CHAPTER

9

Preparation of a Neurosurgical Manuscript, with Emphasis on Library Research

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DISCLAIMER

Procrastination is the curse of medical writing. Writer's cramp and myopia pale by comparison.

I was reminded of this again today, when I began to prepare the present chapter. I had postponed the starting time to late on the last possible day. Then, when I saw that no natural disaster or major illness was going to remove me from this obligation, I began to assemble paper, pens, and dictionary. I welcomed the diversion of an hour-long telephone conversation with an insurance salesman, and I even straightened up the den before returning to my desk. The two preliminary paragraphs consumed an hour in the first draft. I rewarded myself with two trips to the refrigerator. Finally, after waiting in vain for additional inspiration, I stopped for the evening.

I can only offer advice about how to prepare a medical manuscript. I haven't yet been able to master the fine points myself. So, as preachers often tell their congregations, "Do as I say. Don't do as I do."

BEGINNING

The medical writer actually begins the manuscript long before he sits down to write. He starts with an idea or an assignment. For example, the clinician encounters a problem on the ward or in the operating room, the researcher is confronted by an unexplained phenomenon, or the teacher is asked to prepare an instructive review of a medical topic. Each of these individuals must then find out what is already known about the problem at hand.

The second step, that of consulting more experienced individuals and of reviewing the medical literature, is the biggest chore. But it is absolutely necessary! The same care must be spent in this phase as in creating the foundation of a building. Everything added on later rests on this background knowledge and in large part stands or falls according to the strength of the foundation blocks and their arrangement in respect to each other. And like the architect's reputation, the medical writer's

reputation is the direct result of whether his work is functional, beautiful, and enduring, or whether it collapses because of inadequate preparation, flawed materials, or poor workmanship.

In most medical manuscripts the references are listed at the end. This gives the appearance that the references are an afterthought or have been tacked on for completeness. In actual fact, the references are of major importance. The medical author needs to begin his project by finding out the existing knowledge to gain the most informed approach to the topic and to avoid reduplication of effort. Just as no good lawyer comes to the courtroom without knowing all the background information on his case, a medical writer must spend the necessary time and effort to become an authority on his subject. There is just no substitute for doing one's homework!

As the medical writer reads on a topic, he finds out who has been working in that area. It is then worth writing or speaking to those individuals to find out their current or unpublished thoughts, which may be more pertinent than their published articles from previous years. In addition, consultation with experienced and respected individuals in the same general discipline of medicine is usually worthwhile regarding the perceived importance of the problem under discussion, the reputations of the key people working in the area, the recollection of unpublished presentations or discussions on the subject, etc. This may help the neophyte put his project in perspective and interpret the existing medical literature. It may also supply him additional sources of information.

KEEPING CURRENT

Before discussing how to search the medical literature, I will consider briefly a related topic—namely, how a neurosurgeon maintains and updates his general knowledge in his field. In this era of rapid scientific advancement, an individual quickly falls behind without a conscious effort to continue his education.

Source

By being at the source of new developments, the neurosurgeon theoretically could remain "on the cutting edge" of medicine in general and neurosurgery in particular. In practice, this is not possible because no single medical center pioneers in all areas, and the neurosurgeon would spend all of his time travelling and visiting, with no time left over for his ordinary activities. Still, regular attendance at weekly neurosurgical conferences and occasional trips to other neurosurgical centers are worthwhile ways to stay current. The neurosurgeon who does this is rewarded with new information, but he must realize that it is raw material that has

not yet been adequately analyzed or received the test of time. It may be difficult for him to decide what has promise and what does not.

Meetings

Presentations at medical meetings and continuing education courses are usually more carefully prepared than those given at weekly conferences and, although the lag time is longer, the material has been analyzed more carefully by the time it is presented. Periodic attendance at medical meetings, especially those that permit discussion and audience participation, allows the neurosurgeon to hear about current developments and at the same time provides him some protection against erroneous or misleading information. Lists of upcoming meetings and courses of interest to neurosurgeons can be found in several general medical and neurosurgical journals (7). Each monthly issue of *Neurosurgery* contains such a calendar, with each January and July issue listing meetings for the subsequent 12 months.

Journal Articles

Journal articles have an even greater lag time than meeting presentations. Commonly, 6 to 12 months elapse between the completion of the project and the publication of the written report. However, the reader receives a more thoughtful and detailed presentation that has been subjected to peer review and editorial tailoring. The reader can refer back to it at any time, and the listed references permit the reader to find related material if he desires.

Over the years, I have found it helpful to scan the contents of a number of journals on a regular basis. The overall list of medical journals now published is overwhelming. For example, the Duke Medical Center Library receives 19 journals listed alphabetically between the *Journal of Nervous and Mental Diseases* and the *Journal of Neuro-Visceral Relations*, and 34 journals between *Neurochemical Research* and *Neurosurgical Review*. The list of journals scanned can be much smaller, of course, and Table 9.1 contains a list of journals that would be of interest to an American neurosurgeon.

I keep a checklist of the journals I scan and visit the library periodically to look at those to which I don't subscribe. Other papers come to my attention in various ways. I make an index card for each of the articles that is published in the *Journal of Neurosurgery*, *Surgical Neurology*, and *Neurosurgery*, and for any other interesting papers. I also obtain photocopies or reprints of a few papers each month that are of special value to me. I then file the cards and reprints by topic (Table 9.2). This system permits me to monitor the current neurosurgical literature. Fur-

TABLE 9.1

Journals of Interest to the North American Neurosurgeon

General Neurosurgery
1. *Acta Neurochirurgica*
2. *Journal of Neurosurgery*
3. *Journal of Neurosurgical Sciences*
4. *Neurochirurgia*
5. *Neuro-Chirurgie*
6. *Neurosurgery*
7. *Neurosurgical Review*
8. *Surgical Neurology*

Neurology or Several Disciplines
1. *Annals of Neurology*
2. *Archives of Neurology*
3. *Brain*
4. *Canadian Journal of Neurological Sciences*
5. *Journal of Neurology, Neurosurgery and Psychiatry*
6. *Journal of the Neurological Sciences*
7. *Neurological Research*
8. *Neurology*

Special Interest Areas
1. *Applied Neurophysiology*
2. *Child's Brain*
3. *Developmental Medicine and Child Neurology*
4. *Journal of Microsurgery*
5. *Journal of Trauma*
6. *Pain*
7. *Spine*
8. *Stroke*

thermore, the file cards and reprints accumulate like money in a savings account, and now after 20 years I have at hand a collection of references that provides me the basic material to prepare a talk or initiate a literature search on any neurosurgical topic without a lot of preliminary work. I recommend this or a similar system as a way of staying current and of facilitating the preparation of medical talks and manuscripts.

Recently the National Library of Medicine, through the MEDLINE system, has made available a monthly computerized search service called SDILINE. MEDLINE is the acronym given the on-line version of MEDLARS (Medical Literature Analysis and Retrieval System), and it provides computerized access to the articles in about 3000 current medical journals. The SDI in SDILINE stands for Selective Dissemination of Information. It provides a monthly printout of references in areas of an individual subscriber's interests. For a small fee (at the Duke Medical Center Library, this is $3.00 per month plus 15¢ for each page of references printed off-line), the individual's subjects are searched against the update portion of MEDLINE each month, and he is provided journal article and

TABLE 9.2

Topics for Neurosurgical Filing System

1. Neurosurgery in General; Neurosurgical Philosophy
2. History; Biography
3. Diagnostic Techniques; Neuroradiology
4. Operative Techniques
5. Neuro-ophthalmology
6. Neuro-otology
7. Cranial Nerves
8. Pain: Trigeminal Neuralgia
9. Pain: Other
10. Cerebellum and Posterior Fossa: Acoustic Neurinoma
11. Cerebellum and Posterior Fossa: Other
12. Third Ventricle: Pineal
13. Hypothalamus: Pituitary
14. CNS Infections
15. Craniocerebral Trauma
16. Intracranial Pressure; Cerebral Edema
17. Blood-Brain Barrier
18. Brain Tumors
19. Pseudotumor Cerebri
20. Cerebral Hemodynamics
21. Cranial Vascular Disorders: Cerebral Infarction; Cerebral Hemorrhage
22. Cranial Vascular Disorders: Microvascular Neurosurgery
23. Cranial Vascular Disorders: Angiomatous Malformations; Arteriovenous Fistulas
24. Cranial Vascular Disorders: Aneurysms; Subarachnoid Hemorrhage; Intracranial Arterial Spasm
25. Intracranial Venous Sinuses
26. Skull Base; CSF Rhinorrhea and Otorrhea
27. CSF Physiology and Cytology
28. Hydrocephalus
29. Congenital Anomalies: Dysraphism
30. Congenital Anomalies: Craniovertebral Junction Anomalies
31. Congenital Anomalies: Other
32. Degenerative Disc Disease and Spondylosis
33. Spine: Injuries
34. Spine: Tumors
35. Spine: Other
36. Peripheral Nerves
37. Autonomic Nervous System
38. Epilepsy
39. Functional Neurosurgery: Behavior
40. Functional Neurosurgery: Dyskinesias
41. Functional Neurosurgery: Other
42. Neurology
43. Neurophysiology, Neuroanatomy
44. Neuropathology
45. Neuroanesthesiology
46. General Surgery and Medicine

book chapter references from the most current issue of *Index Medicus* before that issue even arrives in the library.

Reviews, Tapes, Indexes, and Abstracts

Reviews, tapes, indexes, and abstracts may also be of value to the neurosurgeon. Review articles on specific topics appear from time to time in medical journals and can be found by scanning journal contents. In addition, the *Bibliography of Medical Reviews* appears in the *Index Medicus* and in the *Cumulated Index Medicus.* Audio tapes of a variety of individual presentations from neurosurgical meetings are made available commercially within a few months after these meetings. In addition, yearly reviews of the neurosurgical literature are given at the annual meetings of the American Association of Neurological Surgeons and the American College of Surgeons and at the Cook County Review Course in Neurological Surgery.

Various indexes of the medical literature have appeared over the years, and these will be discussed below. Two of these have dealt specifically with neurology and neurosurgery. Unfortunately, the *Concise Clinical Neurology Review: CCNR* stopped publication in June 1980. It had been the more current of the two. The other index, *Neurosurgical Biblio-Index*, is published quarterly as a supplement to the *Journal of Neurosurgery* in cooperation with the National Library of Medicine. Through the use of MEDLARS, the *Neurosurgical Biblio-Index* lists neurosurgically oriented articles that have appeared in recent issues of some 2300 journals published throughout the world. The index listing appears several months to a year or more after the original article has been published.

Abstracts of neurosurgical articles are published in *Neurosurgery*, *International Abstracts of Surgery* (published with *Surgery, Gynecology, and Obstetrics*), and *Excerpta Medica* (Section 8): *Neurology and Neurosurgery.* These appear 6 months to more than 1 year after publication of the original article. Similarly, abstracts are published each year in the hard-cover *Year Book of Neurology and Neurosurgery*; the lag time is generally 1 to 2 years between the publication of the original article and the appearance of the abstract.

Books

Reviews of neurosurgical topics also appear in book form. *Advances and Technical Standards in Neurosurgery* and *Progress in Neurological Surgery* are two such series of books that have been published in recent years. The proceedings of numerous continuing education courses and medical meetings are also published each year, and some of these provide useful topic reviews for the neurosurgeon. Many are single volumes, but

some have appeared in series (*e.g., Advances in Neurology, Advances in Neurosurgery, Seminars in Neurological Surgery, Research Publications of the Association for Research in Nervous and Mental Diseases,* and *Cerebrovascular Diseases* (Princeton Conferences). *Clinical Neurosurgery* contains the invited papers that have been presented at the annual meeting of the Congress of Neurological Surgeons; each volume appears 1 year after the corresponding meeting.

Textbooks and encyclopedias (such as the *Handbook of Clinical Neurology*) are worthwhile as sources of basic information. However, these should not be viewed as current because of the greater than 1 year delay between preparation and publication.

Audiovisual Aids, Self-Assessment Examinations

Other sources of information for the neurosurgeon wanting to stay current include a variety of audiovisual materials and at least two self-assessment programs. The existing neurosurgical audiovisual aids have been catalogued by Dr. Courtland H. Davis, Jr., and plans are underway to have this Audio-Visual Index for Neurosurgery published. The Joint Committee on Education of the American Association of Neurological Surgeons and the Congress of Neurological Surgeons has also sponsored a self-assessment examination for neurosurgeons in conjunction with the Surgical Education and Self-Assessment Program Number 3 of the American College of Surgeons. This *SESAP-SANS III* examination has been subscribed to by more than 750 neurosurgeons. In addition, a commercially available continuing education series, *Contemporary Neurosurgery,* is now in its second year. Every 2 weeks the subscriber receives a review of a neurosurgical topic, with a self-assessment examination.

It is obvious from the foregoing presentation that a neurosurgeon has many avenues for staying current. These vary somewhat in format and timeliness, but all provide ongoing information about neurosurgical topics.

When he is faced with the need to find out more about a specific area, the neurosurgeon can begin with the material he has collected while keeping current. Then he needs to search the medical literature. During this process, the neurosurgeon will find pertinent references, and he may find it convenient to note these on previously prepared file cards (Tables 9.3 and 9.4). In this way, he will have the complete reference listing for later use in manuscript preparation (after he checks the citation against the original article for accuracy) and a notation of the source of the reference which is necessary if he wants to obtain the article through interlibrary loan. The compilers of indexes and abstracting journals may modify the original reference by omitting the names of authors after the

TABLE 9.3

Library Reference Card for Journal Article

Subject:

Authors:

Title:

Journal: Vol. ___, Inclusive Pages ___ – ___, Year ___
Reference Obtained From:
Notes:

(continue notes on back)

TABLE 9.4

Library Reference Card for Book Citation

Subject:

Authors:

Title:

Inclusive Pages: ___ – ___
Book Title:
Book Editors:
Publisher: City: Edition ___ Year ___
Reference Obtained From:
Notes:

(continue notes on back)

third author, shortening the title, and occasionally making mistakes. Therefore, it is imperative that the neurosurgeon obtain a copy of the original work and verify the accuracy of the citation and the content of each reference he uses.

SEARCHING THE LITERATURE

William Beatty, Librarian and Professor of Medical Bibliography at Northwestern University Medical School, stressed an important point with the title of one of his papers, "Searching the Literature Comes Before Writing the Literature." In that 1973 article (3) and an updated version in 1979 (4), Professor Beatty summarized the methods available to the physician who wishes to search the medical literature. The following remarks are based in large part on those two useful papers.

Quick Current Search

Abridged Index Medicus. For a quick search for a few recent references, the neurosurgeon can consult the *Abridged Index Medicus* or request a MEDLINE search at a medical library. The *Abridged Index Medicus* indexes 118 of the most frequently used English language journals by subject and author.

MEDLINE. MEDLINE (MEDLARS plus "on-line") provides computerized access to the articles in about 3000 medical journals for the current year and the 2 previous years. This search can be carried out in 15 to 30 minutes. Up to 25 references will be printed out for immediate use; a larger number can be printed out off-line at the National Library of Medicine in Bethesda, Maryland, and mailed to the searcher.

Other Computerized Lists. There are at least 38 other computerized data bases in the biomedical field, available through the National Library of Medicine (Bethesda, Maryland), BioSciences Information Service (Philadelphia, Pennsylvania), Chemical Abstracts Service (Columbus, Ohio), Excerpta Medica (Lawrenceville, New Jersey), Institute for Scientific Information (Philadelphia, Pennsylvania), Psychological Abstracts Information Service (Washington, D.C.), Smithsonian Science Information Exchange, Inc. (Washington, D.C.), Toxicology Information Response Center (Oak Ridge, Tennessee), and other organizations. In addition to those dealing with medical subjects such as epilepsy, several supply information about research grants (Table 9.5). Audiovisual materials catalogued by the National Library of Medicine can be found through AVLINE.

References Since 1960

The sources mentioned in the section "Keeping Current" can be used to start a search of the neurosurgical literature since 1960, and some of these sources also extend back before 1960. In addition to the *Neurosurgical Biblio-Index,* there are several other recurring bibliographies that might be helpful. *Parkinson's Disease and Related Disorders: Citations from the Literature* appears biweekly; *Epilepsy Abstracts* is published monthly; and both the *Cerebrovascular Bibliography* and

TABLE 9.5

*Computerized Grant Information**

I. For information on specific grants that are available	
A. FEDREG	On-line equivalent of *Federal Register Abstracts*, which summarizes the contents of the government's daily *Federal Register*. Includes announcements of available federal fellowships and grants as well as presidential proclamations and orders, proposed rules, new rules, notices, meetings, hearings, etc. File material dates from March 1977 to the present.
B. Grants	Describes over 1500 grants available from local, state, or federal governments, private foundations, associations, and commercial organizations. Grants are categorized under 88 broad subject fields (*e.g., medical education, medical research,* etc.) File is updated monthly to include notices of grants having application deadlines within the next 6 months.
II. For information on who awards the grants	
A. Foundation Directory	Gives data on more than 3000 foundations having assets of $1 million or more or which award, annually, grants of $100,000 or more. The foundations described represent 80% of all foundation giving in the U.S. Revised semiannually.
B. National Foundations	Covers more than 21,000 U.S. foundations. Supplements the Foundation Directory file. Revised annually.
III. For information on grants that have been awarded	
A. Foundation Grants Index	Lists grants awarded by over 400 major American philanthropic foundations. Grants less than $5000 and those to individuals are not included. File is updated with about 20,000 new awards each year and covers the period 1973 to the present.
B. Smithsonian Science Information Exchange (SSIE)	Contains summaries of research projects in all scientific areas funded by more than 1300 government, commercial, and private organizations. Projects described are being carried out currently or have been completed during the most recent two years. In addition to a brief report on the research, each record lists the investigators, agency performing the work, and the funding source and amount.

* Modified from Duke Medical Center Library listing.

Electroencephalography and Clinical Neurophysiology: Index to Current Literature appear quarterly.

Medical Subject Headings (MeSH). MeSH is published each January as a companion to the *Index Medicus.* It contains an alphabetical list of the words, normal and inverted phrases, cross-references, and symbols that are used to organize the *Index Medicus* and *Cumulated Index Medicus.* This list serves as a guide for the neurosurgeon who needs to look up material in the two indexes.

Index Medicus. Using the *MeSH* headings, the library researcher begins with the current monthly issue of *Index Medicus* and works back to the January issue. The *Index Medicus* covers both English and foreign-language journals. Under each topic heading, the English articles are listed first, in alphabetical order by journal title. Then the foreign language articles (set off by brackets) are arranged alphabetically by language. Within each language group the references are listed alphabetically by journal title. The *Index Medicus* contains numerous entries (there were approximately 245,000 citations in 1979), and it is an excellent source for references. However, only about 2600 of the more than 19,000 biomedical journals published throughout the world are indexed.

Cumulated Index Medicus. At the end of each year the *Index Medicus* listings are integrated and published together as the *Cumulated Index Medicus.* After the neurosurgeon has looked through the *Index Medicus* issues for the current year, he consults the *Cumulated Index Medicus* volumes in sequence back to 1960.

Science Citation Index. The *Science Citation Index* shows who is citing whom, and for this reason it is especially useful in finding out who has modified an operation, a diagnostic test, or some other procedure. It is published in bimonthly paperback issues and a hardbound annual cumulation each year. The *Science Citation Index* was begun in 1961 and now lists by author all the references cited in approximately 3000 journals and more than 1000 new books each year.

Meeting Guides. There are several guides that enable the neurosurgeon to locate papers presented at medical meetings. These include *InterDok (Directory of Published Proceedings), Index to Scientific and Technical Proceedings, Proceedings in Print,* and *Conference Papers Index.*

Guides to Books. Among the compilations of medical books in print, two are especially helpful. The *National Library of Medicine Current Catalog* is issued quarterly, with an annual cumulation. It indexes recently published books by subject and author. Bowker's *Medical Books and Serials in Print* is an annual list of English language medical books arranged by subject, author, and title. Since 1978, serials have been listed as well.

Translations. The neurosurgeon who wants to find an English abstract or translation of a foreign article can consult several sources. Many foreign journals include short English abstracts of their articles; this is noted in the *Index Medicus* and *Cumulated Index Medicus.* Abstracts of foreign neurosurgical articles appear periodically in *Neurosurgery* and in *International Abstracts of Surgery* (published with *Surgery, Gynecology and Obstetrics*). *Abstracts of World Medicine* was published between 1947 and 1971; *International Abstracts of Biological Science* has been published since 1954; and *Abstracts of Soviet Medicine* has appeared since 1957. *World Transindex,* currently in its third volume, has replaced the *World Index of Scientific Translations* (1967–1977).

The National Translations Center of The John Crerar Library in Chicago has some 200,000 translations on file, as well as the locations of more than 200,000 translations available from other sources. This center is the largest institution in the United States for information concerning English translations of foreign literature in the natural, physical, medical, and social sciences. A semimonthly magazine, the *Translations Register-Index,* lists the newly available translations by subject and source.

Guides to Audiovisual Materials. Until 1978, the *National Library of Medicine Current Catalog* contained information about films, cassettes, and other audiovisual materials. Since then, these have been listed in the *National Library of Medicine Audiovisuals Catalog.* In addition, AV-LINE offers a computerized access to the accumulated National Library of Medicine listings. As mentioned previously, Dr. Courtland H. Davis, Jr. has collected information about some audiovisual aids of interest to neurosurgeons.

References Before 1960

Many of the sources already mentioned in "Keeping Current" and "Searching the Literature: References Since 1960" extend back before 1960 and are helpful guides to the literature of that time. For example, *International Abstracts of Surgery* began in 1912; *Excerpta Medica,* in 1947; and *Bibliography of Medical Reviews,* in 1955. In addition, the following indexes are important guides to the medical literature before 1960.

Index Medicus. The first three series of the *Index Medicus* were published from 1879 to 1899, 1903 to 1920, and 1921 to 1927. *Bibliographia Medica* filled the gap from 1900 to 1902.

Quarterly Cumulative Index to Current Medical Literature. This was published between 1916 and 1926.

Quarterly Cumulative Index Medicus. This index replaced the *Index Medicus* and the *Quarterly Cumulative Index,* and was published between 1927 and 1956.

Current List of Medical Literature. The *Current List of Medical Literature* appeared between 1952 and 1959, and bridged the gap between the *Quarterly Cumulative Index Medicus* and the modern *Index Medicus* and *Cumulated Index Medicus.*

Index-Catalogue of the Library of the Surgeon General's Office, U.S. Army. This 61-volume series of books was published in five sets, from 1880 to 1895, 1896 to 1916, 1918 to 1932, 1936 to 1955, and 1959 to 1961. It indexed books as well as journal articles.

Developing the Reference Tree

After the diligent neurosurgeon has collected his references from the sources just discussed, he needs to obtain copies of these original papers and read them. It is surprising how many errors creep into the medical literature, and the surest way of keeping from perpetuating these errors is to consult the original articles.

Then the neurosurgeon needs to consult the references cited by these authors, and *their* references in turn. He repeats this sequence as often as necessary to follow each lead to its termination, like the branches on a tree. Only after he has read all of this material will the neurosurgeon have a reasonably complete background of information about his subject.

PLANNING THE PROJECT AND COLLECTING AND ANALYZING THE DATA

After he has researched his topic in the library (and not before!), the neurosurgeon can prepare his grant application, plan and execute his clinical or experimental research project, gather the facts about the technique or cases he wants to report, or write his subject review. If his project is thought out carefully from the beginning, it is likely to provide worthwhile information when it is completed. In fact, the project should be planned so that it *will* provide answers (positive or negative) to one or more questions. This is the best way to guard against equivocal results and indecisive conclusions. Careful planning will also make it easier for the neurosurgeon to later prepare any manuscripts or talks that grow out of his project.

Brilliant writing can't salvage a poorly planned experiment. Clarity and precision should be built into the project from the start—in the laboratory or on the ward. Based on the background knowledge gained from his search of the pertinent medical literature, the neurosurgeon must decide in the beginning what it is that he wishes to answer, solve, prove, or demonstrate. He must then decide how to accomplish his goal decisively, choosing the best methods, materials, statistical techniques, etc. for the purpose. After collecting the data carefully, he must analyze his results in the light of existing knowledge. He may then come to some conclusions about his work and make recommendations based on those conclusions.

Again, the key to success in this phase, just as in planning the project, is clear thinking.

WRITING THE MANUSCRIPT

Ethical Responsibilities

An author has several ethical responsibilities, as detailed by DeBakey and DeBakey (13). These responsibilities involve the areas of originality, scientific integrity, patient identification, copyright, authorship, literary form, and submission for publication.

Originality. In a strict sense, there is very little completely new material published in the medical literature each year. An author should avoid repeating something that is already known or that has already been done. Yet, an author may make a worthwhile contribution by extending our knowledge in some area, by altering a concept or technique, or by critically reviewing and interpreting existing information in a new way. He owes it to his reader not to waste his time. His material should contain at least some element of originality, just as it should be well worked up and well presented.

Scientific Integrity. The investigator-author has a duty to his patients and experimental animals, and also to his colleagues and to society. His research must be carried out in accordance with established ethical guidelines regarding patient safety, informed consent, avoidance of pain, etc. He also has the responsibility of reporting his own work, truthfully and accurately. He must not publish the work of another investigator without that individual's consent and without proper acknowledgment. He must be sure of the significance he attaches to his results, and should guard against premature publication.

Patient Identification. An author must protect the identity of the patients presented in his writings. Cases should be numbered consecutively in the report; patient initials and hospital numbers should be omitted. The author must obtain written consent from any person who can be identified in a photograph that is to be published.

Copyright. On January 1, 1978, a major statutory revision of United States copyright law became effective (17). It has expanded and clarified copyright practices. The new law clearly states that copyright in a work is held by the author or authors until it is transferred in writing. Journals such as *Neurosurgery* now require the transfer of copyright from the authors of a paper to the publisher before the paper is published. Also, written permission must be obtained from the original author and the original publisher for the use of previously published material such as illustrations, and for direct quotations of more than a certain length (*e.g.*, 6 printed lines or 50 words). Appropriate credit must be given in the

figure legend or text for borrowed materials. Even if a previously published illustration has been modified, this fact and the source of the original illustration should be noted.

Authorship. The list of the authors of a paper should include only those who had a significant role in planning and conducting the project and in preparing the report. "According to DeBakey's law, as the number of names in the by-line increases, the likelihood decreases that any but the senior author has participated in the actual writing" (13). Individuals or organizations that have provided major assistance, financial or otherwise, should be acknowledged briefly at the end of the article.

Literary Form. The author has an obligation to the reader to present material that is well researched, accurate, complete, and easy to read.

Submission for Publication. The author should submit a manuscript to only one journal at a time for consideration of publication.

Beginning the Manuscript

There are basically two ways to begin a manuscript. One may prepare an outline and then add flesh to the skeleton, or one may simply start writing. In either case, after the first draft is done it is wise to put it aside for awhile before rewriting it. Cycles of thinking and rewriting should follow until the manuscript seems to need no further work. Then it should be given to a knowledgeable friend for an outside opinion before the final draft. At least one of the early revisions should be devoted to eliminating useless words, phrases, and sentences. One of the later revisions should be to put the manuscript into the specific form required by the journal to which it will be submitted.

Different types of articles have different forms (15), and the tyro would do well to use a standard format for the type of paper he is preparing. The usual research presentation contains, in order, the title, authors and institutions, abstract, key words, introduction, materials and methods, results, discussion, conclusions and/or summary, acknowledgments, and references. However, when the author is planning and conducting his project, he actually gathers his material in a somewhat different order: introduction, references, authors and institutions, materials and methods, results, discussion, conclusions and/or summary, abstract, key words, title, acknowledgments.

Style

Accuracy and detail are more important in a scientific manuscript than is literary style. However, style helps get the message across. There are a number of excellent sources available to the medical writer concerning basic grammar, English usage, synonyms, scientific writing, and literary

style (1, 2, 5, 6, 8, 9, 12, 14, 16, 18–29, 32–42). These supply the guidelines, but the best teacher of medical writing is experience. Just as the neurosurgeon learns his operative technique mainly by operating, so he must learn to write by writing.

The successful neurosurgical author learns to write for a specific audience, choosing precise words and writing with words of action (nouns and verbs rather than adjectives and adverbs). He gives his words more impact if he uses the active instead of the passive voice. The reader's mind may wander if the author is redundant or writes with jargon (overuse of technical or scientific terms), clichés, or slang. Excessive wordiness, the use of multiple nouns as adjectives, and the use of nouns as verbs will also confuse and irritate the reader. To capture and hold the interest of the reader, the author should use short words and short sentences whenever possible, avoid technical terms when they are not necessary, and explain complex matters in such a way as to be educational but not patronizing (10, 11).

The writer should be as specific as possible. For example, "infarction in the right frontal lobe" is better than "cerebral infarction," which is better than "stroke," which is better than "CVA."

By all means, the writer should beware of making statements of priority. Palmer (31) has summarized this nicely in a letter to the Editor of the *Journal of the American Medical Association*. Palmer (31) concluded, "The point is that an author can *never* tell how many cases of any entity have previously been reported; no amount of library research will permit more than a rough guess." Furthermore, ". . . the author also must understand that, as important as the entity seems to him, others who have dealt with similar cases only rarely have bothered to write them up."

The writer must review his material to be certain that his word usage, spelling, and grammar are correct. DeBakey (10) tells the following story to emphasize the importance of punctuation. A visitor to a classroom observes for awhile and then writes on the blackboard, "The visitor thinks the teacher is a fool." The teacher replies simply by inserting two commas: "The visitor, thinks the teacher, is a fool." Just think what a difference it would make if you angrily replied to someone who was giving you a hard time, "Don't give me any of your lips!" Two commas or one letter can change things completely. The neurosurgical author must take the pains to write and rewrite carefully. He should take the same care in writing his papers as he does in treating his patients.

Specifics

Title. The title is the "name" of the final content of the manuscript. It is the guide for researchers scanning the literature and is the most widely

circulated part of the article. It is the portion cited in indexes and in the reference lists of other authors. Therefore, the author should choose the title carefully, making sure that it captures the essence of his paper (6).

Abstract. Next to the title, this is the most widely read part of the paper. It should be a capsule version of the article, usually less than 250 words in length. It must inform, not merely indicate. "It should contain, in brief, all of the salient information in the report and should be written so that, standing alone, it makes sense to one who will not read the article itself" (6). It must not contain material not covered in the paper (30).

Opening Sentence. This sentence, and the first paragraph, introduce the problem. It should be written in such a way that it will entice the reader into reading the rest of the paper.

"The experienced writer knows that he must lead his reader *to*, *into*, and *through* his article. He leads the reader to the article by his choice of title and by his abstract; he leads the reader into the article by his introduction" (6).

References. For various reasons, the reference list is the portion of a scientific paper most likely to contain errors. The author may not have ready access to a first-rate medical library, he may be too lazy to consult the original references, or he may copy the information incorrectly onto his index cards. He may leave this portion of his work to the end, and may at that point be tired of the project or in a hurry to meet a publication deadline. Frequently an author will take great pains to plan, execute, and write up his project, only to turn over the job of preparing the bibliography to his secretary, who probably has had no training as a medical librarian and little experience with manuscript preparation. A medical writer should check original sources and should avoid perpetuating errors of content and citation. Invalid references naturally raise questions about the credibility of the entire paper. If the paper has gone through several drafts, the author must check the final draft to see if the reference numbers are still valid.

Special Instructions. Every journal has its own format for abbreviations, weights and measures, drugs, radioisotopes, equipment, microorganisms, etc. The writer should consult the instructions for authors in the specific journal for which his paper is being prepared.

Final Draft. In preparing the final draft of his paper, the writer would do well to reconsider the medical expositor's ten commandments:

"1. Thou shalt not, unless circumstances be extraordinary, release for publication a paper that neither contains anything new nor sheds new light on something old.
2. Thou shalt not allow thy name to appear as a coauthor unless thou hast some authoritative knowledge of the subject concerned, hast participated in the underlying investigation,

and hast labored on the report to the extent of weighing every word and quantity therein.

3. Thou shalt not fail to place within quotation marks the words of another, nor shalt thou fail to verify the accuracy of thy quotations.
4. Thou shalt not consider that to alter the words of another frees thee from the obligation to credit that other with an idea that thou hast borrowed from him.
5. Thou shalt not publish a reference in such manner that the reader will think thou hast read a certain article if thou hast read only an abstract or paraphrase thereof.
6. Thou shalt not write to please thyself but to meet the needs of thy reader.
7. Thou shalt not publish, as if thou wert sure of it, that of which thou art not sure.
8. Thou shalt not allow one part of thy paper to disagree with another part thereof.
9. Thou shalt not mix categories.
10. Thou shalt not fail to verify, again and yet again, thy arithmetic" (23).

Before the final copy is typed, the author and his typist should reread the instructions to authors from the journal to which the manuscript will be sent. Special attention should be paid to:

a. Placement and length of abstract
b. Style of heads and subheads
c. Style and numbering (Arabic or Roman) of tables
d. Style and numbering of figures and figure legends
e. Form of references and their citation
f. Typing instructions
g. Number of copies to submit

Remember that neatness counts!

CONCLUSIONS

The neurosurgeon has many ways to stay current. If he keeps appropriate files as he does so, he will develop an excellent base of information on neurosurgical topics. If he then decides to prepare a manuscript on some aspect of neurosurgery, he will have some appropriate material to consult. Many more sources of information are also available to him, and he should consult as many of these as possible. This detective work is done primarily in a medical library. Using the available guides, the researcher can find an amount of pertinent information that is proportional to his effort. With sufficient work, he can piece together the necessary foundation for his manuscript, and if he takes equal pains to

plan and complete his own part of the project, he has the potential of producing a worthwhile report. Yet, that is not the end of it. He must continue to apply the same care to the preparation of his manuscript if he wants to finish with a paper that will be published and read, and that will be a source of pride to him.

To prepare a medical paper, the neurosurgeon must be able to think clearly, use resources, be creative, work under pressure, and make necessary changes to refine the finished product. These are the same attributes he relies on every day in his practice. Any neurosurgeon should be able to prepare a good manuscript. The raw materials and guides are all there. It just takes effort, time, and patience. Fortunately, the process gets easier with experience.

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