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Since that hectic week in October, 1970 in East Lansing, there have been numerous occasions when yours truly, as Chairman of the ISPE (neo-CAPE) Publications Committee, paused to wonder what sort of monster he was instigating. That of course was the original intention — instigation of a noble project, wherein some brilliant leader, experienced in matters of publishing and planetarium education, would come forth and bring to life the lofty aims we had been nurturing.

We wanted first and foremost a new platform for anyone in our field to sound off about his goals, his problems, his accomplishments, and his philosophies. We sought a working tribute to the growing professionalism of planetarium education itself as a specialized discipline; witness the remarkable growth of the regional associations and the creation of ISPE. We felt some instrument was vitally needed to further real communication between the communities of professional research astronomers and planetarians. Last, but by no means least, we wanted to demonstrate vividly to all the various segments of the planetarium community they have a large number of problems and interests in common — so why fuss about differences?

As can be seen from the masthead, our sought-after genius hasn’t shown up yet; hence this instigator has turned boy publisher. Brushing aside old saws about rushing fools and fearing angels, I’ve learned a new vocabulary, visited the printing plant, made lots of new friends, and, all in all, had an exhausting fantastic time putting it all together.

Lest this last statement make the journal seem too much like a solo effort, much credit for its structure must go to the original members of the ISPE Publications Committee, and especially Larry Gilchrist of Calgary, Alberta, our current Committee Chairman. We much appreciate the grit and determination of Jack Howarth, ISPE Executive Secretary in all he has done. And of course, I am very proud of the editorial staff who have agreed to serve and whom you will meet through these pages.

Oddly enough (or perhaps not), our biggest disagreement was over choosing the journal title, and we dispensed with several dozen possibilities before finally electing THE PLANETARIAN. As the reader will discover, the word ‘planetarian’ is not to be found in any dictionary — it has nothing to do with flatworms (sic) or astrology by the way — but is the product of Norman Sperling’s fertile imagination. Because we wanted a journal for all planetarium folk, this new name represents by definition (dictionary publishers please note) any person associated in some manner with a planetarium of any size or type, be he teacher, student, professor, docent, technician, writer, artist, entertainer, guest . . . .

We sincerely hope our new journal will live up to all this. It will, but only if you make it so through your contributions.

Frank C. Jettner

Letters

Enclosed you will find a copy of the new edition of the Boy Scouts of America Astronomy merit badge pamphlet. I am sending it so you and your association will be aware that we have such a merit badge and just what the requirements are for a Scout to meet in earning the merit badge.

I would like to ask the help and cooperation of your organization in letting them know this new pamphlet is available and also to enlist their support to serve as counselors for the subject. Anyone who volunteers their services should write to us, and we will forward their names to the local council of the Boy Scouts of America in which they live.

Thank you very much for your help in promoting the Astronomy merit badge program.

Richard D. Dutcher
Program Executive
Boy Scouts of America
North Brunswick, N.J. 08902

(EDITOR: We find the Astronomy merit badge pamphlet most impressive, and we urge you to get a copy for your own edification by writing to Mr. Dutcher. We have also found Scout counseling a blast; "try it, you'll like it!")
MESSAGE FROM THE PRESIDENT

I would like to take this opportunity to welcome the affiliate societies as well as commercial firms and individuals into our new International Society of Planetarium Educators.

I am glad to say that this society is now in being and safely underway. This has been one of my greatest concerns. I had felt that it was so important to establish a working organization and set of bylaws that would permit the society to become firmly established. I think that there has been a recognized need for a professional society of specialists in the planetarium field. As you probably know, the constitution committee patterned ISPE along the lines of the American Astronomical Society and it was felt that a professional status is needed for people in the field of astronomical education involving planetariums.

Two of the major benefits that we can look forward to from such an organization are the journal called *The Planetarian* and the major meeting held each two years.

I feel it very important to go right ahead with the bylaws and give the organization a real chance to function under the present structure. Then at a later time if there are short-comings, the bylaws can be amended. There certainly are many pros and cons concerning the details of the bylaws, but I think that it is much more important to proceed with vigor in encouraging all people in planetarium education to join with us in making this society a really big thing.

Let us all support our new journal to the fullest extent and make the first meeting of ISPE in San Francisco a truly outstanding and memorable event.

Looking forward to seeing you all in San Francisco.

Sincerely,

Paul R. Engle

Paul R. Engle

The astronomical community was saddened by the death of Prof. Harry E. Crull of the State University of New York at Albany on April 25, 1972. We will miss his penetrating wit, his never-ending efficiency, and his skilled aptness at getting quickly to the heart of whatever problem was at hand. Harry was truly one of the pioneers in American planetarium education, dating back to his first position out of graduate school in 1933 as a lecturer at the Adler Planetarium in Chicago during the World's Fair. After 18 years as the founding director of the Holcomb Observatory and Planetarium of Butler University, Indianapolis, Harry came to Albany with the vision of founding a graduate department of planetarium education, a dream willed to his assistant, your Executive Editor.

The Editorial Board will welcome your cards and letters telling us what you may think of the format and content of this first issue of *THE PLANETARIAN*. Constructive criticism is needed — remember, this is your journal!

**CONTACT**! is our Question-Answer column which will begin in the next issue. Tom Gates will edit the column, and each issue will feature as many useful and/or unusual requests for information as we have room. Tom promises to send a researched personal reply to every letter sent him, and there are no holds barred on questions or requests for help, providing they are related to the legitimate purposes of this journal. So **CONTACT**: Mr. Thomas Gates, Space Science Center, 12345 El Monte Rd., Los Altos Hills, Calif. 94022.

---

Harry E. Crull
We in the planetarium business often profess to be expert in the field of communication. Our job is to communicate fairly technical concepts of science to audiences of all ages and descriptions by means of all manner of graphic aids and imaginative demonstrations. We attempt to explain and entertain simultaneously, and sometimes this can be very difficult. It is with considerable pleasure then that we introduce the following, rather remarkable lecture by Dr. Isaac Asimov, which is relevant to this cause. The address was given extemporaneously on October 25, 1968 to a joint meeting of GLPA and MAPS at the Strasenburgh Planetarium, Rochester, New York.

Those present for the occasion will largely remember that Asimov stole the show! His speaking style and obvious tongue-in-cheek commentary were entrancing and often downright funny, and we think that this edited transcript reflects this. Beyond that, he also had something to say. There appears to me at least three pertinent ideas suggested by this paper.

First, most of us pride ourselves on being able to speak extemporaneously, to communicate our thoughts without recourse to a script or bulky notes. This address seems to me to be a classic example of how one can develop a train of thought in an amusing way, occasionally go off on a wild tangent but then quickly return, ("Where was I? Oh yes.")

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Second, Asimov's science writer is in a real sense a perfect analogue of the potential role of the planetarium operator. He could well be the science communicator for professional astronomy. His future work, especially in the university planetariums, might be to labor with his professional colleagues to "render down" that which is truly significant in the frontiers of astronomy, to make it clear and "in English" for the remainder of the universal community.

Third, the address is interesting in pointing out some of the historical linguistic problems of communication in science. It should give many readers a fresh insight and interest in this subject. 

Frank C. Jettner

SCIENCE AND COMMUNICATION

by Dr. Isaac Asimov

I am told that I am to discourse on the general subject of communication, and the reason I am chosen for this purpose is because I have in a way established myself as a communicator. In other words, I write on a variety of subjects for a variety of audiences, and since I do so successfully in the sense I can con publishers into paying me for what I write, why this makes me a professional communicator of unimpeachable moral integrity, honesty, and efficiency. What I would like naturally to do then is to discuss the difficulties of communication in order to make myself sound even more unimpeachably morally integrous, and all the rest.

In the past scientific advances have been delayed on a number of occasions because of the lack of efficiency in communication. As a matter of fact, scientific advances really began to spurt forward only when there came to be enough scientists and enough intercommunication to establish a sizeable and viable scientific community. In early modern times the advance of science had already reached the point where no one person could single-handedly advance science very much. If he made discoveries, kept them to himself, or wrote about them in secret notebooks, or even wrote a book which had limited circulation, the tendency was to forget him and his work once he died until it was rediscovered. However, once scientific academies were founded, once scientific journals began to be published, once the work of one person began to spread out so that everyone knew about it, then we had a community. Even so, there were occasions when this community failed in its goal as fast as might reasonably be expected, and one of the reasons for this failure was often language difference.

Through the 18th century when modern science was beginning to take off at a rapid rate, the three chief languages of science were French, German, and English in that order. By the 19th century, the order had changed to
become German, French, and English. In the 20th century, as you all know, it is the turn of English to be in first place. In any case what happens to someone who makes a discovery in a language which is neither German, French, or English? The chances are that he is ignored.

We will take an example. In the 18th century, about the 1770's or 1780's, the French chemist, Antoine Laurent Lavoisier, who was undoubtedly the greatest chemist who ever lived, completely reorganized the science of chemistry by advancing for the first time the theory of combustion. It has been accepted ever since. It states that carbon, hydrogen, and other elements combine with oxygen, and this produces either rusting or flame, if it takes place quickly enough, and so on. This overthrew the previous theory of phlogistics, which explained some of the same facts but less well.

Now it so happened that another scientist named Mikhail Lomonosov advanced very much the same theory as Lavoisier, but did it in the 1740's, about a full generation before Lavoisier. But Lomonosov had the incredibly poor taste to be born a Russian! And he compounded the felony by writing in Russian, with the result that to western Europe, he might as well have written in south Martian! Because nobody paid any attention. Yet somehow, there are people who are dying to find out if Lavoisier could either read Russian or knew somebody who could read Russian! Now you will say, why should anyone suspect an upstanding character like Lavoisier, one of the most attractive people in the history of science—and who unfortunately in the course of the French revolution had a little mixup with the authorities and got his head cut off—why should anyone suspect that he could possibly read Russian, either directly or indirectly? And the answer is that all us great men have our little failings!

Lavoisier had a charming little failing, which was a kind of ingrained tendency not to give credit. As an example, a gentleman named Joseph Priestly, an English Unitarian minister who dabbled in chemistry, discovered oxygen, which in line with the phlogistan theory, he called dephlogisticated air. In the light of the phlogistan theory a name like dephlogisticated air explained exactly what he thought he had. He went to Paris to do things and visit people, and he visited Lavoisier. Now Lavoisier at that time was busy combusting things in closed systems and finding out that some of the air, but not all of the air, was used up in the process. For a while, he was stumped. Priestly told him about his discovery of dephlogisticated air, and this was all that Lavoisier needed. He now realized that there were two gases in air, one of which was Priestly's dephlogisticated air, and there was something else that did not support life or combustion. He called it azote, meaning "no life", but we now call it nitrogen. Lavoisier repeated Priestly's experiments, gave the gas a new name, oxygen, which means "acid producer", because he thought it was essential to the structure of all acids. This is wrong, but we keep the name anyway out of sentiment... , and because the imagination boggles at going back into the literature and changing every one of the 2,700,000,000 oxygens into...
something else... Besides, there is a vested interest. You might teach kids that what we used to call oxygen we will now call something else, but nobody could possibly teach it to adult chemists! And since adult chemists control the science, you see, we are stuck....

Where was I? Oh yes.

Lavoisier described his experiments beautifully and made a great deal of sense out of them, and he utilized Priestly's discovery to revolutionize the study of combustion and the science of chemistry. Nobody begrudges Lavoisier the title of Father of Modern Chemistry, because I can list at least four or five different reasons why he deserves it. The only thing is that in writing it up, he didn't mention that actually Priestly had done this particular experiment first and that he had spoken to Priestly.

I am under the impression that someone asked him if he had spoken to Priestly, and he said, "To who?"

A couple of years later, it seems that another English scientist, named Henry Cavendish, studied a gas he called fire-air, which we shall call hydrogen, and reported that when it combined with oxygen, it formed droplets of liquid which looked like water, smelled like water, tasted like water, had all the chemical reactions of water, and therefore was water! This was a great discovery, because until then, there were still a few people who had the lingering notion that water was an element in the Greek sense, and here it was made of two simpler substances, fire-air in combination with dephlogisticated air. Now at this point, Lavoisier was dealing with something which wouldn't quite fall into place until it occurred to him that perhaps this fire-air and dephlogisticated air combine to form water. This with his own researches completed something, which we have come to call Conservation of Mass. He repeated Cavendish's experiments, a little bit better than Cavendish had done it, gave fire-air a new name, hydrogen, which means "water producer", reported his experiments, and failed to mention Cavendish!

You will not be surprised to hear that Priestly and Cavendish refused absolutely to accept Lavoisier's new theory and remained devotees of the wrong phlogiston theory to the ends of their lives. I guess they figured they would rather be wrong with everybody else than right with Lavoisier!

Now you understand why people wondered if Lavoisier knew Russian. But apparently he didn't, and apparently Lomonosov's discovery was really honestly rediscovered by Lavoisier. Not only does Lavoisier get all the credit, but Lomonosov is virtually unknown everywhere except in Russia. There they have done their best; they have named a crater after him on the moon.

Now, Russian is of course a Slavic language and therefore quite beyond the pale. This same sort of thing tends to happen though, even in Teutonic languages which are on the fringe. For instance, in the mid-nineteenth century two chemists worked out what we now call the Law of Mass Action. I will not bore you with a description of it; just take it for granted that it is of importance in physical chemistry. Their names were, if I recall correctly, Cato Maximilian Guldberg and his brother-in-law, Peter Waage. And again, they did not use the utmost discretion because they were born Norwegian! And they wrote in Norwegian! And writing in Norwegian, no one paid any attention to them until the work was translated in German a couple of decades later. Everyone said, "Hey," they said, "Guldberg and Waage have discovered the Law of Mass Action!" Now this was a matter of considerable chagrin to a Dutchman named Jacobus Henricus Van't Hoff, because he had had the good taste to discover the same law and publish it in German before the Norwegian work was translated into German but after it had been written in Norwegian. Now! Science had advanced. It had, what shall we say, developed a higher code of ethics, and Guldberg and Waage get the credit for the discovery, even though they didn't write it in German. Van't Hoff was left with this great discovery becoming what you merely call confirming evidence. Now you can well imagine that Van't Hoff gritted his teeth at that.

Now if we work our way closer into the core of this communication problem, we ask ourselves, what if somebody wrote in American? Now you say, you mean English, don't you? And I say no, I mean American because, although under protest, German and French scientists were willing to read English journals, by which they meant journals published in Great Britain, nobody, but nobody, in...
At Cape, 1970

Probably the most poignant moment in the history of "Planetarium" occurred on the evening of October 22, 1970 at CAPE, East Lansing, Michigan. Prior to the annual Armand Spitz banquet lecture of GLPA given by Prof. George O. Abell, the convention sat hushed and deeply moved as Armand's taped voice, tired and sometimes broken by his ill health, gave his last public message to the planetarium community:

All these things (planetarium meetings, seminars, and the formation of the ISPE) are happening—throughout the country, in Canada, and elsewhere in the world. All my dreams of many years are beginning to come true. I am thankful for this modern contraption (the tape recorder) which lets me lie here in my bed and say hello to you all.

When I first became interested in planetariums, there was nothing but jealousy and rivalry among them. Sometimes it went so far as to develop into personal bitterness and almost feuding. It was my hope that not only could we introduce the stars to more people with a small planetarium, but this might also help to bring people who operate planetariums closer together, (to) let everybody realize there is nothing but gain for all in the picture when there is such cooperation.

As a result when Spitz Laboratories was first organized in Philadelphia, I held a meeting which first assembled college and semi-professional astronomers who operated planetariums. Lo and behold, I got them to share ideas, and they seemed to enjoy it. It wasn't so bad after all! But in the back of my mind ever since—that was in 1947, I think—there has been the dream that Planetarium would (become) a profession.

Heaven only knows, you being here today at a meeting like this—and the fact these meetings are being held in different sections of the country with the participation of hundreds and hundreds of planetarium men, I mustn't forget, also women—within my heart of hearts I am quite confident that now Planetarium is a profession and that we're going at it in the proper way.

So it's only the fact that this paralyzed body of mine refuses to cooperate that prevents my being there with you other than in voice. Actually, I have succeeded in making two trips only within the last year. One was to Chesapeake to see the eclipse of the sun (March, 1970). The other was in October (1969) for the wedding of my son, Larry, who at the time had just recently returned from his fifth trip to Antarctica. (After) especially the excitement of seeing Larry married to his nurse, whom we love very much, and the excitement of the eclipse, I was much too much a physical wreck to contemplate doing any more traveling—as much as I would like to be in East Lansing with you right now.

—Armand N. Spitz

(EDITOR: Because of a technical difficulty, the end of the message was erased from the tape. However Mrs. Grace Spitz has kindly advised: "This message was spoken in September 1970 at the conclusion of a visit with Margaret Noble, Jo Torpy, Von Del Chamberlain, and Russ Blake, immediately following the University of Maryland seminar these four had attended. They told us in some detail of this and of the new International Society of Planetarium Educators. This, then, is what prompted Armand's response. —I remember that in addition, he wished the East Lansing meeting might be a good and profitable one."
Come to the Bay Area

The Space Science Center of De Anza and Foothill Colleges cordially invites you to the first ISPE-PAC Planetarium Conference. The San Francisco Bay Area is yours for the week of November 13-17, 1972, where you will meet and discuss “Planetarium” with your colleagues from around the world. Sessions on philosophy, techniques, programs, education, publicity, audio, graphics, shop, and administration will fill your mind and notebook with ideas. World-famous scientists from Stanford, Lick Observatory, and NASA Ames Research Center will participate, and you may visit their facilities, as well as those of the Morrison and Minolta Planetariums. The world’s finest restaurants and the delight of Pacific Ocean seafood await your palate. Exciting nightlife is yours to behold, and a complete wives’ schedule will acquaint them with the women’s world of the Bay Area. The fine wines of the Santa Clara Valley may be sampled, and scheduled tours of the famous Paul Masson Winery are only minutes away.

Make your plans to come now!

The Golden Age of Planetariums Investigated in the Land of the Golden Gate

by Thomas M. Gates

The ISPE-PAC Conference will begin Sunday evening of November 12th with a registration social, where acquaintances can be initiated and renewed, and the shop talk we all love to pursue so much can be indulged to the fullest. Conference sessions will begin on Monday, November 13th.

Our goal is to have a blend of sessions, visitations to facilities, and individual time which will afford the maximum benefit to be derived from the conference. Some past conferences have been so heavily scheduled with sessions that the participant is so exhausted after several days, he nearly collapses. Others have left a sense of rambling and lack of application of time to sessions so vital to expanding our effectiveness in the field. Yet other conferences have had too much or too little of visitations to facilities pertinent to our endeavors. Our conference in the Bay Area will strive to achieve the best blend of sessions, visitations, and shop talk time so as to maximize the success of the conference.

It is important that participation from the field be present at the conference and to this end we are officially inviting you to present a paper. Presentations are limited (continued on page 32)

PRE-REGISTRATION

Please send complete program information and registration forms for the ISPE—PAC Conference of November 13-17 to:

Name______________________________________________________

Home Address________________________________________________

City________________________ State_________ USA __________

or Zip

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Wife Along? ______________  Yes or No

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I wish to give a 20 minute paper. ______________  Yes or No

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- Three motorized variable star projectors (Mira, Algol, and Delta Cephei) to vary these stars' brightnesses according to their light curves.

You'll find some... but not all... on other "major" planetariums (at over $200,000)
Stars Over M.S.U.
by LeRon W. Cobia

Today began with the quiet hope of spending most of it on preparation of our coming public program, Stardust. As my thoughts and words began to flow, an all too familiar telephone ring interrupted, to remind me of the press of our daily obligations. The call was about lesson scheduling for our 6000 students in Nat. Sci. 191. Shortly after, hard decisions had to be made on the artistic and photographic preparation of media for Stellarphonic Moog — a live Moog Synthesizer and light show beginning soon. The Workshop for Michigan Planetarium Teachers was just two days away. The schoolkids were late for their 1:30 show. . . .

Sound familiar? Eventually the manuscript for Stardust would be completed — behind schedule as usual. This is probably typical to many readers, and certainly so to the staff of the Talbert & Leota Abrams Planetarium of Michigan State University.

Since beginning operation in February, 1964, some half-million people have passed through the sky theatre. A full range of programs have since been offered, and new types are constantly being tried, resulting in a sense of creativity felt by our staff and students.

The heart of the Abrams Planetarium is a Spitz Model STP projector. The building also houses offices, art preparation room, darkroom, workshop, and display hall with adjacent blacklight hall leading to the sky theatre. The theatre seats 254 and contains a projection and control booth and numerous auxiliary audio and projection devices.

Perhaps the most important activity is the continuing effort to offer training and information to new planetarium teachers. (Editor: M.S.U. is currently the only school which offers a M.A. in Teaching degree with specialization in planetarium education.) Also important are various uses in university instruction, offerings to schoolchildren from area schools, and the public programs.

Thus our seemingly confused days, attempting to accomplish numerous tasks at once, seem on reflection to be directing us toward maturing exploration of the uses of a university planetarium. At least we like to think so.

* * *

Opposite page: upper left, Director Von Del Chamberlain holds the very first Spitz Planetarium (made from a soap can) in front of the Spitz STP instrument; lower left, exhibit specialist Zen Billeadeaux discusses the next saw cut with assistant Don Van Horrick in the shop; upper right, the STP control console, known locally as the abode of the Wizard of Oz; right center, pretty secretary Pat Russell keeps busy with scheduling; and lower right, technician John Hare is making a frantic repair before showtime.
Of Stars and Domes

by Mark R. Chartrand III, Amer. Mus.-Hayden Planetarium

A common topic in planetarium shows and in popular talks on astronomy concerns the motions of the Earth. It is very easy to become confused about these motions, particularly the ones due to the motion of the Solar System as a whole through the Galaxy. The Sun's (and thus the Earth's) motion through the Milky Way is best described and perhaps most easily understood if it is considered as the sum of two simpler motions.

When we speak of motion through the Galaxy, we really mean motion with respect to its center (which by the way we have never seen, in ordinary light at least). The most basic motion and the fastest is that of a star, such as the Sun, in a nearly circular orbit around the center of the Galaxy. This is similar to the orbit of a planet around the Sun and is characterized by a velocity and period of revolution which depend on the distance from the center (cf. Kepler's Laws). However, unlike the Sun, the Milky Way cannot be considered a point mass à la Newton, and the usual simple relation between orbital velocity and distance does not hold. In fact, this process is usually turned around, and the observed velocities are used to give information about the mass distribution of stars in the Galaxy as a function of their distance from its center.

The speed of galactic revolution of a star at our distance from the center of the Galaxy (about 10 kpc or 32000 light years) is 250 km/s, and the direction of motion is toward the constellation of Cygnus — more specifically, toward RA 21h 20m, Dec +49°, or about 6° NE of Deneb.

Most stars, including the Sun, are not in precisely circular orbits around the center at this distance and corresponding speed. An average of the motions of many nearby stars, however, will be close to this velocity and is called the "Local Standard of Rest". With respect to this standard, the Sun and other nearby stars have small, so-called "peculiar" velocities, and it is this which is usually referred to as "the motion of the Sun" in popular talks. This relative motion amounts to about 20 km/s toward RA 18h, Dec +30°, a point in the constellation of Hercules about 10° SW of Vega. Therefore, to determine the Sun's total motion, we should add its peculiar motion to its orbital motion, but this is a small addition.

One must hasten to point out to audiences that despite our motion toward Hercules, we will never "get there", since the stars which make up that constellation are also in motion in other directions.

More on this subject next time.

The Megapenny

Those acquainted with Norman Sperling, director of the Princeton (NJ) Day School planetarium, are aware that he has an imagination beyond compare, besides being somewhat of a nut. Here's his latest caper from the Princeton Pocket of April 26, 1972.

We read; "I have a problem with the kids not understanding the magnitude of things. We fished around for a way to help them visualize the smallest of astronomical numbers — a million — and hit upon the idea of collecting a million pennies." Eventually the plan is to turn the so-christened Megapenny over to his school's scholarship fund.

When the drive began in February, 1971, Norm for some unexplained reason (cheap?) also paid his last visit to the barber, and by this spring, his "long golden brown locks" were past his shoulders. Driven by local needling, he decided to auction off his hair for the Megapenny drive at a public haircutting in the school dining hall. Would you believe a bid of 10,000 pennies? A Bill Hilton bid 55 pennies for one sideburn, which he donated to the freshman class. Three freshmen then bid 100 pennies for the second sideburn, which they donated to Bill Hilton.

The hideous puns which abounded we won't repeat; however we're sure Norm will appreciate it if you want to send him your 2¢ worth...
Radio Astronomy Notes
Conducted by G. L. Verschuur

Radio Stars

During the last few months radio astronomers at the National Radio Astronomy Observatory in Green Bank, West Virginia, have discovered that some of the best known stars in the sky, Algol, Antares and Beta Lyrae, are transmitting radio signals of a completely unexpected nature. Our Sun is known to be a strong source of radio emission, but placed at the distance of any of the above stars, we would be unable to pick up its transmissions with present day equipment. Therefore, the fact that stars such as Algol and Antares are detectable suggests that something very strange is occurring in their atmospheres or surroundings.

Close examination of the data shows that it is the faint blue companion of Antares which is the one that is the radio transmitter. Two other binary star systems have now also been found to be radio transmitters. Both are in Cygnus, and both are strong X-ray emitters as well. Astronomers are at present completely at a loss as to how to describe these phenomena, since not all binaries are radio emitters, or X-ray sources either.

Algol appears to be emitting very irregular radio signals, quite unlike any other radio star, and the incredible thing that has emerged is that, optically too, Algol, which is supposed to be one of the best studied stars, has also shown peculiar variations in its optical spectrum. There is a suggestion such variations may well have been found years ago if the astronomers concerned hadn't thrown away the measurements as bad data! Perhaps some theory for these variations will have been suggested by the next issue of this journal.

Molecules in Space

Radio astronomers have now picked up radio signals from 22 different species of molecules in interstellar space. Seven of these were discovered in 1970, some ten in 1971, and so far only one new one in 1972. Most are organic molecules, i.e. they are carbon based, which shows that organic chemistry is extremely common in our Milky Way system. Of course our own life forms depend on organic chemistry, and astronomers now speculate with more confidence about life elsewhere in the universe.

Some of the more interesting molecules discovered, by means of the radio spectral lines they emit, are carbon monoxide, formaldehyde, hydrogen cyanide, methyl alcohol, acetaldehyde and hydrogen sulphide. None of these are very pleasant substances, but the amounts found in space are very small indeed, being thousands of times less dense than the hydrogen atoms in clouds between the stars. The hydrogen density is typically 1 to 10 atoms per cubic centimeter.

The interesting thing so far appears to be many of these molecules are found in only two or three directions, suggesting that sometimes clouds in space go through a rich molecule producing phase, the details of which are not yet understood. One of these directions lies just off what radio astronomers think is the center of the Milky Way galaxy. There appears to be a region, possibly a cloud in interstellar space, at an unknown distance from the sun in which some 20 different species of molecules have been found. The chemistry going on there is clearly quite incredible—and as yet totally unknown—and whenever radio astronomers want to search for a new molecule in space, they first point their telescopes at this cloud. It does not mean that this cloud, called Sagittarius B2, is really the only one of its type in the Milky Way; it only means that it is the best studied so far.

Another direction in the sky in which many molecules have been seen is the Orion nebula, which appears to be surrounded by clouds containing variously formaldehyde, water, ammonia, carbon monoxide, cyanogen, methyl alcohol, hydrogen cyanide and carbon monosulphide.
Many “straight” people have asked me to describe what it is like to be a planetarium person, and why we are so weird. A benevolent smile cannot completely mask my bewilderment in trying to accommodate them. No simple explanation can begin to relate the many facets of planetarians, so I usually proceed with examples of their behavior.

To begin, I suggest to anyone really interested in planetariumism that he hide in the bushes outside a building and watch people as they go to their cars in the parking lot. You can always spot a planetarian because he is the one who:

1) seems momentarily paralyzed when confronted with sunlight. He blinks a lot and throws his arms in front of his face as he shrinks back. Besides the obvious, all should know the planetarian actually reacts so because he is afraid of the sun. An unfixable sunlight leak in his dome would put him out of a job.

2) may seem to stumble as he leaves a building at night. He will be looking up, checking whether the real sky is set correctly. He may pause, take a battery-operated pointer from his pocket, and seem to trace lines in the sky. This series of motions will seem automatic, as if he has no control over his actions. Careful listening may determine he is also unemotionally mumbling to himself.

The observer might also glance around at the empty cars, for 9 times out of 10, the one with the most dented fenders will belong to the planetarian. You see, he has frequent minor wrecks, caused by inattention, particularly at night. He prefers to look up at the sky to ascertain directions, instead of using well-marked road maps or the compass attached to his windshield. It’s an ego thing, difficult to overcome . . .

HELP! If you have something funny you would like to share, please send it to me: Jane Geoghegan, 405-F Hamilton St., Richmond, Va. 23221.
PRINCIPLES OF PLANETARIUM OPERATION

Co-Editors: Frank C. Jettner and Von Del Chamberlain. Originally conceived as a first year graduate level handbook in planetarium education, written by the leading specialists in the field, installments will appear in each issue of THE PLANETARIAN until completion. It is suggested each installment be removed from the centerfold, punched, and stored in a looseleaf binder for future reference. ISPE and the Co-Editors regret they cannot furnish special binders for this purpose. Questions regarding the text matter may be directed to either Co-Editor or the author of the chapter.

PLANETARIUM PROGRAMMING FOR THE GENERAL PUBLIC

by Von Del Chamberlain, Abrams Planetarium, Michigan State University

I. Introduction

To the public the planetarium is a sky theatre. Characteristic of the theatre, the operator has the opportunity to take his audience where he will, and to present knowledge by captivating his audience within a well-structured plot. Most people return to a planetarium to experience a kinship with the universe, rather than to be consciously instructed about it.

Therefore, subjects for public presentation ought to be selected with great care, developed with even greater care, and delivered with skill. The opportunity to teach is there; make no mistake about it. The important question is how to teach.

The easy way is to teach what is in the astronomy textbooks, essentially as found there. People will sit and listen or perhaps benefit by relaxing both mind and body in the simulated night. A better procedure is to dramatically illustrate discoveries of astronomers and other scientists, converting their technical literature and textbooks into vivid ideas for all to comprehend.

The following are some important questions for the planetarium programmer to consider as he develops a specific topic for presentation to the general public. Why does this topic appeal to me? What is there about it which makes me want to present it to others? Can I generate interest in the subject within people who are otherwise uninformed about astronomy? Does the subject have different meaning to people of various ages, professions, and interests? How can the material be presented to establish continued interest in this and related topics? How can I captivate audiences, igniting their interest in the subject matter? How, indeed, can I present the required information to win as much respect for the subject as I have for it myself? How can I present the material so that members of the audience will want to return soon to learn more?

When he thinks he has the answer to these questions, the programmer should next begin to select and sequence ideas, to decide on techniques of presenting them in visual and audible impressions, and to climax with the most important ideas. He will eventually unite his own feelings with those of great men of discovery, to produce an hour of spoken and visual discourse worthy to be presented under the stars. Outstanding presentations are more the result of the creative ability of those who dream them up than the cost and sophistication of the equipment used to present them.

The modern planetarium is an audio-visual facility with inherent emphasis on the visual. People come, expecting to receive interesting visual stimuli. Their attendance is usually prompted more by what they expect to see than what they expect to hear in the lecture. However, spoken words are the threads binding visual material into meaningful impressions for the viewer. It is very important that public programs be highly visual and well spoken. It is far better to strengthen understanding on vital points of information both visually and vocally than to rely on spoken words alone. This is, of course, why special effects are so important.
II. Preparing the Program

A. Selection of Topics

Two philosophies appear in deciding topics for public programs. Some arrange a sequence of subjects so people who attend regularly will be introduced to a rather complete spectrum of astronomical information. Others prefer to select each topic on its own merit, keeping in mind current public interests and the abilities and interests of their planetarium staff. The latter often still provide opportunity for members of the community to obtain a well-rounded knowledge of astronomy by offering non-technical adult education courses in addition to the regular public programs.

The procedure of deciding each topic independently of preceeding and following ones has several advantages. Obviously, we communicate that information best which is of the greatest interest to us. One naturally tends to select those subjects which he is best prepared to teach. On the other hand, care should be taken not to completely avoid topics which may require considerable new learning. If, as the case should be, we are constantly keeping abreast of new information and also deepening our knowledge of the standard subjects, we will always be looking for those topics which have the greatest potential to be outstanding public programs, and we can choose these without being restricted to a previously decided sequence. We will also probably do a better job of responding to the reactions of our audiences and to change our treatment of the subject matter based upon public response.

In comparing these two methods of planning program topics, one should note that both will probably result in broad coverage of astronomy and space studies. Change of content from program to program is one of the factors inherent in good programming. Planetarians are constantly trying to outdo each other, not only in quality of presentation, but in unique choice of subject matter as well.

Choices relating to sequencing of program topics will likely be influenced by the objectives of the institution governing the planetarium. One at the Kennedy Space Center would naturally concentrate attention on different subjects than one in a typical natural science museum. A state supported university planetarium might well have different objectives for public programs than one owned and operated by a community school system.

Choice of program topics and range of coverage will also depend upon the nature of the surrounding community. For example, population density is an important factor. Planetariums in large metropolitan areas may not have to work as hard for attendance as those in smaller areas. More frequent and more varied changes in topics would be more necessary in lower population areas than in large cities. Another community factor is the ethnic grouping of residents. The traditional Christmas program would probably be received quite differently in Oak Park, Michigan (predominantly Jewish) than it would in the typical American city.

Some of the very best public programs result from discovery of some original procedure of presenting the subject — a procedure involving attention-maintaining stimuli. The topic itself may be new or old. Selection of that particular topic for development as a public program depends upon the ability to present it in a highly interesting way. Once we have a refreshing idea for our presentation, we likely will prepare it with great enthusiasm.

An example of the importance of the principle of original approach to program development is illustrated by a program on the often used topic of seasons. This program was entitled “Sun, Stars, and Seasons”. The basic idea was to begin with dramatic presentations of popular impressions of the seasons and work in careful explanation of why seasons occur. Enthusiasm leading to refreshing ideas began with the suggestion of using a set of projected landscapes, each showing the same features but each in a different season. As seasonal changes of the sky were described, the landscape projections dissolved from season to season. Explanation of the cause of seasons was worked in at various points. In addition the program included dramatic demonstrations of a meteor shower in August, a summer thunderstorm complete with clouds, lightning flashes and thunder, the Harvest moon, and a snow storm with snow appearing to build up on the ground as the landscape slowly dissolved from autumn to winter. The music of Vivaldi, “The Four Seasons”, added the final touch.

B. Researching the Topic

Once the subject has been selected, the programmer must not only search his own mind for ideas, but also the minds of others who have been so interested. He must, of course, make sure that he understands the important aspects of the subject by reviewing textbooks and reading up-to-date literature. Notes taken as he studies will later help to sequence ideas into meaningful order.

One of the most enjoyable attributes of planetarium work is the need for continual learning. Personal improvement is required not only in the fields of astronomy and related sciences, but in such areas as instructional media, public speaking, theatre, writing, psychology of learning.
C. Format and Sequencing

After the topic has been researched, the programmer selects those aspects which seem most suitable for the public presentation. They must then be sequenced into a logical and interesting order.

Several commonly employed formats are: (1) chronological, (2) phenomenological, and (3) spacial order. The first should be familiar and is probably the most commonly used. The second is a sequence of similar physical events presented so that explanation of one naturally leads to better understanding of the next. For example, discussing different sized asteroids can lead to conclusions about the probable origin of meteorites. The third type refers to moving from one object in space to another according to their relative locations. The most common example of this is a discussion of the solar system, working outward from the sun through the planetary system, or perhaps the reverse order, beginning with Pluto and working inward.

Less frequently used methods of public programming are: (4) theatre plays presented under the stars, (5) music under the stars, and (6) dramatic stories presented using planetarium equipment.

The fourth method is illustrated by one of the several dramatic portrayals of the life of Galileo enacted in the round or on a stage under the planetarium dome. Projection equipment supplements the performance.

Musical concerts can offer tasteful variation to the usual public show. Some star and planetary motion might be added. More elaborate musical programs might use considerable projection equipment, combining light, pictures, and motion with the sound.

The sixth method, teaching by the use of a story, is a most interesting one and requires considerable creativity. Some planetariums have presented science fiction stories; e.g., in 1971 Abrams Planetarium presented an original production entitled “The New World”. It was extremely well attended. Later, a short story by Isaac Asimov, “The Last Question”, was developed by the combined effort of the Strasenburgh and Abrams Planetariums. Much astronomical information can be presented in story form. The best science fiction for the planetarium has not yet been written. It will be conceived specifically for planetarium presentation, employing the special qualities of the hemispherical theatre screen and multi-media effects. If large public planetariums continue to thrive, we will likely see elaborate programs of this type, reminiscent of “2001, A Space Odyssey”.

DISCUSSION QUESTIONS: What science fiction stories are you familiar with which might be done in the planetarium? What would be the value of doing them? What would the production problems be? Consider some basic themes which might be developed into science fiction stories for planetarium presentation.

We should emphasize there are no hard and fast rules specifying how programs are to be arranged. The important thing is that the sequence be one which maintains clarity in an interesting way. Most commonly, the programmer merely sequences ideas according to his best judgement, including historical and scientific information brought together so the result flows with continual use of visual and audible stimuli, and the ideas flow from one to another in a coherent, interesting way. The sequence should result from dramatic use of media tools, climaxing in central ideas.

Ideas must also be sequenced in such a way that they can be smoothly presented with the existing equipment. This means all motions of the planetarium projector and other instrumental operations must be carefully taken into account. This is often extremely important. We suggest that once a tentative sequence has been decided, the programmer work through it with his equipment. This can be done even though contemplated auxiliary special effects are not yet prepared. This procedure will, in fact, assist in preparation of the auxiliaries since the programmer will become aware of important limitations around which they must be planned and built.

Following the run through the sequence with the planetarium, the outline is then revised so that it is not only effective from the standpoint of good theatre but from the operational standpoint as well. It is also helpful to discuss the sequence with co-workers or other interested individuals to obtain other opinions about the ordering of information intended for the program.

D. Writing the Program
§1. Title.

After the important aspects of the program topic have been sequenced and the general method of treatment decided, the title can be properly selected. Until this time, some uncertainty existed as the exact nature of the program. Of course, decision on the title may be left until later, but it is usually helpful to begin to consider public response to advertising at this point. For example, promotional materials must be prepared with sufficient time to be printed and distributed before the program opens.

The title should be one which will catch both the attention of the potential audience and the luster of the subject matter. Consider the different impact of the following possible pairs of titles: (1) “The Solar System” and “Children of the Sun”, (2) “Meteorites” and “Fire in
the Sky", (3) "Mythology" and "Kingdom in the Sky", (4) "Navigational Astronomy" and "The Stars Show the Way". An attention-arousing title is the first indication to the public that the program itself will also be enjoyable.

DISCUSSION EXERCISE: Invent attractive titles for programs on the following subjects: (1) unidentified flying objects, (2) astrology, (3) evolution of stars, (4) galaxies, (5) chronological history of the earth, (6) Mars, (7) the Sun, (8) features of the moon, (9) asteroids, (10) comets, (11) nebulae.

§2. Seating and Prelude.

The physical design of planetariums varies greatly, but better planned ones normally try to prepare the audience before entering the sky theatre. Two types of preparation are desirable. Displays, music, and other artistic effects help to set the mood, preparing people mentally for the program by causing them to think about related ideas. Perhaps even more important, people must be physically prepared; one must not forget the crucial importance of dark adaption.

Dark adaption is a variable problem. It is obviously more important when programs are presented during daylight hours than in the evening. It is most extreme on sunny days when snow covers the ground.

Dark adaption can be accomplished by several means. Some planetariums are constructed so the audience spends time in a display hall and/or "blacklight gallery" before entering the theatre. This does not completely solve the problem since some viewers often arrive just before program time and immediately enter the theatre. So it is important to contain the audience in the theatre with subdued lighting for a few minutes before the formal program actually begins. Traditionally, programs often begin with sunset, the lights slowly dimming to allow members of the audience sufficient time for dark adaption.

It is appropriate to plan programs with interesting stimuli in the theatre as the audience enters and is being seated. This is done by the use of suitable music and projection effects started when the doors are opened. Projected clouds and sunset colors with relaxing music are often used. Special light projection effects, which may have no direct bearing on the program but are interesting nonetheless, may be used. Prelude music and "seating slides" are also suitable. Seating slides, often projected in multiples, are normally concerned in some way with the program topic. Some examples are: (1) Christmas card pictures used before the Christmas program, (2) outdoor seasonal scenes used with programs about the seasons, (3) pictures of space vehicles and the earth and moon from space for programs on space exploration themes, (4) scenes from ancient Greece for mythology programs, (5) a flower panorama for shows given in the Spring, and (6) telescopic views of celestial objects for general use.

§3. The Program.

After sequencing, the manuscript is prepared, putting the entire program together on paper. It can usually be divided into three parts: the introduction, the body, and the ending.

As is the case with any public presentation, the beginning must capture and direct attention to the rest of the program. Faced with a given time span, the audience as well as the equipment must be under the control of the lecturer. The introduction is the time when he hopefully obtains this control. It is, without question, one of the most important stages of the entire production.

Having established the setting for the remainder of the program, the carefully sequenced material is presented, being careful not to lose momentum.

The ending is as important as the introduction. This is when the program works to make the audience want to return soon. Music and all effects pick up the tempo to produce the climax.

§4. Activities Afterward.

There are many reasons to consider activities following the public program. A variety of informational and entertaining activities can be appropriate.

When a show does not include much sky identification, the audience might be invited to remain, if they choose to do so, for a brief discussion on the current sky. This satisfies those who came hoping and expecting to learn sky features and provides opportunity for individuals from the public to become personally involved.

Another example is the playing of record albums, radio plays, etc. Most planetariums have excellent sound systems. Music fitting the interests of the community will be enjoyed by many who will remain after. In addition, radio plays may relate to planetarium subject matter; e.g., Orson Wells' War of the Worlds goes well after programs about Mars. Even Count Dracula played in complete blackness is appropriate on Halloween night.

Films which are too long to include in the program, but which are closely related to it, are appropriate after-program features. A wide variety of special films are available which are not generally familiar to the public. Another "double-feature" possibility is to schedule a short but special talk or slide show following the regular program.

Finally, a tried and proven activity for the late evening is the "Star Party". A collection of small telescopes and knowledgeable individuals to man them are valuable assets to any planetarium. People delight in the opportunity to look through a telescope, experiencing the thrill which is basic to the personal realization of the majesty of the celestial universe.

(to be continued in the next issue)
Closed Circuit Television is unequaled for public display, as well as instructional purposes. At THE BURKE-BAKER PLANETARIUM OF THE HOUSTON MUSEUM OF NATURAL SCIENCE, the system pictured above takes full advantage of the precise tracking, versatile servo systems, and unusual load-handling characteristics of the Boller & Chivens 16-inch reflector. The main optics display the night-time sky. A pickaback solar telescope monitors the sun in either Hydrogen-Alpha or White Light with automatic, remote or manual selection. A solar guider automatically tracks the sun. Auto dome rotation and a rain detector allows unattended daytime use. Remote controls three stories below are also provided. 10:1 zoom ratios yield dramatic close ups.

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What’s happening in your section of the world? Would you like to find out who’s doing what and where in our profession? Then this is the part of THE PLANETARIAN that hopefully will keep you up-to-date. This section is for you, about you, and by you. If you don’t keep your Regional Contributing Editor informed, the rest of our membership will be in the dark too. So please send whatever news you may have about your activities to your RCE. . . .

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PAC

The Planetarium Association of Canada reports they have voted overwhelmingly to affiliate with ISPE, the changes in their Bylaws to permit this having passed. In the future their general meetings in even-numbered years will be joint meetings with ISPE, starting this year in San Francisco. The membership fees have also been changed to include ISPE dues; please write to RCE Sig Wieser for details. Sig is also PAC Secretary-Treasurer. Current President is James F. Wright of the H.R. MacMillan Planetarium in Vancouver.

At the McLaughlin Planetarium in Toronto we learn they recently gave a gift to the 1,000,000th visitor since opening in 1968. Dr. T. Clarke has been pursuing research in computer graphics there, and Dr. Henry King has just resigned from the National Council of the Royal Astronomical Society of Canada, due to the demands of his research. He spent three weeks in May in London and Athens lecturing and otherwise collecting material for his work on planetary machines.

GLPA

The Great Lakes Planetarium Association held its last meeting at Mount Clemens, Michigan, October 7-9, 1971. Among the speakers were J. Allen Hynek of Northwestern University, who delivered the annual Armand Spitz address, Richard Teske of the University of Michigan Astronomy Department, and Barnett Rosenburg of the Michigan State Biophysics Department. (Editor: Dr. Teske’s entertaining address on Life in the Universe will be featured in a forthcoming issue of THE PLANETARIAN.) There were also numerous seminars on such topics as “Teaching High School Astronomy”, “Project Viking”, and “Meteors and Meteorites”. About 60 persons from throughout the Great Lakes region attended.

New officers of GLPA, who will serve for two years, began their terms this March 21. President is Don Tuttle, director of the Elgin (Illinois) Planetarium; president-elect is John Soroka of the Waverly (Michigan) High School Planetarium; and the secretary-treasurer, to whom all general correspondence should be directed, is David Batch, Abrams Planetarium, Michigan State University, East Lansing 48823.

On March 25, there was a meeting of the Executive Committee at Elgin, Illinois. It was decided to hold the next general convention of GLPA in Youngstown, Ohio in October, the exact dates to be announced later. A number of possible speakers and activities have already been suggested. Expansion of the activities of the education, publications, and instructional materials committees was also discussed.

SEPA

The Southeastern Planetarium Association held its Second Annual Conference at the Fernbank Science Center, Atlanta, Ga. on June 1-3. Among events planned for the conference were tours to the Nuclear Research Center at the Georgia Institute of Technology and the Lockheed Georgia Company; an observing session at the Fernbank Observatory and a viewing of the videotapes taken of Apollo 16 and certain Messier objects with the 36” telescope; Dr. G.L. Verschuur of the National Radio Astronomy Observatory speaking on Our Milky Way Seen From Afar; Dr. W.G. Pollard of Oak Ridge Associated Universities speaking on Black Holes; and twelve papers given by SEPA members.

Because the conference was held after the closing date for news insertion in this issue of THE PLANETARIAN, more information will appear in the next issue.
The Middle Atlantic Planetarium Society held its spring meeting on Long Island, April 14-16, 1972, at the Half Hollow Hills High School Planetarium and the Vanderbilt Planetarium at Center Port. Some 80 persons from Virginia to Massachusetts to Michigan attended what became a most successful and rewarding conference.

The first general session featured, among others, Donald Lunetta of the McGraw-Hili Planetarium discussing *Planetary Techniques in Nonplanetarium Environments*, and Bruce Dietrich, Reading Pa., who expounded upon the *Ultimate Planetarium*, which does away with the “thing” in the room’s center and coats the dome with millions of Light Emitting Diodes. Art Maynard of West Islip, L.I. demonstrated a rather ingenious system using an overhead projector and masked transparencies containing words in *Word Projection in the Planetarium*. Many delegates also got a “charge” out of *The Uses of Electricity in the Planetarium* by Herb Schwartz of Brooklyn.

At the first dinner F. Peter Simmons, director of the Advanced Space Astronomy Division of Grumman Aerospace spoke on the use of the Space Shuttle in astronomy and related its applications to earth-based observatories. He then described the planned *Large Space Telescope*, an orbiting 120” telescope.

The second day was filled with numerous seminars and special programs by members. We especially note a "Seminar For the Deaf", with panelists Richard Peery, Trenton, N.J., Terry Dickinson, Rochester, N.Y., and Lionel Daniel, Vanderbilt Planetarium. This generated considerable interest, and by the end, the subject had switched to working with the mentally and physically handicapped in general.

The second dinner featured the presentation of the award to the winner of the First Annual MAPS Gadget Fair, Mr. David Woll of Franklin and Marshall Planetarium, Lancaster, Pa., for his “alarm clock/solder drop/solar eclipse projector”. Mark Levine, who instituted the Fair, had the honor of presenting him the coveted (?) *Tinkertoy* for tinkering excellence. The dinner speaker was Dr. Henry C. Courten of Dowling College, L.I., a world-traveller interested in observing solar eclipses and looking for planet-like objects near the sun.

In the business session new officers of MAPS were announced: John Richardson, Huntington Valley, Pa. continues as President; Peter Connors, Half Hollow Hills, N.Y., new Vice President; Tom Stec, Norristown, Pa., Treasurer; and Phyllis Pitluga, Secretary. New Society Directors are Jackson Wilcox, Worcester, Mass., Mark Chartrand, New York Hayden Planetarium, and Mark Levine, Vanderbilt Planetarium. At the invitation of Mike Bennett, the fall meeting of MAPS will be held at Spitz Laboratories, Inc., Chadds Ford, Pa. Exact dates and program information will be announced in the September issue of THE PLANETARIAN. (Reported by Mark Levine)
All western eyes are on the new installation at San Diego in Balboa Park, The Fleet Space Theatre under the direction of Mike Sullivan. Plans are for a spring opening with the all-sky projection system, the new Spitz STS Planetarium with PDP-15 computer, and a cinerama projection system. The biggest and best omniphonic sound system yet will also be installed. The lines are beginning to deepen in Mike's face as he races to get his facility and program ready.

Don McDonald, director of the Minolta Planetarium of DeAnza College, recently travelled to the Hansen Planetarium in Salt Lake City to obtain Final Journey, an original science fiction story written especially for "Planetarium" by Mark Littman. He is also negotiating with Dennis Gallagher of Omnitheatre, Inc. to bring in The Beginning and End of the World. If finalized, that show will be running during the ISPE-PAC conference in November.

Another popular production is The Jupiter Family being run at several western planetariums. Written by Tom Gates and Don McDonald, it is available as a package of script, tape, and slides on loan from Garth Hull, Educational Programs Office, 204-7 NASA Ames Research Center, Moffett Field, Calif. 94035.

Are you going total eclipse observing this July? If so, tell us about it when you get back. Please send in your reports, photographs, and any hints on unusual ways you may intend to use your material for upcoming planetarium shows. Items received by August 1 will make the September issue of THE PLANETARIAN, and the remainder will be featured in the December issue. Please write to: Mr. Donald L. Bean, Peter Hurst Planetarium, 3225 Fourth Street, Jackson, Michigan 49203.

Some unusual productions are being run in planetariums these days. Both the Strasenburgh Planetarium in Rochester and the Abrams Planetarium in East Lansing this spring featured The Last Question, a science fiction story by Isaac Asimov adapted for the planetarium theatre. Described as humorous, thought-provoking, and totally absorbing, the play explores the problem Man faces trillions of years in the future as the Universe runs out of energy. It begins in 2061 when the last question is asked for the first time by two half-drunken computer attendants, and continues over 10 trillion years as Man and his computers become increasingly sophisticated.

The Strasenburgh Planetarium in conjunction with the Rochester Blackfriars also put on the Greek comedy, The Birds May 11-21. This very funny play by Aristophanes tells how the Greeks of 2400 years ago were concerned about the integrity of their government, the effects of war, and the search for a Utopian life. Sound familiar?

The Miami Planetarium has lately gone in for some far out double features, created by Jack Horkheimer. Seems his programs are being reviewed by the local film critics, as well as the newspaper science editors. Jack created a wild multi-media show called Cosmic Jazz, followed recently by Cosmic Jazz: Edition Two. The show made DOWNBEAT yet! His June lecture will grab you - BUCK ROGERS: RIGHT ON! Jack feels he has convinced the Miami press his planetarium productions are a new art form. Whee!

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WANTED: planetarium director for the Jacksonville Children's Museum. Minolta MS-10 projector. Teaching certificate desirable. School system benefits for either a 10 or 12 month position. Apply in writing to Dr. G. Dekle Taylor, Jacksonville Children's Museum, 1025 Gulf Life Dr., Jacksonville, Florida 32207.

PROSPECTIVE EMPLOYERS: The Executive Editor has on file several letters from well-qualified planetarium teachers seeking new employment. Please write if interested or call 518-457-3207.

**************
The Technical Side
by O. Richard Norton, Fleischmann Atmospherium/Planetarium

This section is concerned with the technical side of planetarium program production. This includes all aspects of special effects projection, slide production, motion picture application, sound effects, and other effects used in the planetarium to illustrate phenomena and create a desired illusion and environment. To complement widely varying mechanical and photographic capabilities, the techniques discussed here may range from simple though effective special effects projection to relatively complex multiple projection, slide, and audio techniques. Mr Norton welcomes articles from readers for future publication in this feature and letters in response to published columns. Write to him c/o University of Nevada, Reno, Nevada 89507.

The old cliche’ that “a picture is worth a thousand words” can be expanded in the planetarium to “a picture in motion is worth a thousand still pictures”.

Motion in special effects projection can be classified into four broad areas: circular, linear, elliptical (or any conic section other than circular), and compound or random (two or more motions in combination). In the first four issues of THE PLANETARIAN, these four motions will be featured here. We shall begin with circular motion.

Basically, two techniques may be used to produce circular motion: optical and mechanical. The most obvious method of optically rotating an image is by mechanically rotating a dove prism around the optical axis of a projection system. The prism is held by its edges and mounted in the center of a wheel. The wheel prism unit is turned by either a pulley belt (an O-ring) connected directly to a small pulley on the motor, or a friction drive can be used. A more positive method of turning the prism is to substitute a solid spur gear for the wheel.

Two problems are inherent in this optical method of rotation. Invariably, a secondary prismatic image is created by the prism that moves with the rotating prism. Since this image does not cross the primary image, it is easily removed with a simple mask. The other problem involves mounting the prism so the optical axis of the prism is coincident with that of the projection system. Any misalignment causes the image to wander around a stationary point on the dome. Thus it is necessary to provide adjustments for either the prism mount or the projector to achieve perfect optical axis alignment.

The most obvious use of this rotation system is to rotate 35 mm slides projected on the dome zenith. This allows all the spectators to view the slide upright for a short time. Another very effective use is to rotate totally isolated slides of spacecraft against a moving star background. To maintain realism and to keep dome distortions to a minimum while rotating, the spacecraft on the slide should be relatively small.

More versatile than the use of a dove prism is to use a 3 ¾ x 4 ″ lantern slide projector that can accept a “mechanical slide” or moving slide mechanism. Lantern slide projectors tend to be avoided, especially by the smaller planetarium facilities because of their bulky, noisy nature and the problem of scattered light. Actually, their use as a “general projector” for mechanical slides far outweighs the above inconveniences, all of which can be alleviated with some careful thought.

The moving slide mechanism is simply a rectangular frame fastened onto a backplate. This frame can be constructed without the use of machine tools and can be made of stock aluminum or even wood. The backplate has a rectangular hole cut into it slightly smaller than 3 ¾ x 4 ″. The entire frame fits into the slide holder of the projector. In the center is mounted a 35 mm slide of the subject to be rotated. Here, the slide itself is mechanically rotated rather than the image. There are none of the optical or alignment problems involved with optical rotation in this simple method.

There are two alternative methods of mechanical rotation, one by a pulley belt and the other by gears.

An excellent use of this technique is the creation of a double star system. Here, the circular disk has two holes cut in it, one considerably larger than the other. The larger aperture representing the more massive star is close to or even overlapping the axis of the disk (center of rotation), while the smaller aperture (less massive star) is placed quite far out on the disk. The illusion created is one of a double star system seen face on with the more massive component closer to the center of mass of the system.

The use of the mechanical slide to create circular motion has almost unlimited application in the planetarium. Those who object to using lantern slide projectors in a small dome could adapt this technique to a 35 mm projector whose focal plane is easily accessible. Miniaturization of the above mechanisms, though possible, can be troublesome and difficult to construct and handle.

* * *
A Directory of Institutions Offering Coursework in Planetarium Education

Edited by Frank C. Jettner, SUNY at Albany

We believe this directory is fairly accurate and complete as of the publication date. Please send any changes and detailed information about new entries to the author as Executive Editor of The Planetarian. A revised edition of the directory will be published annually henceforth in the March issue.

For application forms or detailed information about the programs, please write to the person named.

Prof. Noble Gantvoort
Planetarium
Adams State College
Alamosa, Colo. 81101
Two 5-week summer institutes each summer (2 hrs each)

Mr. Michael Bennett
Education Director
Spitz Laboratories, Inc.
Chadds Ford, Pa. 19317
Two 1-week summer institutes each August. Graduate credit (1½ hrs each week) optional from West Chester State College (PA). Participants may attend either or both weeks. Specific planetarium teaching skills are emphasized: 1st week, elementary grades usage; 2nd week, secondary and collegiate usage. Open to novice and experienced planetarium teachers.

Dr. Joseph M. Chamberlain
The Adler Planetarium
1300 S. Lake Shore Dr.
Chicago, Illinois 60605
The Adler Planetarium is a special administrative unit of the Chicago Park District, operated jointly under a private Board of Trustees. It is directly associated through its academic staff with the Departments of Astronomy of Northwestern University and the University of Chicago, each of which offer the B.S., M.S., and Ph.D. The museum's planetarium is used for in-service training for their graduate students. In addition six of the adult education courses offered during the year may be taken for credit (2 hrs) through DePaul University.

Dr. Marjorie Gardner
Science Teaching Center
University of Maryland
College Park, Maryland 20742
Summer CCSS Program, cosponsored by MAPS, followed by AVI Program for advanced planetarium educators. Offered 1970, 1971, omitted 1972. Qualified planetarium specialists may be admitted to the general graduate education degree program.

Mr. Von Del Chamberlain
Abrams Planetarium
Michigan State University
East Lansing, Michigan 48823
M.A.T. degree with major in planetarium education. Special courses for novice planetarium teachers offered some summers. Ph.D. in science education (Curriculum) with emphasis on planetarium usage can be arranged.

Prof. Paul R. Engle
Observatory Director
Pan American University
Edinburg, Texas 78539
B.S. in Astro-Science with option in astrophysics or planetarium astronomy.

Dr. Billy A. Smith
Chabot College Planetarium
25555 Hesperian Blvd.
Hayward, Calif. 94545
In-service teacher training workshops in planning, tentatively scheduled to begin 1973/74.

Dr. Michael Seeds
Dept. of Math. and Astronomy
Franklin and Marshall College
Lancaster, Pa. 17604
B.S. with dual emphasis in physics/astronomy and education; graduates receive Pennsylvania state teachers certificate. Plans for expansion of program to include earth and environmental science majors.

Dr. William J. Kaufman
Griffith Observatory and Planetarium
P.O. Box 27787, Los Feliz Station
Los Angeles, Calif. 90027
Griffith Observatory is a unit of the City of Los Angeles. Planning is underway to provide in-service training for astronomy graduate students at UCLA.

Prof. Gibson Reaves, Chairman
Dept. of Astronomy
University of Southern California
Los Angeles, California 90007
B.A. in astronomy with planetarium education option. Masters program in non-research aspects of astronomy appropriate to planetarium teaching now in planning.

(continued on page 32)
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THE PLANETARIAN, 6/72
Asimov

Europe who was the least bit self-respecting ever read American journals. In fact, if questioned, they would have denied that American journals existed!

In the 1870's America had exactly one physical chemist of the first rank. In fact, although the Europeans didn't know it at that time, he compared in excellence to any European physical chemist. His name was Josiah Willard Gibbs. He worked at Yale, and he led a very quiet life. His sisters ran his house for him, and he walked from his house to Yale and from Yale to his house over and over again, and people said, "That's Professor Gibbs"; and other people said, "Who?", and that's his entire biography. . . .

Except that he worked out something called the Phase Rule, and he wrote it up in incredible length, in the finest of mathematics. In fact, he wrote it up so well that nobody ever since then has had to do much work on the Phase Rule. Oh, a little polish here, a little refinement there, a little rephrasing here, but essentially, he invented the Phase Rule in its final form, so to speak. It came full-grown out of his forehead, and he presented it to the Transactions of the Connecticut Academy of Sciences. They looked at this weighty manuscript filled with the very finest of mathematics, and they asked each other, "What is this?" They weren't sure whether they should publish it or not, because maybe it was a huge come-on. Not one person in the Academy or for that matter in the United States and very few in Europe could understand the significance of the mathematics or the importance of the work that J. Willard Gibbs had done.

It was published in the 1870's however, and sank promptly into what one might call a trough of nothingness. Occasionally, some unusually intelligent scientist in Europe would notice it and remark upon it. For instance, James Clerk Maxwell in Great Britain saw it and said this was great stuff. And unfortunately, he died very shortly thereafter! No connection, I believe. . . .

Finally Ostwald in Germany and LeChatelier in France, two of the European founders of physical chemistry, translated the material into German and French respectively, and it was when translated into German that it finally penetrated the ivory towers of the European scientists. One of them discovered to his dismay that he had worked out pretty much of the Phase Rule, and here it was, the credit and priority were snatched away from him by the fact that some 15 to 20 years earlier, this American savage had done it! And who was this European who got this thing snatched away from him? It was our old friend, Jacobus Henricus Van't Hoff! Getting it in the neck again!

Now I have always thought that my heart would bleed for Van't Hoff, because he had been cheated of the equivalent of two different Nobel prize-winning type materials, even though the Nobel prize wasn't being given in the 19th century, by the fact that people from outlandish places did it secretly first, publishing it where no one could see it, in languages no one had ever heard of, and letting him do all the work independently and getting no credit. Except that when they finally did begin the Nobel prizes, who got the first Nobel prize in chemistry? Why it was our friend, Jacobus Henricus Van't Hoff, for work he did in a third field altogether on solutions, which by some unexplainable good luck nobody had turned out to have beaten him in Patagonia or in Australia or in somewhere like that! But he had to do it three times!!

Now the question arises; was it possible to publish an article in German and still be ignored? After all, German was the language in 19th century science, and the answer was, yes indeed! It was possible if you wrote in German and included one little facet that is perhaps the most easily misunderstood science of all. I am referring of course to higher mathematics, where you use figures of as many as three digits. . . .

I'll have to sneak up on this one.

The greatest biological discovery of the 19th century was Darwin's Theory of Evolution by Natural Selection. The key words are natural selection. For a long time, since
ancient times in fact, there has been the suspicion that some sort of evolutionary development was the only way in which you could account for the manner in which the classification of species existed. All these different species are all so well adapted, all so intricately interrelated, that if you assumed that every species was independently created, it was too great and too unnecessarily complicated an assumption; whereas if you assumed some form of evolutionary development, it was neat. The only problem was, how would evolutionary development work? In other words, just to say “evolution” is just to say “automobile” without an “engine”. What you have to discover is the “engine”, and what Darwin did was to present evidence in favor of natural selection as the “engine” which kept evolution going. In other words, there are always variations in every litter, in every group of youngsters, in every new generation, and those that came to terms best with nature, landed the most quickly, had the strongest teeth, could hide best, were most seductive in their approach to the opposite sex; name it; they survived best. As a result of natural selection over the generations, species varied amongst themselves. New species formed; old species died out; and the entire vast panorama of evolution was powered.

Unfortunately, there was one basic flaw in natural selection as presented by Darwin, that Darwin knew about, that everyone else knew about, and that somehow everyone agreed to ignore because it would spoil everything if they didn’t ignore it. They didn’t want to spoil everything because Darwin’s theory was too beautiful to spoil. The thing was that in time, some explanation would be found, and meanwhile, let’s keep it going. The flaw was this: Darwin and everyone else in his time assumed that if you had two individuals, one of whom was unusually short, and if they married (to use a human-type term), their offspring would be intermediate in height. In other words all of the extremes in these properties of organisms would melt toward an undistinguished medium if there were random marriages performed. (Well, since we are an adult audience, “random matings”. You see, sometimes I speak to youngsters, who all know more about it than adults. . . .) In that case, upon what would natural selection cease? If, for instance, it was important for a giraffe to have long legs and a long neck, obviously, amongst any generation of giraffes those with long necks would do better and survive better and have more kids. But then the long-necked giraffes have the extreme poor taste to fall in love with short-necked female giraffes, or vice-versa if the long-necks were females, and had kids with shorter necks, I mean what was the good of the long neck? Nobody could answer that.

Although they made up theories. A man called von Nagely — I think his first names were Karl Theodore; 19th century scientists all have five first names for some strange reason — was a Swiss botanist, and he worked out a theory called orthogenesis. With all due respect to any Germans in the audience, there was something about 19th century Germanic scientists that made them very strong on theory, which they expounded in very turgid prose. I like to think this is partly because of the nature of the German language, which for some reason cannot be translated into any other language in such a way as to make it thoroughly comprehensible. It’s a built-in property. I say this out of prejudice; I am a great pro-English person. In any case he worked out a theory called orthogenesis to explain why it was that evolution could go in a particular direction, even though if we consider random matings, the extremes would always melt down into the intermediate. He felt that there was a kind of evolutionary inertia, as might be exemplified for instance by the evolution of the horse, which started out as the cute little Eohippus, about this tall, with four toes, four little hoofs on each cute little leg, and as time went on, it got larger and larger and fewer hoofs, three hoofs, and then one hoof with two little teeny hoofs that didn’t quite make it, and then finally one hoof, that’s all, and it became about this tall, you know. He said never mind that the slightly taller ones might marry the slightly smaller ones and become intermediate in size, so that the species never really grew. There was a kind of biological inertia that carried you forward in the direction you were going, no matter how you made it. So the horse just naturally got bigger and bigger with fewer and fewer toes. You could see, looking into the future, that eventually the horse would be as tall as this building and have no toes at all. . . .

And in fact, it was felt that this was one of the reasons that certain species became extinct, such as the Irish elk. It had huge antlers, and the idea was that the antlers got bigger and bigger until, far from being useful, far from being selected naturally, they became a hindrance to the animal. He couldn’t hold his head up, you know; he kept hitting against low hanging branches. The Irish elk would fight, and their antlers would get interlocked. Still, they would keep getting bigger and bigger, even though they were actually hurting him, until finally they caused the Irish elk to become extinct.

This was von Nagely’s theory of orthogenesis.

Meanwhile in the neighboring Austro-Hungarian Empire in the city which is now called Brno (but which in the German language was Brunn, and I will call Brunn because I can’t pronounce Brno!) was an Augustinian monk who was frustrated! . . .

But not for the reason you think!! . . .

His ideal was to be a teacher in science for high school
students, and he had tried to pass the test given out by the Austro-Hungarian monarchy, that they wanted all prospective high school teachers to pass before they became high school teachers. And he flunked three times running. He retired to his Augustinian monastery in considerable chagrin, you may be sure, unaware of the fact that despite his failure, his name would be made immortal by his researches.

And you ask, what were his researches? Well, I’ll tell you. He had two interests. He was interested in botany, and he was interested in mathematics. And since a monk is usually kept pretty busy, he had no time to run both his hobbies, so he combined them. He grew plants and counted them. . . .

He grew sweetpeas, and he would self-pollinate the sweetpeas and observe what happened. He had different varieties; he had tall peas and short peas, green peas and yellow peas, smooth peas and wrinkled peas, all different varieties, and then he would cross them. He noticed that, for instance, if he crossed tall peas and short peas, he got only tall peas; no short peas at all, no intermediate peas, only tall peas. This was right against the general conception of the extremes melted away into an undistinguished intermediate. On the other hand, when these tall peas that had been originated through a cross were self-pollinated, then of the offspring there were tall peas and short peas in a 3:1 ratio. However, if he took the tall peas that only had tall peas for ancestors, they gave rise only to tall peas. So apparently there was some difference between the pure tall peas and the hybrid tall peas. The short peas which disappeared when crossed with tall peas reappeared again with certain number in the following generation.

He continued this sort of experimentation, and he worked out theories. For instance, every plant contained what you might call hereditary factors. Each one had two. There might be an hereditary factor for tall, and there might be an hereditary factor for short. If a tall plant had two tall, a short plant two shorts, and you combine them, the offspring have one tall and one short and show up as tall. If you self-pollinate them, you get various combinations: two tall, one tall and one short, one short and one tall, and two shorts. It all worked perfectly, and he wanted to publish it.

However, the question was, should he publish or should he not? He was not a professional botanist, but just a lowly monk in an Augustinian monastery. He couldn’t pass his science test, and he was a little nervous about trying to present this. So he sent his manuscript to von Nagely, who happened to be the greatest botanist in the near vicinity, and he asked him for a comment. Von Nagely looked upon this paper with complete horror. In vain did he look through it to find some turgid theory, some appropriate suggestion in the high empyrean of Teutonic language that no one could understand. Instead he found in it figures, and this was something that he himself did not like. He sent back the paper with some cold comments. If Mendel would send him some peas, he offered to grow a few peas himself and look at them. Presumably upon looking at them, he would work out a theory. Mendel was easily discouraged. He published the paper and did no further research. There were other reasons too; he grew fat, he couldn’t bend down, he was made head of the monastery, and he got into a big hassle with the Austro-Hungarian monarchy over whether the monastery should pay taxes or not. This sort of thing wears a person out.

One part was published in 1866 and another in 1868 in the journal that was called something like the Transactions of the Natural History Society of Brno, which was distributed all over Europe. It was a perfectly respectable journal in the best German, and I imagine that lots of people saw it. But you see, the difficulty was that if a person was a physicist and was used to higher arithmetic, he was not likely to look at biological papers. If a 19th century biologist however were to come to this paper and notice it, read that there were three digit numbers in it, why he would pass on to the next paper without bothering to look at it. As a result, for 34 years nobody looked at this paper which contained within it what we now call the Mendelian Theory of Inheritance.

In 1900 however, we come upon Hugo deVries, and he represents a different story. It starts in a different place with a German called Helmholtz, who was the first to specifically express what we call the Law of Conservation of Energy in 1847. According to him, energy could be neither created nor destroyed; you could only swoosh it around a little!

So he asked the question, where does the energy of the sun come from? Now this, I wish to point out right now, is the penalty for working out a great scientific discovery. Until Helmholtz’ time, nobody had specifically worked out the Law of Conservation of Energy, and if someone had said, why does the sun shine like that, the proper answer was: “Because it does, jerk!” But Helmholtz couldn’t answer that way. The energy had to come from somewhere, and there was no place that we knew about in the mid-nineteenth century which would supply that much energy for a long period of time.

He tried different ways. Suppose the huge sun was made up completely of hydrogen and oxygen which were burning, and to hand out as much energy as it does right now, it could only last for 1500 years, and then the whole thing would be burnt up. You would just have a huge globe
of water there. But we know that the sun has been at it for longer than 1500 years; we just know, that’s all. And then he calculated maybe meteorites were falling into it, and splash, splash, all the energy of the motion of the meteorites would supply the energy. Fine, except that would increase the solar mass to the extent where the earth would be constantly whipped around its orbit a little faster each year, and the year would shorten by an amount which could be easily detected, by people who run planetariums for instance. And this was not detected, so that was out.

Finally Helmholtz thought he had it. The sun would be contracting; in other words, all parts of it would be falling toward the center, and the gravitational energy would be converted into radiational energy. He determined that the amount of contraction of the solar diameter would be so small that for all historical times it would not be large enough to be noticed.

This was great! This answered everything until such time as Helmholtz decided, well now, suppose we run time backwards and look into the past. Obviously then, the sun is slowly expanding. When would it have expanded to such a great degree that it would enclose the orbit of the earth? The answer turned out to be 100 million years. In other words, in order for the sun to convert the gravitational energy of its own contraction into radiational energy at its present rate for a 100 million years, it would have had to start out something like 186 million miles in diameter; in other words, enclose the earth. Well, that just meant that the earth was created 100 million years ago; it sort of came off the outside of the sun, and the sun contracted away from it, and the earth cooled down, and all the rest, and he announced this theory.

As a result both geologists and biologists screamed with horror, rage, and disappointment. The geologists said they knew for sure that the various aspects of the earth’s crust required more than 100 million years to form, and biologists, who had just been working out the theory of evolution, Darwin’s theory, knew that it took more than 100 million years for all this evolution to take place. And they said so. But physicists are a very important bunch, who say you cannot argue with mathematics, and therefore, there was absolutely no compromise on their part.

Little by little, the geologists decided to mumble off in a corner by themselves. . . . Some of the more helpless biologists decided to try to adjust evolution to this little discovery. The gentlemen, like Hugo deVries for instance, decided that perhaps evolution proceeded in jumps. In other words, it wasn’t that an antelope gradually had a longer and longer neck until it became a giraffe. Maybe the antelope went to sleep one day, and he woke up the next morning, and heavens, he was a giraffe. Or maybe the mother giraffe with a short neck had a baby giraffe with a

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suddenly long neck and had to explain it to Papa giraffe!

While musing on this, he came across in a Dutch meadow in the 1880's a patch of evening primroses, which had been imported from America. They had obviously grown from an original plant, you see, which had been scattering its seeds right there, but they were of all different kinds. Some were tall, some were short, some were like this, some were like that, and he gathered them up, brought them home, and bred them. He found each variety bred reasonably true, but every once in a while, they gave birth to another variety. Heavens, evolution was indeed proceeding in jumps. He called them mutations.

And this is what happened to Hugo de Vries. After he worked up what we might call the Corrensian Laws of Inheritance, and having done that, he said, "Hey, I might as well check the literature!", and he did check the literature, and he discovered Mendel's Laws of Inheritance. You may well imagine he was chagrined also. Meanwhile in Austria.... Eric von Tschermak had worked up what we might call the Tschermakian Laws of Inheritance, and then he checked through the literature, and he found Mendel's paper. All three worked it up independently in the same year; all three went back into the literature; all three found Mendel; all three published their own papers as confirming evidence, quoting Mendel as the discoverer. It is really, to me, one of the triumphs of scientific ethics that not one of these three men pretended that he hadn't seen the paper. Not one of these three men thought that he might get the credit if he kept his mouth shut. They all sacrificed their chance at immortality for the sake of what I can only say is honesty. Of course, as you may well imagine, the only reward that Eric von Tschermak and Carl Correns have received for this thoroughly wonderful attitude of theirs has been complete oblivion!....

Hugo de Vries escaped complete oblivion because of the theory of mutations which he had worked up. But the Mendelian Laws of Inheritance went a complete generation before being discovered. And was there any harm as a result? Well it's hard to say. The proper test of this is to run a control. In other words, let's turn the universe back to 1866, point out the Mendelian Laws of Inheritance to all the great biologists of the time and assure them that they were true. And now, let's see how genetics would develop. Consider that genetics right now is the hottest branch of science; that it breeds Nobel prizes like rabbits; in fact, the most recent one (1968) went to Marshall W. Nirenberg and a couple of helpers for breaking the genetic code. We can only wonder what would have happened, if we would have had an additional generation to work on it. Now granted, I know very well that science doesn't exist in a vacuum, that the little branches of science are all interdependent, that there wasn't much you could do about genetics until you also invented such things as the proper X-ray photographs, and you had all the various molecular biological techniques, and you had paper chromatography, and a few other things like that. Granted. Granted. But we would have had an extra generation to think about it, to puzzle out what experiments could be done. It is impossible, I think, that we would not have been farther ahead now in this extremely vital branch of science if we had not lost a complete generation in the 19th century, simply because something, which was written for all people to see, was not quite seen.

It would seem then that nowadays, to come up to the
present, one way of assuring the world that science will continue to advance as rapidly as it might, is to make every effort to improve communications. The situation has not grown better than it was in Mendel’s day; it has rather grown worse, simply because science suffers from an embarrassment of riches. Every year, there is more work being done, more work being reported, more work to be read, more work to be absorbed. Nobody can do it; nobody can keep track, even in their own narrow specialty, and each year, the specialties grow narrower.

I suggest therefore, that one specialty that must be developed and that will be developed, I’m sure, is that of the science writer. Essentially, he is the science communicator. He is the person who is no specialist. There is nothing he knows particularly well; it’s just that he knows a little bit about a whole lot of things, and what he does is write about them for others to read. Of course, this is an entirely self-serving function, because I look upon myself as a full-fledged science writer, born in advance of his time! I am leading the way! I am a pioneer! As I always say, I don’t know as much biology as a biologist or as much physics as a physicist, but I know more physics than a biologist, I know more biology than a physicist, and I know more astronomy than both of them put together! I can write on any field with a certain eager superficiality which will not satisfy the specialist in that field but which will please the non-specialists. I can let them take off from there.

I once wrote a story on this subject, called “Dead Hand”, with a thrilling plot, terrific characterization, and an absolutely exciting climax. But the important thing about it is that I introduced my science writer. You see, I envisaged a future in which all scientists immediately upon attaining their Ph.D.’s or an equivalent degree promptly applied for a basic research grant. You see, all research was subsidized by the government, as it virtually is now. Furthermore, once you get your grant, you specify the field in which you are to do your work. That is your field for the rest of your life. You are by no means to work outside of the field, because that would be intellectual anarchy. It would be resented by everybody else, because no matter where you work, there would be somebody else’s basic research grant, and you know, you go around establishing territorialities. Furthermore, as you work, your field narrows and narrows and narrows, so that constantly, you get to know, as the old saying goes, more and more about less and less, until finally you know everything about nothing.

There is one exception to this, because in this same future, where everyone specializes on their own work, it is taken for granted that a writer not write on his own experiment. After all, let’s face it. What is there about a scientist that should make us think that out of necessity, he can write readable English? We don’t suppose that just because he is a scientist he can cobble his own shoes; just because he is a scientist he can write a symphony; just because he is a scientist he is a dead shot with a rifle. I mean, he may be able to do any of these things, but not necessarily! And since the skills involved in writing are of the highest quality, and the process calls for greater talents and a greater share of genius than any other — no one else says so, so I’ve got to!! — why assume that a scientist can do this? Of course, any one of us who reads any scientific journal can tell at a glance that very few scientists can write; in fact, very few can write their way out of a paper bag, which is why so many of them act as though they are in paper bags!

Therefore, what you have to get is a science writer, a specialist in English prose, in the difficult task of putting words together in such a way that they say what you think they are saying. These science writers in my story never went to college. They kept their minds pure! And uncluttered! And for a purpose! The scientist brought his results to the science writer, and naturally he tried to get the best science writers he could, the ones who charged the highest fees, and he was anxious for them to present it, because if they presented it well, it might mean all kinds of honors and rewards for him. So he would bring the manuscript to them, and the science writer would read through it. He would then say, “I don’t understand a word.” So the scientist would anxiously start explaining, you see, and he would say, “So what I am trying to say is this. . . .”, and the science writer would say, “Well, why don’t you say so?” Little by little, they would work it down and melt it down and render it. You know, when you get something very fatty, when you render it, you have only this charred little bit left. That’s what he would get in the end, a small paper written in English! Once that was done, the science writer would look at it and say, “Hey! Guess what? Two years ago, when I was working with someone else on his research, he said the same thing you said! So don’t bother!”

My ideal would be that the entire course of scientific production might through the use of the appropriate science writers be reduced in volume to 10% of what it might otherwise be and increased in meaning of 1000% of what it might otherwise be. We would get a scientific output of such concentrated intelligence and meaning, that perhaps science would take off on a vast new progress. If so, it would please me enormously — if such a society ever really came to pass — to be able to look back and recognize that I, myself, with all my faults led the way to a precursor of the true art of communications.

(End)
THE GOLDEN GATE

to 20 minutes each. Audio-visual equipment is available for your use, but please indicate what you need. Topic areas include the following:

1) Education sessions — covering programs for the elementary grades (K-8), senior high (9-12), and college (undergraduate, graduate, and adult education);
2) Public sessions — covering programs for public consumption which are not part of a curriculum program;
3) Philosophy sessions — covering approaches such as live vs. taped deliveries, canned programs, multi-media vs astronomy-only uses of the planetarium, and others;
4) Technical sessions — covering hardware such as graphics, audio, electro-mechanical devices, implementation and application techniques;
5) Administrative sessions — covering publicity ideas, scheduling, traffic control, staffing, and other management areas.

Papers should be specific in nature and refer to techniques, programs, innovations, materials, and philosophy of interest to the group.

Sessions in these topical areas will feature contributed papers and a group exchange with a panel composed of the contributors and individuals in the subject area known for their achievements. Since time permits only a few papers in each topical area, please get your abstract or brief regarding the paper in early. Abstracts are dated as received and given priority on a first-come basis.

Accommodations have been arranged at three nearby motels; Howard Johnsons, The Royal Executive Inn, and The Vagabond. Room rates run $14.00 per night for a single, $16.00 to $18.00 per night for a double (one bed), and $18.00 to $20.00 per night for a double (two beds). Some persons undoubtedly will prefer the last, doubling up to save on expenses. We are arranging bus transportation, but realizing some of you will rent cars, we need an indication.

We currently anticipate a conference registration fee of about $30.00, depending upon the amount of outside financial support we can secure. PPA has already pledged some help. Speakers, transportation, the main banquet, and as many dinners and lunches as can be purchased, will be accommodated in that registration fee.

Time and meeting places will be allotted for ISPE, PAC, and the regional associations to hold business meetings. Several items important to the future of ISPE will be considered.

With Stanford University, the University of California at Berkeley, the University of California at Santa Cruz, Lick Observatory, and NASA Ames Research Center all close by, a number of good speakers in both astronomy-space science and education are available. We have secured some speakers, to be announced shortly, and have a number of others who have indicated interest in speaking.

A number of activities for the wives will be available, including concerts, ballet, and other programs nightly at the new 2700 seat Flint Center for the Performing Arts right on the De Anza College Campus. In addition, some of the world’s finest wines are produced in the Santa Clara Valley, and a wine tasting party is being planned.

Truly, we anticipate one of the “great” conferences. Please send in your name on the pre-registration coupon now. We will send a complete packet of information and a registration form. But please do it soon. We are making arrangements for about 200 persons, and if we need more, we would like to know early.

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The Planetarium Institute is a consortium of six Bay Area planetariums devoted to undergraduate instruction in planetarium education. A masters degree program is in planning. Other institutions in the consortium are A. F. Morrison Planetarium, City College of San Francisco, College of San Mateo, DeAnza Jr. College, and Foothill Jr. College.
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