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# HOW TO WRITE

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and

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Inspiration, Perspiration ..... 20

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# The ABC's of Clear Writing

by

Loyd L. Turner

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You probably spend a great deal of time expressing yourself--or trying to express yourself--on paper. Why not do a better job of it by following a few down-to-earth principles--the ABC's of clear writing?

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ENGINEERING SUCCESS depends on the communication of clearly written technical information. Now, more than ever before, clarity in our written reports is a decisive factor in the success of our work.

THIS BOOKLET, reprinted from a Convair Fort Worth presentation prepared by Loyd C. Turner, may assist you in writing your reports. Some of the suggestions may help simplify and clarify your writing.

IF reading this booklet makes you more aware of the need for better, clearer, and simpler writing, it will have served its purpose.

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WRITING ..... for easy reading

There's no magic formula for good writing. In fact, getting ideas from your head into the other fellow's head by means of black marks on white paper is a downright difficult job.

It's a harder job than getting your message across by talking to him. When you're talking, you can see what kind of impression you're making. You can emphasize points by raising your voice or pounding the table. You can smile, gesture, and so on to help get your meaning across. And if there's still some doubt, your listener can ask questions.

But when you're writing, you generally don't have a second chance. For good or bad, the words are down on paper. And you're stuck with them, regardless of whether your reader gives them a meaning totally different from what you had in mind.

This booklet will help you get your meaning across in writing. And in your writing at Convair, meaning is all-important. If you write something that your readers don't understand, or something they misunderstand, you have failed as a writer.

And what's worse, you have caused confusion and have wasted time and effort. Not only your time and effort, but the time and effort of everybody who tries to figure out what you had in mind.

This booklet assumes that you have a working knowledge of informal everyday English. That's enough. This booklet has little to say about grammar and its rules.

This booklet has lots to say about getting your meaning across, which is more important than grammar. And it discusses the ABC's of clear writing--the kind of writing that will help put your meaning across to others.

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Our aim at Convair  
is to write material  
that is

- . well organized
- . easy to read
- . clear to the average reader

There are at least four  
results of clear writing.  
Your reader will

- . read it faster
- . understand it better
- . remember it longer
- . enjoy it more

the abc's ..... of clear writing

- -

. . . here are the principles we're talking about

a think..then write

b let the reader in on it

c write to express..not to impress

d write like you talk

e keep sentences short

f use familiar words

g prefer the simple to the complex

h be concrete

i put action in your verbs

j appeal to your reader's interest

k revise and sharpen

think ..... then write

-a-

who

what

where

when

why

Clear writing is like an iceberg: one-ninth you see, eight-ninths you don't. The part that gets on paper is small compared to the part that goes on in your head.

Clear writing is the result of clear thinking.

If the ideas are confused in your head...if the points you want to make are vague to you...they won't be any clearer just because you put them down on paper.

To write clearly, you must do a lot of thinking beforehand. You must figure out just what you want to say. And why you're writing in the first place. And who your readers are.

Decide what's wheat and what's chaff-- and throw out the chaff. Plan to stress the main idea so that your readers will be sure to get it.

Organize the material in some logical way. According to time, maybe. Start with what happened first, what happened next, and so on. Or arrange the material according to importance, listing the most important point first, the next most important second, and so on. Or you may want to organize the material in straight 1-2-3 order. Any logical arrangement will do.

The pattern you can use most often is the who-what-where-when-why order of a news story. State your main idea briefly at the beginning. Then give the points and details supporting this idea.

Once you have organized the material, you can then concentrate on the job of saying what you have to say. You'll find that you can write it briefly and clearly.

Like many other good things in the world, clear writing doesn't just happen. You've got to plan it.

let .....the reader in on it

-b-

Here's the kind of writing we've declared war on. Below is a single sentence from something Convair published about a company policy.

The president or any vice president acting jointly with the secretary or any assistant secretary of the corporation is authorized with full power of revocation and substitution, to empower and vest designated employees of this corporation with authority to execute in the name and in behalf of this corporation agreements, in forms previously approved by the general counsel, with those employees who are involved in intra- and inter-division transfers and with those persons to be employed who will incur reimburseable travel and moving expenses in relocating at the place of employment, which agreements set forth the conditions of such transfers and reimbursements.

Quickly now, who did what to whom?

Most of the writing we do at Convair is to inform. So it's generally a good idea to tell the reader--at the beginning--what it's all about. Suspense is important in some forms of writing, but rarely if ever in ours. The "whodunit" writer aims to mystify; we aim to inform.

The beginning of a piece of writing is the most important part.

So start punching right off. Come to the point quickly. Get the reader into the midst of things. Start with something that matters, such as your main idea. Or tell the reader something that will make him sit up and take notice. Preferably something that is of interest to him.

You'll find that if you pick out your main idea and state it briefly at the beginning, you'll have little trouble staying on the beam for the remainder of the memo or letter or what-have-you.

And the reader will have less trouble following you if he has some idea where you're going.

Don't start off in a roundabout fashion. Don't bore your reader with a long-winded introduction. If you do, he's likely to quit reading before he gets to the main idea.

write .....to express--not to impress

-c-

Look at these two samples of writing. See how a few words, identical in meaning, can give you a totally different picture of the man who wrote them.

First, consider this:

"I am at present engaged in the sale of corn on commission. It is not an avocation of a remunerative description."

Got the picture of the man who wrote that? Okay.

Now suppose the man had expressed the same thought in these words:

"I sell corn on commission. It doesn't pay."

You get a picture of quite a different person, don't you? The first man is windy and pompous. The second is forceful and direct.

They were different people, too. The first was Micawber, the famed blowhard in Dickens' David Copperfield. The second was a businessman who put Micawber's thought into clear writing.

Biggest fault of most writing at Convair is that the writer is trying to impress someone. His secretary, maybe, or his department head, or the division manager.

So the writer makes sure that he uses a lot of polysyllables. And he writes long sentences and involved paragraphs. He's going to prove that he can handle the king's English as well as the next fellow. The result is sometimes full of sound and fury, signifying nothing.

Somewhere he got the wild idea that this kind of writing makes him appear intelligent.

But somewhere he lost the real idea: that he's writing to inform his readers...to get facts from his head into their heads.

When you're writing primarily to inform, you should use words generally familiar to your readers and you should keep your sentences reasonably short. Write to EXpress, not to IMpress.

The person who can express complex ideas simply is likely to go further in the world than the person who writes gobbledygook.





keep.....sentences short

-e-

English sentences are getting shorter and shorter. In the seventeenth century, sentences averaged about 45 words. By the nineteenth century, the average had shrunk to about 30 words. Today, the average is less than 20 words.

That's the average for written material which reaches a large audience--newspapers, magazines, best-sellers. These are written in the kind of sentences people like to read. In fact, people pay hard-earned money for the opportunity. Reader's Digest, for instance, averages only 15 to 16 words per sentence. So does Newsweek.

Unfortunately, the business world--Convair included--has not yet whittled its sentence length down to size. It's still about a century behind the times.

The logic of writing short sentences is obvious. The longer the sentence, the more words. The more words, the more relationships. The more relationships, the more effort for the reader. The more effort for the reader, the more chance he will misunderstand, and the sooner he will quit reading.

People don't like to read material made up of 40-word sentences, even if they get it for free. Reading tends to become hard when sentences average above 20 words.

So keep your sentences short. Sprinkle periods liberally over what you're writing.

Keep the average length of your sentences below 20 words. With 20-word sentences, you can write on nearly any subject in this world or the next.,

Note that we're talking about averages. There's nothing wrong with a 40-word sentence, or even a 60-word sentence, now and then. You'll need a long sentence occasionally for variety. But balance these long sentences with some short ones of five or ten words, to keep the average length below 20 words.,

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Whenever you can shorten a sentence, do. And one always can. The best sentence? The shortest. -- Gustave Flaubert

There are few things in life as beautiful as a simple sentence...or as rare.

use ..... familiar words

-f-

These days you don't get much chance to show off your vocabulary treasures. Like your tuxedo, they have to stay at home most of the time.

That's hard, but it's fair. Particularly for the reader.

If you have a big vocabulary full of sesquipedalian polysyllables -- that's fine. It'll help you read. It'll help you learn. It'll help you think. It'll even help you work crossword puzzles.

But use it sparingly in your writing.

Why? Because when you want to communicate with somebody, you have to use the words he has in his head.

If he doesn't understand some of the words you use, he's likely to miss your meaning.

Bear this simple truth in mind. Unless he understands, you have accomplished nothing.

Fortunately for all of us, the chance of striking awe by means of beg words has about run out. The United States has passed the yokel stage where it can be impressed by a flow of polysyllables.

When people are interested enough in the subject, they put on their hip boots and try to wade through the long sentences and highbrow words.

But the average person at Convair and elsewhere is only mildly interested in what he is expected to read. If he finds the first paragraph is made up of tortuous sentences and unfamiliar words, that's all she wrote, as far as he is concerned. He doesn't have the interest or the time to figure out what the writer was trying to put across.

You won't lose your reader if you give him more short sentences and fewer complex words.

There's no better way to clear, crisp writing style than short sentences and short words.

So keep your mixture of polysyllables lean. Keep the percentage of hard words (three or more syllables) under ten percent.

If you mix in more than one three-syllable word in ten, you're taking chances. That's about the limit for easy reading.

prefer .....the simple to the complex

-g-

Most complexity in written material is the fault of the writer. It's not the fault of the reader. And certainly not the fault of the subject.

If you want to write so that you can be easily understood, prefer the simple to the complex. Prefer the simple word to the complicated word. Prefer the simple sentence to the complex sentence. Prefer the simple paragraph to the involved one.

The skeptic may say, "That's all right when you're dealing with simple subjects. But you don't mean for this principle to apply when you're writing about complicated subjects?"

Emphatically yes! That's when you need the principle more than ever. Here's why.

A reader has only a limited amount of mental power. If he has to use all this power in figuring out your words and their relationships, he has none left to grasp the complicated thoughts you're trying to express.

This point is not so philosophical as it may sound. The more you think about it, the more you'll agree with it.

And once you agree with it, you'll prefer the simple words and sentences when you write.

This doesn't mean that you should use simple words and sentences and paragraphs all the time. The word prefer is a key one in this principle of clear writing.

A steady diet of simple words and sentences would get mighty monotonous to the reader. Vary the diet so that he won't get bored. Variety is the spice of reading as well as of life.

Use simple, short sentences frequently, but not all the time. Use familiar words when possible, but if a foot-and-a-half-long word is really necessary, use it. Keep most paragraphs short, but don't be afraid to toss in a fairly long one if logic demands it.

Don't think for a moment that the principles of clear writing put you in a strait jacket. You have all the freedom you'll ever need. You can give free rein to your individual writing style. And you should...for variety's sake.

be concrete .....

-h-

The three laws of good writing are: (1) be concrete, (2) be concrete, and (3) be concrete.

Use lots of concrete, specific words that stand for things you and your reader can see, hear, taste, touch, and smell. If possible, call a spade a spade. Concrete nouns are good bait for catching readers and holding them.

Shy away from abstract words which soar into the blue and stand for things you can't pin down. It's hard to say just what abstract words do mean. And they often mean different things to different people. Take "democracy" and "indoctrination," for example. You'd probably have a hard time finding three people who agree on the exact meaning of these two common words.

Abstract words make your writing dull and foggy. The more of them you use, the harder your writing is to understand.

Here's the difficulty. When you become familiar with an abstract word, you generally forget that it may bring only a fuzzy or misleading idea to the mind of your reader.

Consider these two sentences:

In industrial communities the chief motivation for the purchase of curtains is practicality.

In factory towns housewives buy curtains that wash well.

The first sentence is abstract, hard for the reader to understand. The second is concrete, easy to grasp.

Here's another example;

It is suggested that the voucher be rewritten with the explanation that official business was performed on December 10.

How vague can you get? Who suggests? Who should rewrite the voucher? Who performed official business?

Be concrete. Be specific. Write it like this:

We suggest that you rewrite the voucher, explaining that Joe Blow performed official business on December 10.

If you want to keep your writing clear and crisp and understandable, load it with concrete nouns and verbs.

put action ..... in your verbs

-i-

Write most of your sentences like this: subject...verb...object. The habit of trying first for this subject-verb-object combination should be as automatic as pushing the starter button before stepping on the gas.

Why? Because then you'll be using active verbs. And active verbs are the kind that give snap and punch to your writing.

You'll also be writing like you talk. Odds are that you use active verbs more in talking than in writing. Active verbs are more natural, more direct, more forceful than passive verbs. Increase the percentage of active verbs, and watch your writing come to life.

Let's take a very simple example.

- (1) The boy hit the ball. (active)
- (2) The ball was hit by the boy. (passive)
- (3) The hitting of the ball was done by the boy. (still more passive)

The first version has the subject-verb-object combination. It has an active verb. This is how you would normally speak this thought.

The second version has a passive verb. The snap of action has almost gone.

The third version is a completely backward arrangement. The action has now disappeared. The verb force has become the subject of the sentence.

Also, notice how much longer and indirect the second and third versions have become.

In good writing--writing that sells--about one word out of ten is a strong active verb. One of the things you like about Time - if you like it - is the strong-flavored active verbs cropping up everywhere. They make for a lively style. The story marches along.

Much of the writing at Convair suffers from an overdose of passive verbs. As a result, it's lifeless and uninteresting.

Some people are so infected with "passivitis" that they use passive verbs to issue instructions, orders, and requests. This is contrary to the laws of logic and the laws of grammar. We'll not go into details, but normally you should use the second person ("you") and an active verb to issue an order or instruction.

For instance: "You must notify the personnel department of any change in ;your address." Or more simply: "Notify the personnel department of any change in your address."

This is the natural way to speak and write. Why violate both logic and grammar to write the sentence with a passive verb?

Like this: "The personnel department will be notified by you of any change in your address." Or worse: "It is requested that the personnel department be notified of any change in your address."

Why do people write like this? The main reason is that passive verbs make it easy for them to pussyfoot, hedge, and generalize. They don't have to commit themselves. They can leave out the doer of the action.

For instance, instead of saying they believe something, or Convair suggests something, they write "it is believed," or "it is suggested," and so on.

Once in a great while you may have good reason for writing something that's not too clear. Then use the impersonal, passive way of writing. But when your purpose is clear communication, use lots of active verbs, and write direct and to the point.

Ever hear the story of the plumber who wrote to the Bureau of Standards that he had found hydrochloric acid good for cleaning out clogged drains?

He got the following answer: "The efficacy of hydrochloric acid is indisputable, but the corrosive residue is incompatible with metallic permanence."

So the plumber wrote back that he was glad the Bureau agreed with him.

The Bureau tried again: "We cannot assume responsibility for the production of toxic residue with hydrochloric acid and suggest use of alternative procedure."

The plumber again expressed his appreciation to the Bureau for agreeing with him.

Finally, in desperation, the Bureau climbed down off its high horse and wrote:

"Don't use hydrochloric acid. It'll eat hell out of your pipes."

appeal ..... to your reader's interest

-j-

It's this basic attitude, this yearning for concreteness, this lifelong itch to get down to facts, cases, people, things, colors, sensations, sounds, events, scenes, movement, dialogue, that makes a professional writer what he is. He can't understand other people who don't have that itch...When he hears and sees the millions of high-flown generalities that fill the world's air and cover the world's paper, he wants to talk back, to ask for practical illustrations, living examples, who-said-exactly-what-to-whom and how-does-this-affect-Mrs.-McNulty-in-Hackensac-New-Jersey...

The ordinary person never understands this. He thinks the secret of writing is something entirely different. He wants rules...he'll do the rest and supply the material, the ideas to be expressed. Unfortunately things don't work that way: to write well, you must think differently; you must have the itch for reality...

-- Rudolf Flesch

If writing interests a reader, it'll do a better job of informing him or influencing him. So be sure to touch the reader's interest.

You've already learned that he likes short sentences, concrete nouns, and active verbs. He also likes an informal conversational tone.

And he likes personal pronouns--"we," "I," "me," "you," "they." These pronouns increase his interest because they help make writing come alive. Personal pronouns show that the writer is talking about people--not just about things and facts and ideas.

But the problem of appealing to your reader's interest is broader than that. Stated simply, it's this: When you write something, the reader -- not you -- is the all-important person.

Don't forget the reader for a minute. Write to him and for him. Put yourself in his place.

This memo you're going to write -- what is there in it that's of interest to him? Pick out that something and get it into the memo early, perhaps in the opening sentence.

Unless your writing is at least mildly interesting to the reader, and unless he can understand it, he isn't going to read it.

revise ..... and sharpen

-k-

Nearly everything you read has been revised at least once. Most successful writers go over their material and sharpen it up after it's written.

So don't feel that revising your writing is something to be ashamed of. Everybody does it.

Here's a sentence from a Convair memo.

In view of the nature of the above problem, and the many and varied opinions of quality control, shop, and contracts, as well as the magnitude of some of the discrepancies that have existed in the past, it would be highly appreciated if a basic procedure in the form of a DSP could be initiated and released in the very near future outlining the policy that should be followed in making routine decisions wherein it is necessary to rework discrepancies found to exist by the ferry crew either prior to or after takeoff of an aircraft for delivery.

Note how the sentence shrinks when you cut out the "fat" words and come straight to the point. The reader will now get the meaning right away.

We need a DSP immediately telling us how to handle ferry crew squawks.

A good test for any kind of writing is to read it aloud. This will help you spot words and sentences that should be changed or thrown out.

When you write a first draft, you usually put down words and sentences that seem very clear at the time. Later, upon reading it closely, you'll no doubt find that you can make the meaning clearer by changing some words and deleting others. You'll probably discover that you can leave out phrases and sentences and even paragraphs. Possibly you can improve what's left by rearranging it.

Look for "fat" words that say nothing. Look for worn-out phrases. Look for unnecessary sentences. Look for paragraphs that don't carry their own weight. Cross out all of 'em. You'll be amazed at the crisp sound of what's left.

This is your last chance to give the reader an even break. So chop that long paragraph in two--the reader likes white space. Underline important words and thoughts so the reader can't miss them. Or highlight them by putting them into separate paragraphs. If necessary, repeat your main point to make sure the reader gets it. Then ask yourself: Will the reader be able to understand this without working at it? If not, then you're not through working on it.





how ..... to use the fog index

-n-

The Fog Index is no cure-all and is not supposed to be. But it does give you a good idea of how difficult a piece of writing is to read and understand.

And you can be sure that if what you have written has a Fog Index of more than 12, it's above the easy-reading range. You're writing on the college level of complexity. You're placing under a handicap the ideas you're trying to express. And you're likely to be either ignored or misunderstood.

Earlier in this booklet, we urged you to use short sentences averaging 20 words or less. We also urged you to use short words and to keep the mixture of polysyllables lean--10 percent or less. These two factors--20-word sentences and 10 percent hard words--total 30. Multiply this by .4, and you get a Fog Index of 12. That's the danger line of reading difficulty.

The Bible, for the most part, has a Fog Index of 6 or 7. Time magazine measures about 10. Even the Atlantic Monthly has a Fog Index of only 12. This booklet has a Fog Index of less than 8.

It stands to reason that if you are writing something for all employees, or for all employees in a department, you should write it with a Fog Index of 11 or less. Preferably less.

And bear this in mind, too. Just because a person has lots of schooling and can understand written matter with a Fog Index of 17-plus, this doesn't mean he likes to read such stuff. He doesn't like to stand on mental tiptoe and strain to get the meaning. He would much rather read stuff written with a Fog Index of 12, or 10, or 8. Wouldn't you?

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Learn the ABC's of clear writing. Practice what this booklet preaches. Your writing will become simple, clear, direct, and understandable.

You'll be writing for easy reading.

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POPULAR SCIENCE WRITING REQUIRES INSPIRATION, PERSPIRATION

Physicist Stephen Hawking's "A Brief History of Time: From the Big Bang to Black Holes" Bantam Books, April 1988  
100 weeks on New York Times bestseller list, 1 million copies in hardcover edition alone.

Scientists who have written for the mass market say the experience can be very fulfilling--but it can also be tedious and time-consuming.

What is your motive for writing a popular nonfiction book? A strong desire to write is the most essential for ensuring success. That is what serves as the driving force to see a book through to completion.

60,000 copies on average to get on one or more of the bestseller lists. Most popular science books max out at 20,000 copies.

Stephen Jay Gould, prof. of Zoology at Harvard University is one of the most prolific scientist/writer. Wrote "Wonderful Life: The Burgess Shale and the Nature of History" (New York, W.W. Norton & Co. Inc., 1989; "The Mismeasure of Man" (W.W. Norton & Co. Inc., 1981). He says, "All the cliches--that it's based on a desire to communicate, to better educate the public, which funds scientific research; that those of us who can do it should be doing it; that it's a responsibility, a duty, and a challenge; that reaching a bigger audience is the job of any intellectual--I believe all that, but it's not the primary reason for writing. Quite simply, I love to write."

Can you write? It is certainly not something to be considered lightly, and it's not something every scientist is capable of doing or will want to do. Writing a popular science book for the mass market is an endeavor that requires a commitment of time and energy, and an ability to communicate complex concepts, formulas, and ideas in a way that is understandable to--and entertaining for--the lay audience.

Ferris, an astronomy instructor at the Univ. of Calif., Berkeley, is considered by many to be one of the bards of popular science books. Ferris does not do research and considers himself a writer rather than a scientist, says, "Scientists need to appreciate the time factor as well as the fact that writing a mass-market book is most likely harder than what they're used to writing. There's no way the general reading public can really understand a concept unless the author can put it in clear, simple language."

Robert Shapiro, prof. of chemistry at New York Univ., author of "The Human Blueprint: The Race to Unlock the Secrets of Our Genetic Script" (New York, St. Martin's Press, 1991); "Origins:

A Skeptic's Guide to the Creation of Life on Earth (New York, Summit Books, 1986). He says, "It's absolutely harder, and an enormous zapper of energy. You really have to relish the process. I just found that I really enjoyed trying to capture the essence of scientific ideas in a way that non-scientists who came for dinner would not just appreciate, but enjoy."

#### MAKING SCIENCE FUN

How does one go about making science sound enjoyable? "Through the use of metaphors and other literary artistry," says Bantam's Meredith. Metaphoric devices, she explains, "allow the writer to draw pictures in the heads of the reader that may not be as precise as a scientific experiment, but will lead the reader to a 'eureka' experience in reading new thoughts." Publishers look for clarity of expression--verbal as well as written--from potential scientist/authors, Meredith says, as well as a writing style that incorporates metaphors.

Edward O. Wilson, Harvard University's Frank B. Baird Jr., Prof. of Science, usually relies on one of two methods. "One is to embed the fairly hard, technical data into a matrix of general introductory and more simplified explanatory material--much like raisins in a muffin," he says. Readers are thereby drawn in and can move along easily through the material and are sufficiently attracted to it that they will be able to more willingly endure the technical descriptions. That way, you can put real science in amongst simpler language."

The other method that Wilson uses is to to think of himself as standing before a classroom of both scientists and nonscientists, and consider how he would verbally acquaint people with the material. His techniques obviously, have met with success: Wilson is the winner of two Pulitzer Prizes, one in 1979 for *On Human Nature* (Harvard University Press, 1978), a popular book, and one in 1991 for "the Ants" (Harvard University Press, 1990), a more technical work that he cowrote with former Harvard professor Berthold Ho:lldobler (*The Scientist*, May 27, 1991, page 22).

Robert M. Hazen, a research scientist at the Carnegie Institution of Washington's geophysical laboratory and author of *The Breakthrough: The Race for the Superconductor* (Summit Books, 1988), uses a similar method of visualizing the audience for whom he is writing. Hazen who is also a professor of earth sciences at George Mason University, says that the most effective approach is to tell stories. "People like, and can relate to, and are entertained by stories. Rather than lecturing, or writing the equation for Newton's law and describing the physics, you might offer an anecdote about what happened to your friend when he didn't wear his seat belt."

Ronald K. Siegel, a psychopharmacologist at the Univ. of Calif., Los Angeles, "popularizes" his subject matter--taking it to the streets, so to speak. Says Siegel, author of *Intoxication: Life in Pursuit of Artificial Paradise* (New York, E.P. Dutton, 1989) and *Fire in the Brain: Clinical Tales of*

Hallucination" (E.P. Dutton, 1992), "No matter how well I may write a book that details the mechanisms of drugs at a molecular or physiological level, it's going to be boring and read by only a handful of people. People communicate with each other at a behavioral level, and they interact at a behavioral level. That's the level that is meaningful to them, and writing about my field--the effects of drugs on behavior--on that level then [makes for] a popular book."

Simplifying and popularizing your topic, however, by no means implies that you should write "down" to the general audience. "What I write for the general public is essentially at the same level as what I write for professional colleagues," says Gould. "Certainly, it doesn't include the same form of mathematical argument, and it doesn't presuppose knowledge of technical terminology and concepts, but I don't think the conceptual depth is much different."

#### REALITIES OF THE MARKET

One of the appeals of writing a popular science book, says Siegel, is that "you can express yourself a lot more freely. You can editorialize, and go beyond the bounds of your data, more than you can in an academic journal, where you're constrained not only by the journal's format, but by the scientific format." That freedom, however, is bridled on the one hand by one's own sense of responsibility--to present rational and logical evidence in support of the hypotheses presented--and on the other by the realities of the popular publishing world.

Unlike scientific papers, books are commodities--products that are packaged and sold. "What you think is a good product for sale is not necessarily the final arbiter of what goes out," says Hazen. "The title 'The Breakthrough' was not my title," he says, noting that it came from the president of a large bookstore chain. "I originally proposed '1-2-3 Superconductor. The 'hip' name for the superconductor was 102-3. It was cute. I didn't like the new one better, but it was a marketing decision."

The consensus among the scientist/authors interviewed for this article is that as long as you're publishing reputable material, there's no credibility lost; indeed, if you do your job well, credibility is gained. Says Wilson: "Responsible popular writing, which tries to illustrate what a scientific process is, or to explain some complex phenomena that can only be understood through scientific knowledge, actually receives a great deal of favorable attention from other scientists. When you do it responsibly, your credibility is actually enhanced....Scientists are now in a position of being able to appreciate overviews, syntheses, or simple introductions to other areas."

#### TIPS FOR CONQUERING THE MASS MARKET

Suggestions from authors and publishers on how to turn your scientific expertise into a book for a popular audience.

1. Determine if you have a viable idea. Do enough people care

about the subject matter? Is it alluring? Can it be made interesting to a general audience?

2. Examine your motivations.

3. Try your hand at a short essay and determine if it's enjoyable for you to take complex information and make it informative for, and entertaining to, nonscientists.

4. Determine if you have an ability to use metaphors or other literary techniques, and most important, if you enjoy the process.

5. Write up a proposal, consisting of an overview of what the book will cover, an outline, and a couple of sample chapters.

6. Get a good literary agent who is willing to help you shape the proposal and take the book around to publishers.

7. Once you get a deal, make sure you schedule the appropriate amount of time to do the project.

8. During the writing phase, communicate with your agent and your editor about any problems or difficult passages.

#### REACHING THE MASSES

Two stages to book publishing--writing, editing, and printing the manuscript serve as the first; marketing the product is the second. Since publishers rarely invest much money on advertising, reviews and publicity tours serve as the means by which the result of your hard work is promoted.

Upon publication, advance copies are sent to newspapers and magazines for review. Such reviews, particularly in publications such as the New York Times and Publisher's Weekly, are important and can help a book gain sales momentum. But inevitably, no matter how well-researched and well-written your book may be, odds are you'll get a bad review or two.

Even two-time Pulitzer Prize winner Edward O. Wilson has experienced his share of negative reviews of his popular science books. In some cases, critics give bad reviews because they "fail to absorb the book," he says. In other instances, a reviewer might be simply mistaken about the science. Yet there is also a third possibility: The critics may just be on to something.

While authors are frequently advised to ignore bad reviews, Wilson says, "it's dangerous to ignore them. If there's a pattern in the response--if several say your writing is too terse or turgid or preachy--you really ought to take it into account," he says. But don't dwell on the negative, he advises: "File [the reviews] away."

If the reviews are positive overall, your topic catches the public's fancy, and your book takes off, you might be asked to go



on a publicity tour. "No one is ever forced to go on a publicity tour," says Univ. of Calif., Berkeley, astronomer Timothy Ferris, a veteran of the radio and TV circuit.

"But, if you are asked, the thing to remember is that your [main] responsibility is to communicate with the public. This is not some celebration of how great a guy you are, and it's not a two-week vacation in Hawaii."

Ronald K. Siegel received much media attention from his book, "Intoxication..." He offers this advice to avoid burnout from lengthy book tours: "Watch or listen to the shows the publicist has scheduled for you and be selective. Know that radio call-in shows can be done over the phone from your office. If you're flying from city to city, you might want to consider taking rest periods."

If you don't have the time or desire to go on a publicity tour, Siegel says, "you can ask the publisher to divert money from tour promotion to [giving away] free copies." Siegel, for example, had "Intoxication" sent to every member of Congress who has jurisdiction over drug policy, as well as to members of several Cabinet departments. "It's not so much for publicity, but more for communicating ideas--which is what popular science books are really all about."