage professionals engaged in the both applied and basic sciences to enter into more comprehensive collaborative efforts. **Medical Ecology** can be likened to a kind of informational ecotone, (an ecotone is the

border between two or more ecosystems). It is well established that ecotones harbor the greatest varieties of species, compared to the adjacent ecosystems that contribute to them, and ecotones are therefore places which serve to maintain ecological diversity and resiliency. If environmentally-related health problems affecting millions of people in different locales are of such a complex nature that it requires numerous scientific disciplines just to define them, then a new, more inclusive way of dealing with those problems must be forthcoming if we are to continue to succeed as a species.

Medical Ecology strives to supply the missing connections between the health and the ecological sciences, allowing both groups to develop a richer language, in which both can take advantage of the relevant parts of the other's disciplines, resulting in more powerful ideas for solving common problems. Formulating new, more inclusive, iterations for old problems caused by a disturbed environment is the main objective of Medical Ecology. Identifying all of the essential components of a problem, in turn, allows for a more complete solution to it.

I have constructed a course entitled **Medical Ecology,** which I have taught for the last five years at Columbia University. The term *Medical Ecology* was first coined by Rene Dubos during his illustrious days as a researcher at The Rockefeller University. I had the privilege of knowing him during my stay there as a Guest Investigator between 1967-1969. This term has fallen out of use in recent times. I elected to offer a course in **Medical Ecology** out of a need to draw attention to an obvious connection between one's well-being and the environment in which we all live. Another important learning

objective was to demonstrate that problems related to damaged ecosystems and human health risks could be couched in ecological terms compatible with the practice of public health. The initial course was successful, as deemed both by student evaluations and peer review comments. It continues to be well attended and appreciated by all who enroll.

2. Proposal for continued support for the Medical Ecology Website.

In 1999, I posted the first web pages for medical ecology on the internet. It was a modest beginning that has now grown to a substantial body of knowledge regarding ecological and health-related aspects of the atmosphere, food, water, and infectious diseases. Today, there are over 40 pages of information, with hundreds of useful links to the world's literature and resources for these critical topics. It has received over 1,500 visits with the last 6 months and is being used as an educational tool in the classroom, judging by the regularity of visits. What is more encouraging is the international distribution of use. Virtually every time zone is represented. Recent additions to the site include The Vertical Farm Project under "Food", and numerous infectious diseases. Trachoma will be added to the site soon.

3. Budget

A total of **$20,000** will be sued to maintain the **Medical Ecology** website and expand its information base. $1**0,000** will be needed to hire a web coordinator, while the rest will be

used to support my own work on the site over the next year. A 25% overhead allocation is requested for grant management by Columbia University ($**5,000**).

Total funding level requested: **$25,000**

Biographical Sketch

Dickson Donald Despommier

A. Professional Preparation

Fairleigh Dickinson University	Biology	BS	1962
Columbia University	Medical Parasitology	MS	1964
University of Notre Dame	Biology	Ph. D.	1967
Rockefeller University	Guest Investigator	1967-1969	

B. Appointments

Professor of Public Health and Microbiology, Columbia University, NYC, 1982-present.

Associate Professor of Public Health and Microbiology, Columbia University, NYC, 1975-1982.

Assistant Professor of Public Health, Columbia University, NYC, 1970-1975.

Assistant Professor, Medical College of Ohio, Toledo, Ohio, 1969-1970.

C. Publications:

Related to Proposal:

Despommier, D.D. 2003. Toxocariasis: clinical aspects, epidemiology, medical ecology, and molecular aspects. Clin Microbiol Rev. Apr;16:265-72.

Despommier, DD. Medical Ecology Website, 1999-2003 at: www.medicalecology.org

Despommier, DD, Gwadz, R.G., Hotez, P, Knirsch, C., ***Parasitic Diseases***, Apple Trees Productions, LLC, Pub., New York , NY. Fourth Edition. 2000. pp 345

Despommier, D.D., ***West Nile Story***. Apple Trees Productions, LLC., Pub., New York, NY. 2001. pp. 134

Unrelated to Proposal:

1. Despommier, D.D., M. Kajima, and B.S. Wostmann. 1967. Ferritin-conjugated antibody studies on the larva of *Trichinella spiralis.* J. Parasit. 53: 618-624.
2. Despommier, D.D., and B.S. Wostmann. 1968. Diffusion chambers for inducing immunity to *Trichinella spiralis* in mice. Exp. Parasitol. 23: 228-233.
3. Despommier, D.D., and B.S. Wostmann. 1969. *Trichinella spiralis*: Immune elimination in mice. Exp. Parasitol. 24: 243-250.
4. Despommier, D.D., and M. Muller. 1969. Particle-associated functional antigens of *Trichinella spiralis* larvae and immunity in mice. Proced. 2nd International

Conference Trichinellosis. Warsaw, Poland. Wiadomosci Parazytologiczne. T.X.V. Nr. 5-6: 612 (abstract).
5. Fuchs, M., G.B. Craig, and D.D. Despommier. 1969. The protein nature of the substance inducing female monogamy in Aedes aegypti. J. Insect Physiol. 15: 701-709.
6. Dennis, D., D.D. Despommier, and N. Davis. 1970. The infectivity of the newborn larva of *Trichinella spiralis* in the rat. J. Parasit. 56: 974-977.
7. Despommier, D.D., and M. Muller. 1970. The schistosome of Trichinella spiralis: Its structure and function. J. Parasit. 56: Sec. II. Part 1. 2nd Internat. Cong. Parasitol. pp. 76-77.
8. Despommier, D.D., and M. Muller. 1970. Functional antigens of *Trichinella spiralis*. J. Parasit. 56: Sect. II. Part 1. 2nd Internat. Cong. Parasitol. p. 76.
9. Despommier, D.D. 1971. The immunogenicity of the newborn larva of *Trichinella spiralis*. J. Parasit. 57: 531-535.
10. Despommier, D.D., and G.J. Jackson. 1972. Actinomycin-D and Puromycin-HCl in axenic cultures of the nematode, *Neoaplectana glaseri*. J. Parasit. 58: 774-777.
11. Despommier, D.D. 1973. A circular thermal migration device for the rapid collection of large numbers of intestinal helminths. J. Parasit. 59: 933-935.
12. Purkerson, M., and D.D. Despommier. 1974. Fine structure of the muscle phase of *Trichinella spiralis* in the mouse. In: Trichinellosis.(ed. C. Kim), Intext Publishers, N.Y.C. pp. 7-24.
13. Despommier, D.D. 1974. The stichocyte of *Trichinella spiralis* during morphogenesis in the small intestine of the rat. In: Trichinellosis.(ed. C. Kim), Intext Publishers, N.Y.C. pp. 239-255.
14. Despommier, D.D., M. Muller, B. Jenks, and M. Fruitstone. 1974. Immunodiagnosis of human trichinosis using counterimmunoelectrophoresis and agar gel diffusion techniques. Am. J. Trop. Med. Hyg. 23: 41-44.
15. Despommier, D.D., S. Weisbroth, and C. Fass. 1974. Circulating eosinophils and trichinosis in the rat: The stage responsible for induction during infection. J. Parasit. 60: 280-284.
16. Despommier, D.D., L. Aron, and L. Turgeon. 1975. *Trichinella spiralis*: Growth of the intracellular (muscle)larva. Exp. Parasitol. 37: 108-116.
17. Despommier, D.D. 1975. Adaptive changes in muscle fibers infected with *Trichinella spiralis*. Amer. J. Pathology 78: 477-484.
18. Feldman, A., H. Rosenkranz, and D.D. Despommier. 1975. Guanine-cytosine content of DNA from the mature muscle larva of *Trichinella spiralis* as determined from buoyant density and thermal-helix coil transition measurements. J. Parasit. 61: 570-571.
19. Despommier, D.D., and M. Muller. 1976. The stichosome and its secretion granules in the mature muscle larva of *Trichinella spiralis*. J. Parasit. 62:775-785.
20. Despommier, D.D., W.C. Campbell, and L. Blair. 1977. The in vivo and in vitro analysis of immunity to *Trichinella spiralis* in mice and rats. Parasitology. 74: 109-119.
21. Crum, E., D.D. Despommier, and D.D. McGregor. 1977. Immunity to *Trichinella spiralis*. I. Transfer of resistance by two classes of lymphocytes. Immunology. 33: 787-796.

22. Despommier, D.D., D.D. McGregor, and E. Crum. 1977. Immunity to *Trichinella spiralis*. II. Expression of immunity against adult worms. Immunology. 33: 797-805.
23. Despommier, D. 1977. Immunity to *Trichinella spiralis*. Amer. J. Trop. Med. Hyg. 26: 68-75.
24. Despommier, D., M. Sukhdeo, and E. Meerovitch. 1978. *Trichinella spiralis*: Site selection by the larva during the enteral phase of the infection in mice. Exp. Parasitol. 44: 209-215.
25. Williams, R.W., N.K.B. Hagan, A. Berger, and D.D. Despommier. 1978. An improved assay technique for matrone, a mosquito pheromone, and its application for ultrafiltration experiments. J.Insect. Physiol. 24: 127-132.
26. Bell, R.G., D.D. McGregor, and D.D. Despommier. 1979. *Trichinella spiralis*: Mediation of the intestinal component of protective immunity in the rat by multiple, phase-specific, antiparasitic responses. Exp. Parasitol. 47: 140-157.
27. Despommier, D.D. 1979. The immune system and parasitism. In: "Infectious Diseases." June, 1979.
28. Despommier, D.D., and A. Laccetti. 1981. *Trichinella spiralis*: Proteins and antigens isolated from a large-particle fraction derived from the muscle larva. Exp. Parasitol. 51: 279-295.
29. Despommier, D.D., and A. Laccetti. 1981. *Trichinella spiralis*: Partial characterization of antigens isolated by immuno-affinity chromatography from the large-particle fraction of the muscle larva. J. Parasit. 67: 332-339.
30. Despommier, D.D. 1981. Partial purification and characterization of protection-inducing antigens from the muscle larva of *Trichinella spiralis* by molecular sizing chromatography and preparative flatbed isoelectric focusing. Parasite Immunology 3: 261-272.
31. Despommier, D.D. 1981. The Laboratory Diagnosis of *Entamoeba histolytica*. Bull. New York Academy of Medicine 57: 212-216.
32. Seawright, G.L., D.D. Despommier, W. Zimmerman, and R. Isenstein.1983. Enzyme immunoassay for swine trichinellosis using antigens. Trop. Med. Hyg. 32: 1275-1284.
33. Silberstein, D., and D.D. Despommier. 1984. Antigens from *Trichinella spiralis* that induce protection in the mouse. J. Immunol. 132: 898-904.
34. Lefkowitch, J.H., S. Krumhotz, K.-C. Feng-Chen, P. Griffin, D. D. Despommier, and T.A. Brasitus. 1984. Cryptosporidiosis of the human small intestine: A light and electron microscopic study. Human Path. 15: 746-752.
35. Burnham, J.C., and D.D. Despommier.1985. Development of the male genitalia of *Trichinella spiralis* during its enteral phase of development in the mouse: an SEM study. J. Parasit. 70: 310-311.
36. Murrell, K.D., and D.D. Despommier. 1984. Immunization of swine against *Trichinella spiralis*. Vet. Parasitol. 15: 263-270.
37. Capo, V., D.D. Despommier, and D.S. Silberstein. 1984. The site of ecdysis of the L1 larva of *Trichinella spiralis*. J. Parasit. 70: 992-993.
38. Silberstein .D.S., and D. D. Despommier. 1985. Effects on *Trichinella spiralis* of host responses to purified antigens. Science 227: 948-950.
39. Silberstein, D.S., and D.D. Despommier. 1985. Immunization with purified antigens protects mice from lethal infection with *Trichinella spiralis*. J. Parasit. 71: 516-517.

40. Despommier, D.D. 1985. Preparation and standardization of antigens useful in the diagnosis of swine trichinellosis. Develop. Biol. Standards. 62: 53-56.
41. Isenstein, R.S.; H.M. Marks; D.W. Webert; J.C. Judkins; C.M. Parker; and D.D. Despommier. (1985). In: ICT6 Trichinellosis (ed. C. Kim), The State University Press; Albany, N.Y., pp. 240-245.
42. Pincus, S.H., P.V. Cammaratta, M. DeLima, and D.D. Despommier. 1986. Eosinophilia in murine Trichinosis. J. Parasit. 72: 321-324.
43. Capo, V.,D.D. Despommier, and D.S. Silberstein. 1986. Immunocytolocalization of two protection-inducing antigens of *Trichinella spiralis* during its enteral phase in immune and non-immune mice. J. Parasit. 72: 931-938.
44. Symmans, W.A.; C.H. Beresford; D. Dickson; D. Despommier, B.J. Reeder, and C.S. Shepherd. 1986. Cyclic eosinophilic myositis and hyperimmunoglobulin-E . Ann. Internal Med. 104: 26-32.
45. Stewart, G.L.; D.D. Despommier; J. Burnham; and K. Reins. 1987.*Trichinella spiralis*: Behavioral, structural, and biochemical studies on larvae following exposure to components of the host enteric environment. Exp. Parasitol. 63: 195-204.
46. Despommier, D.D., A. Gold, S.W. Buck, V. Capo and D. Silberstein. 1990. *Trichinella spiralis*: A secreted antigen of the infective L1 larva localizes to the cytoplasm and nucleoplasm of infected host cells. Exp. Parasitol. 72: 27- 38.
47. Despommier, D.D. 1990. *Trichinella spiralis*: The worm that would be Virus Parasitology Today. 6: 193-196.
48. Gold, A.M.; D.D. Despommier; and S.W. Buck. 1990. Partial characterization of two antigens secreted by the larva of *Trichinella spiralis*. Mol. Biochem. Parasit. 41: 187-196
49. Despommier, D.D.; W.F. Symmans; and R. Dell. 1991. Changes in Nurse cell nuclei during infection with *Trichinella spiralis*. J.Parasitol. 77: 290-295.
50. Baruch, A.M., and D.D.Despommier. 1991. Blood vessels in *Trichinella spiralis* infections: a study using vascular casts. J. Parasitol. 77: 99-103.
51. Vassilatis, D., D.D. Despommier, D. Misek, R.I. Polvere, A.M. Gold, and L.H.T. van der Ploeg. Analysis of a 43 kDa glycoprotein from the intracellular parasitic nematode *Trichinella spiralis*. 1992. J. Biol. Chem. 267: 18,459-18,465.
52. Despommier, D.D. 1992. Tapeworm infection: the long and the short of it. New England Journal of Medicine. 327: 727-728.
53. Despommier, D.D. 1993. *Trichinella spiralis* and the concept of niche. J. Parasitol. 79: 472-482.
54. Jasmer, D.P., S. Yao, D. Vassilatis, D.D. Despommier, and S.M. Neary. 1994. Failure to detect *Trichinella spiralis* p43 in isolated host nuclei and in irradiated larvae of infected muscle cells which express the infected cell phenotype. Mol. Biochem. Parasit. 67: 225-234.
55. Montgomery, J., Feldmen, A., Despommier, DD., Stewart, G.L., and Haeling E. 1995. A method for isolation and partial purification of large quantities of *Trichinella spiralis* Nurse cells. J. Parasitol. 81: 649-652.
56. Capo, V.; and D. D. Despommier. 1996. Clinical aspects of infection with *Trichinella spp*. Clinical Microbiol. Reviews 9: 47-54.

57. Vassilatis, D.K.; Despommier, D.D.; Polvere, R.I.; Gold, A.M.; and Van der Ploeg, L.H.T. 1996. *Trichinella pseudospiralis* secretes a protein related to the Trichinella spiralis 43-kDa glycoprotein. Mol. Biochem. Parasitol. 78: 13-23.
58. Vassilatis, D.K.; Polvere, R.I.; Despommier, D.D.; Gold, A.M.; and Van der ploeg, L.H.T. 1996. Developmental expression of a 43-kDa secreted glycoprotein from *Trichinella spiralis*. Mol. Biochem. Parasitol. 78: 25-31.
59. Despommier, D.D. 1997. *Trichinella spiralis* and the concept of Parakines.In:9th International Conference on Trichinellosis. August. Mexico City.
60. Gold, A.M.; and Despommier, D.D. 1997. A major secreted glycoprotein of *Trichinella spiralis* L1 larvae is related to the serine peptidases. 9th International Conference on Trichinellosis. Mexico City..
61. Polvere, R.I.; Kabash, C.; Kadan, I.; Capo, V.; Gold,A.M.; and Despommier, D.D. 1997. *Trichinella spiralis*: collagen type IV and type VI synthesis. Exp. Parasitol.86:191-199.
62. Capo, V., D.D.Despommier, and R.I.Polvere. 1998. *Trichinella spiralis*: Vascular endothelial growth factor is up-regulated within the Nurse cell during the early phase of its formation. J.Parasitol. 84: 209-214.
63. Despommier, D.D. 1998. How *Trichinella spiralis* makes itself at home. Parasitology Today. August. p.318-323.

BOOKS

1. Katz, M., D.D. Despommier and R. Gwadz. *Parasitic Diseases*. Springer-Verlag Pub., New York and Heidelberg. First edition. 1982. pp. 264.

2. Despommier, D.D. and J. Karapelou. *Parasite Life Cycles*. Springer-Verlag Pub., New York and Heidelberg. 1987. pp. 127

3. Katz, M., D.D. Despommier, and R.W.Gwadz. *Parasitic Diseases*. Springer-Verlag Pub., New York and Heidelberg. Second Edition. 1989. pp. 301.

4. Despommier, D.D., Gwadz, R.G., and Hotez, P.J. *Parasitic Diseases*. Springer Verlag Pub., New York and Heidleberg. Third Edition. 1994. pp. 333.

5. Despommier, DD, Gwagz, R.G., Hotez, P, Knirsch, C., *Parasitic Diseases*, Apple Trees Productions, LLC, Pub., New York , NY. Fourth Edition. 2000. pp. 345

6. Despommier, D.D., *West Nile Story*. Apple Trees Productions, LLC., Pub., New York, NY. 2001. pp. 134

CHAPTERS

1. Despommier, D. 1976. Musculature. In: Ecological Aspects of Parasitology, C.R. Kennedy, ed. Elsiever Excerpta Medical North-Holland Pub. pp. 269-285.
2. Despommier, D.D. 1980. Experimental Parasitology. In: The Laboratory Rat. Chapter II, Vol. II. J. Baker, H.J. Lindsey and S. Weisbroth, eds., Academic Press, N.Y.C., pp. 225-244.
3. Despommier, D.D. 1983. Biology. In: Trichinella and Trichinosis. W.C. Campbell, ed. Plenum Pub. Corp., N.Y.C. pp. 75-142.
4. Despommier, D.D. 1983. The Interpretation of Serological Tests for Human Parasitic Infections. In: Immunodiagnosis for Clinicians: Interpre- tation of Immunologic Assays. M.H. Grieco and D.K. Meriney, eds. Year Book Medical Publishers, Inc., Chicago, Illinois. (pp. 324-335).
5. Despommier, D.D. 1985. Antigens of *Trichinella spiralis* In: Trichinellosis. (C.Kim, ed.). Proceedings of the 6th International Conference on Trichinellosis. August 6-9, 1984. Val Morin, Quebec, Canada. pp.8-16.
6. Despommier, D.D. 1985. Preparation and standardization of antigens useful in the diagnosis of swine trichinellosis. In: Developments in Biological Standardization. Diagnostics and vaccines for parasitic diseases. (M. Tiru and W. Hennessen, eds.) S. Karger, pub. Basel, Munich, Paris, London, and New York. pp.53-58.
7. Despommier, D,D. 1986. Trichinellosis. In: Immunodiagnosis of Parasitic Diseases, Vol. 1 . K. Walls . and P. Schantz, eds. Academic Press, Orlando, Fla. U.S.A. pp. 163-182.
8. Despommier, D.D. 1987. The Immunobiology of *Trichinella spiralis*. In: Immune Responses in Parasitic Infections: Immunology, Immunopathology, and Immunoprophylaxsis. Vol. I. Nematodes. E.J.L. Soulsby, ed. CRC Press, Boca Raton, Fla. pp.43-60
9. Despommier, D.D. 1995. *Trichinella spiralis* and its enteral site niche. In: Eneteric Infection (M. J. G. Farthing; G. T. Keusch; and D. Wakelin, eds.) Chapman and Hall Medical Pubs., London. pp. 107-116.
10. Despommier, D.D. 1995. *Trichinella spiralis*. in: Infections of the Gasterointestinal Tract (M.J. Blaser; P.D. Smith; J.I. Ravdin; H. B. Greenberg; and R. L. Guerrant ed.). Raven Press, New York. Chapter 77.pp 1179-1188.
11. Despommier,D.D. 1997. Trichinella and Toxocara. in: Topley and Wilson's Microbiology and Microbial Infections. 1997.
12. Despommier,D.D. 1997. Trichinella and Toxocara sp. in:Pediatric Infectious Diseases. (S. Long, L.K.Pickering, and C.G.Prober, eds) Churchhill-Livingstone, Pubs. New York. 1997.pp.1469-1475.
13. Hamer,D.,and D.D.Despommier.1998. Intestinal Nematodes. in: Infections of the Gasterointestinal Tract.(S.L.Gorbach, J. G. Bartlett, and N.R.Blacklow,eds). W.B. Saunders, Pubs. Philadelphia. 1998.pp. 2456-2465.
14. Hamer, D, and D.D.Despommier. 1998 Tissue Nematodes. in: Infectious Diseases. (S.L.Gorbach, J.G. Bartlett, and N.R. Blacklow, eds).W.B. Saunders, Pubs. Philadelphia.

15. Despommier,D.D. 2001. Trichinella and Toxocara sp. in: Pediatric Infectious Diseases. (S. Long, L.K.Pickering, and C.G.Prober, eds) Churchhill-Livingstone, Pubs. New York. 2001. *in press.*
16. Despommier, D.D. 2001. *Trichinella spiralis*. in: Infections of the Gasterointestinal Tract (M.J. Blaser; P.D. Smith; J.I. Ravdin; H. B. Greenberg; and R. L. Guerrant ed.). Raven Press, New York. 2001. in press.

INVITED LECTURES

1. The 3rd International Conference on Trichinellosis. Miami, Florida, 1972. Coordinator of meeting and Chairperson, Symposium on Mechanisms of Immunity.
2. European Workshop on Immunology. Amsterdam, The Netherlands. 1974. "The Antigens of the Stichosome of *Trichinella spiralis"*.
3. American Society for Microbiology (New York Chapter). Symposium on Intracellular Parasitism held at The Rockefeller University, N.Y.C. 1974. "*Trichinella spiralis:* The World's Largest Intracellular Parasite".
4. W.H.O. Post-Graduate Course on The Immune System and Parasites. Nairobi,Kenya.1979. "Immunity to *Trichinella spiralis"*.
5 The 5th International Conference on Trichinellosis, Noordwak aan Zee, The Netherlands, 1980. Co-chairperson, Session in Immunopathology; presented two papers on the *antigens of Trichinella spiralis.*
6. The 6th International Conference on Trichinellosis , Val Morin, Canada 1984. "Antigens".
7. The use of affinity-purified antigens from *Trichinella spiralis* in the diagnosis of swine trichinellosis. Internat.Assoc.Biol. standards/WHO Symposium on Parasitological Diagnostics and Vaccines, Feb. 20-22, 1985. Stockholm, Sweden.
8. Trichinella and structural changes in mammalian muscle fibers: observations of a non-malignant transformation process. Symposium sponsored jointly by The Helminthological Society of Washington and The New Jersey Society for Parasitology.May 11, 1985.
9. Immuno-Parasitology: Recent advances in diagnosis and vaccination. Dean's Day Symposium . P&S 126th Alumni Reunion. Columbia University, May 10&11,1985.
10. Stage-specific antigens of *Trichinella spiralis.* Gordon Research Conference on Immunology and Molecular Biology of Parasites. August 3-7, 1987.
11. Chair, session on Trichinellosis. Lecture title: Biology of the parenteral phase of *Trichinella spiralis.* Third Latin American Congress of Tropical Medicine and the Ninth National Congress of Parasitology. Mexico City,
12. Structure-function relationships in the development of the Nurse cell-parasite complex of *Trichinella spiralis.* South Eastern Society of Parasitologists Annual meeting, Boone, North Carolina. April 18-20, 1990.
13. *Trichinella spiralis:* The world's largest virus. Lecture in: "Biology of Parasitism" course at Woods Hole, Mass. July 5, 1990.
14. Development of the Nurse cell-parasite complex in *Trichinella spiralis* infection. Lecture in Biology of Parasitism course at Woods Hole, Mass. July 10, 1992

15. *Trichinella spiralis* and the concept of niche. President's symposium. Annual Meeting of the American Society for Parasitologists. Philadelphia, Pa. August, 1993.
16. "On the Value of Trout". In: "The Economics of the Environment". G. Chichilniski, course director.
17. "My Life as a Worm". Annual Theobald Smith Lecture. Cornell University Medical School. 1993.
18. "Trypanosomiasis, a Tale of Two Continents". 16th Annual Darwin Festival. Salem State University, Salem, Massachusetts. February 15, 1995.
19. "The Nurse cell-parasite complex of *Trichinella spiralis*: Roofing and other home building activities. Plenary Lecture, British Society for Parasitology. April, 1996
20. *Trichinella spiralis* and the concept of Parakines. Symposium, 9th International Conference on Trichinellosis. Mexico City. August, 1996.
21. *Trichinella spiralis*: Nature's master architect. U. Texas at Houston, Feb. 1997. Celebration of the merging of the departments of Pharmacology, Toxicology and Physiology.
22. University of Pennsylvania School of Veterinary Medicine, New Boulton Center Annual Conference on Parasitism. May 3, 1997 "*Trichinella spiralis*: how the worm turns".
23. Gordon Research Conference on "Parasitism" New Port, Rhode Island, July, 1997. *Trichinella spiralis* and Nurse cell biology".
24. Key note speaker, International Health Conference, Einstein Medical College. "Medical Elective in the Tropics for 4th Year Medical Students". April 30th, 1998.
25. Climate Change: What does it mean for South Florida? Sponsored by the Environmental Protection Agency. Wyndam Miami Biscayne Hotel. May 26th, 1999. "Implications of Climate Change for Public Health"
26. Invited Speaker: Ecology and Health Conference sponsored by :NIEHS, EPA, State of North Carolina, Duke University, University of North Carolina. Title: Medical Ecology: A New Way of Looking at Public Health. June 28th, 2000.
27. Keynote speaker: Coastal Ecology and Health held at Marine Biological Station in Wilmington, North Carolina, Sept 7th, 2000. "Medical Ecological Aspects of Estuarine Environments"
28. . Lamont Colloquium: "Medical Ecological Aspects of Riverine Environments". September 8th, 2000.

OTHER ACTIVITES AND LECTURES

1. 1978 - "Trout Stream Ecology" team taught with Pete Jacques, Warren Prell, and Steven Tiffinger. Midland Park High school Adult Education Program.
2. 1978 - "New Horizons" - Lecture East Jersey Trout Unlimited.
3. 1981 - "New Horizons" - Lecture East Jersey Trout Unlimited
4. 1982 - "New Horizons" - Lecture East Jersey Trout Unlimited
5. 1983 - "New Horizons" - Lecture East Jersey Trout Unlimited
6. 1988 - "New Horizons" - Lecture East Jersey Trout Unlimited
7. "Trout Stream Ecology" annual lecture to Fly Fishing School, East Jersey Chapter Trout Unlimited. 1989-Present.

8. “We All Live Downstream”. Special symposium sponsored by East Jersey Trout Unlimited. New Jersey Meadowlands Development and education Center, Carlisle, New Jersey. Weekend of Sept. 14-16, 1991.
9. “Non-point Source Pollution on Non-federal Lands”. Annual National Meeting of Trout Unlimited. Hershey, Pennsylvania. 1992.
10. “What lives under the rocks in the river”? Third Grade classes at The Roscoe Central School, Roscoe, New York. May 10, 1993.
11. “Why We Should Value Trout”. Two lectures for Sixth and Seventh Grade Assembly, Hillside, Queens middle School. 1993.
12. Overview of Ecology. Eighth Grade Biology Class, Hillside, Queens Middle School. 1993.
13. Trout Stream Ecology. Friends of Fishes course to gifted High School students. The American Museum of Natural History, New York. 1993.
14. Career Day. Public School 128 in Manhattan. Mr. Stewart Cohen, Sixth Grade. 1994.
15. Polar Biomes. St. Andrews Academy, Brooklyn. Ms. Sarah Anderson, Eighth Grade. 1994.
16. Alberta, the Last (?) Frontier. Central Jersey Chapter Trout Unlimited. 1994.
17. “Trees And Trout, A Natural Combination” - Lecture, Central Jersey Chapter Trout Unlimited. March, 1995.
18. “A Celebration of Trout”, a night of music, poetry, and literature devoted to celebrating the habitat of trout. Alumni Auditorium, Columbia University. March 15, 1995.
19. “Trees And Trout, A Natural Combination” - Lecture, Ray Bergman Chapter Trout Unlimited. April, 1995.
20. “Trees And Trout, A Natural Combination” - Lecture, East Jersey Chapter Trout Unlimited. April, 1995.
21. “What Lives Under The Rocks In The River”? - Lecture and demonstration, Grade 3, Roscoe Central School. April, 1995.
22. Arbor Day Tree Planting, Roscoe Central School, Grade 3. April 25th, 1995. 60 saplings of various hardwood trees planted.
23. Arbor Day tree Planting, Roscoe Central School, Grade 3. April 26th, 1996. 20 Norway maple trees (10’ tall) planted.
24. Arbor Day Tree Planting, Roscoe Central School, Grade 3. April 25th, 1997. 43 hardwood trees planted.
25. Livingston Manor School, Grade 3. April 24th, 1997. “What Lives Under the Rocks in the Stream”? The Lorax reading.
26. Roscoe Central School, Grade 3. April 25th, 1997. “What Lives Under the Rocks in the Stream”?
27. “Trout and Trees, and Natural Combination”, Feb. 1997. Friends of the Rockaway River.
28. “Trout and Trees, a Natural Combination”. March, 1997. North Jersey Trout Unlimited.
29. “Planting trees along a river as a focal point for environmental education to grade school-aged children”. Annual meeting of NABS in Prince Edward Island, Canada. June, 1998.

30. Annual tree planting on Roscoe and Livingston Manor school grounds. Arbor Day (April 26), 1998.
31. Arbor Day tree planting: Roscoe Central School. 28 sapling sycamore trees. Each child in the third grade took home a tree to plant near a river. April 30, 1999.
32. Stream walk for Roscoe Central School and Livingston Manor Central School. April 29th, 1999.
33. "Stream Ecology Lecture" CFFCM, May 8th, 1999
34. "Where does your water come from"? 5th Grade, P.S. 81, Riverdale, New York, May 11, 1999.
35. "What is a watershed"? Story Telling Room, 5th and 6th Grades, Norman S. Weir School, Paterson, New Jersey, May 11th, 1999.
36. "Environment Day" co-sponsored by East Jersey Trout Unlimited and Ramapo College. 1999
37. Parasitology Up-date. Plaza Hotel, NYC August, 1999. Columbia-Harvard faculty. Medicine Review
38. What Good Is A Tree?. East Jersey TU. 2000
39. The Man Who Planted Trees. Ray Bergman Chapter, TU, 2000
40. Arbor Day 2000. Tree planting, Roscoe, NY
41. Parasitology Up-date. Plaza Hotel, NYC. August, 2000. Columbia-Harvard faculty. Medicine Review.
42. West Nile virus. City As School. May 11, 2001
43. West Nile virus. Wingate High School. May 18, 2001
44. The Ecology of Trout Streams – May 25, 2001. Annual teachers meeting of "Trout in the Class Room." New Paltz, New York

COURSES AND GUEST LECTURES IN COURSES

1."Parasitic Diseases". Required course to the second year medical students. Since 1971 to present.

2. "Ecology 101" (We All Live Downstream). Offered university-wide to all qualified graduate students. 1992, 1994, 1995, 1996, 1997.

3. "Advanced Microbiology". Required for all first year graduate students in the Department of Microbiology. 1992- 1998.

4. Environmental Sciences core course. Team taught. Four lectures: Introduction; Water; Energy; Land Use. 1993-1998; Introduction and Land Use, 1993-present.

5. "Medical Ecology" section of first year medical school course. Three lectures: Atmosphere, ozone depletion and skin cancer; Food and Disease; Water and Disease; Cases.1996-1998.

6. Annual guest lecturer at New York University Medical School “Tissue Nematodes”. 1978-1998

7. Annual guest lecturer, Cornell University Medical School. “*Trichinella spiralis*” 1978-1999. 1999- “Introduction to Eukaryotic Parasites”

8. Medical Ecology. Spring, 1999, 2001

9. Medical Ecology. Spring. 1999. Fairleigh Dickinson University

10. Topics. Cholera: Then and Now. Fall, 2000