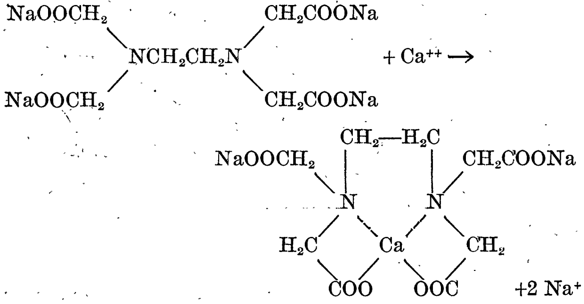
Comments and Communications

Demineralization of Hard Tissues by Organic Chelating Agents

THE sodium salts of ethylene-diamine tetracetic acid are noncolloidal organic chelating agents that resemble the inorganic polyphosphates (e.g., sodium hexametaphosphate) in their ability to form soluble nonionic chelates with a large number of metallic ions. The reaction with calcium is thought to proceed as follows:



The resulting complex is stable over a wide range of temperature (*1*). Complex compounds with calcium and other heavy metal ions are formed at variable hydrogen ion concentrations. These compounds are formed most efficiently in alkaline solutions (*2*). Since decalcification of bone and other hard tissues has hitherto only been accomplished in acid media, it was of interest to see whether these chelating agents would make a suitable demineralizing medium.[1]

Preliminary investigations have shown that demineralization in saturated aqueous solutions at pHs ranging from 5.0 to 10.3 can be accomplished. The solubility ranges from 11 g/100 ml water for the disodium salt (pH 5.0) to 103 g/100 ml water for the tetrasodium salt (pH 10.3). The time required is about the same as that needed for a comparable specimen in the formic-citric acid method of Morse (*3*), and slightly longer than that required for 5% HNO_3. Preservation of structural detail and of the staining properties of the tissues seems excellent. This was particularly evident in the elements of the pulp and bone marrow. Further experiments to determine the optimal pH and concentration of the chelating compounds for the preservation of enzymes and tissue elements are now being conducted.

LEO M. SREEBNY

Division of Oral Pathology
College of Dentistry
University of Illinois, Chicago

GORDON NIKIFORUK

Department of Pedodontia
Faculty of Dentistry
University of Toronto

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[1] The chelating agents used in this work were obtained from Alrose Chemical Company, Providence, R. I., and the Bersworth Chemical Company, Framingham, Mass.

References

1. SCHWARZENBACH, G., and ACKERMAN, H. *Helv. Chim. Acta*, **30**, 1798 (1947).
2. *Powerful Organic Chelating Agents*. Tech. Bull. No. 2. Framingham, Mass.: Bersworth Chemical Company.
3. MORSE, A. *J. Dental Research*, **24**, 143 (1945).

Zoological Nomenclature: Notice of Proposed Suspension of the Rules in Certain Cases for the Avoidance of Confusion and the Validation of Current Nomenclatorial Practice

(A. (n.s.) 7)

NOTICE is hereby given that the possible use by the International Commission on Zoological Nomenclature of its plenary powers is involved in applications relating to the undermentioned names included in Parts 1 to 4 of the *Bulletin of Zoological Nomenclature*, each of which parts was published on April 20, 1951:

(1) *Applications in Part 1*

1) *Pleurocera* Rafinesque, 1818 (Class Gastropoda), (pp 6–17) (File 83).
2) *Aphidius* Nees, 1818 (Class Insecta, Order Hymenoptera), (pp. 18–20) (File 149).
3) Trivial name *ajax* Linnaeus, 1758 (as published in the combination *Papilio ajax*), (Class Insecta, Order Lepidoptera) (pp. 26–30) (File 192).
4) *Mytilus* Linnaeus, 1758 (Class Pelecypoda), (proposed validation of an error in *Opinion* 94), (pp. 31–32) (File 193).

(2) *Applications in Part 2*

5) *Scaphander* Montfort, 1810 (Class Gastropoda), (pp. 35–36) (File 378).
6) *Monoculus* Linnaeus, 1758 (pp. 37–39) (File 377).
7) *Rantus* Dejean, 1833 (Class Insecta, Order Coleoptera), (pp. 40–45) (File 171).
8) *Acantholyda* Costa, 1894 (Class Insecta, Order Hymenoptera), and *Acanthocnema* Becker, 1894 (Class Insecta, Order Diptera), (p. 46) (File 175).
9) *Rhina* Latreille [1802–1803] and *Magdalis* Germar, 1817 (Class Insecta, Order Coleoptera), (pp. 47–55) (File 202).
10) *Cardinia* Agassiz [1841] (Class Lamellibranchiata), (pp. 59–64) (File 208).

(3) *Applications in Part 3*

11) Trivial name *sirtalis* Linnaeus, 1758 (as published in the combination *Coluber sirtalis*), (Class Reptilia) (pp. 67–68) (File 433).
12) *Crangon* Weber, 1795, *Alpheus* Weber, 1795, *Crangon* Fabricius, 1798, and *Alpheus* Fabricius, 1798 (Class Crustacea, Order Decapoda), (pp. 69–80) (File 231).
13) *Scyllarides* Gill, 1898 (Class Crustacea, Order Decapoda), (pp. 81–82) (File 473).
14) *Lysiosquilla* Dana, 1852 (Class Crustacea, Order Stomatopoda), (pp. 83–85) (File 474).

15) *Odontodactylus* Bigelow, 1893 (Class Crustacea, Order Stomatopoda), (pp. 86–87) (File 475).
16) All names for "Petrificata" in Vol. 3 of Linnaeus, 1768, *Systema Naturae* (ed. 12) and in corresponding portions of the following ~~later editions~~ of the above work: (*a*) Gmelin (J. F.), 1793, *Syst. Nat.* (ed. 13) Vol. 3; (*b*) Houttuyn (M.), 1785, *Natuurlyke Historie,* Vol. 3; (*c*) Turton (W.), 1806, *Gen. Syst. Nature,* Vol. 7 (p. 66) (File 418).
17) *Conchidium* Oehlert, 1887, and *Pentamerus* Sowerby (J.) 1813 (Class Brachiopoda), (pp. 89–96) (File 286).

(4) *Applications in Part 4*

18) *Ligia* Weber, 1795, *Ligia* Fabricius, 1798, and *Carcinus* Leach, 1814 (Class Crustacea, Order Decapoda), (pp. 99–102) (File 209).
19) *Capsus* Fabricius, 1803 (Class Insecta, Order Hemiptera), (pp. 103–104) (File 211).
20) The trivial names *quadratus* Fabricius, 1787, and *albicans* Bosc, 1801–1802, as alternative trivial names for the Sand Crab (Class Crustacea, Order Decapoda) (p. 105) (File 271).
21) *Tettigonia* and *Acrida*: proposed validation as from Linnaeus, 1758 (application submitted under *Opinion* 124), (pp. 106–118) (File 328).

2. The present notice is given in pursuance of decisions taken, on the recommendation of the International Commission on Zoological Nomenclature, by the Thirteenth International Congress of Zoology, Paris, July 1948 (*Bull. Zool. Nomenclature,* **4**, 51–56, 57–59 [1950]; *ibid.,* **5**, 5–13, 131).

3. Any specialist who may desire to comment on any of the foregoing applications is invited to do so in writing to the Secretary to the International Commission, 28 Park Village East, Regent's Park, London, N. W. 1, Eng., as soon as possible. Every such comment should be clearly marked with the commission's file number as given here.

4. If received in sufficient time before the commencement by the International Commission of voting on the applications in question, comments received in response to the present notice will be published in the *Bulletin of Zoological Nomenclature*; applications received too late to be so published will be brought to the attention of the International Commission at the time of the commencement of voting on the application in question.

5. Under the decision by the International Congress of Zoology specified in paragraph 2 above, the period within which comments on the applications covered by the present notice are receivable is a period of 6 calendar months calculated from the date of publication of the relevant part of the *Bulletin of Zoological Nomenclature.* The four parts now in question were published on April 20, 1951. In consequence, any comments on the applications published in those parts should reach the Secretariat of the International Commission at latest by October 20, 1951.

FRANCIS HEMMING
Secretary to the International Commission
on Zoological Nomenclature

May 11, 1951

Protochemical Cells

ELECTROCHEMICAL cells derive their energy in large part from oxidation-reduction reactions—that is, from electron exchanges. If, ~~however~~, an oxidizing and a reducing substance are directly mixed, the resulting electron exchange yields no available electrical work. In order to obtain such work from these chemical reactions, it is necessary to separate spatially the site at which oxidation takes place, the anode, from the site at which reduction is occurring, the cathode, and also to provide means for electron transport at these sites by metallic conduction.

In living cells metabolic processes involving oxidation-reduction occur, but these cannot be immediate energy precursors for bioelectric phenomena because metallic conductors are not available for the required electron transport.

Can electrical work arise from proton exchanges in a manner analogous to electron exchanges? That is, can it arise from acid base rather than oxidation-reduction reactions? Electrical work should appear if the sites at which protons are released and at which they are accepted are separated, and if protonic conductors exist.

The conductance of water, hydrogen ions (H_3O^+), and hydroxyl ions (OH^-) is due largely to proton jumps, similar to the electron jumps that account for metallic conduction. The glass "electrode" provides a familiar example of a proton exchange site which affects the electrical potential of the cell of which it forms a part. It is well known that a glass membrane does not function as a hydrogen ion electrode until it is properly aged in water. ~~The proton reaction at~~ the glass-solution interface may be written as

$$H_2O + H^+ = H_3O^+$$

or

$$OH^- + H^+ = H_2O.$$

These reactions are evidently analogous to the iodine-iodide electrode process,

$$I + \varepsilon^- = I\varepsilon^-,$$

for example, which takes place on the surface of an inert electron conductor such as platinum. The platinum serves to bring in or take out electrons, and the glass performs a similar function with protons.

Let us consider an isothermal electrochemical cell (*A*), consisting of a (platinum) hydrogen electrode, a solution containing hydrogen ions and chloride ions, and a silver-silver chloride electrode:

$$(A)\quad \begin{array}{ccccc} \text{(Pt) } H_2 & | & \text{solution} & | & \text{AgCl, Ag} \\ \text{(electrode)} & | & H_3O^+, Cl^-, \text{etc.} & | & \text{(electrode)} \\ & (a) & & (b) & \end{array}$$

At the surface (*a*) the reaction is

$$\tfrac{1}{2}H_2 + H_2O = H_3O^+ + \varepsilon^-$$

and at (*b*)

$$Ag^+Cl^- + \varepsilon^- = Ag^+\varepsilon^- + Cl^-.$$

The total potential of this cell depends on (*a*) the pressure of the hydrogen gas and the activity of the water and of the hydrogen ion constituent; (*b*) the