

In your case I think it would be desirable for you to establish connection with the Council by degrees. Soon you would have a representation of your own on the Council—that would come about naturally. The present organization is highly flexible and in no way fixed. It is responsive to the desires and wishes of our scientific organization combined or divided, just as is necessary or desirable. You need not in any wise fear that you are excluded from the organization of the Council or that you will have to "break into it in any way." It will only be necessary for you, as I see it, to have your plans well worked out and matured and to remember that the Council is a research organization and that it is designed for that one purpose—to encourage and extend the scientific research work in this country.

PHARMACEUTICAL RESEARCH.*

BY JOHN URI LLOYD.

We have listened with increasing interest to the outline of the Research Committee's systematic plans, so graphically presented by Dr. C. E. McClung. Would that we might all live to enjoy the consummation of the ideals expressed, forecasting as they do great achievements in a field that is practically limitless. When I found my name on the evening's program, as one appointed to discuss the subject "Research," I accepted that it meant, for my hearers, a rather prosaic evening devoted to details, but our friend's remarks have given me so inspiring an opportunity that I am led to venture into the realms of speculative thought whose outreaches are pleasurable to myself, and I hope will not be tiresome to my hearers.

Fifty years ago, when I was an apprentice in a drug store, a copy of a New York magazine came into my hands that came very near discouraging me from attempting the study of pharmacy. I found therein a statement, by a French chemist, to the effect (if memory serves me correctly) that if a book were printed with one million names on each page, one million pages in the book, and a million such books in one library, it would take a million libraries to hold the names of all the compounds that might, theoretically, be made from the known acids and the known alcohols. This statement was altogether hypothetical, and highly imaginative. There may have been an error of a few millions, but to a rustic boy, what would be the difference if there were a mistake in such a number? Calculating on such a basis is about the same as estimating star distances by sun distance units. When one considers a star that lies entangled in the milky way's infinity, what matters an error of a few million miles? When research is made of the millions of compounds cited by the French chemist, perhaps the astronomer's "milky way" has no speculative advantage. But I am only a humdrum pharmacist, as the world views such as ourselves; rights such as come to others, seem not in our sphere. Let us then, in propriety, come nearer home.

Very happily, Professor, have you told us that pharmacy is to be embraced in the program of your Research Committee. The question then is, have we, as pharmacists, ought to offer in the way of research opportunity? If so, what, and in what field does it lie?

In speaking of pharmacy, let me now use the word "art," since some may resist the application of the term "science" to pharmacy. And yet, I make bold to assert that this "art" of pharmacy embraces every "science" known, unless it be that of astronomy, and few will deny to us a share in the life that is the direct gift of the sunshine. This claim I presume to make, not altogether by reason of the modern conquests of pharmacy, but by historic right. Very remote must lie the field of human activity that held no pharmacist. Chemistry is an underlying

*An address delivered before City of Washington meeting of the American Pharmaceutical Association.—Response to address of Dr. C. E. McClung.

part of pharmacy, botany is a part, biology is a part. In whatever direction one turns sight, lies something that contributes, or has contributed, to the art of pharmacy. From the ocean's depths to the mountain's top, came pharmaceutical research opportunity in the past. Whether in the frozen arctic or the torrid tropic, whoever enters a natural science field finds there the footsteps of the pharmacist. Turn to the east, west, north or south. Comes there not from each a something that gives the pharmacist an opportunity? Scarcely so deep into the earth can we go but that something is found to take the pharmacist's thought. From the beneficent ray of the sun that shines upon all alike, to the rarest element discovered by the diligent search of the chemist, all are utilized in humanity's remedial service.

Pharmacy is perhaps a cult, but if so, that cult has been honored by mention in the great research work now being instituted. May I not, then, as one of the "cult," through years of experience at least, claim as a pleasurable duty the privilege of calling attention to opportunities lying still untouched in outreaches before us, as I see them from my limited sphere of observation. "Limited," did I say? Is the word correctly used? Let us take the text of fact, as here we stand, and in speculative research thought together pass into the realms of the beyond.

If, in darkest night, we take a lighted candle into a forest dense as the Kentucky "woods" of my homeland as a boy, that flickering yellow ray gives but a narrow circle of light, very feeble, very limited in area. Here faces us the furrowed bark of a tree that, as a tree, is hidden in darkness. There, indistinct, stands a bush that passes mostly into shadow. Here, as we turn our eyes, appears the bark of another tree, there rises a different bush. In the shadows beyond the bush appears a spindling sapling too indistinct to identify. It may be hickory, ash, maple or beech. Who knows? From the gloomy beyond intrudes a something—what is it?—our light is too feeble to penetrate the gloom. The extent of our vision is circumscribed, but small as is the circle of yellowness, it is enough to show that we stand in a woodland; that so far as can be determined by the flickering light of the candle, it is but a little wood and, large enough however to beckon us onward.

Bring next a coal-oil lamp. Brighter is this light, enlarged is the circle. Under its magic, springs a vision of fact where before was speculation. Where by the flickering candle light we saw only a part of an object, such as a bit of rough bark, we now perceive the trunk of a great tree, which yet brings to our vision no branch. High into the blackness above us, it ends in the shadows of night. The enlarged circle of light brings to our vision other trees that stand as sentinels, silent as death, beyond those shown by the feeble candle. Peering upward, we perceive drooping branches; leaves are hanging down from the twigs that interlace overhead. A squirrel's nest of leaves can be seen to rest in the fork of this small tree. An outlaw owl gazes down with wondering eyes, then snaps its bill in our very face as it silently flutters, like a ghost, into the impenetrable ring of darkness. In the outer shadows lie bark and brush, indistinctly outlined and fading into obscurity. The ring of darkness has been increased by the brighter light.

Bring now an electric torch. The circle of vision is again enlarged. Its brilliant light brings to view the very top of the great oak beneath which we stand. Far now may we peer into the distant recesses about us. Behold, we comprehend that we are in the midst of a mighty forest! But though the light has been intensified and the circle enlarged, the surrounding zone of darkness is but enhanced.

Avarice of scientific ambition beckons us. Let us not stand still—let us move onward, as explorers. Step by step we advance into the recesses of the great forest. We hesitate and turn about, and in backward glance catch glimpses of the reverse side of the bark-furrowed tree. The part we saw a moment back is now hidden from us. We stumble, cast our eyes downward; life structures are beneath our feet. We stoop, pick up a fragile flower. Behold, its beauties have

been crushed beneath the tread of our careless heel! We turn again, trampling leaves and herbage as we press onward, ever onward, passing into the darkness of the outer unknown, while the unseen beyond ever encircles us. Listen! what is that? The cry of a night creature comes to our ear. An insect buzzes, strikes our face, and disappears. Out of the gloom came the cry, into the gloom goes the insect. The *beyond* engulfs it all—the silent tree, the insect that rustled into our face, the night creature whose cry alone came to our ears.

Comes now the thought that neither candle, lamp, nor electric light has shown to us anything but that which lay on the *outside* of whatever came to sight. Of the great tree's trunk, the surface of the bark has alone been seen; the root of the tree is hidden in earth, the leaves that droop from above seem ever one-sided, the nether part like the reverse side of the moon, being always unseen. Nothing do we know of what lies beneath the bark of the beech, the hickory, the oak or the maple. We know not what possesses this or that tree's center, or embraces its roots. The light and processes are inadequate. All, all, except the very surface, is mystery.

Take now an axe, chop through the brown bark of this tree. White is the wood beneath. Another tree we next chop, red is the wood. From the wound of this tree oozes a fragrant juice, from that one comes a fetid smell. On close inspection we note that this leaf is red, that one green, the next is green above and yellow beneath. Some are covered with down, others with prickles. The unnoticed thorns of this branch bring the blood from our venturesome fingers. Anger stirs us to revenge—us, the uninvited invaders of this peaceful world! The call of science is upon us. Let us crush these things of life. Let us, in the name of our cult, tear apart their tissues.

Turn we now to the microscope. From out the littleness of a needle-point, behold, up starts a world of wonders. Now appears lacework of a delicacy unreachably by the art of man. Next we behold geometrical structures of mathematical exactness, now are perceived beautiful figures, interlocked, of what were seemingly but strands of thread. Behold the wonders of the micro-cells. Red is the juice that flows from this group, green from that, yellow from yet others. Wonders multiply—the half cannot be told, and yet, 'tis now but the glories that lie in a series of pin-points from the great forest's structure.

Yet we are not satisfied, research has but commenced. Comes now the retort and the test tube, reagent after reagent is applied to these beautiful creations, these things of life and order. Seeking acids, alkalies and other destructive agents made by man, we begin "research work" on the life tissues of these inoffensive bits of life-bred structures. A mighty maze we find now confronting us. Complexities thread complexities, inexplicably entangled is it all. This form is dominated by grease or oil, that by tannates or acids. Substances, such as pigments, everywhere abound. But the forest is not one plant, one bark, or one wood. Leaves and shrubs that have been seen to differ in form, size and color, are found to differ more widely yet in juice and content. This uncouth bit of bark is sweet, that beautiful flower is bitter. As search continues, the very presence of air and light brings changes to eye, nose and taste. Back to the woodland's natural wealth let us turn our thought. Scarce have we stepped from our track in this mighty forest. We stoop, scrape from the bark of a tree a bit of moss. Who knows the wonders locked in that delicate texture, that makes of a tuft of moss or a film of lichen, a thing in itself?

Let us press onward in our research work. East of the Mississippi River are more than ten thousand flowering plants, and an unknown multitude of lichens and mosses. Who knows the natures, sizes and shapes of the weird forms known as fungi—be they microscopic or otherwise? What of the micro-fungi or the pond-nourished algae, not even as yet classified by name? What are the limits of the insect life in our circle of light? Is not the biologist seeking the unknown in the night bird's structure? And yet, the scope of vision shown by the brilliant

electric light, is but a point in this forest waste, less than a point, if our mental conception of it all be not sufficiently trained to comprehend its littleness. Let us increase our vision. Follow now the sun.

Turning from the fields and forests of the east and middle west, let us cross the Father of Waters. From spreading fields we pass to the desert, with its wealth of strange herbage and yet stranger creatures. Let us explore the mountains to their very tops, creep through canyons where foot of man has scarcely trod. Let us trace the cactus, from the small specimen in its northernmost limit, to the gigantic forms dominating the land of Mexico, passing into tropic jungles farther south. Returning, trace we now the ocean's beach, from Alaska southward. Study not only the fields of herbage, but the living creatures, fish, reptile and crustacea that creep in the shadows or flash in the sunlight of the shoals of the tropic shores. Cross next the ocean, halting but a moment at Honolulu, to reach at last the scarce-explored continent of Australia and New Zealand. Turn back, sailing over waters alive with life that even flashes like fire in the night, to South America, where, once more in forests dense, flourish vines, herbage and trees even unnamed by the botanist, where for thousands of miles man has scarcely trod the earth, where roll rivers mighty, where are vast mountain fastnesses yet unexplored. Sail next to the great African continent, enter its deserts, note its tropic mountains, snow-capped. Creep into its swamps and jungles, reeking with miasmatic life, with insect pest, with beasts innumerable. Pass next through the long-worn land of Egypt, whose silent relics of man's activities lost in times gone by are yet new to modern research. Pass thence to India. Who knows its jungle wealth? The Himalayas rival the Andes in their incomparable height and silences. Persia, with its poet's thought, is yet untouched. The Arabian continent of charm and questionings, beckons yet him who meets its charm, as in the days of the famous Oriental story-tellers, whose imaginative spell never created a world to parallel that which is to be unfolded by science.

Enough, enough! Cover we must our eyes, press our hands over our aching temples, shut out the beyond, north, south, east, west. We have not even touched the land of the millions in "Celestial" China; the great outreaches of Russia are passed in silence.

Enough of wonders and mysteries that perplex and overwhelm. In it all we find opportunities for thought, even though it must be to illustrate man's insignificance and feebleness.

"But what," one may ask, "has such as this to do with pharmacy?" Better might one not ask, "Where in it all lies *not* a research opportunity for the pharmacist?" Have not tree and shrub, life structures and inorganics from near and far been his field from days remote to the present? Would the plans for research, as explained to us to-night, be complete, were the pharmacist's field to be neglected?

Listen! Who will venture to assert that one twig, one leaf, one creature of this mighty maze, be it vegetable or animal, big or little, has as yet been disen-thralled from mystery by chemist, pharmacist, physicist or biologist? Is not even the germ cell that lies before our micro-eye, as incomprehensible as is the giant redwood of the land of golden thought? Does not this research plan, so lucidly explained to us, inspire a hope that this world of mystery and opportunity will increasingly give blessings to man, from its great wealth of hidden secrets?

But my time is exhausted, the clock strikes. Have we, in the wanderings of this half-hour's mental search, found a closed door? Is not the enlarged circle of light, cast by the lamp of modern science, bounded by an enlarged circle of darkness, does it not yet beckon us onward?
