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THE MARYLAND CHEMIST OF THE YEAR

David E. Henrie, Chemistry Department, Loyola College

In connection with an interest in basic research, we have begun an investigation into the Second Law of Thermodynamics. This law has resulted in a great deal of philosophical debate, and, in our view, has led to the adoption of a philosophy of fatalism by many. Most of the investigations of entropy have been carried out in the laboratory with observations of entropy changes in that part of the universe termed "the system". Our concern has become a broader one, that is: what about the remainder of the universe, i.e. its surroundings? We have noted several interesting phenomena which, we believe, have fundamental implications with respect to order - disorder phenomena, and our very existence.

1) "My mother always told me to 'straighten up my room' when I was a child. I discovered that I seemed to spend an inordinate amount of time in this ordering process, and, soon after I had completed it, another area of the house such as the attic or basement was in need of similar ordering. When I completed that process, it seemed that again my room was in need of ordering.

At the time, these experiences were merely frustrating. Later, however, when I learned about the second law in college I began to suspect the truth. I was still living at home and attempted to explain to my mother my hypothesis that if my room was permitted to become disordered, the remainder of the house would remain in some semblance of order. However, as in many instances, my scientific arguments did not prevail over 'tradition.'" [1]

2) More recently we have noted similar order-disorder phenomena at Loyola College. We have a departmental collection of tools and these are located (at some $t=0$) in a large tool box. It seems that we are constantly reordering, and replacing, tools. We usually begin the semester ($t=0$) with a completely stocked tool box. At virtually any time after $t=0$, if one has occasion to look for a specific tool it will not be found in the tool box. If it is found it will be in some location far removed from the tool box and, very frequently, it is impossible to discover any possible use for the specific tool in the region near its location.

3) The other specific manifestation of this phenomena occurs in our offices. It seems they are constantly becoming disordered and at the most inconvenient times, e.g. when one needs to find a specific piece of information. In fact, one of our colleagues, who is on sabbatical, recently returned to collect his mail and discovered a significant amount of disorder in his office, which had not been occupied. This suggests, contrary to popular opinion, that it is not the occupant of the office who is responsible for its disorder and yet in this, nature seems grossly unfair since the occupant must spend considerable effort to reduce entropy. We all know that this is a futile effort and we postulate that aging is perhaps caused by such efforts. In this connection, Dr. H. C. Freimuth has pointed out an interesting observation, viz, that efforts to order one's environment (office) are accompanied by an increase in the entropy of one's brain. [2]

...cont'd on p. 7

ADVANCE NOTICE: January Meeting

January 17, 1979 at Eudowood Gardens

6:00 pm: Alsoph H. Corwin (JHU): *Nutrition and Health*8:30 pm: Monroe Lanzet (Chanel, Inc.): *Everything You Need to Know about Cosmetics But Were Afraid to Ask*

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GUNTHER L. EICHHORN: A distinguished chemist whose outstanding work reflects great credit on himself and on the National Institutes of Health.

The Chesapeake Chemist is published monthly September through May by the Maryland Section of the American Chemical Society. Address editorial comments to Eli Freedman, 2411 Diana Road, Baltimore, Md. 21209. Send advertising copy and inquires to Merle I. Eiss, McCormick and Co., Inc., 204 Wight Avenue, Hunt Valley, Md. 21031. The Maryland Section is not responsible for opinions expressed herein. Editorials express the opinions only of their authors. The Editor is responsible for all unsigned material.

MARYLAND CHEMIST OF THE YEAR AWARD

GUNTHER L. EICHHORN

Gunther L. Eichhorn, the Maryland Chemist of the Year for 1978, was born in Frankfurt am Main, Germany. He graduated from the Louisville Male High School, and received an A.B. degree in chemistry from the University of Louisville. He then went to the University of Illinois, where he was awarded an M.S. in chemistry (1948), and the Ph.D. (1950).

From 1950 through 1954, he was an assistant professor at Louisiana State University; during the same period he spent his summers as a postdoctoral fellow at Ohio State University. He was an associate professor at Louisiana State from 1954 to 1957. In 1958, he was a Guest Scientist at the Naval Medical Research Institute.

Since 1958, he has been at the Gerontology Research Center of the National Institute on Aging (one of the National Institutes of Health), where he is now Chief of the Laboratory of Cellular and Molecular Biology at Baltimore City Hospital.

GUNTHER L. EICHHORN - AN APPRECIATION

Gunther L. Eichhorn, the recipient of the 1978 Maryland Chemist Award, is internationally recognized for his contributions in Inorganic Biochemistry, a field now frequently called Bio-Inorganic Chemistry. This field is one of the most exciting areas of research in chemistry today. Dr. Eichhorn is a leading pioneer in this area and has edited the definitive treatise in the field, a one-thousand page, two-volume work entitled *Inorganic Biochemistry*. These volumes are "the bible" of the area.

Dr. Eichhorn's laboratory has made a number of significant research contributions. His group has uncovered and explained numerous phenomena involving the effects of metal ions on nucleic acids, including the reversible folding and unfolding of nucleic acid helices. He has offered reasonable explanations of the reasons why metal ions may cause mutation and errors in transcription. His laboratory has made exciting discoveries concerning the effects of metallo-antineoplastic agents on nucleic acid structure and on replication by polymerase enzymes. Although the systems are complex, Dr. Eichhorn has been able to explain them with fundamental chemical concepts.

In order to fully understand these important effects, Dr. Eichhorn pioneered the application of NMR and CD spectroscopy to the study of both small molecules and biopolymers. His research has stimulated approximately seventy groups, worldwide, to work in these areas. Two chapters in *Inorganic Biochemistry* were written by Dr. Eichhorn and served as the best discussions of these subjects until recently. One of the chapters, although written in 1971, is still the best chapter available on metal ion interactions with polynucleotides.

Dr. Eichhorn had earlier contributed significantly to the study of metallo-proteins and enzymes by applying CD spectroscopy to these systems. While still primarily an inorganic chemist, Dr. Eichhorn made several significant contributions to the understanding of the reactions of coordinated ligands. Again, he was a pioneer in these fields. ...cont'd on p. 6

DECEMBER MEETING

DATE:

Wednesday, December 13, 1978

PLACE:

Knott Science Center
The College of Notre Dame
of Maryland
North Charles Street

SPEAKER & TOPIC:

8:30 pm
THE MARYLAND CHEMIST
AWARD ADDRESS
Dr. Gunther L. Eichhorn
National Institute on Aging
"The Interaction of Metal Ions
With Nucleic Acids: Implications
For The Aging Process"

SOCIAL HOUR:

There will be a social hour
after the meeting.
Refreshments will be served.

It is not necessary to be a member of the American Chemical Society to attend the dinner or the talk. The talk may be attended without going to the dinner. You are invited to bring your spouse and friends to both the meeting and the dinner.

----- TEAR OUT DINNER RESERVATION FORM -----

Enclosed is \$ _____ (\$6.50 per person)* for dinner
reservations at the College of Notre Dame for the following persons:

NAME (Please print or type) AFFILIATION

* Please make check payable to Maryland Section, ACS, and mail together with reservation form to Howard Cohen, Glidden Pigments Div., SCM Corp., 3901 Glidden Road, Baltimore, MD 21226. Reservations may be made by phone at 633-6400, ext. 7360/7203, but please mail check in advance to avoid the long line at the door on meeting night.

Return by December 8, 1978

EICHHORN ...cont'd from p. 4

Dr. Eichhorn's professional activities have also been outstanding. He has always been highly valued as a referee of papers and proposals because he has consistently done an excellent job. He has organized many excellent symposia. Dr. Eichhorn has always encouraged young scientists in research. He is a valued administrator and has recently helped to reorganize part of the National Institute on Aging at Baltimore City Hospital. Dr. Eichhorn has long been a loyal supporter of local ACS functions and a frequent participant in discussions.

-- Luigi Marzilli
Department of Chemistry
The Johns Hopkins University

Abstract of Dr. Eichhorn's Talk

THE INTERACTION OF METAL IONS WITH NUCLEIC ACIDS:
IMPLICATIONS FOR THE AGING PROCESS.

It is generally believed that the biological aging process has a genetic determinant, and evidence has been obtained that the cellular genetic information transfer processes change with age. Interactions of metal ions with nucleic acids have profound effects on genetic information transfer. Metal binding to DNA influences the structure of the DNA-protein complexes that are found in chromatin. Metal ions that bind DNA phosphate decrease the affinity of DNA for polypeptide, while base binding metal ions produce dramatic conformational changes in DNA-polypeptide interaction. Metal ions can crosslink DNA and RNA strands, degrade RNA, alter the specificity of enzymes that act on nucleic acids, and cause mispairing of bases in double helix formation. On the other hand, metal ions are required for every aspect of genetic information transfer, including DNA, RNA and protein synthesis. Nevertheless, the "wrong" metal ion, or even the "right" metal ion in the wrong concentration, can produce errors in information transfer. Metal ions of the kind and concentration required for the essential functions are introduced into living organisms from the environment. Metal ions of types and concentrations that are harmful are introduced in the same way. There are marked age-dependent changes in the concentrations of metal ions in the living cells. The effects of such concentration changes on genetic information transfer suggest the possibility that metal ions can influence the aging process. A specific example of such influence is the accumulation in brain cells of aluminum ions, which bind to chromatin and may have a relationship to Alzheimer's disease.

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We all know of apparent exceptions to the Second Law. There are certain people who seem to manage to keep things completely in order. We are suspicious of them and have begun to suspect that there is some mechanism whereby a specific coupling between order and disorder can be carried out. We suspect it is a closely guarded bit of secret knowledge which most of us are not aware of and we thus find ourselves struggling futilely against the immutable progression of disorder or, if you will, time's arrow.

We believe it is time to launch an all out attack on this problem, before it is too late. Perhaps we should consider a moratorium on *all* experiments which result in negative ΔS for the system. We should actively seek government funding to study the phenomena and look for specific coupling effects, for example, when one office is straightened up does another office become significantly disordered?

If such couplings can be observed, we could institute a system of scheduling processes which are entropy reducing so that the entropy increase in the coupled region does not occur at an inconvenient time.

Colleagues interested in cooperating with us in this project are cordially invited to contact us.

Acknowledgements - We gratefully acknowledge our many colleagues and students for suggesting this problem. Dr. M. P. Miller deserves special thanks for locating several misplaced parts of this manuscript in the middle of a stack of extra copies of a 1972 general chemistry quiz. M. Daley is thanked for putting the unnumbered pages of the original manuscript in order and for typing this manuscript.

NOTES

- [1] Item 1 is a personal reminiscence from Dr. X. Regrettably, his name was recorded on a paper towel which should be somewhere in the author's office.
- [2] Private communication to the author by HCF after his review of this manuscript.

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