

SHORT COMMUNICATION

SCANNING ELECTROCHEMICAL MICROSCOPY BASED ON ION TRANSFER ACROSS IMMISCIBLE ELECTROLYTE SOLUTIONS[‡]

Theodros Solomon^{1,*} and A.J. Bard

Department of Chemistry and Biochemistry, University of Texas at Austin, Austin, Texas 78712,
USA

(Received April 15, 1997; revised May 16, 1997)

Abstract. A liquid/liquid interface at the tip of a micropipette, and across which ion transfer can take place, is used as a probe for imaging a metal substrate using scanning electrochemical microscopy. Images were obtained that were comparable in quality to those found using metallic ultramicroelectrode probes.

INTRODUCTION

Recently it was shown [1] that a micro-interface between two immiscible electrolyte solutions (micro-ITIES), and across which electron transfer can take place, can be used as a probe for substrate imaging using the technique of scanning electrochemical microscopy (SECM). Under properly controlled conditions, a micropipette containing a concentrated aqueous solution consisting of the oxidized and reduced forms of a redox couple can be regarded as analogous to a metal electrode at which interface an electron transfer can take place. This may then be applied as an SECM probe to image various surfaces. Micropipettes can now be easily constructed using commercial pipette pullers, so that the tedious routine of constructing metal ultramicroelectrodes, with the attendant problems of polishing, securing flat surfaces, etc. can sometimes be avoided.

In an attempt to broaden the versatility of micropipettes for SECM investigations, the possibility of using ion (rather than electron) transfer across the ITIES for SECM imaging was investigated. This preliminary communication reports on the results of SECM imaging using a micropipette and based on the transfer of I⁻ across the water-nitrobenzene interface.

Ion transfer across a liquid-liquid interface supported at the tip of a micropipette (with the aqueous (w) phase being inside the micropipette) has been investigated experimentally and theoretically by Girault *et al* [2-5]. Experimentally, the techniques of linear sweep and cyclic voltammetry have so far been used. The cyclic voltammogram for ion transfer at the tip of a micropipette is highly asymmetric, resulting from the nature of the diffusion process at the interface. Thus, ion transfer from inside the

[‡]Authors' contribution to commemorate the 10th Anniversary of *Bull. Chem. Soc. Ethiop.*

¹Permanent address: Department of Chemistry, Addis Ababa University, P. O. Box 1176, Addis Ababa, Ethiopia.

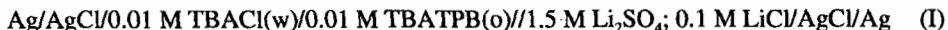
pipette to the organic (o) solution outside (w → o) may be regarded as being controlled by linear diffusion, whereas ion transfer towards the pipette from outside (o → w) is controlled by hemispherical diffusion. The cyclic voltammogram is thus peak-shaped for ion transfer (w → o), whereas a steady state current is observed for ion transfer o → w. As a result, it is often difficult to assess experimentally (using cyclic voltammetry) the reversibility of ion transfer. Furthermore, mass transfer for "ingress" (motion towards the micropipette from outside) is much faster than that for "egress" (motion from inside the micropipette to the solution outside), and hence the return scan for egress/ingress transfer is not clearly discernible in the cyclic voltammogram. For an ingress/egress transfer, the sweep rate dependence of the reverse peak does not increase in the classical manner with the square root of the sweep rate. In spite of such asymmetry, the voltammogram for ion transfer at the micropipette can be used as a basis for imaging in the "generation-collection" mode of SECM operation.

The principle of the generation-collection mode of SECM using a metallic ultramicroelectrode tip to image the surface of a substrate has been reported [6], so only a brief outline will be given of this principle as applied to ion transfer across the micro-ITIES.

In the substrate generation-tip collection mode, an ion that can transfer within the available "potential window" from the organic phase to the micropipette containing the aqueous phase, is electrochemically generated by the substrate, which is placed in the organic phase. The metal substrate is embedded in an insulator. The micropipette is held at the potential corresponding to the steady state current for diffusion of the generated ion from the organic phase to the micropipette tip. As the micropipette is lowered towards the metal substrate, the tip current increases corresponding to an increase in current due to the transfer of this ion from the organic phase to the aqueous phase. If, however, the tip is positioned away from the metal substrate, and above an insulator, no transferable ion immediately reaches the tip, and there is no current due to ion transfer. Thus at the boundary between the metal and the surrounding insulator, the micropipette tip senses a sharp change in current. This change in current is then used for imaging purposes.

EXPERIMENTAL

Tetrabutylammonium tetrphenylborate, TBATPB (Fluka), tetrabutylammonium iodide, TBAI (Fluka), tetrabutylammonium chloride, TBACl (Aldrich), iodine (Fischer), nitrobenzene (nb) (Mallinckrodt), lithium chloride (Alpha), lithium sulfate (MCB) were all used as received. Cyclic voltammograms for the cell:



with and without 1 mM I₂ or 1 mM TBAI in the organic phase were taken using the BAS 100 A Electrochemical Analyzer. The set-up for the SECM experiments was the same as that described previously [1]. The micropipettes were constructed from a glass capillary 1.2 mm o.d. and 0.68 mm i.d., and drawn to a sharp tip using a laser-based pipette puller (Sutter Instruments) to a size of 50 μm i.d. For the SECM experiments, a 2 mm diameter Pt disc electrode screwed at the base of a Teflon cell was used as a substrate. A bipotentiostat (Ensmann Instruments) was used in a 2-electrode mode both to generate I⁻ from I₂ at the Pt disc, and to set the tip potential corresponding to the I⁻ transfer. Prior

to SECM imaging, the tip potential was adjusted to a value of 0.30 V (Cell I, but with 1mM I_2 added in the organic phase) and the micropipette positioned on the Pt side of the boundary between the Pt and the surrounding Teflon insulator. The substrate potential was set to a value of -0.45 V (Cell II):



in order to reduce the I_2 to I^- . The micropipette was lowered towards the Pt substrate until a sharp rise in current due to the ion transfer $\Gamma(o) \rightarrow \Gamma(w)$ is detected. The downward vertical motion was then stopped and the tip scanned in the direction of the insulator until a sharp decrease in current was detected. Thereafter, the micropipette was scanned forwards and backwards over an area of 250 $\mu\text{m/s}$ (X-axis) x 100 $\mu\text{m/s}$ (Y-axis), at a scan rate of 25 $\mu\text{m/s}$ (X-axis) and 10 $\mu\text{m/s}$ (Y-axis).

RESULTS AND DISCUSSION

It was first necessary to select the potential at which I_2 is reduced to I^- at the platinum substrate. From the voltammogram of Cell II, a value of -0.45 V was chosen. Next, it was important to set the potential of the aqueous phase to a value suitable for the transfer $\Gamma(o) \rightarrow \Gamma(w)$. For this purpose, a study was made of the ion transfer process across the water-nitrobenzene interface supported at the tip of a micropipette using TBAI in the organic phase. The cyclic voltammograms for the supporting electrolytes (Cell I) and for the organic phase containing 1 mM TBAI are shown in Figures 1a and 1b, respectively. It is seen that addition of TBAI to the nitrobenzene solution produces an asymmetric wave which is due to the transfer of I^- . The steady-state positive current corresponds to the transfer $\Gamma(o) \rightarrow \Gamma(w)$, whereas the peak corresponds to the transfer $\Gamma(w) \rightarrow \Gamma(o)$. This voltammogram was used to determine the tip potential (at which iodide is transferable) to be used for the SECM experiment. A potential of 0.30 V (see Figure 1b) was selected for this purpose. As expected, the voltammogram was no different from Figure 1a when I_2 was added, (Cell III), since there is now no ion that can transfer across the interface within the available "potential window".



Although the formation of I_3^- in the organic phase is a possibility, this should not create any complication, since the potential of the aqueous phase in the micropipette was set to a value corresponding to the transfer of I^- (as ascertained by the experiment using TBAI). Besides, the potentials at which the two ions transfer across the water-nitrobenzene interface is very different, since

$$\Delta_o\phi_{I^-}^{w/o} = -0.195 \text{ V}, \quad \Delta_o\phi_{I_3^-}^{w/o} = 0.242 \text{ V} \quad [7].$$

The SECM image of a part of the Pt disc and a part of the surrounding Teflon insulator is shown in Figure 2. It is seen that the image fairly reproduces the actual situation at the boundary between the two surfaces, thereby proving that ion transfer in the substrate generation-tip collection mode of SECM operation can successfully be used for substrate imaging.

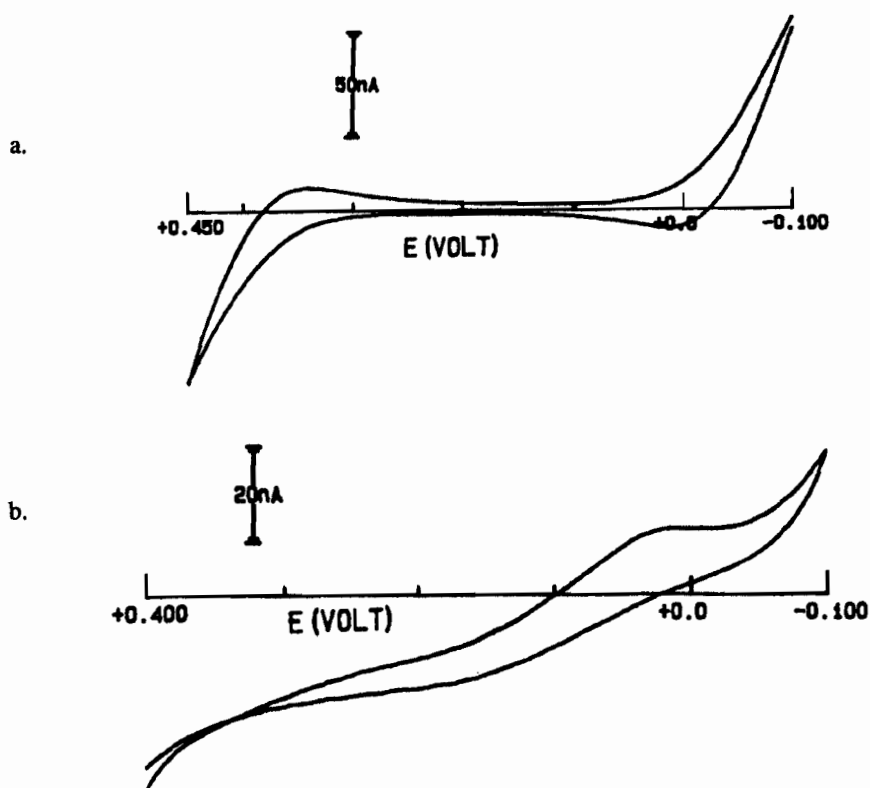


Figure 1. (a) Cyclic voltammograms of the cell: $\text{Ag}/\text{AgCl}/0.01 \text{ M TBACl}(\text{w})/0.01 \text{ M TBATPB}(\text{nb})//1.5 \text{ M Li}_2\text{SO}_4; 0.1 \text{ M LiCl}/\text{AgCl}/\text{Ag}$ (sweep rate 25 mV/s); (b) same as (a), but with addition of 1 mM TBAI in the organic (nb) phase (sweep rate 10 mV/s).

A few remarks may be made about the application of this technique. Most ions whose $\Delta G_{tr}^{o \text{ w} \rightarrow \text{o}}$ are tabulated in the literature are not electroactive, and hence cannot be generated at the substrate, (e.g. ClO_4^- ; tetraalkylammonium ions, etc.). A few, even if they are electroactive, have values that lie beyond the available potential window (e.g. Br^- , Cl^- , etc.). However, there are some ions that act as mediators for electron transfer which can be used for ion transfer studies. Examples are the viologens; in fact, the transfer of methyl and heptyl viologens across the water-nitrobenzene interface has been

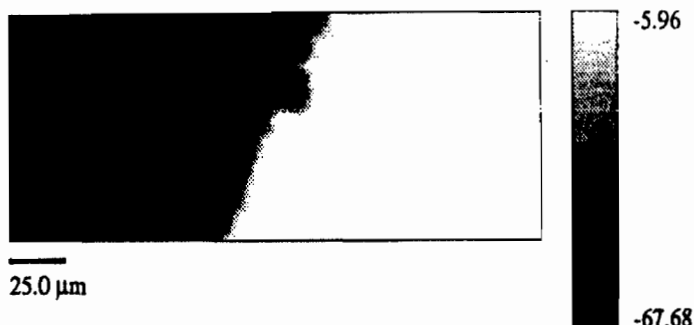


Figure 2. SECM image of a Pt disc (white zone) embedded in Teflon. Tip potential: 0.30 V; substrate potential -0.45 V (1 mM I_2 added in the organic phase).

reported [8]. Another is $Ru(bpy)_3^{2+}$, which is not only electroactive, but also transfers across the water-nitrobenzene interface with a standard Gibbs energy of transfer close to that of TBA^+ .

In conclusion, micropipettes that support liquid-liquid interfaces across which electron or ion transfer can take place, can have broad usefulness as probes for SECM imaging. Future work will report on their use for imaging a variety of substrates, including e.g. interdigitated electrodes.

ACKNOWLEDGMENT

T.S. would like to acknowledge the USIA and CIES for a Visiting Fulbright Scholar Award.

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**10TH ANNIVERSARY OF THE *BULLETIN*
OF
THE CHEMICAL SOCIETY OF ETHIOPIA
(June 1987 - June 1997)**

**Anniversary Symposium
June 13, 1997, Faculty of Science, Addis Ababa University**

Editor's Note. The Executive Committee of CSE decided to publish *The Bulletin of the Chemical Society of Ethiopia* in June 1987. The biannual Journal is peer-reviewed and publishes all aspects of research papers in both basic and applied chemistry. The research papers published in the Journal are indexed and abstracted in major services including Chemical Abstracts, Chemistry Citation Index and Environmental Abstracts. Since its maiden issue in June 1987, the Journal has been regularly published for the last ten years.

The Tenth Anniversary of *The Bulletin of the Chemical Society of Ethiopia* was celebrated during June 13-14, 1997. A half-day Symposium entitled "**The Role of Chemical Societies in Fostering Chemical Science and National Development**" was held on June 13, 1997. In the meeting, British Council Ethiopia financially supported to bring Dr J. D. Smith of the University of Sussex (UK) to deliver a lecture entitled "The Royal Society of Chemistry for Science and Humanity". Three Scientific lectures were also presented in the Symposium by Professor Theodros Solomon and Dr Ermias Dagne of the Department of Chemistry, (AAU) by Professor Kurt Kalcher of Karl Franz University, Austria,. The lectures of Dr Smith and Prof. T. Solomon are published in this issue. For the occasion, a two-day Exhibition on "Science Publications and Publishers" was also organized concurrently during June 13-14, 1997. June 13-14, 1997 at Faculty of Science, Addis Ababa University. The participating institutions were The Chemical Society of Ethiopia, Department of Chemistry (AAU), AAU Science Library, AAU Book Centre, Berhanena Selam Printing Enterprise, Mega Publishers British Council Ethiopia, ACPSERIC, PC House, ETCON and Longmans.

Due to reasons beyond our control, Professor Berhanu M. Abegaz could not attend and give his lecture at the Symposium. As part of the Anniversary commemoration, his lecture on "Scientific Societies in the Advancement of Science" is scheduled for July 23, 1997.

On the Symposium, an opening address was made by Dr Gezahegn Yirgu, the Associate Dean of the Faculty of Science, AAU. Congratulatory messages from H.E. Ato Asrat Bulbula, Commissioner of the Ethiopian Science and Technology Commission (ESTC), Professor Berhanu Abegaz and Dr Wendimamegn Mammo (former Editor-in-Chiefs of the *Bull.Chem.Soc. Ethiop.*), Dr Fikru Tafesse (Lesotho, Advisory Board Member) as well as from the Ethiopian Scientific Society (ESS) in North America, were read.

MESSAGES TO 10TH ANNIVERSARY OF THE BULLETIN OF THE CHEMICAL SOCIETY OF ETHIOPIA, held on JUNE 13, 1997.

I. Opening address by Dr Gezahegn Yirgu, the Associate Dean of the Faculty of Science, AAU

Dear Dr Negussie Retta! President of CSE, Symposium Participants!

I am honoured to speak, on behalf of the Ethiopian Scientific Community, to address this important meeting organized to commemorate the 10th Anniversary of the *Bulletin of the Chemical Society of Ethiopia*. The Chemical Society published its maiden issue of Vol 1 No. 1 in June 1987 and, since then, it appeared regularly biannually to Vol 10 No 2 in December 1996. When the maiden issue was published in 1987, several members of the Ethiopian Scientific Community questioned the sustainability of publishing due to several limitations that would possibly hinder the process, such as finance, housing, critical mass of experts for the Editorial Board members and local researchers in the different subdisciplines of the field, as well as manpower that would handle Journal. All these important parameters did not deter the *Bulletin of the Chemical Society of Ethiopia* from appearing biannually for the last ten years and, therefore, one of the main themes of the Chemical Society is achieved. Two of the Societies objectives are clearly expressed in the Bylaws of the Editorial Board of the Journal: (1) to serve as a communication and information medium among professionals in chemistry and related fields, and (2) to communicate original research findings and to disseminate new ideas, and inventions in chemistry and related fields. These are directly in line with the objectives of the Society.

It is evident that similar statements are expressed in the aims of the other

professional Societies. If professional societies play the universal role of information media and communication of original research findings, they can be truly regarded as vehicles of research and development.

The level of Development and Scientific advancement of a Nation usually correlates with the size and the level of activities of its Technological and Scientific Societies. This can be easily exemplified by the giant and very influential American and European Scientific Societies. I am quite sure this will be very much highlighted by the speaker delegated by the Royal Society of Chemistry and I do not have to further elaborate this matter. On the basis of the Ethiopia's underdevelopment in Technology and Science, therefore, it may appear that the publication of the *Bulletin of the Chemical Society* is a paradox. One can easily conclude that the sustained publication of the journal should, therefore, be attributed to the strong leadership of the Chemical Society, the diligent effort of the Editorial Board and the International Scientific Society that renders service to the Journal, both as International Advisors and Referees. I give my admiration to the first Editorial Board of the Journal which, from the outset, has carefully selected high-caliber scientists and convinced them to serve in the interest of the *Bulletin of the Chemical Society of Ethiopia*.

The Society obtained continued support from the major donors, the Swedish Agency for Research Cooperation with Developing Countries (SAREC), through the Ethiopian Science and Technology Commission, and the Research and Publication Office of Addis Ababa University (Ethiopia) and obviously, finance would not have been earmarked by the this donors unless they are satisfied by the activities of the Society.

In regard to scientific publications in Africa we note that the continent quite heavily relies on research communication media of other continents. In light of this, it is interesting to note that the Bulletin is the only major chemistry journal in Africa, other than the South African Journal of Chemistry. About 82% of the papers in the

Bulletin of the Chemical Society of Ethiopia are submitted from African Researchers. As also clearly reflected by the contributions of the papers, the African Scientific Community has obviously gained confidence in the *Bulletin of the Chemical Society of Ethiopia* and, in this connection, it is my wish that it will still be the major Chemistry medium for Africa and witness commemoration of its 20th Anniversary by the year 2007. It is my wish again that this important Scientific publication of the Society will make the Society, a centre of excellence in Africa to launch a Journal of Chemistry devoted to the Continent.

I am quite confident the experience of the Chemical Society of Ethiopia is a lesson to other Ethiopian and African Scientific Societies and the Society will share its immense experience to those which consider journal publications in the future.

In the name of the Faculty of Science of Addis Ababa University and the Ethiopian Scientific Community, I would like to express my heart-felt congratulations to the Chemical Society of Ethiopia for having taken such an exemplary undertaking of Scientific publication.

Finally, I would like to thank the Society for giving me this opportunity to give a key-note address and I declare the Symposium open.

Thank you.

II. Message from H.E. Ato Asrat Bulbula,

Impressions from ESTC on the 10th anniversary of the *Bulletin Bull. Chem. Soc. Ethiop.*

Mr President,
Participants of the Symposium,

On behalf of Ethiopian Science and Technology Commission and that of my own, I would like to extend to all of you a very cordial welcome to the Symposium which is dedicated to mark the 10th anniversary of the *Bulletin of the Chemical Society of Ethiopia*.

Mr President,

The influences of S&T professional associations and their publications on development and societal matters have an impact beyond the geographical boundaries of nations. The initial take off of societies towards focusing on development problems on a global scale was attained in New Delhi in December 1980 at a seminar organized by the American Associations for the Advancement of Science (AAAS), the Indian Science Congress Association (INSA), and the Indian National Science Academy (INSA). One hundred participants drawn from 35 countries representing various professional associations attended the seminar. The over-all discussions and recommendations were geared towards devising means for the participation of professional societies in solving development related problems in areas of applied research and development, in scientific and technical information, education, training, planning and evaluation. Since then, societies have tried to convince their respective governments to let them involve in S&T research and policy making activities.

The relationship of these societies has also strengthened through the exchange of their publications. They have set their own standards for the registration of journals on international citations so that these publications could be circulated beyond their geographical boundaries.

Nationally, these associations/societies bestow a large portion of the non-financial rewards to professionals since they publish research papers, provide fellowship and prizes, convene professional meetings and conferences. In addition, they participate in setting professional standards and provide continuing education in their specific fields of interest. Associations attract the best talents that the nation has, and can also serve as referral points to their governments on policy and development issues.

Thus, the rationale for bringing the capabilities of professional associations to have a constructive bearing on societal and development problems is justifiable. Besides, efforts in using S&T for development may hardly be significant unless it recognizes and respects the role that professional associations can play in this regard.

Societies compress a reservoir of individual scientists and technologists with specialized knowledge, experience and expertise that can be mobilized to accomplish specific tasks. They can devise a peer review system to evaluate research proposals, projects and outputs to as to enable development or service institutions to effectively utilize their limited resources. Since they constitute a vital portion of the scientific and technical infrastructure of a country, they can be involved in the process of identifying research and development needs and priority areas of national development programmes and strategies.

Professional associations/societies can also contribute to educational development activities. They can assist in curriculum formulation and publication of educational

materials. They can play a commendable role in educating the general public regarding the importance of Science and Technology through the various media. They can inculcate interest and appreciation to S&T among the youth by popularizing their specialized field of interest through school clubs. Of the 54 professional Associations on our record today, The Chemical Society of Ethiopia is one of the strongest and senior scientific societies in the country.

Mr. President,

Seen from the above perspectives and by all standards we have at the Ethiopian Science and Technology Commission, CSE has proved its worth through regularity not only in the issuance of its Bulletin but also in maintaining its high scientific standard and which, we are proud to acknowledge, has been indexed and abstracted by chemical abstracts, chemistry citation Indexes and Environmental Abstracts.

We believe the *Bulletin of the Chemical Society* and its sisterly newsletter, *SOLUTIONS*, have important role to play in the dissemination of the technology in the field.

Other areas of its important activities are the numerous workshops and symposia it has been able to successfully organize for the exchange of views and experiences on issues related to chemical technology.

With this regard and including all other activities of the Society, I would like to give you the assurance of the support from the Ethiopian Science and Technology Commission.

Finally, Mr Chairman, friendship and partnership would be a mere word were it not underpinned by institutional and personal contacts. Constructive dialogue and the readiness to listen to and help each other. Such is, I hope, the purpose of this

symposium and the spirit by which, I do hope the proceedings of this symposium will be guided.

Mr. President! The Commission will always be behind you.

Thank You
Asrat Bulbula
Commissioner, ESTC.

III. Message from Professor Berahnu Abegaz (founding President of CSE and the founding Editor of the *Bulletin of the Chemical Society of Ethiopia*).

Dr Negussie Retta, President of CSE,

It seems that our efforts to enable me to attend the Tenth Anniversary Symposium of the *Bulletin of the Chemical Society of Ethiopia* have become unsuccessful. Please allow me to express my sincere gratitude to you and your colleagues in the leadership of the Society for all the efforts you made in this regard. I am, therefore, following your suggestion to convey the following message through you to the symposium participants

It is with a great sense of respect and admiration that I send to you my best wishes and greetings on this June occasion marking the Tenth Anniversary of the *Bulletin of the Chemical Society of Ethiopia*.

About 14 years ago some forty-odd chemists from the various administrative regions of Ethiopia met and decided that a National Society of Chemists be established and affixed their signature to a document which formed the legal basis for the founding of The Chemical Society of Ethiopia. I was one of them. I was given the special privilege of chairing the ad-hoc committee that was charged with the responsibility of registering the Society. This was done over a period of just under a year and we soon organized the inaugural

conference of the Society in the city of Nazareth in 1984. I served as the founding President of the Society and in 1986 the Presidency passed to the more able shoulders of Ato Berhane Mewa.

Ato Kedir Ibrahim was the first Editor of the Society and the Chemistry Newsletter was launched during his term. When I took after him, I was assigned the task of establishing a peer-reviewed publication. An Editorial Board was established and in 1987 the *Bulletin of the Chemical Society of Ethiopia* was launched. Some of our own colleagues and friends were initially sceptical about the wisdom for starting a peer reviewed publication. Among them were some who had not been in favour of starting the Society four years earlier. Many felt that chemical science had not developed in the country to the level of maintaining a journal, and still other argued that there were so many journals in the World that one can hardly justify the launching of yet a new publication. The Chemical Society of Ethiopia has proved itself as a viable professional society and its publications: Chemistry Newsletter, the *Bulletin and Solutions*, have not only met the needs of national chemists but also those of other scientists in the region.

Mr. President! It pleases me immensely to see that in the two and half years since I left the position of Editor, the *Bulletin* has made great progress. It is therefore, very proper that I congratulate the members of the subsequent Editorial Boards for a job well done.

The *Bulletin* has become a symbol of progress of chemical sciences for Ethiopian chemists. No other publication of chemistry in Africa has achieved the level of regularity and excellence that the *Bulletin* has. Analysis of the authorship of papers over the past ten volumes, published by the Society reveal that *ca* 80% of the authors are from outside Ethiopia and the vast majority of these are from other African

countries, notably from Nigeria, Kenya, Egypt, etc. This suggests that the Bulletin has also responded to the needs of other scientist in Africa. Although I was very intimately involved in the creation and launching of the Journal and its production for the first 6-7 years, having spent the last two and half years in Southern Africa, I have also had the opportunity to observe it form outside. I can now attest to the high regard that scientists and libraries have for this publication. Scientists, who have no knowledge of my involvement in the early years, have expressed their congratulations. Some of them have intimated the contradictions they felt upon listening to the grim image of Ethiopia by the international news media, on the one hand, and on the other, by the quality and regularity of the journal over so many years.

This symposium will give a special opportunity not only for retrospective reflection of the past ten years but also to develop a vision for the future. We should identify the most strategic areas for engagement through the most effective ways of disseminating chemical knowledge. CSE may want to consider diversification of its publications. Chemical Education and Popularization of Science are areas that should warrant greater focus in the future. The World is said to be going through the era of information revolution through the emergence of new technologies. We should use these technologies and use them creatively for new and better ways of nurturing the growth of chemical sciences. CSE is one of two or three Societies in Africa with extensive knowledge and experience in the generations, processing and dissemination of information in the chemical sciences. I should, therefore, expect subregional and regional initiatives to come from many other directions other than itself and its likes. Electronic publishing, forming links

and partnerships with other societies, co-publishing, even merging publications, and produce different issues of the same volume from various localities in a synchronous manner may be worth considering.

Mr President! Just before I finish, I should use this opportunity to acknowledge various persons and bodies for the contributions they made during my tenure as Editor. Foremost would be the hard work and dedication of the members of the Editorial Board, the support given by the members of the Executive Committee of the Society over the years, the patrons and donors that gave financial and other materials support, the international reviewers who refereed papers, the authors who had confidence in the Bulletin and many more. All the above should be credited and recognized for the Bulletin is truly a shared achievement. It would be difficult to mention by name all those who gave critical support to the success of the Bulletin. But I humbly request permission to name only one person, the late Ato Gebeyehu Dagnew who was a senior official at the Educational Materials Production and distribution Agency (EMPDA) of the Ministry of Education. Ato Gebeyehu's support and encouragement was so indispensable, that it would be difficult for me to imagine the difficulties we would have faced without his support. We counted on him - and he delivered what we asked, invariably going far beyond the call of duty of his position. He was such a source of inspiration to me that I want to pay a special tribute to him.

Mr President, may Ato Gebeyehu Dagnew's soul rest in peace!

Thank you
Berhanu M. Abegaz
Professor of Chemistry,
University of Botswana

IV. Message from Dr Wendimagn Mammo, on Sabbatical leave in Gotenberg, Sweden.

Dr Ghirma Moges
Editor-in-Chief
Bull. Chem. Soc. Ethiop.

Dear Dr Ghirma,

I hope the Symposium on the Role of Chemical Societies in Fostering Chemical Science and national Development and the Science Publications and Publisher Fair which you are going to conduct in connection with the 10th Anniversary of the *Bull. Chem. Soc. Ethiop.* will be a great success.

Ten years ago when the first issue of the Bulletin appeared, many thought that it was a rather ambitious endeavour and the Volume 1 number too would never see the light of day. They were all wrong. Ten volumes and twenty issues later, the Bulletin is now on the verge of celebrating its tenth anniversary. I believe that our experiences were rather rare considering the challenge of producing a "world-class" journal in a developing country. Past and present editors and editorial board members and all others who have been associated with the Bulletin in one form or another have to be commended for the great job they have done to ensure that the Bulletin appeared regularly and that it maintained a high academic standard.

A question I frequently ask myself is: "Would the Bulletin have ever taken off the ground if it were not for the vision, relentless effort, dedication and devotion of Prof. Berhanu Abegaz?" My answer is no. I had the honour of working with Prof. Berhanu for several years and have witnessed how much of his valuable time and energy went into the Bulletin. If it were not for his professional competence, editorial skill, and leadership there would

have been no *Bull. Chem. Soc. Ethiop.* today.

Over the years we have acquired a lot of experience and skill in journal production. Anybody who goes through the past issues of the Bulletin would witness that we have come a long way. Our recent efforts to institutionalize the activities of the Bulletin are beginning to take effect. I am now, more than ever, confident that the future of the Bulletin is secure. I hope it will remain to be a major chemistry journal in Africa and a constant source of pride for all those who are associated with it.

Yours sincerely,

Wendimagn Mammo
Gotenberg, Sweden.

V. Message from Dr Brook Lakew, President of the Ethiopian Scientific Society (EES) in North America,

Greetings,

In this year of the 10th Anniversary of the *Bulletin of the Chemical Society of Ethiopia*, the first thing which comes to our mind is that the Chemical Society of Ethiopia (CSE) is one of the most active societies in the Country. That its members have, against all odds, tried to champion the role of scientific research and education in general and particularly the role of chemistry as an engine of industrial and economic development and social progress.

The *Bulletin* of the CSE, a publication of international stature, a publication which has carried papers authored by scientists from many continents, is a perfect example of the visionary work started 10 years ago by Prof. Berhanu Abegaz and his colleagues.

Scientific societies are truly a metric of how developed and economically advanced

a nation is. The US, Japan and many other nations (including India) have hundreds and thousands of scientific societies, clubs, forums, magazines, groups with a multitude of journals, regular conferences...etc. These scientific groups provide the nurturing environment that produces outstanding scientists and new and innovative ideas.

In the world of sports, Ethiopia's track and field runners, are worldwide celebrities, and no competition is considered worth following unless the Ethiopians are there. When one looks closely at how a steady stream of world class athletes are produced, one finds that besides extensive training, there is a critical mass of world class runners within Ethiopia proper to provide for real international level competition; to provide role models and support. Without this critical mass, it is impossible to imagine the decades of success Ethiopian athletes have enjoyed in international sports events.

Similarly, without a critical mass of organized scientists who interact, who support each other and whose ideas and assumptions are nurtured or challenged within a society, it is impossible to imagine in Ethiopia the pursuit of science at the level of advanced nations.

The new advances in telecommunications have created opportunities and challenges for all people in the world. The exponential advances in chemistry, physics, biology, astronomy, computation.... are making the already wide gap between developed nations and countries such as Ethiopia, even wider every day. Catching up is becoming an Olympian task.

The challenges to Ethiopian scientific societies are many and difficult. They include, among others, challenges:

1. To organize scientists in viable institutions that will last for the decades to come and provide the optimal medium for their members. Institutions which will also become advocates for science in the nation.
2. To link with modern telecommunications Ethiopian scientists, students and educators to their peers in other parts of the world and end their isolation. Publishing quickly bulletins (like the CSE bulletin), newspapers and other materials on the World Wide Web; exposing discoveries and activities on a global forum can now be done in a cheaper and faster way. Papers can be reviewed by scientists on other continents who are now an e-mail message away. Discussion forums can be started on the Internet with members linked by a computer server linking Ethiopian chemists, physicist, computer experts the world over. The ESS currently sponsors such a forum between the Addis Ababa University's Computer Science Department and computer experts abroad. The server is in the US.
3. To find mechanisms to generate revenues to cover their expenses in an accountable manner. Annual revenues and expenses could be posted on the World Wide Web, for transparency, which in turn may encourage potential sponsors.
4. To hold regular visionizing sessions, during which, members are asked to think about the future, to brainstorm and focus on where they see their discipline and Ethiopia to be in 30 years from now. Visionizing seminars like "Ethiopia Chem 2050" could be envisaged.
5. To chart an achievable path to the visionized end with clearly identified sub-goals that the current generation of scientists could reach and be proud of and be rewarded for.
6. To devote some of their energy toward state-of-the-art research and education in order to have credible reputation in

the world arena. A guarantee for quick linkage with foreign institutions and end isolation. Which in turn could result in a net flow of funding and researchers from the world over. As it is hard to catch a running horse by the tail but easier by its neck, Ethiopia needs to do some level of research and education in advanced, current technical and scientific fields or it will trail forever.

7. To design a mechanism to reward the best and the brightest in each scientific field in order to produce role models for the young and also to encourage achievers to achieve even more.
8. To look into distant education with the aim of not only continuously educating their members, but of interacting with peers elsewhere, giving classes to other parts of Africa and the world from a site in Ethiopia.

The previous list is by no means exhaustive but intended to generate discussions along those lines. In the 21st Century Ethiopia will either be a net exporter of knowledge and information or it will remain dependent and poor.

It has been said by many, including

President Clinton in a recent speech last month that the 'last 50 years were the years of physics, the next 50 years will be the years of biology'. This in reference to the explosive advances in genetic engineering, human genome mapping project etc. Biochemistry and its many sub-disciplines seem to be slated for explosive growth and may be the CSE could be looking into harnessing these advances for making Ethiopian science even more visible and vibrant.

The challenges are immense, and the opportunities even greater. Since Abebe Bikila and the numerous athletes who followed have done it in sports, it should be possible to make an Olympian effort. An effort that does not end in a few years but in decades and win the gold for the current generation and many others for the coming one. Again, we wish a happy anniversary to the CSE *Bulletin* and may God help us get there-where we want.

Congratulations to Prof. Berhanu Abegaz and all his colleagues at CSE.

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