Science

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Contents 1939- 1940

Pages

1 Other Planets: Artillery in the Skies

2 Other Suns : Uses of different Parts of the Head

3 Synthetic Products : Diamond Iron

4 Salt : Technicolor

5 Television : Man's conquest of the Air : Operations

6 Vitamins : Pasteurization of milk

7 The Five Senses and the Somatic Senses

8 -9 Development of Science; guns etc.

10 Sugar Beets

11 Shortest Day of the Year

12 Sea Fish

How the Shadow of Eighted by Other S Appear If Viewed Shadow, as Clear a by the Reflection of and Semi-darkness mons Solar Disc, a ews Created by the ence of Two Sun Placed Differe

By PROF. LU The Distinguished and Director of D Fr CHAP (Concluded fro

AST week we would be clos it were to be a

Lights—The Days and Nights Both Would Be So Bright

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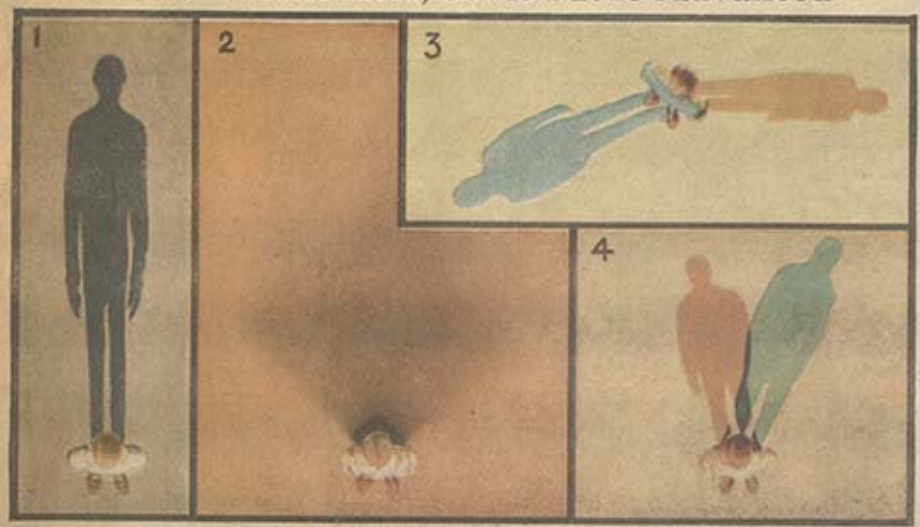

How the Shadow of a Man on the Earth, Lighted by Other Suns Than Ours, Would Appear If Viewed From Above: 1. A Shadow, as Clear as a Silhouette, Caused by the Reflection of a Tiny Sun. 2. Shadow and Semi-darkness Projected by an Enormous Solar Disc. 3 and 4. Colored Shadows Created by the Simultaneous Presence of Two Suns of a Double Star, Placed Differently in the Sky.

If the Earth Were to Revolve About a Cold Sun, in the Center of a Ball-like Cluster of Hot Stars, These Would Stud the Entire Sky, Like Brilliant Lights. The Days and Nights Both Would Be So Bright

By PROF. LUCIEN RUDAUX,

The Distinguished French Astronomer and Director of Donville Observatory, France.

CHAPTER II.

(Concluded from Last Sunday)

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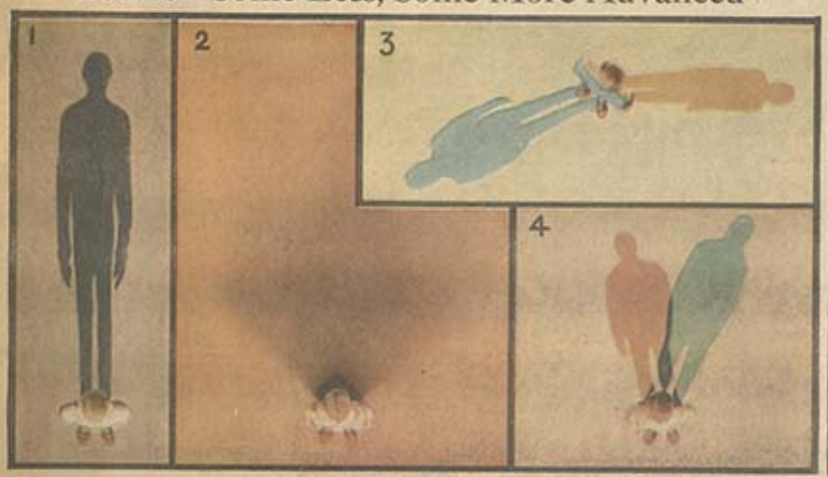

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If the Earth Were to Revolve About a Cold Sun, in the Center of a Ball-like Cluster of Hot Stars, These Would Stud the Entire Sky, Like Brilliant Lights. The Days and Nights Both Would Be So Bright That We Could Move About as We Do in Full Daylight.

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CHAPTER II.

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LAST week we considered how life would be changed on this world if it were to be adopted by some of the various monster stars, so much bigger than our own sun, which the astronomer sees everywhere. But even more spectacular changes would result from coming under the sway of one of the double stars which go revolving around each other.

In its form nearest to our present condition, this would mean another sun of the same size as our own and the same kind. Even that would be startling enough, with two suns in the sky at once much of the time and occasionally perhaps one eclipsing the other. Then when the earth swung around between the two, there would be a sun for the day time and another that would shine all night. Sometimes we would see a sunset in the West and at the same moment a sunrise in the East. Almost everyone in the electric light industries would become unemployed.

The action of tides pulled about by two suns and a moon might make the vicinity of the ocean a dangerous place to visit, even after the seven seas had found their new high level caused by the melting of all the ice and snow at the two poles. It might be that the tropics, baked by one sun after another and no relief of darkness for so much of the time, might become uninhabitable and the North and South poles the pleasantest places in which to live.

If one of the two suns were a dead star, that is, a cold, burned-out sun, it would only have the appearance of an extra moon, with little effect on the climate. But some of these double stars or binaries are of quite different qualities, giving out different colored lights. In some cases, if one had a planet like our little earth, the changing play of color would be fantastic beyond the imagination of the maddest artist that ever lived.

It would take a corps of mathematicians a lifetime to plot the combinations of colors that would go with the queer calendar of a world placed in the custody of a sun of one color but lighted and perturbed by a second of another color. In the month of January, when the two suns would be close together in the sky, neither would have any advantage and the result would perhaps be a neutral light effect which the eye might accept as something perhaps as white as ordinary sunlight. Soon this balance would be broken, when the suns started to eclipse each other.

As one disappeared behind the other the state of things would rapidly become modified, the light of the principal or nearest sun would be greater and shine alone while the other finally disappeared behind it. The countryside would be covered with a single colored sheet of light and when the eclipse disappeared the white light would reappear. Inversely the temperature, which would reach its height when the two suns would be together, would be lowered during the eclipse.

A play of lights would be particularly curious when the suns are oppositely placed in the sky. For they would light men, houses and objects simultaneously. Everywhere the two lights playing on the same surface would have an indefinable color. Each light would fix itself on a point sheltered from the other: for example, on the back of a man or the shady side of the streets. We would be in the presence of an infinite number of possible combinations of a very beautiful and very strange character. Then, too, we would have to keep track of the alterations and modifications, for a green light mingled with a red light would make us look white. Ordinary words are inadequate to describe the scene which we would look upon every day.

But we can get some idea of the picture by describing artificial illumination. We would all be living on what would seem to be the stage of a theatre. Our surroundings would be turned as by some magic hand into a fairy-like garden. With the changes in light our skins would look green, blue or yellow. A whole new color scheme would have to be devised. Our lives and emotions would be as strange as some of the colors we would see. During the sunlight hours trees and flowers and all nature would appear like an extravagant tropical scene beyond our imagination.

The nights during certain periods of the year would last only a few hours, offering to us the most magnificent spectacles. For while the earth would be thus illuminated, the moon would still be circling around it. The moon, lighted by two suns, would appear no longer as a silver disc but as a two-colored globe larger than we usually see it. Our earth would receive light from the moon too.

Under such swiftly changing conditions a woman who wanted to have the right makeup on at all times would have a heart-breaking task. Perhaps in time women would develop a complexion that would shift with the light, as the chameleon shifts the colors of his skin to suit his background, and thus she might present a peaches-and-cream complexion in spite of the color tricks of the two suns.

The shadow thrown by the sun on our present earth is just a dull colorless spot, nor is it sharp, like a silhouette. This is because our sun, though not very big as suns go, and not very near, is sufficiently so that it has visible size, and therefore the edges of the sun shine slightly around any object, making the outline of its shadow somewhat fuzzy. If the earth were revolving around a sun so small or distant as to look as other stars do, merely a point of light though much brighter, a shadow would be as black and sharp as if painted on the ground in heavy black ink.

It Is Possible to Suppose That on an Earth Enjoying an Almost Perpetual Day, Due to the Illumination of Two Succeeding Suns, the Growth of Plants and Vegetables, Encouraged by the Red and Orange Beams From the Suns, Would Reach Gigantic Proportions.

If the earth were circling close to one of the monster but not very hot suns, then at noon a man would have almost no shadow at all. Late in the afternoon and early in the morning, there would be a faint hazy smudge following him around but it would not have enough shape to tell whether the thing was cast by a man, woman or a post.

But the strangest appearance would result from lighting by a double-star, each star giving out a light of a different color.

If the Earth Received Light From Two Suns, and If the Short Nights Could Come at Certain Times in the Year, There Would Be Seen the Incomparable Spectacle of a Two-colored Moon, Created by the Light Which It Receives on Either Side From Each of the Two Suns.

On worlds where these two stars shine in the sky, two shadows would appear crossing each other. Each of these, instead of having a somber hue of grey or black, would be tinted by the light coming from the sun toward which that shadow turns. In a word, each of the stars colors the shadow cast by the other star. On our earth there is no other star, so that our shadows are somber and uncolored. If we were lighted by a double star—one star being yellow and the other green—we would always be followed about with two shadows, one green and the other yellow.

The effect on vegetation of two different suns would be quite as radical as on animals. If both gave rays favorable to plant life one might expect things to grow with almost explosive vigor where moisture and soil were also favorable.

The farmer would be pleased to plant cabbage seed Monday morning and get a full crop perhaps the following Saturday. However, most of the joy would be taken out of his life by a crop of even faster-growing weeds and he could surely count on an army of large, active and competent insect pests which would work overtime and do justice to the situation.

It is not impossible that if two suns send out quite different rays, the vegetation of the world would divide into two classes, each favoring a different sun. Where sun number one is in the sky the plants big and little that worship him would spread their leaves to his rays, while the others would curl up and shrink from sight, waiting their turn to unfurl with the rise of their luminary. The war between the two classes would begin when both suns were in the sky together.

Still another possibility would be a planet like ours revolving about a dark star, a dead sun from which it received nothing but cold, reflected light, as the earth does from the moon. Of course, if a cold star could suddenly take the place of our hot sun, this earth would freeze up in short order. But we would not freeze up if we happened to be in the center of a ball-like cluster of hot stars, all far enough away not to cause gravitational disturbance.

Each of such suns would be so distant that they would all look like extra-bright stars and yet their combined light might be enough to keep us comfortably warm. In that case there would be neither night nor day nor any change of seasons. Every corner of the earth would be like every other, the poles like the equator, and always, except in cloudy weather, the same bright starlight. Also, with so many points of illumination in the sky, a man would cast no shadow, though there would be darkness something like shadow under very wide sheds.

Vegetation could get along under these conditions because plants thrive so far down in the ocean depths that the human eye can hardly see.

No astronomer has seen a planet except those of our own solar system, but the presumption is that there are millions of them, many under such conditions as would not permit us to live more than a few moments.

Others are probably so close that as far as general conditions are concerned we could thrive there. It is, however, not impossible that even if there are billions

(Continued on Page 23)

Artillery in the Skies!

By GEORGE S. WORTHINGTON

FOR the last 10 minutes the pilot had flown a shifting course, his wheelings directed by orders that came through the earphones clamped to his head. Below was a green and brown vagueness—enemy territory. The voice in the earphones came from the bomb-aimer lying over his instruments down in the belly of the big airship.

"Steady now," came the voice. Then a tremor ran through the plane's frame. Another followed. Two 1,000-pound projectiles, crammed with explosives, were whistling down to the faraway ground—and to the factory, airdrome or troop concentration at

In the first days of aerial bombing during the great war, bombs of a crude type were taken aloft and dropped haphazard over the side of the plane by hand by the pilot. Bombing today has become an exact science with the bomb-aimer a highly skilled technician. Above, are adaptations of diagrams which appeared in the London Illustrated News when the Vickers "Wellington" bomber was undergoing test flights earlier this year.

extent national and racial frontiers have been fixed by considerations of defence. The Alps guard Italy from invasion from the north. The Pyrenees make any military movement between France and Spain difficult. Even the Pripet Marshes in eastern Poland form a natural boundary against Russia. A large part of Europe's military history has been the story of the various national groups struggling to reach and hold secure boundaries. And that effort has always been guided by experience of the traditional forms of warfare—warfare with armies and fleets.

The bomber came. The mountains were brushed aside, the broad rivers and marshes ceased to bar the invader.

What is the real purpose of military operations? Ultimately, most schools of military thought agree, it is to convince the population behind the defending army that peace at the attacker's terms is better than further resistance; warfare is in reality aimed at the civilian population, and the defending army's task is to prevent its being reached. The Franco-Prussian war ended with the fall of Paris. The prime objective of the Fascists in the Spanish civil war was Madrid and later Barcelona. In the last war, it is generally agreed, the semi-starvation that resulted in Germany from the British naval blockade brought the collapse of the old government and the signing of the armistice some time before all resistance had been overcome in the German armies.

Just where the bomber functions in this—at least, in the concepts of most military theorists—is easily seen. The bitterly opposed invasion by armies is made unnecessary because the plane goes right through to the real objective and begins to deal its crushing blow before the army has more than started its slow and costly march. That, put simply, has been the theory, at least.

But the air arm is new enough to be full of unknown quantities and mysteries. Mystery No. 1 is defence. How effectively can the bomber be stopped before it reaches the place where its load can do considerable damage? How vulnerable will it remain to attacking planes? How efficient in long-term operation are present-day anti-aircraft guns? How quickly will they improve, and how much better can they be made?

Only Experience Tells

VERY little of the knowledge of what aircraft will and will not do is gained in the laboratory, it has been repeatedly pointed out. All lessons are learned in the hard school of experience. And that is where, in all probability, most of the information about the planes that are taking to the air in the present conflict will be made available.

The mystery does not stop with the all-important question of defence. It extends to the size and nature of the opposing forces. The numbers of an army are soon known, even if there is any attempt to keep them secret. The facts about an artillery force are also hard to conceal. Fleets, except perhaps in their submarine branches, are similarly easy to estimate in a general way. In the same way the movements of these forces, again with the exception of the submarines, are within the knowledge of the enemy. Modern communication being what it is, surprises in modern warfare are not common. A large concentration of troops, the gathering of a fleet, is not long unknown. But with the air arm it is different. Tiny, where the fleet is huge, affecting the lives of few where the army division intimately involves whole sections of the population, the air force can be a secret. And that is why in most discussions of the relative air strength of the powers several estimates—all provisional—are given of the kind and number of each country's planes.

Surprises, and all the military advantage inherent in surprise, must also be conceded to the bomber. Its swift movement, its small size and the small number of people that need have any knowledge at all of when and where it takes off and for what objective make it the ideal weapon for sudden and unprepared-for attack.

Generally speaking, military authorities seem to agree that the modern technique of bombing is fairly well settled, though it is generally believed that great gains in accuracy are possible. One of the most dramatic ways of delivering bombs at their objective is the dive attack. Each in its turn, the planes in the raiding group are pointed directly at the target and begin a nose-dive towards it. Then, when it can safely approach no nearer to the earth, the bombs are released, and the plane shoots upward again. The bombs continue along the path they held when the plane carrying them was still sighted on the target.

Method number two is the low-flying attack, where the bomber zooms over the ground, releasing the load just before it gets over the target. Because the bomb does not fall vertically, but comes to the ground at an angle, a small parachute has been devised for the bomb in this type of attack. This has two advantages—it allows the bombs to fall straight down and land on its target with a vertical impact, giving the maximum effect; it also delays the explosion for a few seconds, enabling the bomber to be safely out of the way when it occurs.

Scientific Aiming

IN terms of accuracy in reaching an objective these methods are relatively crude in comparison to the scientific bomb-aiming as it has been developed in some aeroplanes. The only aiming processes related to it are the firing of guns from one moving battleship to another, also moving and the use of anti-aircraft guns. When the bomb-aimer releases his projectiles, his plane is moving at terrific speed. This means the bomb is not going to fall in a vertical line, for it will retain considerable forward motion from the movement of the plane. The wind, no matter how light, will also militate against its taking the shortest way to the ground. A moment's thought

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"A hit," said the voice in the earphones. A few seconds later the long, muffled roar of the explosions came up. Then there were other similar roars. The pilot glanced around. The other bombers in the group were releasing their bombs. The raid had reached its turning point. Soon he would be circling back to his own air field.

The pilot had merely steered the ship, first across the miles of country to the raid's objective, and then in the irregular, shifting course during which the aimer had determined his target through his elaborate aiming apparatus. It was the aimer who gauged the speed and direction of the wind, the speed of the plane and its height from the ground and then translated these and other facts into adjustments on his "sights." Then he centred the target in his finder and pressed the switch to pour half a ton of destruction upon it.

Through his window in the bottom of the plane he saw the bombs hurtle earthward, seeming to waver a little as they grew smaller with distance. He saw, too, the sudden, billowing smoke as the huge masses of explosive detonated.

And then his work was over for that trip. He lay quiet, idly glancing down through his window as the bomber sped home.

* * *

Since man had enemies he wished to destroy he had been quick to take advantage of any higher position he might find himself in to drop projectiles on his adversary. From the mouth of his dwelling in the cliff the caveman rolled a boulder on to the sabre-toothed tiger. When besieging foes came right up to the walls of his castle, the medieval baron poured down upon them molten lead and boiling oil. But using the force of gravity to carry projectiles remained fairly static until the advent of flying. Almost from the time it became practical, the flying machine intrigued military men. It was quickly seen that dropping explosives from a plane would be in many cases a feasible alternative to hurling them from a field-gun, for the invention in reality provided a new way of doing the work of the artillery. Not that the full possibilities of bombing were immediately seen and taken advantage of—far from it. General Douhet, the Italian author of the theory of military aviation that bears his name, was called to order at the beginning of the last war for referring to the airplane as a "weapon." It scandalized his superiors to hear the airplane cleaned with the sabre, the bayonet and the field-piece—all of which had been tried and found not wanting in a hundred battles through history.

Technique of Bombing

BOMBING in the early days of the last war, it will be recalled, was a fairly simple affair. In its earliest forms, the flier got over enemy territory, estimated he was near enough to some important objective, and then dropped his bombs over the side of the cockpit.

That was the beginning. Today the equipment and the technique is as far advanced as the modern naval gun has advanced from the crude brass tubes which medieval soldiers, stuffing them with their newly invented gunpowder, used to hurl rounded stones at the battlements they were attacking.

A glance at history is enough to discover how revolutionary the coming of the bomber was. Since men lived in societies at all the primary concern of each group has been its own security. Any map will show to what extent national and racial frontiers have been fixed by considerations of defence. The Alps guard Italy from invasion from the north. The Pyrenees make any military movement between France and Spain difficult. Even the Pripet Marshes in eastern Poland form a natural boundary against Russia. A large part of Europe's military history has been the story of the various national groups struggling to reach and hold secure boundaries. And that effort has always been guided by experience of the traditional forms of warfare—warfare with armies and fleets.

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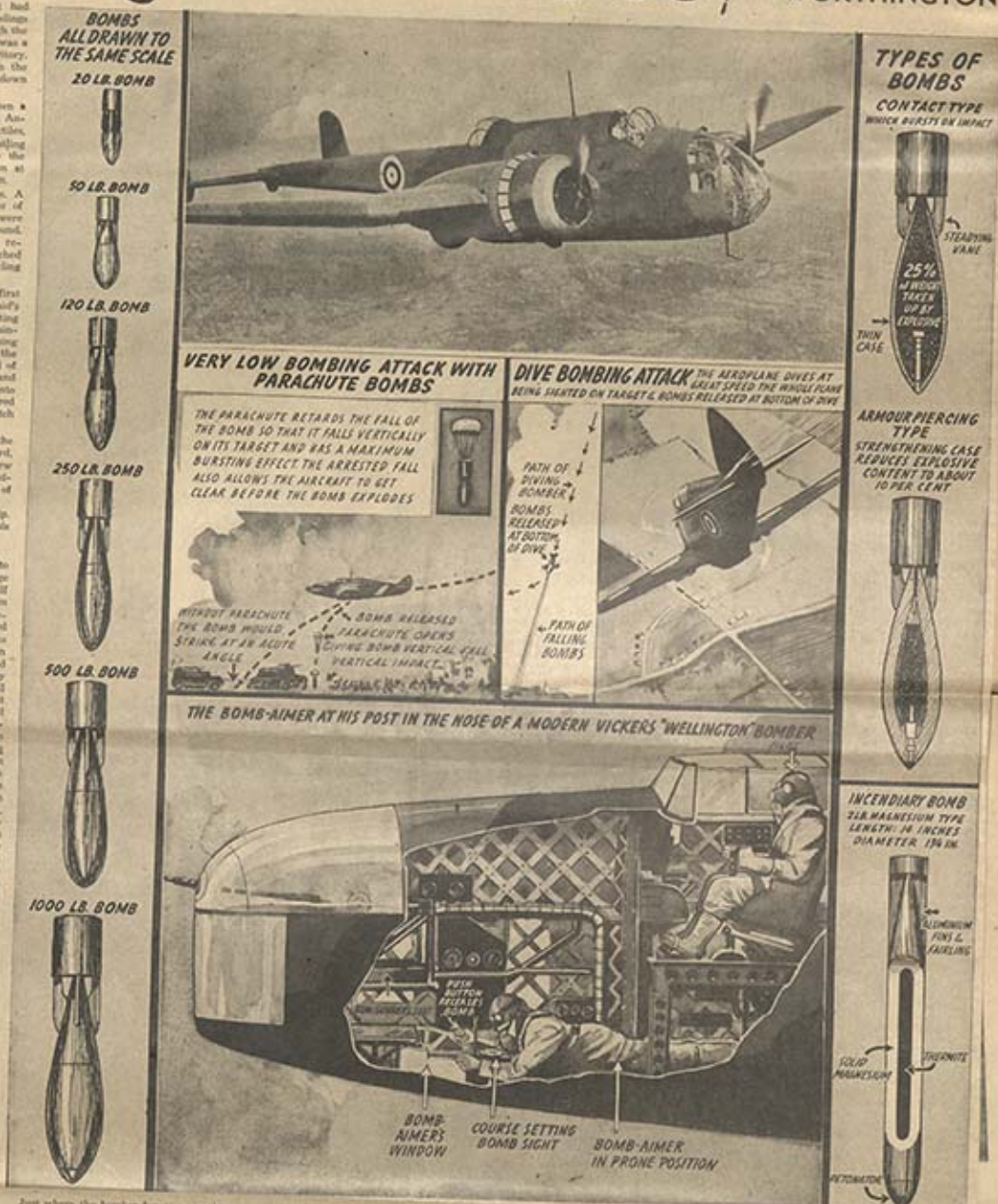

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(Continued on Page Six)

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CHAPTER I.

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CHAPTER I.

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WOULD it be desirable for the human race if a bigger and better sun should adopt our little earth?

The sun, in whose planetary family we belong, is a comparatively small and insignificant star. Everywhere the astronomer aims his telescope, he sees not only bigger stars but hotter ones, cooler ones, various-colored ones and binaries, or double stars. Some of these doubles are one hot and one cold, but in the case of some of the others, their planets would have two blazing suns in the sky, a blue one and a red one and everything casting two shadows of different colors.

If the astronomer could shop around in the heavens, he could find plenty of wonderful propositions for adoption, each with delightful possibilities. No astronomer, however, regrets that such a swap is impossible, in fact he is glad that no demagogue can talk the world into trying it. No matter what the advantages might be, the calamities that would inevitably accompany them *elsewhere* than outweigh the benefits.

Even the nearest star is too far away for the most powerful telescope to see if it has any little worlds, surrounding it, like a family around a hot stove constantly turning round and round to warm all sides. But there is no reason to imagine that ours is the only star in the universe that has children or that it is unusual in this particular.

Our sun is 1,297,000 times bigger than the earth, which could fall into that furnace without even making a worthwhile splash, but there are stars like Antares which is 90,000,000 times bigger than the sun.

Suppose in answer to a unanimous prayer from every inhabitant of the earth old enough to vote, the Almighty should transfer the custody of our little world from the sun to a monster like Antares.

One of the innumerable resulting headaches would be the destruction of our calendar. If the earth were to be placed at the same distance from the center of the big new sun as it is from our present one, it would not do at all, because we would be actually well inside the flaming star itself. In order to survive the heat the earth's orbit would have to be so far away in some cases that instead of taking 365 days to circle the big star as is our time with our small one, even a Methuselah would not live through so much as a single season of the year. It might take so long that not even a nation would last through an entire year.

In our 365-day trip around the sun the Summer is so short that when Fall comes our Winter overcoats are still in moth balls and will still fit us and the furnace hasn't rusted much. Also there are plenty of mechanics surviving from last Winter who know how to fix it and where to get new parts. But imagine the problem if nobody had needed a woolen garment or a heating plant since the days of Julius Caesar, with a long, hard Winter of about 2,000 years ahead.

Snakes, frogs, wood-chucks, bears and other eminent hibernators, after that endless Summer, would probably have lost most of their ancestors' talent for going into a trance, yet would have to face a hibernation not of months but a long string of centuries.

If a huge star, not so hot as our sun, was selected, the world would have to be placed quite close to it. Then, in order to have enough centrifugal force to offset the gravity pull of such a mass and not fall into it, the earth would have to go around it at terrific speed, so fast that the year might be cut to a few weeks, with an entirely different but equally disturbing set of complications. The trees would hardly begin to bud in the Spring before it would be time for them to fall in the Fall, and the farmer would have his troubles trying to coax anything out of the ground in such a crazy climate.

A monster sun quite close to us would be able to shine around the world touching nearly the whole of it at a time, so that at least the edge of the great disk would be visible most everywhere most all the time. This would change the entire aspects of the polar regions, causing the ice caps to melt gradually away. That, in turn, would fill up the oceans until all the present seaport cities would have to be abandoned.

In the course of a few thousand years humanity, in a nightless world, might get over its habit of sleep, remaining awake and active from the cradle to the grave. Perhaps this would reduce the span of life a corresponding amount but still nothing would be lost but a few dreams because the part that is slept away is lost anyhow.

Yet few people would pay much attention to little things like these because of more appalling and fatal manifestations. Our little moon being close is able to stir up quite a tide which is increased when the distant sun reinforces it. In the Bay of Fundy tides run as high as 60 feet. With a body so prodigious as one of these monster suns close at hand, the mere revolution of the earth would cause the oceans to bulge toward it in a tide that would go roaring over all the sea coasts, the lowlands and far up the highest mountain ranges.

An Enormous Sun Would Continually Light More Than Half of the Earth. Under These Conditions the Polar Regions Would Never Be Dark and It Always Would Be Possible to See a Part of This Disc on Their Horizon. Thus the Character of the Polar Regions, Such as We Know them, Would Be Entirely Changed.

If the Sun Were to Be Replaced by a Similar One of Fantastic Proportions, But With an Orange Light and a Lower Temperature, Sun-Bathers Could Expose Themselves for Only a Few Moments, and Only at the Time When the Blazing Disc Would Be Nearing the Horizon. At All Other Times of the Day It Would Be Necessary to Protect Oneself From the Intense Heat of Such Light, Which Only a Skin and Organism Different From Man's Could Resist.

It would seem as if most of the fertile parts of the earth would be drowned out and man would have to live permanently in the barren mountain tops. There he would cower before hurricane winds and deluges of rain. The gravitational pull on the earth's crust together with the stresses caused by the violent changes of water and atmosphere pressures would precipitate a series of earthquakes, such as no human eye has seen.

Even if all these things could be avoided by some miracle and every aspect of Nature made to keep the peace, still the human race would probably start to sicken and die in all sorts of mysterious ways merely from the difference in quality and quantity of the new light. It has been pointed out often enough how delicately and beautifully Nature on this planet is adjusted to the needs of living things. This is stating the truth, wrong-end to. The truth is that life during millions of years has managed to adjust itself to the general conditions as it found them. Now slight a change in these is needed to cause disaster is seen from the havoc of a flood or drought.

The Russian astronomer, Alexander Tchizhevsky, announced that all mass movements in the history of humanity coincided with a period of maximum intensity of sun spots. He called these movements epidemics of psychoses, in other words unreasoning human stampedes.

If a few pimples on the sun's bright face can upset humanity, one can imagine what an entirely different sun in size and quality of light might do. Creatures on the earth have learned to thrive under such rays as ordinarily get through the air to them. Other rays which the atmosphere filters out or reduces, are deadly in stronger doses. Humanity, instead of taking sun-baths at noon would wear light-reflecting clothes. It would be suicide for a nudist to yield to his exhibitionary tendencies except perhaps just before sundown and after dawn.

All the violence of Nature and fear of exposure to the light could be avoided by choosing a star a bit smaller than the sun. We might choose one even smaller than the earth and thus be on a basis of gravitational superiority, with some of the advantages that wives find in henpecked husbands. The surface of our planet would know conditions quite different from those which exist just now.

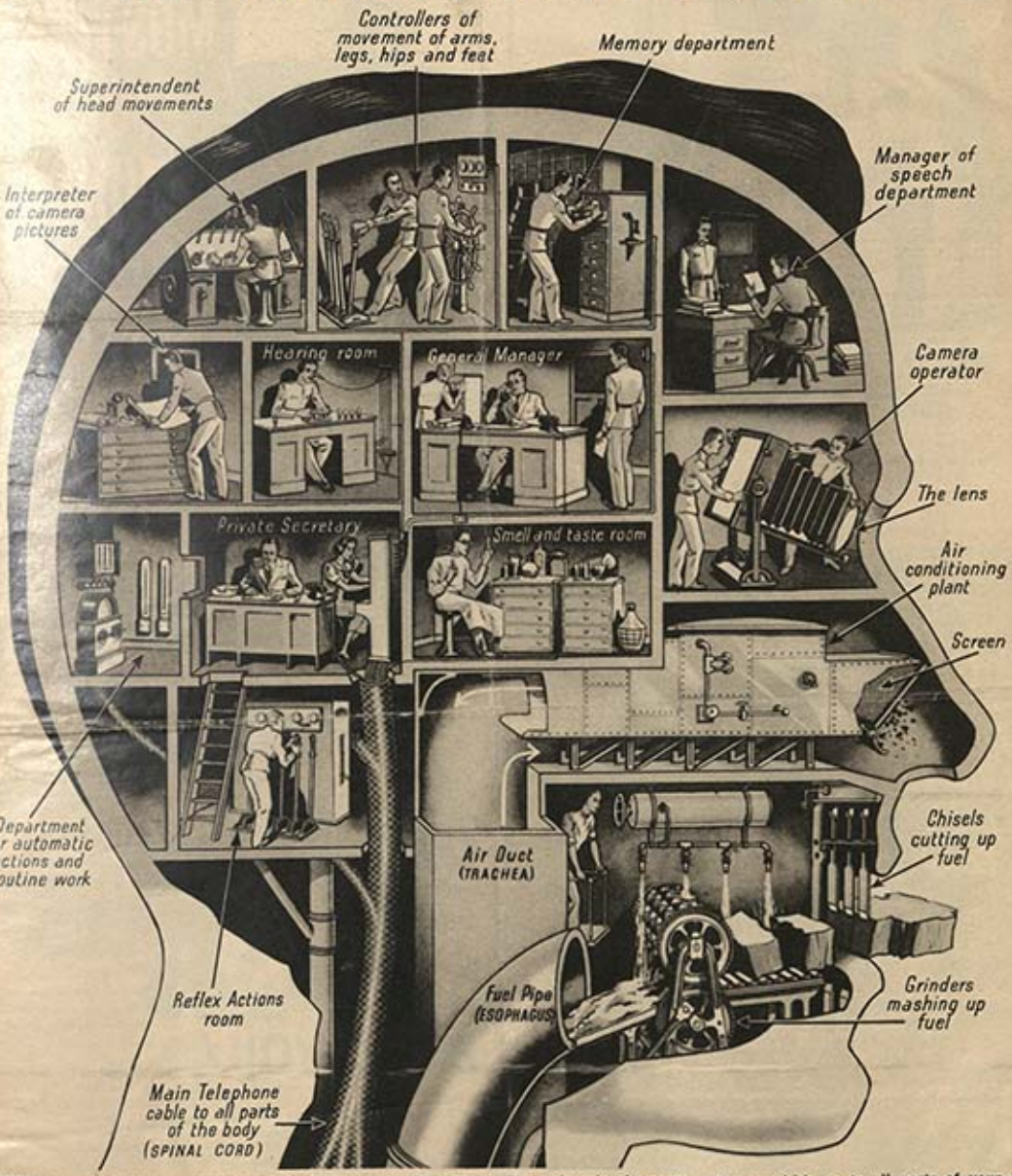
Seen at the same distance as our sun, a tiny sun would be nothing more than a brilliant point without apparent diameter quite the same as any star but with a more intense light. The daylight which it would give us would be less luminous, like a sort of dawn which fills the entire sky.

This cold light would create a kind of polar state over the entire earth; the tropical races would be forced to adopt Eskimo customs and the Arctic regions would be quite unlivable and plunged into a total night, the pale rays of the sun arriving only obliquely. The sea under this weak force would no longer react to the influence of the moon. Fantastic tides would not exist; the ebb and the flow would be similar and the movement of the water would be sluggish and feeble.

Thus while an enormous sun would cause a tempest

(Continued on Page 2s)

The Wonders Within Your Head



EVEN as you read this, you are using much of the highly complicated machinery in your head which is symbolized in this drawing.

The air you are breathing is going through your air conditioning plant; the food which you have eaten is being prepared as fuel for your body.

Your eyes are acting as a camera, with the lens focused on this page. The pictures taken by the camera are being interpreted in a special part of your brain, and at least some of the things you are reading are being filed away in your memory department. The noises in the room about you are being registered in your hearing room; the smell of flowers, perfume or dinner, taste of gum or tobacco, are being registered in another area, your smell and taste room.

One section of your brain directs your voluntary actions (such as turning the pages of the magazine); another section is concerned with automatic actions (such as the beating of your heart). The general manager is the cerebrum, giving orders and receiving reports through the nerves which go to all parts of your body through the telephone cable in your spine.

From soldiers who were wounded in the World War, doctors learned much about the specialized work of certain brain areas. One man, after getting a shrapnel wound in the head, could not read printed words, although he was able to write and speak normally. Another, with a different portion of his brain injured, could not understand spoken words, but could read, write and speak normally.

CHEMISTRY SHOWS THE WAY

(Continued from Page Sixteen)

developed into a great industry, though a young Englishman was the first man to make such a dye from the tar barrel.

Before the modern days of such chemical dyes, since the day when Eve stained her first leaf dress scarlet with the juice of the madder plant, men and women had to depend for such colors on berries, roots and other vegetables. Limited in range, they were inclined to fade and wash out.

Then came aniline dyes to revolutionize the color range. Here is how they began:

Queen Victoria's husband, the Prince Consort, an early believer in chemistry as a force, brought over Hoffman, a great German chemist of a century ago, to found in England the first college of chemistry. This Hoffman was what we should call a coal tar bug. It was natural that he should interest his English students in this nuisance of a waste product left when coal was coked to make gas.

Birth of Aniline

ONE of them was a young fellow, not yet 20, called William Henry Perkins. He poked about in the tar tub, in a search for artificial quinine since the Dutch had a monopoly on the real drug. He produced a dark, gooey substance called aniline and never thought of it as a storehouse of color and ether magic.

One day by mischance he dropped into this black mess a piece of silk. He quickly fished it out—and, lo and behold, it came up, not black, but mauve.

That color, Perkins' Purple or Tyrian Purple, was the first chemical dye. It was the grandfather of thousands of such dyes since developed.

What effects that had! Perkins later developed from coal tar alizarin, a red dye that surpassed the color of the historic madder plant. Madder was man's red dye since the dawn of history. Egyptian mummies were wrapped in cloths dyed with madder juice. Libyan women wore cloaks colored with it. A century ago from the south of France to Arabia hundreds of thousands of acres grew madder for dyeing.

This historic crop was ruined when Perkins discovered alizarin red. Since then the change has gone on, symptomatic of the change which chemical discovery is making throughout the world's economy.

Though Perkins went on to win great honor, it was Hoffman, when he went back to Germany, who really launched the great aniline dyes industry and made coal tar almost a German monopoly in the production of medicine. That was, until the last war, when other nations, through necessity, wrested her secrets and her leadership from her and created their own chemical industries. Today you find such industries functioning not only in the United States and Canada, but in Russia and Japan. Chemicals have become the base of civilization, of peace and of war.

Dyes suggest scents, and in this field man has made nature a piker by producing, out of extraordinary materials, perfumes of limitless variety. Perfume is one of civilization's finest achievements. The chemist has made society pleasant to the smell so that it has no longer to burn incense when lords or ladies congregate, or keep herbs on the bench because of the stench in the judge's nostrils.

Perfume in Paint!

PERFUME in some guise has become a part of everyday life. It is in your soap, your shaving cream, talcum powder, every toilet article used by man and woman. Glue which used to smell like glue now smells like spring in the valley. Ballrooms scent their air. Theatres have helped arouse romance by spraying certain perfumes to match the music. There is perfume in paint, leather, stationery, linoleum, even upholstery.

Today, according to Dr. C. M. A. Stine of du Pont's, chemists have ceased to look on wood, coal, metal and fibres as raw materials and have gone further back to the basic sources of all earthly things. They now work primarily with the elements—carbon, oxygen, hydrogen and nitrogen—found in the air, water, soil, coal and many forms of plant life. From these they seek to create new, useful compounds as nature has created the old ones like wool and wood.

Chemistry is not new. Industrial chemistry goes back a long way. The Chinese had it when they invented gunpowder. The monks who made wine were chemists by instinct or experiment. So were the earliest leather tanners, distillers, glass makers, dyers, makers of Damascus steel. But it is only in the last century, the past quarter-century, that the front has been widened into a drive to fashion and create wholesale. Time was when by-products were a nuisance. Today by-products are merely something for which man has not found a use. Today's by-products may be the foundation of an industry of tomorrow.

The Germans seek "ersatz" but so do we. The Germans are making their sausage skins out of wood, not to mention molasses and chocolate. They are taking the albumen in fish and by a mechanical process like that used with milk (casein) and wood pulp (cellulose) are making clothes.

Naturally they are driven by necessity. So are the Allies. So are North Americans. Do you know that British chemists have an invisible waterproofing with which they can treat openwork stockings so that they will hold water like a tin can? Not only does this stuff not show on any fabric; it won't clean or launder out. You can spill tea, coffee, milk or ink on a piece of treated material and it rolls off, without staining, like water off a duck's back.

Every aspect of life is affected by the industrial triumphs of chemistry. Take those guimpes, today's survival of centuries-old wimples which nuns wear. Many of those guimpes today, their cuffs and collars also, are made of a plastic material similar to that used for airplane windows, interlined with cotton, linen-finished and cleanable.

Thus the sister of mercy like the waitress and the lady of fashion find life made easier or more beautiful by chemistry's triumphs. Today a woman may dress from hat to heel with suitable accessories and not sport a single thing that is of the material of which it seems. Ladies have come a long way from leaves, leopard skins and flannel off a sheep.

* *

Chemistry Shows the Way!

You wear wool that never saw a sheep; eat food never grown on soil; drive in cars made of milk; look through glass made of cotton. This is wizardry, sure enough, but just a vision of things to come!

By FREDERICK GRIFFIN

TODAY'S chemists can change milk into wool as fine as any sheep's fleece. Out of a spruce tree they can spin gossamer underwear. They can take coal black as night, add water and air, stir in a witch's cauldron and make silk fit for a lady of title. They can grow vegetables without soil, breed rabbits without fathers, maybe turn a rabbit into a lion.

They can make dry ice out of smoke, beautiful paints out of corn on the cob, automobile bodies out of the soya bean.

The fairy prince who—all for Cinderella—changed a pumpkin and mice into a gold coach with white horses had nothing on the scientific wizards who work for today's industry.

Once the alchemist dreamed of being able to turn lead into gold. Today the chemist from materials base as lead can create industries worth millions of dollars. The tar barrel, for example, has become for him a kind of sorcerer's tub. Over it he waves a magic wand and out come colors (dyes) such as nature never conceived and perfumes not imagined in Araby.

Coal tar, once a dark thick oozy useless residue which used to clog the pipes making illuminating gas, has become a key item in the wealth and health of nations.

The chemist means his wand [illegible] for suburban housewives to have comforts and luxuries Henry the Eighth's wives never knew; for working girls to enjoy delicacies the Empress Eugenie could not have bought.

Industrial chemistry spans only the lifetime of living men. Wholesale revolution brought about by chemistry goes back only a quarter-century. As recently as 1795 when Lavoisier was being sent to the guillotine, a member of the French revolutionary tribunal sneered, "The republic does not need chemists."

Not so many years later it was a chemist, Pasteur, who saved the silk industry for France, saved its wine industry, saved its cattle by fighting anthrax, conquered rabies and developed a knowledge of bacteria which has made possible modern surgery and much of the victory over disease.

The Key to Processes

WITHOUT chemistry there would be no modern world. The physicist gave us steam, electricity, power; great pressures, tremendous temperatures. The engineer built the machines to use them. But without the chemist to supply the key to mysterious processes, to concoct ingredients, to work out in retort and test tube extracts or products, we should be without the ease, speed, comfort, health, entertainment and beauty which [illegible] man. Industry has turned them into countless articles of everyday use. Every year the range is being widened as new processes are being discovered. On this continent alone over 2,000 this continent unknown. The Germans had a corner on the production of chemical dyes, medicines, many other things. Their patents were seized when these products were cut off and production began here. On this base of experimentation grew a mammoth industry turning out chemicals, fertilizers, dyes, perfumes, plastics, explosives, lacquers, medicines, artificial materials, substitute compounds.

appeal which may replace or supplement silk. The natural silk still remains to be fashioned into lovely clothes. Rayon and nylon, made from cheap and inexhaustible sources of basic supply, simply provide silk-seeming fabrics to countless thousands who could never have afforded to buy the products of Japanese or French silkworms.

The strength of industrial chemistry lies in the fact it pro- and other odd things.

Cotton as a crop was severely hit by rayon, now by nylon. Today the chemist takes cotton linters or waste and from it he makes the water-white plastic which goes into airplane windows and as a thin sheet between two sheets of ordinary glass to make your automobile windshield unshatterable.

By sheer magic the chemist makes out of animal and vegetable bases the plastics out of which are made tooth brush handles, combs, toilet sets, steering wheels, instrument panels, fountain pens, drinking glasses that will bounce but not break, bottles, door knobs, fountain pens, costume jewelry and hundreds of other everyday artistic and useful articles.

The farm, producing too much food, with crops like corn and cotton no longer in demand as of yore, may find itself a big source of supply of the materials to make plastics. Much experiment is being carried on to find industrial outlets for farm products. The Germans have been very busy on the farm front to find "ersatz" or substitute products to aid them in their thirst for self-sufficiency. So has Henry Ford; he has banked heavily on the soya bean as a basis for plastics. Today steering wheels and other auto accessories are made from plastics; indeed an all-plastic car body may be made from such material.

Chemistry is behind many of the ups and downs of the farm. By developing abundant fertilizers it made the farm productive to the point of ruinous surpluses. It provided competitive substitutes for many of its standard crops. Now it is finding industrial and mechanical uses for crops previously grown for food, fodder or clothing.

Take milk. From it come fat, butter, cheese. But a sea of skim milk has been so much daily waste. Now the chemist is taking the casein in it as a base for many plastics. Your buttons are possibly made from milk. Many fancy rings, bangles, necklaces are born of milk. Billiard balls need no longer be of ivory; they may have come from a cow. From this source water, reduced chemically to a creamy, thick, sticky mass; then at tremendous pressure forced through tiny nozzles or spinnarets from which emerge the filaments or threads of wool or silk.

That brings us to nylon, which is called the first real synthetic fibre made without the use of either vegetable or animal matter. Nylon was announced a little over a year ago, after du Pont laboratories had spent over $10,000,000 in research. Now it is being turned out as a fabric to compete with rayon and silk. It is claimed to equal silk in strength, wearing qualities, sheen; to have greater elasticity; to keep its shape better and be wrinkle-free.

It is said its filaments may be drawn ten times as fine as the finest silk, so that nylon garments may be veritable fairy cobwebs spun of sunshine, moonlight and mist.

This new organic textile is acclaimed as a marvel for making fishing lines and leaders. It also, by another of those chemist's tricks, makes toothbrush bristles. These are all now made chemically. Boars no longer lose their whiskers to keep your teeth clean.

And nylon, believe it or not, is derived basically from coal, water and air. It is vivid proof that chemists no longer just depend on such natural sources as wood, corn and milk to make new products but often seek the basic chemical constituents and build up a synthesis.

One of the first great industrial triumphs on this line was the development of nitrates from the air. This made the soil super-productive with unlimited quantities of fertilizer.

High Pressure Work

UNTIL 30 years ago the world's nitrates came from great beds in Chile, which had a virtual monopoly. Gloomy soothsayers of the period predicted that when these ran out the earth would cease to produce and man would die from famine.

Then in 1908 a German chemist, Haber, managed, under high pressure and a very high temperature, to combine one nitrogen atom with three hydro-

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Coal tar, once a dark thick oozy useless residue which used to clog the pipes making illuminating gas, has become a key item in the wealth and health of nations.

The chemist waves his wand and from it produces very many medicines man could not do without: antiseptics like phenol, local anaesthetics like novocaine, such hypnotics as veronal and luminol. From it he extracts aspirin for headaches, salvarsan to treat social disease, atoxyl for sleeping sickness.

From it has come sulfanilimide new wonder drug and similar compounds, which promise to beat pneumonia.

From it come high explosives and poison gas, asphalt for making roads, varnish for roofing.

Now from coal, coal tar and castor oil comes nylon to make cobweb stockings and chemisettes, more delicate than rayon, finer than spun silk.

Chemists, the modern sorcerers, have made it possible for suburban housewives to have comforts and luxuries Henry the Eighth's wives never knew; for working girls to enjoy delicacies the Empress Eugenie could not have bought.

Industrial chemistry spans only the lifetime of living men. Wholesale revolution brought about by chemistry goes back only a quarter-century. As recently as 1795 when Lavoisier was being sent to the guillotine, a member of the French revolutionary tribunal sneered, "The republic does not need chemists."

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Refined gasoline, fuel of the automobile and the airplane, is a chemical triumph. So is printing paper up to the glossiest used in slick magazines. So is motion picture film. So is refrigeration. So is canned food. So is wrapped food. All in an alliance with engineering, of course.

The National Hockey league games in indoor ice-palace comfort are possible through chemistry. You are able to drive your car in the winter because of it. Northern Canada produces gold, silver, platinum, radium, copper and a score of other minerals because the chemist showed how to extract them pure from rock and ore.

In 25 years past chemists have added some 200,000 new compounds hitherto unknown to man. Industry has turned them into countless articles of everyday use. Every year the range is being widened as new processes are being discovered. On this continent alone over 2,000 laboratories, tens of thousands of chemists, are devoted to industrial research. The chemists have created a new world, every year are creating a newer one.

Certainly it is a changed world since the last war was fought. Chemical industry was then on this continent unknown. The Germans had a corner on the production of chemical dyes, medicines, many other things. Their patents were seized when these products were cut off and production began here. On this base of experimentation grew a mammoth industry turning out chemicals, fertilizers, dyes, perfumes, plastics, explosives, lacquers, medicines, artificial materials, substitute compounds.

CLEOPATRA *never dreamed of the things this young miss is wearing. Every article she wears; even the perfume, rouge and lipstick, can be produced synthetically.*

Chemistry does not so much make substitute or artificial products as new ones. When it creates, first, rayon, second, nylon, it does not so much make substitutes for silk as it makes out of hitherto unused sources new materials of wide popular appeal which may replace or supplement silk. The natural silk still remains to be fashioned into lovely clothes. Rayon and nylon, made from cheap and inexhaustible sources of basic supply, simply provide silk-seeming fabrics to countless thousands who could never have afforded to buy the products of Japanese or French silkworms.

The strength of industrial chemistry lies in the fact it produces new materials, gadgets, comforts as beautiful as those made from the customary natural supplies, in vaster quantity, often in a more useful form and always more cheaply.

Modern Miracles

MORE than that, it has done such miracles with hitherto useless, even waste, material. It has even found for natural products thus replaced or put out of joint by some shift of public need or taste, a substitute usefulness as great if not greater than the original.

Take corn, a great crop, which used to be a feed for hogs and men before both became streamlined. Now some 40 per cent. of the corn grown goes into the making of plastics, those thousand-and-one new products moulded from beautiful and useful compounds produced chemically from corn and the soya bean, from cotton linters and sour milk, from artificial resins and other odd things.

Cotton as a crop was severely hit by rayon, now by nylon. Today the chemist takes cotton linters or waste and from it he makes the water-white plastic which goes into airplane windows and as a thin sheet between two sheets of ordinary glass to make your automobile windshield unshatterable.

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Casein is a stout non-conductor. So from milk comes insulators, switchboard parts, telephone exchange equipment, radio gadgets. It goes into glues and pastes. It also goes into beauty creams, pastes and pomades—so strange are the contrasting tricks of the chemist.

Cat's Food to Casein

LEGEND says that 30 years ago a young chemist left out over the week-end a saucer of skim milk for the laboratory cat. Back Monday morning, he found it untouched, dried into a hard film. Intrigued, he experimented with it, used formaldehyde, found the cat's food changed into a substance hard as bone. That was the discovery of casein.

Skim milk used to be swill for pigs; now—the latest—it makes synthetic wool. The Italians have been doing it. Last year the United States bureau of dairy industry announced perfecting a method of making, from the casein in milk, an artificial fibre resembling the finest quality of merino wool. In some respects it is said better than natural wool; it does not itch the skin, does not shrink as much.

The process for making wool from casein is similar to that used in making rayon or cellophane from cellulose or spruce wood pulp. Each is softened in water, reduced chemically to a creamy, thick, sticky mass; then at tremendous pressure forced through tiny nozzles or spinnarets from which emerge the filaments or threads of wool or silk.

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Then in 1908 a German chemist, Haber, managed, under high pressure and a very high temperature, to combine one nitrogen atom with three hydrogen atoms to form anhydrous (without water) ammonia gas. Nitrogen, as you know, is a constituent of the air we breathe. There are 1,650 pounds of it pressing on every square foot of the earth's surface. It is there for the taking. It is essential to all plant and animal life, which takes it and then gives it back in waste.

Haber took it, from the air, and by 1913 had worked out his process of fixation whereby we get ammonia gas and nitrates. This was one of the greatest chemical strides ever taken by man. On the home front of Haber, the work had an unparalleled result. Without this inspired use of nitrogen from the air, Germany, cut off from Chilean nitrates, could not have made explosives; could not have carried on the 1914-18 war.

(Haber was called Germany's most important individual citizen then. In 1933, under Hitler, he was driven into exile—to England! It is interesting to compare his fate with Lavoisier's, guillotined by a revolutionary France which did not need chemists.)

No need to labor the effect of what Haber's discovery has meant to the world since, in peace and in war. Today millions of tons of fertilizers are abstracted from the air annually.

Which reminds us to tell you about aniline dyes, which the Germans first to harness chemistry to production, also

(Continued on Next Page)

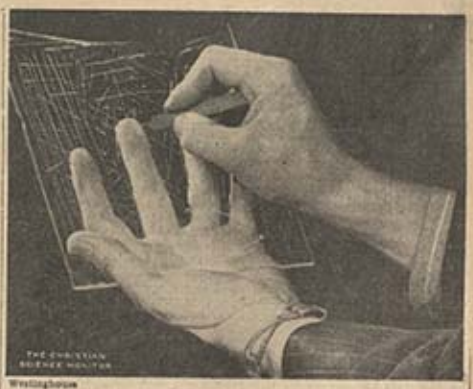
Wonders of Research: Diamond Iron

Metal brought to top heat and cooled by gas becomes hard enough to mark window pane.

By Herbert B. Nichols
Natural Science Editor of The Christian Science Monitor

Metallurgists today introduced a new hardening furnace for steel that uses a "blanket" of gas to prevent singeing the metal while it is toughened at temperatures af high as 2,000 degrees Fahrenheit. Instead of employing oil or water in which to quench steels, researchers find a delicately balanced atmosphere of pure hydrogen and nitrogen eliminates distortion and the formation of scale.

Development of the furnace and hardening technique was announced by Westinghouse laboratories, Dr. A. A. Bates, manager of the metallurgical division, and Howard Scott, research metallurgist. The steel shows no outward evidence of having passed through the fiery ordeal of 1,750 degrees Fahrenheit before cooling in a tunnel. Maintaining an oxygen-free atmosphere inside the furnace prevents any reaction in the steel to distort or mar the metal. Ordinary steel, polished to a mirror finish, retains its finish after a four-hour hardening treatment, according to Dr. Bates, emerging with a hardness approaching that of a diamond.



Westinghouse

Scratching Glass

What modern furnace hardening can do to a piece of steel

Reconstruction Foreseen

For a while at least, the interests of natural science as an intellectual pursuit and discipline for thinking must remain in abeyance in belligerent nations. There the energies, abilities and knowledge of each individual technically trained must be directed toward warfare. Commenting on this editorially, Nature, the British journal of science, says:

"The end to be attained and the end which science should hold ceaselessly before the eyes of the Allied peoples is not destruction, but a constructive ideal—to ensure in the future such conditions as will make possible the advancement of all the peoples of the world without discrimination, according to the status and traditions of each in the light shed by reason and scientific knowledge.

"Possibly the League of Nations came before its time. To extend the fields in which such co-operation between peoples may be applied is the task of the future, when the time comes, as it surely will, for reconstruction."

Earth Chemistry

Investigations into the composition of oxygen has led chemists at Northwestern University into a new branch of research, paleochemistry, or the chemical history of the earth. Dr. Malcolm Dole found three years ago that the proportions of light and heavy oxygen vary in different compounds, as is illustrated by the fact that oxygen is heavier in air than in water.

Extending the investigation to carbonate rocks a billion years old, Northwestern University scholars have confirmed through chemical analysis the geologic theory as to how the rocks were formed. Theory holds that carbonate rocks were laid down in a large body of sea water.

Mechanical Catalogue

The twenty-ninth annual catalogue and directory of the American Society of Mechanical Engineers comes off the press, containing a profusely illustrated section furnishing an authoritative index to American manufacturers of metals and alloys, power-plant equipment, power transmissions, instruments, pumps, fans, compressors, motors and controls, and hundreds of other types of mechanical apparatus.

Minnesota Ore

The iron ore industry of northeastern Minnesota, world renowned for the size of deposits and high average iron content, is steadily losing its position in the pig iron and steel picture of America, according to O. A. Sundness, Chief Engineer of the Synder Mining Company, in a paper read before the Metal Mining Convention in Salt Lake City. Chief among the reasons given were competitive conditions with aluminum, large reuse of scrap iron, and high taxes and royalty rates.

Keeping Apparatus Cool

Light colors are important to the well-being of a steel-clad distribution transformer in summer, just as they are to the comfort of men and women, according to G. W. Penney of East Pittsburgh. He told the American Institute of Electrical Engineers that the color of paint has a marked effect on the temperature of electrical apparatus that must depend for cooling on a relatively smooth outer surface exposed to the sun's rays. A gray paint was advised as the most practical cooling agent.

Higher Skill Wanted

There is a heavy demand today for better, not more, chemists, according to Prof. H. C. Sherman of Columbia University, in a study prepared for the American Chemical Society. So far as numbers alone are concerned, the supply seems to have caught up with the demand, he adds.

By Product of Shears

Cystine, an amino acid of interest to biochemists, costs around $75 a pound. It is prepared from barber shop clippings of human hair.

From Sun Heat

The possibility that mankind may someday generate electrical power direct from the heat of the sun is seen in the function of a thermo-electric generator on display at the New York World's Fair in the Westinghouse Building. Sufficient current to run a small electric fan is derived from the heat of a gas flame.

Within the glass case are 190 thermocouples, connected together in series. Each thermocouple consists of two alloys, Chromel and Alumel, welded together. The welded junctions are heated by a gas flame, which causes a current to flow. The current collected from all 190 units, 11 watts, is powerful enough to operate the fan.

Westinghouse engineers say that method may someday be used to convert heat from the sun into electricity. Sunlight, concentrated by means of lenses or mirrors, could be used in place of gas. Chief obstacle now is the low efficiency of the apparatus. It converts into electricity only a fraction of the heat energy falling on the thermocouple. To operate the small fan 20 cubic feet of gas an hour are required. H. B. N.

How Much Do You Know About— SALT?

1—What is common salt, from where obtained and why is it so valuable?

Common salt, formerly regarded as an elementary substance, is sodium chlorid (NaCl to the chemists.) It is obtained by freezing or evaporating the water of the ocean or of saline lakes, springs and wells or by mining in beds of rock salt. Salt is a necessary ingredient in the diet of human beings and most other mammals, has high antiseptic properties and contributes largely to industry and agriculture.

2—What are some of the household uses of salt beside the seasoning of foods?

Salt is important in the making of ice cream and brine for pickling; for preserving eggs; for salting down pork and beef; as an aid in laundering; for whitening wood work and straw matting and for cleaning bamboo furniture; as an assistant in dyeing and, conversely, for removing fruit stains and rust from cloth; for cleaning articles of gold, silver, copper and brass; for removing ice and snow; as an ant repellent.

3—How is salt, either applied in solution or as a solid, used medicinally in many parts of the world?

Salt is used in the treatment of earache and toothache, bee stings and insect bites, burns, felons, wounds, tired feet and dandruff; for cleaning teeth and as an emetic and mouth wash; as a gargle and for various kinds of salt baths.

4—How has the very word "salt" flavored the English language?

The word "salt" is found in many common expressions in our language, among them "not worth one's salt," "with a grain of salt," "old salt," "below the salt," "the salt of the earth," "to be sent up Salt River," "to put salt on a bird's tail," and "Attic salt." An unabridged dictionary gives the meaning of each of these phrases in case you are not familiar with any of them.

Deep Under the Earth in the World's Biggest Salt Mine, Avery Island, Louisiana.

A Mountain of Salt Near San Francisco, Distilled from Sea Water.

5—How important was salt to various countries of the ancient world?

Trade between the Aegean and southern Russia was largely dependent upon salt and salt was considered so vital that one of the oldest roads in Italy was called Via Salaria, over which the important commodity was carried from Ostia into the Sabine country.

6—Has salt ever been used as a medium of exchange and, if so, who makes mention of the practice?

Cakes of salt have been used for money in Abyssinia and Tibet. Marco Polo mentions its importance in his report on the financial system of the Mongolian emperors back in his time.

7—How much salt would be left if the entire ocean could be dried up?

Assuming that each gallon of sea water contains .2547 lb. of salt, it would yield no less than 4,500,000 CUBIC MILES of rock salt or about 14½ times the bulk of the entire European continent above the highwater mark.

8—What bodies of water contain proportionately more salt than the open ocean?

Enclosed seas such as the Mediterranean Sea and the Red Sea contain a higher proportion of salt than does the open ocean.

9—What is incorporated in table salt to enable it to remain dry and powdery even when exposed to the atmosphere?

A high grade of table salt will have added to it just a sufficient amount of sodium carbonate or trisodium phosphate to combine with the hydroscopic impurities of calcium and magnesium chlorides—which big words may not mean much to you as words but which tiny addition to your salt will save your temper on many occasions, especially at the beach!

10—What gives inferior table salt its bitter taste?

The presence of magnesium sulphate causes a bitter taste to salt. However, magnesium sulphate isn't all villain; it's what gives us Epsom salts, long valued for their medicinal virtues.

11—What other salts are commonly used for medicinal purposes?

Preston salts are the ones that Victorian maidens used to recover from their swooning; we know them better as "smelling salts"; other familiar salt combinations include Seidlitz powders, Rochelle salts and numerous sedative and alkalizing salts.

12—How have the salt producers helped to lessen a certain morbid enlargement of the thyroid gland?

Goitre, which is a disease of the thyroid gland, can almost certainly be prevented by the addition of iodine to the diet. Salt producers now add a small amount of iodine to their finished product, thus aiding in preventing this disease especially in mountainous regions.

13—What are a few of the many industries of modern civilization that owe their existence to common salt?

Salt is indispensable to the manufacture of glass, soap, glaze and enamel, paper, numerous canned and dried foodstuffs, as a refrigeration agent, for chemical treatments of a number of varieties and for many steps in the packing, tanning and metallurgical industries.

14—How many recognized uses have been found for salt and how much of it does the United States use each year?

No less than fifteen hundred uses for salt are known to modern man and this country requires eight million tons of it annually to provide for them.

15—Which is the oldest salt mine in this country and how large is it?

The oldest salt mine in this country was discovered on Avery Island, Louisiana, in 1791. Pillars of salt in the present mine are sixty feet high and the salt deposit is estimated to contain 1,000 acres in its area.

16—Which is the largest salt mine in the western world and how does it compare in size with the City of New York?

At Retsof, N. Y., is a salt mine with a perimeter of 15 miles; if these miles upon miles of subterranean excavations were under New York City, they would require an area as big as lower New York, more than a thousand acres.

17—In what parts of the United States are large quantities of salt obtained by the evaporating of water?

As one might expect, much salt is obtained from the Great Salt Lake in Utah; the ocean water off California also yields great quantities of the commodity by evaporation.

18—In which States is the production of salt an important industry and into what figures does the annual production of salt in this country run?

Louisiana, Michigan, New York, Kansas, California, Ohio, Texas, Utah and West Virginia are important salt yielding States. We produce about $21,000,000 worth of salt in this country annually.

19—What is meant by the phrase, "but if the salt hath lost its savor, wherewith shall it be salted?" and who said it?

Jesus uses this phrase in his Sermon on the Mount (Matthew V:13.) The earthy residue of impure salt remaining after the pure sodium chloride has been washed out is salt "without savor." In His time there were high taxes on salt and dishonest producers often passed on to consumers salt that had large quantities of residue mixed into it.

20—What is the nautical meaning of the phrase, "to salt?"

Sailors mean by this "to put salt between the planks of a ship for the preservation of the timber."

Problems in Technicolor

BLACK IS NOT BLACK and white can never be white. That may sound like a strange contradiction, but contradictions rule in technicolor pictures where dull browns and muted grays are the preferred shades. When you saw Henry Fonda in "Jesse James" you may have thought he was wearing black trousers. Really they were of oxford gray. And when you saw Shirley Temple in a white coat in "The Little Princess" you were seeing things again . . . actually her coat had been dyed a muddy hue somewhere between white and beige.

* * *

Technicolor pictures require a quite different technique than that which might be applied to stage and street costuming. Because of the process to which they're subjected, because of the dyes and washes which they must undergo before appearing in your movie theatre, and because of your optical reaction to these processes, technicolor pictures require even more forethought and care than the usual screen wardrobe and colors must be selected with a particular purpose in mind.

For example, shades which photograph a certain way in the sunlight will be quite changed when "shot" on a sound set. And hues which appear flattering to the naked eye may prove disastrous to the complexion of the wearer in a color picture.

* * *

There are four qualities of "white" in technicolor but none of them is the white you and I know. For exception, dead white was used successfully in a gown worn by Loretta Young in "Kentucky." But the fabric was embroidered organdie, sheer and transparent, not thick and dense.

Technicolor has introduced a whole new set of problems into the film industry, particularly into the wardrobe departments. One amusing instance of this involved Lynn Bari, who worked for days in a blue gown in 20th Century-Fox's "Hollywood Cavalcade." At last, she was scheduled to do a closeup in the light of a candle standing by the desk of a Chinese. The yellow glow from the supposed candle completely transformed the gown into an unpleasant green, reflecting even on her complexion and hair and consequently the gown had to be made again in a different color which wouldn't photograph differently in the candle-light and several days' camera work had to be done over.

* * *

In the same picture, Herschel, the designer, created a lovely expensive gown for Alice Faye of chartreuse crepe. It flattered her complexion and highlighted her blonde hair. But on the screen—it gave her skin a greenish cast and made even the pupils of her eyes look green. In order to use the gown her makeup would have had to be changed as well as the lighting of the set. It was simpler to change the dress to a periwinkle blue.

Another, simpler gown, was made of pink with a blue belt. In technicolor it photographed well, but in the black and white shots, which intersperse the color reels, the pink melted into the blue and Alice was left without a waistline.

In "Drums Along the Mohawk" Gwen Wakeling found two problems on her hands. One, selecting costumes in blending colors for mob scenes and for scenes in which several women appeared; and, two, selecting colors which were used in that day. Dyes we now use were not available then. Thus, earthy colors predominate in that screen drama. "The Blue Bird," starring Shirley Temple, presented to Miss Wakeling the problem of using colors to express character significance. Thus, the Cat is in black silk jersey. Light is in pale yellow. Mrs. Luxury is garbed in royal purple. And Shirley always wears blue or pink.

* * *

Accessories play an important role in modern pictures and seldom is it possible to find matching bags, shoes and gloves. Nearly always, they have to be dyed specially to match the gowns.

Almost every picture, because of improving processes for developing color pictures, gives a bit more leeway in tones which may be used. There is a great difference, for example, in the colors selected for "Suwanee River" and those which were chosen for "Ramona." In the older picture, every ... dipped in beige ... shades. Today, ... reds which w... because of the... Here's anot... he met: In one ... and two Negro ... the bride wa... her wedding ... their clothes must all harmonize ... and yet not be obvious, because their meeting is supposedly accidental. Here is his solution: The bride was in an ivory wedding dress. Her mother was in two shades of blue and ivory, the maid of honor wore a sandy gold taffeta with blue and peach touches, the bridesmaid was decked out in white with pink flowers and the seamstress wore dark brown. The two mammies wore brilliant colored cotton prints.

* * *

Another quandary was solved in this picture in a scene where Don Ameche, garbed in dinner clothes, meets Andrea Leeds, who also is in formal attire—presumably a white dress trimmed in red. Royer knew that if you put a man in black in an outdoor

Hemophilia Treatment Is Devised

Strange Malady of Royal Princes Now Subject of Research.

BERKELEY, Cal., Dec. 19 (U.P.) — A cure for hemophilia—the disease associated with the former Spanish royal family—soon may be announced by the University of California.

The university has gone as far as to announce that its division of biochemistry has discovered an entirely new factor in the mechanism of blood clotting. In event experiments now under way prove successful, the discovery, it is said, would play an important part in the treatment of all diseases where abnormal bleeding occurs such as hemophilia and hemorrhages arising from jaundice and other conditions.

The two most striking examples of hemophilia in modern royal families, have been those in the cases of the late royal family of Russia and the royal family of Spain. In these cases the affliction is transmitted by the mother only to the male offspring. The crown prince of Russia, who was assassinated, and the ex-crown prince of Spain are known to have been afflicted with the malady.

Two Join In Research

Announcement of the discovery of the new factor in treating the disease was made by Dr. David M. Greenberg of the division of biochemistry and Clarence E. Larson, graduate student formerly in the same department but now in the laboratories of Mount Zion hospital, San Francisco. This factor, according to the announcement, is excreted through the kidneys.

The discoverers admit that the extremely complex mechanism which causes blood clotting is only partially understood by science.

Calcium Theory Weakened

Calcium has been depended largely upon as one of the most important elements in the clotting of blood. Dialysis, or the separation of blood substances experimentally, has been presumed to remove only one essential component, calcium.

However, in certain experiments in which the plasma or fluid portion of the blood was thoroughly dialyzed, it was observed that when the plasma proteins were redissolved in a saline solution containing an adequate amount of calcium, no clot was formed for 24 to 48 hours. If to this artificial plasma there was added a small portion of the ultrafiltrate of whole blood or serum, the formation of a firm clot was induced within an hour or less. The indicates the presence of a dialyzable substance other than calcium. It is this substance that is concerned in the new discovery.

...ocracies — whose arma... ...ave been greatly strengthe... ...it also Germany, which ha... ...idated its alliance with ... ...ained additional reserves, ...cumulated further stocks o... ...nd oil. The decision for w... ...ace ultimately hinges o... ...ttitude of the Soviet Union, ...laced in the enviable positi... ...eing courted by both sides. ...French ... the Com...

rst "Sleep" peration In 46 Recalled

t's Experiment Sulphuric Ether lutionized All ery Methods.

t, 1936, North American aper Alliance, Inc.)

YORK, Oct. 3—ober 16 marks a ble day in medical It is the nine- irthday of anaes-

October 16, 1846, st public surgical n under anaes- was performed at assachusetts Gen- Hospital. A far- courageous physi- Boston, Dr. J. D. , was the surgeon, aesthetician — first kind—was Dr. W. Morton, a dentist, aving "put himself y" for ten minutes haling sulphuric hought it might be more use in sur- an in dentistry.

ton had persuaded Dr. nephew of Joseph War- ll at Bunker Hill—to put to the crucial test. w-reel officiated at this tion. No radio broadcast to a waiting world. An ing of the scene is Blum- The witnessing physi- most of them bearded. All flowing stocks, and their k coats are voluminous. over, nose and mouth most essentials common resent day are missing. as made possible largely anaesthesia. The patient table in his shirt sleeves inary dark trousers and s. His shirt open at the ems to be the only com- the operation.

dical class that day had sold in advance that any- ual was to take place. n was late. Anxious to le very elementary ap- s failed to notice the Warren started to co- hast before the incision Dr. Morton arrived. r patient is ready," said n.

ton adjusted the appara- a moment the patient sleep." atient is ready, sir" said n.

e minutes after the con- f the operation and the had recovered conscious- was utter silence in that room.

" said a speaker at the nniversary celebration of n in 1896, "as if those alized that what they had essed would revolutionize al world and that no ld do justice to it."

Pain he Knife

tient declared he felt no tever; merely a slight as though the blunt edge had passed lightly along ed part. Dr. Oliver Wen- se hailed anaesthesia as s gift to humanity. The arrow in the knotted brow has been smoothed for. Warren broke the si- the operating room with "Gentlemen, this is no

esia in those days was doubted and feared, but The relief of pain— inal curse," was con- as wicked — irreligious. not doctors, having first it, a large proportion of xperts ruled it empirical— timent of quacks and ientists, and, as such, ofe nor respectable. y appreciate the signific- of relief. "Brandy or rum?" was the question usually put to the patient before an amputation, to be answered, as a rule, with "Both!"

Sir Humphrey Davy Blazed Early Trail

Very early in history, the mind of the patient was recognized as an important factor in the success of any operation. Amputations in the heat of battle were never so painful as those done afterward. The great Edinburgh surgeon, Sir James Simpson, who first applied anaesthetics to midwifery, tried mesmerism—as it was then called—though with less success than ether and chloroform.

Sir Humphrey Davy in 1800 blazed the trail to modern anaesthetics when he "put himself to sleep" by inhaling nitrous-oxide. In 1842, Dr. Crowford D. Long, of Georgia, performed a surgical operation with the aid of sulphuric ether, but the operation was not in public nor was it widely publicized. The process was not patented.

In Hartford, Conn., Dr. Horace Wells, a dentist, one evening in 1844 attended an entertainment where a young man, while under the influence of laughing-gas, barked his shins badly against the wooden benches. Seating himself, quite by chance, by Dr. Wells, the young man, no longer under the influence of the gas, remarked that his ankles and legs were bloody, adding, "And I felt no pain at all!"

"That might be a good thing in extracting teeth," observed Dr. Wells, and when the entertainment was over he asked the "exhibitionist" administering the gas to come to his office and they would try an experiment. The next day, Dr. Wells, under the influence of laughing gas, had a tooth taken out by another dentist and felt not the slightest pain. Both Dr. Wells and Dr. Colton, the "exhibitionist," for some time after this extracted teeth painlessly by the thousand from grateful patients. Later, Dr. Wells went to Boston, where he interested several dentists in the new discovery, among others his former pupil, Dr. Morton, who afterward convinced Dr. Warren.

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DR. WELLS went to Paris, where he was welcomed warmly and given a doctor's degree. But when he returned to America in 1847 to find his discovery an accepted scientific fact, and the process patented with small credit to himself he committed suicide. "Most of the American discoverers of anaesthesia," says an English writer, "received neither wealth nor even honor for their great contribution to science."

In one of the last decade's many volumes of reminiscences, a certain great lady tells of her first conversation with Queen Victoria. She had been summoned, with her husband, to Windsor Castle for an all-night visit. After dinner, she was informed, augustly, that the Queen wished to speak with her. Down the huge drawing room, the other guests grouped in solemn silence, the great lady was escorted to where Her Majesty sat—a little apart from the rest.

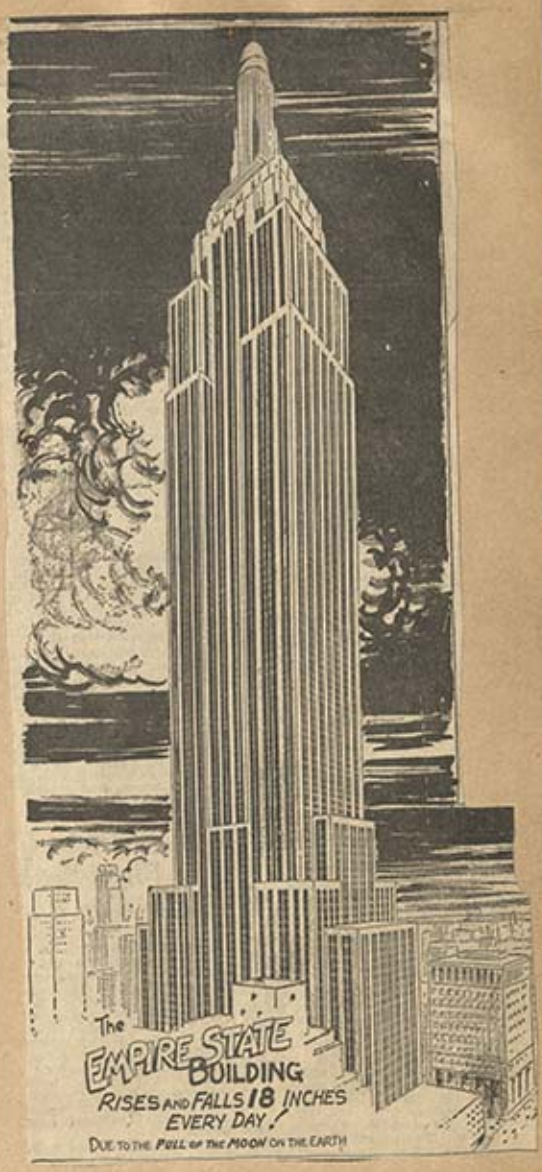
"At the birth of how many of your children," asked the Queen in

Britain Extends Relief to Blind

LONDON, Oct. 3 (C.P.)—Pensions are to be given to the blind of the United Kingdom at 40 years of age instead of 50 and it is estimated 5,000 people will benefit by the change, if the proposal of Sir Kingsley Wood, minister of health, goes through parliament.

The extreme difficulty of training blind people over the age of 40 for an occupation has dictated the proposed pension change. Most of the blind people of this age are unemployed. Reduction in minimum age has been recommended by the advisory committee on the Welfar of the Blind.

There are more than 75,000 registered blind people in the United Kingdom, according to Sir Kingsley Wood. More than 25,00 of them have old age pensions.



Scenes of Remote Exploration Coming Television Thrill

News in Radio

Written for The Christian Science Monitor

Exploring is going to become a great thrill or great disillusionment, depending on the viewpoint, when television becomes one of its publicity channels. This status is not so far away either. The Explorers' Bureau program, which is a feature of the television transmissions of the National Broadcasting Company in New York, is opening up to its armchair audiences scenes as they are lived in remote regions of the earth.

In a recent telecast program Capt. Carl von Hoffman, noted for his travels in Formosa; Earl Hanson, who on his journey to Manaos traveled 20,000 miles through Amazonian jungles; Seward Cramer, authority on the little-known interior of China and James A. Durlacher, of Maracaibo, Venezuela, telecast their experiences on these expeditions.

Portable Equipment Soon?

Who knows, these explorers posed, whether with the future development and improvement of television, it may be only a question of time before television equipment will accompany explorers as they travel to out-of-the-way places, just as short-wave sets have been their only touch with civilization. At the moment, when a prime discovery is made, the television pickup may be set up, and listeners, by a flick of their picture controls, bring exploration history to their homes as it is being made.

In the public mind exploration has come to be associated mainly with anthropological and archaeological research. This is no longer true since exploration has developed with the times and new fields have opened up for it. Today expeditions are mainly for the purpose of finding new minerals, chemicals and metals. Or they may be looking for dye materials, gems, timber, herbs, spices and other commodities.

In the last few years, for example, more than 20 new metals have been found by various expeditions. In fact, many more unknown elements have been found through exploration than through laboratory research, it is believed. It is little known but true that some of the expeditions exploring new regions have really been more intent on discovering new sources of metals, such as nickel, for instance, of which the known supply is inadequate.

As television improves and it becomes possible to telecast over vast stretches of space, people clustered about cities in the centers of civilization and farmers isolated in the country may be able to follow step by step these interesting expeditions and actually see the extension of man's boundaries on knowledge. Such programs will be more than merely absorbing and educational; they can also be a tremendous force for world peace.

The contention so rampant in the world today may be minimized through telecasting at the scene of action, for man will learn to understand the problems of other peoples. Similarly, refusals to grant publicity by radio or television to the aims of a geographical expedition may bring deep suspicions of its motives.

'Plug' on Pictures?

Southern California's 600 television receivers were recently shown an hour's run of a General Motors regular motion picture film, inaugurating industrial movies on the television programs of KHJ-W6XAO in Los Angeles. This new feature of the regular telecasting schedule of W6XAO, which began some nine years ago, included methods of safe automobile operation in town and country, development of the diesel engine, and industrial methods in general in the automobile industry. So well received was this first industrial film that others are to be shown, reports Thomas S. Lee, head of the Don Lee radio-television system.

Australian Radio Census

Today there are 3 radio factories employing 5,519 workers in Australia. Twenty-five years ago there was no radio industry. Thus is the development of the radio industry "down under" epitomized by one correspondent.

There has been a remarkable upward trend in the radio industry going back only to 1931. Dr. Roland Wilson, Commonwealth statistician, in a review of Australian industries in the financial year 1937-38, pointed out that in 1931 there were only 26 factories employing 908 workers.

Increase in the popularity of radio listening naturally has been the cause of the industrial increase. Listeners licenses increased in eight years from 369,000 to 1,056,000.

The greater part of radio set production in Australia is devoted to domestic receiving sets. The industry is chiefly a large scale one, with about 5 per cent of the workers employed in factories in which there are more than 100 operatives.

Australia has taken a prominent part in the development of its overseas radio service, Dr. Wilson points out, and many radio stations in the Commonwealth and New Zealand are of home manufacture.

Science Finds Why Children Laugh And Cry

WHEN baby sits on the floor of the nursery and howls or gurgles joyfully it is usually trying to say something, it is now believed. The young child who has not yet learned to speak is forced to use the most primitive forms of communication—laughing and crying—according to Dr. Catherine W. Brackett of the Child Development Institute of Columbia University in her recent book, "Laughing and Crying of Pre-school Children."

Little boys cry just as much as little girls, although both seem to be quite contented with their lot in life for they spend on an average of only 36 minutes a day in tears. The child who cries least and smiles the most is truly fortunate for he or she will become a social being and will get along well in later life with others. But most babies are rather sober in their philosophic pursuit of life and spend only 96 minutes a day laughing, smiling or just "goo-gooing." All this has been carefully measured.

The old saying that people are born with a sense of humor may be more or less true, for some of the children which Dr. Brackett tested did not respond as well as others. In order to provoke laughter the examiners would "chirrup," play "Peek-a-boo" or tickle the children. Sometimes the apparatus for the test would be a "jack-in-the-box" or a musical toy.

In most of the tests a child used laughter as a direct means of contact with his associates. A child's experience is naturally too limited to permit it to understand the complex situations at which grown-ups laugh. On the other hand some instinct or inherited trait makes a child recognize the absurdity of some comic situation to which he feels he must respond. Therefore, he laughs.

The Youngsters Were Watched Constantly During Their Waking Hours. One Unseen Observer Relieved Another in Gathering the Interesting Data About the Habits, Reactions and Behavior of Boys and Girls Too Young to Go to School.

Most of the children liked an audience when they laughed, which they did more readily when they could share their pleasure with their companions. The children who laughed the most liked to play with the other more jolly members of the group, while the more serious ones played alone or in groups of two or three.

In one of the groups of slightly older children there was a closely knit "gang" of one girl and three boys. When one of these laughed the rest usually joined in.

Crying, in the same way, was found to be largely social. When one member of the group cried the others were apt to join in on the chorus. It seemed to be more of a group resentment against the actions of others rather than because of pain or fear in each individual member.

Of course, the difficult part of testing very young children for this kind of reaction is to watch them carefully. A nursery was established at the Institute so that a child's play and routine activity could be closely observed.

When the weather permitted the children played for two hours in the morning on a spacious roof or in a garden near by. When the weather was cold or rainy a large playroom was used. In making the tests even the daily temperatures were taken into consideration. When it was cold the children cried more; when it was warmer they laughed more. This, Dr. Brackett points out, is not conclusive, for laughing and crying may be affected by dampness in the air rather than by heat or cold. The differences in temperature were slight in any case since the Institute kept them well regulated to safeguard the youngster's health.

All the children were observed directly. In other words the observer placed herself where she had a clear view of a section of the playground on which she focussed her attention for periods of ten minutes each. She was then relieved by other observers.

Physical contacts were carefully noted. For example, two children might be pulling at either end of a toy or playing in the same sand box. This might cause a response not connected with the test. In other words if the toy were intended to make a child laugh and another child came along and pulled the toy away, thereby spoiling the other's fun, this was counted as a "physical contact" and the test was begun over again.

Most of the children cried less when their favorite "cronies" were around. They preferred to drown their sorrows in solitude. As they grew older they cried less and less showing an awareness of social situations in which crying is not an acceptable form of behavior.

The stricter the regulations about routine duties, such as eating, sleeping and dressing, the more satisfied the children seemed. On the other hand their periods of free play led to marked emotional states, indicated by the frequency of laughing and crying.

If boys will be boys then they should let the girls alone, according to Dr. Brackett's figures which show that girls cry more when they are associated with boys. When the girls played by themselves things went smoothly along. Even the boys seemed to resent the more masterful activities of some members of their own sex, for they cried more often when their brothers were around.

Their reactions to all the tests were "loud, unmistakable and immediate," whether laughing or crying. The figures proved that there was a high degree of relationship between language and laughing. The more language a child knew the better he could understand situations and recognize their comic aspects.

In spite of the general applications of these statements Dr. Brackett found that the children showed wide differences as individuals and handled each test in their own way. There seemed to be no indication that intelligence, as rated by psychological tests, has anything to do with these emotional states. In fact the emotional states were usually so characteristic of the type of child that was tested that to a certain extent the child's future personality could be detected.

Fortunately, the young optimists would laugh after falling headlong; the pessimists would wail loudly and demand attention. The optimists would have a jolly time without toys, while the pessimists would have to be coaxed to play with the most amusing toys.

Oddly enough, characteristics of a child's behavior seemed to remain the same for a period of one year. Then they would change. The child would cry less and laugh more. Just why the figures should be the same for a certain period is not known but the circumstances may be likened to an animal shedding its coat of fur once a year.

Sex seemed to make no difference in early childhood in the frequency of laughing and crying, for the boys responded to the tests in the same way as the girls. In the separate age groups, however, boys and girls laughed more often with members of their own sex. This behavior, as far as could be determined, was the same even while the children were busy with the more routine activities of bathing, eating and dressing.

The situations in which the children were involved were all relatively simple. With the younger children reactions to musical toys and games with the examiners constituted the tests. The older children played in small groups on sand piles or see-saws.

Insofar as the accuracy of the tests is concerned it would be difficult to tell what influence the atmosphere of a nursery school would have on a child as compared with that of the home. But the purpose of Dr. Brackett's study was to develop a method of recording the laughing and crying of young children, not of school age, and to find just how consistent this behavior was. In doing this Dr. Brackett arrived at the interesting conclusion that since laughing and crying are used by the child as a method of communication these states are predominantly social and indicate in a small measure the way that these "future citizens" will respond to the more complex situations of later life.

Food, Health and Vitamins

By M. D.

The first in a short series on this new important and much discussed subject

THE most important changes in thought come so quietly that they fare often unnoticed for a long time. The mind is not torpedoed into a change of opinion. "Look out" signalled the Commander of a British ship in the war to his adversary. "Look out—we are going to torpedo you." But no one knows enough of the future current of events and the future history of thought and discovery to signal us, "Look out—something is going to happen." It happens and a good while after we begin to find it out.

Why are we well today and ill tomorrow? Why are some people always well and others never well? We all know something about germs and infections and teeth and tonsils. But is that the whole story?

Of course not. Within the last twenty-five years a new answer has been given to these questions. But it takes a quarter of a century to get things into our heads. It almost seems as if a new generation had to arise before we can get general consent to accept a new idea, however good it is. Sir Walter Scott said about the Scottish race:—"The Scots are not able speedily to admit an innovation, even when it comes in the shape of an improvement." There are others.

A Great Innovation

TO MOST people who have in their minds a conviction that the causes of illness are deep and mysterious, it is a great innovation to admit that this is wrong. The truth is that the causes of most illnesses are simple and that they are more or less under our own control. We eat what we are used to, or what we like, or what we can get, quite regardless of the fact, which has been known since the 18th Century that certain foods protect us against certain diseases. If we eat these foods, we shall not suffer from said diseases. This truth is not so very new, after all.

Tuberculosis

FIFTY years ago, family physicians in Canada advised people under their care not to neglect fats in their diet, even though they did not like fats, but to cultivate a taste for eggs, milk, cream and butter and to take a little Cod-Liver Oil. If you tried to find out the reason, probably you would at last get the doctor to tell you that people ought to take these foods—fats and dairy products and so on because if they did, they would not "go into a decline" or have "Consumption". These were the popular names for tuberculosis fifty years ago.

The specific protective value of certain foods has long been known or at least conjectured. This food is "good for" that disease, people used to say. They meant that if you took a reasonable amount of that food you would not take the disease named. Now we say that foods containing Vitamin A are protective and that a diet that is deficient in Vitamin A leads to lowered resistance, and to infections, particularly to infections of the lung.

Fats, eggs and dairy products contain Vitamin A.

Deficiency Diseases

A "deficiency disease" is the best name for certain diseases, because these diseases are caused by a deficiency of certain foods in the diet. These "Deficiency Diseases" are numerous and within the last few years the number has been growing larger, as new facts about the effect of food on health have been brought to light.

Pasteurization in Ontario at a Glance

1902—Milk first pasteurized in Toronto using English equipment.

1906—Bottling of milk began in Toronto.

1908—Over 60% of Ottawa milk supply pasteurized. Ontario Milk Commission formed.

1909—Pasteurization of all milk advocated by Dr. T. O. Hutchison, M.O.H. of London, and Dr. F. W. Wilson, M.O.H. of Niagara Falls.

1914—Pasteurization of milk made compulsory in Toronto.

1926—All cream sold in Toronto ordered pasteurized by Health Department.

1931—Pasteurization law for Toronto expanded to include milk and all cream products.

1938—Oct. 1—Pasteurization of milk made compulsory in all Ontario cities, towns and suburban areas.

TYPHOID FEVER EPIDEMICS

Caused From Milk-Borne Disease

At Montreal, 1927:
5,002 cases; 533 deaths.

At Chatham, 1927:
109 cases; 7 deaths.

At Montreal, 1930:
130 cases; 26 deaths.

At St. Maurice Valley, P.Q., 1932:
527 cases; 45 deaths.

Food, Health and Vitamins

(Continued from page 22)

Scurvy was the first Deficiency Disease to be discovered. A treatise on Scurvy, by Lind, was published in 1757. He said that by far the best remedy for scurvy was Orange Juice or Lemon Juice, either of which works a rapid and complete cure. As Lind says "Some persons cannot be brought to believe that a disease so fatal and so dreadful can be cured by such easy means. They would have more faith in some elaborate composition, dignified by the title of an Anti-scorbutic, Golden Elixir or the like. Facts are sufficient to convince the unprejudiced."

Infants nursed at the Mother's breast seldom have scurvy but it is not uncommon among bottle-fed infants.

To prevent any danger of Scurvy, orange-juice should be given to infants from about the age of two or three weeks. Scurvy has been banished from the British Navy by the issue of a daily ration of one ounce lemon-juice to each man. It is important to give enough. A ration of two-thirds of an ounce a day had previously failed to prevent Scurvy.

Scurvy is common at present in Northern Russia but has almost disappeared from other parts of Europe.

The Vitamin which prevents Scurvy is found in abundance in fresh fruits and green vegetables and is known as Vitamin C.

SUPPLY OF VITAMINS

The human body adapted itself through thousands of years to its environment. This was naturally necessary if it was to survive at all, but in the civilization which has created for itself, there are many inconveniences which go with this long heritage. One of these is the necessity of providing for an adequate supply of vitamins in our diet.

The things we eat are part of the environment to which we have had to adapt ourselves through the ages, and it so happens that when our prehistoric ancestors got into the habit of eating fresh food and raw food, this food contained certain substances which are necessary for health and growth, and which we now call vitamines.

It would be convenient at many times when we are going on a long journey, or when an army is travelling, to be able to eat all that is necessary in concentrated form. This would do away with the necessity of cumbersome dining car and cook wagons and a great deal of heavy baggage.

As a matter of fact, we can supply the total amount of energy easily enough in concentrated form, but when these adequate diets — adequate from the standpoint of calories—are given to animals, they develop various states of ill health due to the lack of fresh foods and the vitamins therein contained. So for a normal healthy diet, a mixed diet with vegetables, fruits, fats, milk and eggs—and a great deal of it fresh and some of it raw—is the only standard.

However, our research in the vitamins has now gotten to the point where we know the chemical composition of a great many of them, can extract them from the foods in which they are contained, and they can be given in concentrated form. Many of these concentrated vitamins can be procured through drug and food markets.

Do Adults Need Added Vitamins?

The question arises whether it is necessary for an adult to take care to add any vitamins deliberately to his diet (we know that it appears to be necessary in the diet of children, but this was discussed yesterday). Most adults eat a sufficiently mixed and varied diet so that theoretically they obtain all the vitamins they need. It probably is a foolish and unnecessary thing to try to add vitamin concentrates to a perfectly healthy person's normal diet.

However, some researches have arisen lately which appear to indicate that adults need a larger quantity of certain vitamins than they get in their food. This is especially true about Vitamin B. Either the body's inability to utilize this vitamin runs out or in adult life, for one reason or another, foods which contain it are instinctively rejected. In many conditions the Vitamin B concentrate appears to be beneficial.

One of these is gout. It has been reported that in gout, the use of Vitamin B concentrate will prevent attacks and even restore the bones which have been affected by gout, to a normal condition. It is also true that Vitamin B will prevent and cure the form of neuritis which occurs in chronic alcoholism. This is because the alcoholic naturally eats very little and rejects the Vitamin B-containing foods.

Another use for concentrated vitamins is in reducing diets in which fat foods particularly are forbidden.

Formulated the Law Of Gravition

NEWTON—HE EXPLAINED UNIV

OW not what the world
ll think of my labours,
myself it seems that I
en but as a child playing
seashore; now finding
ebble rather more pol-
nd now some shell rather
gressibly variegated than
, while the immense
f truth extended I sa
red, before me."

S Newton, one of the
atest geniuses, perhaps
e greatest so far produced
uman race, spoke of him-
his work. He is the man
w the apple fall from the
d, in addition to seeing it,
about it intelligently.
his exact formula of the
gravitation, "every par-
f matter attracts every
particle of matter with a
proportional to the mass
and to the inverse square
distance between them,"
rter, "directly as the mass,
ely as the square of the
ce," he had explained to
for all time the material
ng of the universe in which
live, and explained and de-
the law and the force in
ence to which the planets,
ding our little earth, move
nd the giant sun.

wton so amazed the world
his mathematical genius
those capable of understand-
is work, then and now, have
d it hard to understand that
marvelous a brain could

The Marquis de l'Hopital, distinguished French mathematician, asked in amazement, "Does Mr. Newton eat, drink, sleep like other men? I picture him to myself as a celestial genius, entirely removed from the restrictions of ordinary matter."

The greatness of Newton is shown in the quotation at the head of this article, in which he describes the littleness of his own work and the limitations of his knowledge. Another statement of man's littleness, contrasted with eternal power and wisdom, you find in the 26th chapter of Job:

"Lo, these are parts of his ways: but how little a portion is heard of him? but the thunder of his power who can understand?"

LITTLE boys and some grown men find it hard to understand how people can live down on the other side of the earth "with their heads hanging down." Nearly all made that objection when the roundness of the earth was first declared. But if the little boys grow up to understand Newton, they understand the upside down problem quite easily.

Matter is held to the earth, on which there is no "up or down," by the mysterious force of gravitation, just as a small piece of steel is held to the magnet by the equally mysterious magnetic power.

Men knew about gravitation long before Newton was born. He explained how it worked.

NEWTON'S life was not exciting. He was elected to Parliament, but is said never to have done anything there except to suggest that a certain broken window be mended. Very pious, he worked hard explaining the Book of Revelations—wrote a book about it that is not worth reading.

It takes a trained mathematician, who understands Newton's gigantic discoveries, to understand how great a man he was.

NEWTON was born on Christmas Day, 1642. His father died before he was born. His mother married a clergyman, her second husband, and Newton lived with his grandmother. His stepfather died, and he returned to his mother. At the grammar school at Grantham he was considered a dull boy "until a successful fight with another bigger boy aroused the spirit of emulation and led to his becoming head of the school." The boy had kicked him, and Newton took an interest in conquering that lad, and later conquered intellectually as he had conquered physically.

At fourteen he went to work on his mother's farm. She complained that he occupied himself with mathematics when he should have been working. Thanks to his mathematics, the name of his mother will be honored as long as men live on the earth.

At twenty-three he discovered the binomial theorem, and a little later the elements of differential calculus, which he called Fluxions. He was the creator of what is now called Integral Calculus.

At twenty-four, says he: "I began to think of gravity extending to the orb of the moon." At the same age he began his work on optics and color.

NEWTON made the first reflecting telescope, in which a concave mirror takes the place of the object glass. He reported his various discoveries to the Royal Society, to which he was elected a Fellow in 1672.

After he "began to think of gravity extending to the orb of the moon" he waited eighteen years before publishing anything about his views on gravitation. Halley, whose announcement of the return of Halley's Comet on a definite date is famous, persuaded Newton to send to the Royal Society his mathematical answer to the question: "What would be the path of a body moving under the action of a central force which varied as the inverse square of the distance from the center?"

He showed that Kepler's Third Law (concerning the movement of the planets) was a consequence of the elliptic path of a planet under an inverse square law. His discoveries caused much wrangling and criticism. Newton hated both.

In 1696 John Bernoulli challenged the mathematicians of all Europe to solve two problems, giving them six months for the solution. Prominent mathematicians protested six months was not long en

On January 29, 1697, copies of the problems were to Newton from France. next day he sent solutio Montagu, President of the Society.

The Society sent them to noulli, who immediately r nized the author, although name was not given, saying knew the lion by his roar." ton did not need six mo One day was enough.

IN 1705, aged 63, Newton knighted by Queen which changed his name to Isaac Newton. Anne wil remembered for that long everything else concerning reign shall have been forg including her great mon which distressed some of nobles, and her great app described in these lines:

"King William thinks all
Queen Mary talks all,
Prince George drinks all,
And Princess Anne eats

Newton was a sickly i not expected to live. women, sent to get medicin the baby, did not expect to him alive when they retu But, thanks to a temperate and mental activity, he live be eighty-five. He died March 20, 1727, and was b in Westminster Abbey, a great honor for that an Abbey, so largely devoted graves of nobodies.

NEWTON'S father was a ple yeoman who till small piece of ground that been in his family for some

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"The Doctor Says"--

Humans Have Five Special Senses and Six Somatic Senses

By LOGAN CLENDENING, M.D.

A correspondent asks: "What is meant by the "six somatic senses?"

The five special senses, of course, are sight, hearing, smell, taste and feeling. We have, however, many other senses. The six somatic senses are called "temperature," "equilibrium," "hunger," "thirst," "muscle sense" and "pain".

Temperature—The skin has terminal nerves to receive feeling and also to notice heat and cold and other special sensations. There are about 30,000 tiny spots on the surface of the body that are sensitive to warmth and about 250,000 similar spots sensitive to cold. When the skin temperature rises, only the warm spots are stimulated. When ice or snow touches the skin, only the cold spots are stimulated. On a very hot day or on standing over a radiator, both hot and cold spots are stimulated. That is why it is so uncomfortable.

Equilibrium—The sense of your position in space is governed by end organs located near the organ of hearing in the skull, the semicircular canals. When you whirl around rapidly or ride on a merry-go-round, these canals are overstimulated and the fluid inside them is disturbed, which puts you off your balance. The reeling drunken man has poisoned the cells of his semicircular canals.

Hunger is a general bodily sensation, probably produced by contractions of the stomach.

Thirst is felt most acutely in the mouth, but it is a general bodily sensation because it can be relieved by injecting fluid into the vein.

Muscle sense enables you to judge roughly the weight of an object which you lift from the floor. It also allows you to judge your distance from an object.

Pain may be either a localized or general bodily sense. General pain arises from fatigue.

◆ ◆ ◆

Most Frequent Disease

What is the most frequent disease in North America?

Acute inflammatory rheumatism is first in prevalence, second in producing disability, second in producing disability, second in producing invalidism and fourteenth in causing death in the United States. There are 6,800,000 patients who have or who have had inflammatory rheumatism out of our population of 127,000,000. There are almost twice as many cases as there are of heart disease.

The disability and invalidism are produced by the damage which acute inflammatory rheumatism does to the heart. It is a frequent cause of valvular disease of the heart. In order to prevent this complication, no matter how light the case may be, the patient, especially a child, should be kept at bed rest or as close to bed rest as possible for six weeks after the acute condition has subsided.

1939 SAFEST YEAR FOR AIR TRAVELERS

1,400,000 Flown 620,000,000 Passenge Miles Without an Injury, Report Says

INDUSTRY MADE PROFIT

Traffic Up 40%, Jobs Gained 22% and Express and Mail Services Increased

The air transport industry in the United States enjoyed the biggest and safest year in its history during 1939, according to a report made public yesterday by Colonel Edgar S. Gorrell, president of the Air Transport Association of America. Every index of the business, including passenger, mail and express traffic, employment, finance and safety, registered marked gains over the figures of the previous year, it is shown.

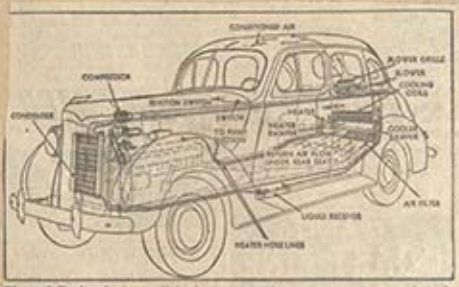
Colonel Gorrell reported that the domestic and international airlines of this country flew 880,000,000 passenger miles last year for a gain of almost 40 per cent over the 1938 figure of 635,000,000 miles. More than 13,000,000 pounds of express were carried in 1939, compared with 9,452,600 pounds the previous year, while mail shipments rose from 23,500,000 pounds in 1938 to more than 27,000,000 pounds. Employment figures for the industry also increased 22 per cent during the year.

For several years the domestic airlines had been operating at an annual loss of more than $2,000,000, but last year put them in the black, the report showed. The report said also that more than 60 per cent of the income in 1939 was from passenger traffic, whereas five years ago airline revenue was 70 per cent air-mail payments and express, and passenger traffic accounted for the rest.

The passenger revenue gain is attributed largely to the safety record set during the last eighteen months, Colonel Gorrell declared. At the close of 1939 the domestic airlines had completed 620,000,000 passenger miles and carried 1,400,000 persons without injury. This is a gain of more than 400 per cent compared with the three years immediately preceding.

"From all records available," Colonel Gorrell added, "it seems safe to say that this is the greatest increase in safe travel of any class of passenger service for any similar period in the history of transportation in the United States."

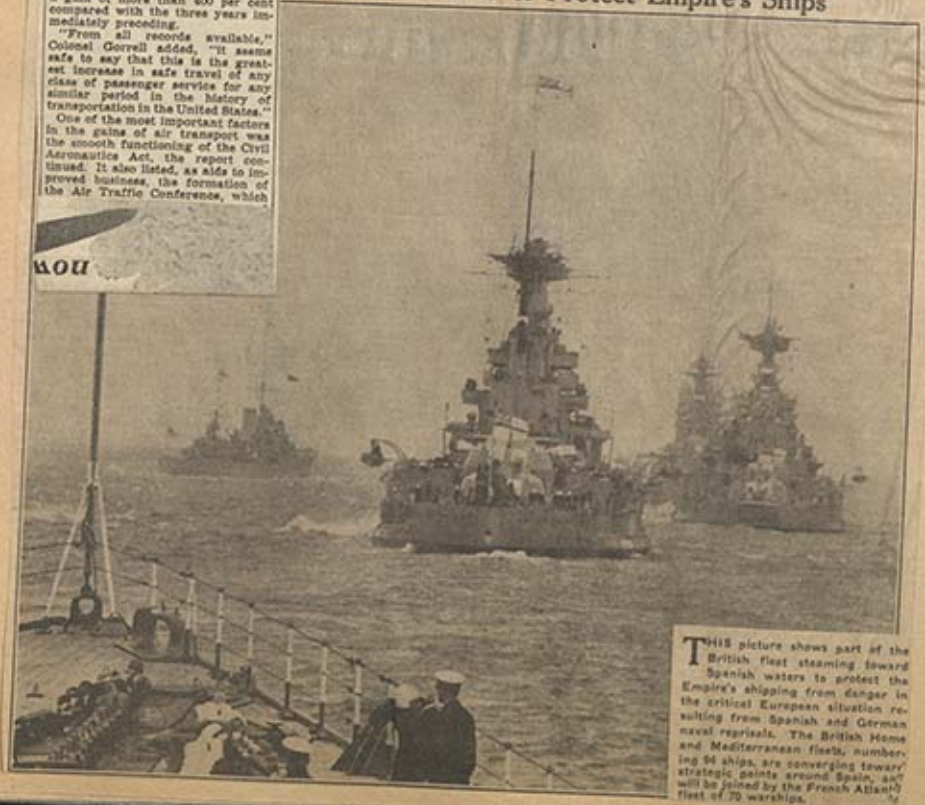
One of the most important factors in the gains of air transport was the smooth functioning of the Civil Aeronautics Act, the report continued. It also listed, as aids to improved business, the formation of the Air Traffic Conference, which



Plan of Packard air-conditioning system for passenger cars and taxis.

ONE air-conditioned taxi, the first ever built, was completed recently and delivered here by Packard on special order of Harry Gehn, distributor, of 750 River Avenue, the Bronx. Painted light cream with pastel blue accents, the "weather-conditioned" cab is cooled or heated by Packard's new air-control unit. The passenger compartment with jump seats has tan and blue leather upholstery. The sedan-type body is on a 133-inch wheelbase. Equipment includes a six-cylinder engine and heavy duty clutch and brakes. While the new taxi passed the police back bureau's rigid tests, Mr. Gehn said similar models will not appear for use until next Fall.

verful Men-o'-War to Protect Empire's Ships



THIS picture shows part of the British fleet steaming toward Spanish waters to protect the Empire's shipping from danger in the critical European situation resulting from Spanish and German naval reprisals. The British Home and Mediterranean fleets, numbering 94 ships, are converging toward strategic points around Spain, and will be joined by the French Atlantic fleet of 70 warships.

One of Canada's New Fighting Planes

Reproduced from
bing and torpedo
g catapulted from
Seven machines
now Dominion air
mbled at Rockcliff
for carrying a to
seven hours' flight
The reproduction
t, a brother of R.

With Gibbs on the Western Front

Gun With 35-mile Range Part of Maginot Defence

Secret Artillery Will Give Germans Taste of 'Hell on Earth' If They Attack Line

By SIR PHILIP GIBBS
(Noted British War Correspondent)

With the British Forces, in France, Nov. 25

After a few days with the French army in the field I am still stirred by an unforgettable impression of the enormous strength of the Maginot Line, that fantastic underworld which might have been invented by the imagination of Jules Verne or H. G. Wells, and by the life and character of the French soldiers who hold it.

One of our own officers who was with me said to me last night that nothing he had read about the Maginot Line had conveyed the least notion to him of what it was like and that everything he had seen was unexpected. That shows how poor words are to convey a picture that is beyond all one's previous experience, and the Maginot Line is like that. For it is difficult to describe a series of earthworks under the hills of France, and quite invisible from above, that stretch from Luxembourg to Switzerland and have in their subterranean depths all the mechanism of immovable battleships.

Dynamos, gun turrets, electric lifts for men and ammunition and great guns moving at the touch of a wheel or a button as smoothly and silently as the springs of a watch — combined with the strength and length of a chain of fortresses under the earth, with endless passages, chambers and roads, with concrete walls and narrow-gauge railways, kitchens, dining rooms, barracks and hospitals.

Does that convey anything? I doubt it. One has to walk through one of these systems for many kilometres, one has to smell and see and hear in these underground wells.

One has to talk with the men and touch the mechanisms in their steel chambers, look far down the vista of tunnels, going for many kilometres from one section to another, when innumerable points of light are flickering out for brief moments of darkness and now and then reaching, as it seems, to infinity. In one of those moments of darkness I listened to the tramp of men, French soldiers marching at a handpace before and behind me. I felt a faint mousey smell and was aware of a strange vibration.

For a moment I had a sense of losing touch with this human world of ours and of walking in some other plane of life, yet the French soldiers who hold the Maginot line get used to it and like it.

"It is not a bad life down here," said one young officer to me. "I have been here for two months and I only go on top now and then for a spell of fresh air. After a few months one begins to feel the need of sunlight, but the air is conditioned by artificial means and the men keep quite fit."

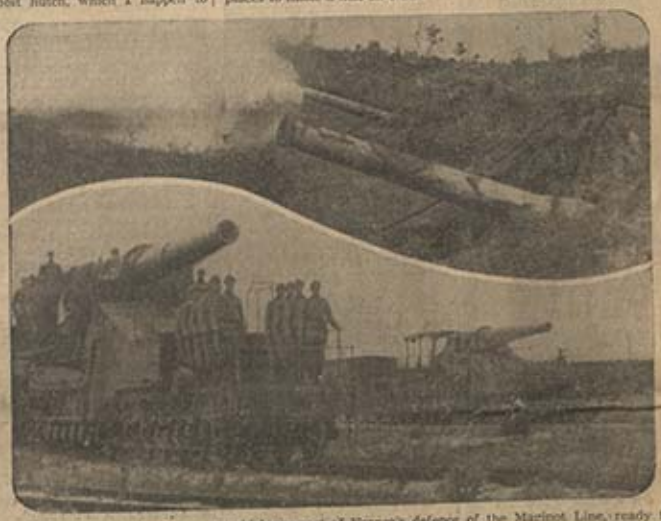
French soldiers have a touch of the child in them and give a human, playful touch even to the steel walls and concrete forts. I noticed two shrubs growing in pots at the entrance to one of the fortress systems just as though it were a bungalow in a Surrey village instead of the steel door of an underground castle. Here also were two white rabbits which they are keeping as pets of the garrison. But there is a sinister sign on the rabbit hutch, which I happen to know. It meant that the little animals are to be used for testing the atmosphere for any gas that might come over the hills one day.

Inside and outside the Maginot line from Luxembourg to the Swiss frontier there is enough gun-power lurking in secret places to make a hell on earth—such a hell as we once saw at Ypres and Paschendaele across the Belgian frontier and in that no man's land of deserted villages and silent woods, from two to ten kilometres wide, between the French and the Germans. I saw many of these emplacements artificially concealed and the French soldiers showed me these monsters and explained their range and mechanism. One of them was sensational in size and power of destruction.

A "Nightmare" Gun

"Do you see any guns hereabouts?" I was asked. I could see nothing but a muddy track, a dark wood and a rising hill. But suddenly, without a sound, within a few yards of where I stood I saw

Please Turn To Page Five—See
Gibbs at Front



Shown here are the huge guns which are part of France's defence of the Maginot Line, ready to meet any possible attack from Germany's Westwall. A line of camouflaged guns appears above, while below, railway guns used for long-distance bombardment and battering heavy emplacements are being moved up.

Monster British Power Unit

The camera here caught a remarkable night picture of the huge Battersea electric power station in London which generates power which goes out over the grid system to vast areas of England, lighting many cities and towns and providing power for huge industrial plants.

Scientific Notes

A DEADLY poison can be extracted from milk.

A mile of glass thread can be spun in three seconds.

Time is measured by the earth's rotation on its axis.

The first practical typewriter was placed on the market in 1874.

Three drops of skunk musk will scent an area of about one mile square.

Russia has a new compass equipped with electric bells that announces the slightest deviation of a ship's course.

Only three patents were granted during the first year after the patent act became effective in the United States.

Inoculations of pollen enable physicians to tell exactly what plant causes distress to a hay fever patient.

A "fog" nozzle that literally smothers flames in clouds of mist has been invented as a weapon against airplane crash fires.

An animal may have several common names in one locality, but it has but one scientific name throughout the entire world.

Scientific Notes

A permanent, outdoor exhibit of old Hawaiian life, including a reproduction of an ancient temple, is being planned in Honolulu.

Small submarines are being built in Germany that will be driven by single motors operated by oxygen and hydrogen instead of by Diesel electric engines.

Compressed air, rather than blasting dynamite, is the newest safety aid for coal mining now being tried out in the Indiana and Illinois coal fields. Large pieces of coal of the so-called premium variety are now being politely pushed out of place by air pressure instead of being ruptured violently by dynamite or other permissible explosives. There are no dangerous fumes liberated as in ordinary blasting.

A magnet producing the strongest sustained magnetic field ever created by man has been built by Dr. Francis Bitter, of the Massachusetts Institute of Technology. The development opens the way to new studies in the structure of the atom and in the inconceivably cold and mysterious world of matter near "absolute zero"—the point beyond which science knows nothing colder. The powerful but small instrument has produced a magnetic field 150,000 times stronger than that of the earth.

Touching the Bottom!

These are the lowest temperatures recorded at each spot in the last 10 years, as furnished by the Dominion Meteorological Bureau, Toronto. The Iroquois Falls temperature, though taken by an official observer, still raises doubt, even among bureau officials. Pond Inlet is Canada's most northerly weather station.

	Fahr.	
Victoria, B.C.	10	Jan. 19, 1935
Vancouver, B.C.	4	Jan. 19, 1935
	ZERO	
Nelson, B.C.	17	Jan. 17, 1935
Charlottetown, P.E.I.	19	Feb. 17, 1934
Saint John, N.B.	21	Dec. 30, 1933
Toronto	22	Dec. 29, 1933
London, Ont.	27	Feb. 9, 1934
Montreal	29	Dec. 29, 1933
Quebec, P.Q.	32	Dec. 30, 1933
Winnipeg, Man.	42	Dec. 28, 1933
Calgary, Alta.	45	Jan. 28, 1929
*Churchill, Man.	47	Dec. 28, 1934
Edmonton, Alta.	49	Jan. 27, 1929
Hotsonpayne, Ont.	51	Jan. 14, 1929
Pond Inlet, Baffin Land	55	Feb. 16, 1931
Prince Albert, Sask.	56	Jan. 8, 1930
White River, Ont.	61	Jan. 23, 1935
Dorset, P.Q.	64	Jan. 14, 1929
Dawson, Yukon	66	Jan. 22, 1934
Iroquois Falls, Ont.	73	Jan. 23, 1935

*Records only from 1932.

Do You Know

What is Candle-Power?

One candle-power represents the amount of light supplied by a standard spermaceti candle burning at the rate of 120 grains of wax an hour.

Where Is Coldest Place On Earth?

Verkhoyansk, Siberia, has an average January temperature of -58 degrees Fahrenheit, or 91 degrees of frost. In February, 1892, the thermometer dropped to -90 degrees. Verkhoyansk is only just inside the Arctic Circle (latitude 67 degrees 37 minutes north), but is the world's coldest spot because it is so far from an open sea, land cooling much more quickly than sea. In Antarctica -77 degrees Fahrenheit has been recorded within a short distance of the ocean.

What Was the Greatest Explosion In Recorded History?

That caused by the volcanic eruption which destroyed the island of Krakatoa, in the East Indies, on August 27, 1883. The stupendous noise of the explosion was heard 3,000 miles away; over 36,000 people were killed by the eruption or by the gigantic sea waves which it set up; dense clouds of ash turned noon into twilight more than 100 miles away, and weather and atmospheric conditions were affected the world over.

What Is Oldest Known Code of Laws?

The one drawn up by Hammurabi, King of Babylonia, who reigned from 2067 to 2025 B.C. The text of this famous code was discovered at Susa, the ancient capital of Persia, inscribed in the cuneiform character on a stone slab eight feet high. About 40 of the laws are erased, but 248 remain, and fragments of other copies found at Nippur and Nineveh supply some of the missing ones. The laws are both civil and criminal, and though exceedingly severe, they show a striving after impartiality and justice. Many of the prescribed punishments are based on the ancient principle of "an eye for an eye, and a tooth for a tooth." Thus a daughter could be put to death if her father had caused the death of another man's daughter; theft was punished by loss of the fingers that committed the crime, and so on.

Manchoukuo to Build Liquefaction of Coal Plants By Next Year

Country Long on Coal But Short On Oil

PLANT STARTED

(By Associated Press)

MUKDEN, Manchoukuo, Oct. 1. — Manchoukuo, long on coal but short on oil, is to have two liquefaction of "coal" plants in operation next year.

The South Manchuria railway, spearhead of Japanese advances on the Asiatic mainland, has begun erection of a plant in Fushun, adjacent to the world famous open-pit mines. The railroad, owned in part by the Japanese government, launched its project after long experimentation and a study of the work done by the Japanese navy.

Its first investment, 1,000,000 yen (about $285,000), is to be followed by an investment of 10,000,000 yen next year. A yield of 2,000,000 tons of oil a year is expected at the start with the output vastly increased when the eventual investment of 40,000,000 yen becomes fully productive.

Japanese authoritative sources disclosed last week Japan has invested $682,000,000 in Manchoukuo since the autonomous state was created under Japanese supervision in 1931. About half was said to have maintained armed forces and only about $40,000,000 used in private investments.

The Manchoukuan government was said to be planning a five-year industrial program involving the expenditure of $410,000,000.

Other Sources

When Manchoukuo set up a government oil monopoly over the protests of Great Britain, the United States and the Netherlands, wiping out the business of Anglo-Dutch Shell, the Standard-Vacuum, Texas Oil and the Soviet's Naphtha Syndicate, it looked to several sources for the 30,000,000 gallons of petroleum products it needs each year.

The shale which overlies several Manchoukuoan oil fields contains a little petroleum but the best of it could not be worked in a country where petroleum was found. The railway has installed a 12,000,000 yen plant at Fushun and expects to raise the output there to 8,000 tons of gasoline a year.

The great Showa Steel Works at Anshan can supply 1,000 tons a year of benzole. Alcohol is manufactured from Manchuria's abundant grains and the government is discussing adding some of it to the commercial gasoline.

Not Independent

But these sources do not assure the Japanese army of a wholly independent [illegible] planes a[illegible] say noth[illegible] new bu[illegible]

Scientific Notes

ALUMINUM first was isolated in 1825 by scientists Davy and Wohler. In 1886, Hamilton V. Castner, of New York, perfected a method of manufacturing aluminum as a sheet metal.

Patents on all revolutionary developments in the television field are held in the United States and foreign countries have had to lease American rights to make progress in the industry.

The cosmic ray, still largely a thing of mystery to science, has energy equal to 15,000,000,000 electronic volts, according to an estimate just made by Dr. Arthur H. Compton, world-famous physicist of the University of Chicago.

Alfred Castanien, aged 82, of Columbus, Ohio, is the inventor of a tub-table-stove combination. The table has a stove at one end for gas or oil heating of water for the tub, which is revealed when one presses a gadget or two.

A calculating machine has been developed at Massachusetts Institute of Technology that does the work of brains. It weighs a ton and comprises more than 13,000 separate parts, including 600 feet of flexible steel tape and nearly a thousand ball-bearing pulleys.

Development of a drouth-resisting wheat, hardy enough to withstand permanent wilting during a severe heat wave, was announced recently by the University of Alberta. The new wheat strain also was credited with good milling and cereal qualities.

British Firm Builds Gas-Proof Rooms

A view of the interior of a gas chamber recently installed by a London firm for the protection of its employes in the event of gas raids over the English metropolis. The chamber is proof against every known form of gas and is equipped with air filters, first-aid station, food lockers and water supply. The chamber has its system of communication with the outside world by radio and telephone.

Scientific Notes

WHILE rats make excellent laboratory animals for nutrition research, mice for cancer, and monkeys for poliomyelitis, ferrets are invaluable to influenza investigators.

A steamfitter's vise of new design has both straight and curved pipe-grip sections in the jaws. The back jaw only moves, thus letting the ends of pipes rest on the bench.

The magnet poles of the earth are not directly opposite each other. A line running from one to the other would miss the centre of the earth by about 750 miles.

On some of the newer airplanes a rotating disc on the instrument panel tells the pilot when he has synchronized his engine within a fraction of a revolution to the minute.

A method that has been patented to make oysters open themselves first shocks them by spinning them in a centrifuge, then places them in water containing a small amount of vinegar.

A new adhesive has been perfected which is said to hold a wide variety of products from felt and paper to glass and marble. Non-inflammable, containing no acids or solvents, it is said to hold longer.

A new machine capable of producing 1,000,000-volt X-rays with an intensity greater than all of the available radium in the world is being installed at the Huntington Memorial hospital in Boston Mass. for the treatment of malignant diseases.

Paper has been processed as dust cloths, for use in wiping off the chairs and tables, as cleaning cloths for washing windows, polishing glassware, scouring woodwork, and for almost any of the other jobs for which cloth is generally used.

Scientific Notes

A THUNDER cloud is electrically charged, both negatively and positively, with the negative pole nearer the ground.

Radium eats through tissue more rapidly than a razor.

The swallow-like swift is the fastest of all birds, being able to outdistance a plane flying 100 miles an hour.

The world's largest imitation moon is at the Griffin Observatory, in Los Angeles, California. It has a diameter of 38 feet.

Chemists in Germany have perfected a new resin compound possessing unusual clearness and light color which is noticeable even in the finished varnish.

A watch 9½ inches in diameter is exhibited in the National Museum in Washington. It is said to be the largest watch in the world.

From orders promulgated by the Chinese Emperor Yao, scientists have discovered that astronomy was known and used as early as 2300 B.C.

Upward of 800 users are recorded for the various parts of the palmyra palm, which is considered the most useful plant in the world.

Chemists in Germany have perfected a method of reclaiming the camphor from waste motion picture films and celluloid. The residue is useful for fertilizer.

Although the moon shines entirely by reflected light, it is a poor mirror, for it reflects only about 7 per cent of the sunlight that strikes it.

A new electrical camera, so small that it can be swallowed easily, is being used by physicians and surgeons to take pictures of the interior of the stomach.

Science In The News

By WALDEMAR KAEMPFFERT

HOUSING THAT DEFIES EARTHQUAKES, HURRICANES

Professor Martin Wagner's solution of the housing problem takes us back in architectural style to the huts of primitive people. He finds that savages solved the earthquake, hurricane and fire problems ages ago.

Back to the Igloo

When Professor Martin Wagner of Harvard read an editorial on the Turkish earthquake in THE NEW YORK TIMES in which it was stated that "engineers can build structures that no ordinary quake can shake down, but at a cost that few can afford," he wrote in to protest. Our statement was based on the supposition that the existing type of city house, bank or skyscraper was to be retained. But revolutionary Professor Wagner thinks that the ideas of architects about residences are all wrong and asks us to consider his prefabricated house, which suggests an Eskimo's igloo or a Hottentot's hut and which stands up in quakes and hurricanes.

Professor Wagner worked for three years in Turkey as an adviser to the Turkish Government. "When I came to America," he writes, "I had only one idea and that was how to construct better and cheaper shelter for the masses." He deliberately pushed aside all traditional shapes and styles.

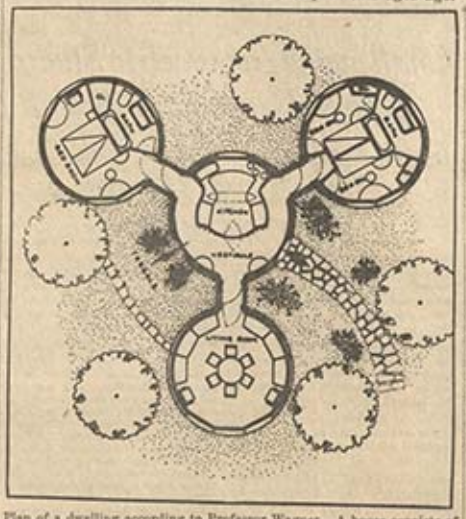
Professor Wagner's mass-produced, prefabricated single-room house (95 per cent of the work is done in the factory and only 5 per cent on the site) has an outer concealed skin of steel. Next to that come in succession a thickness of glass-wool, a sheet of copper, another thickness of glass-wool, a heat reflecting sheet, a thickness of glass-wool and lastly a thickness of plywood, which is what the visitor sees inside as a wall. With that insulation we can well believe Professor Wagner when he says that he excludes heat and cold, moisture and insects, noise and dust.

Reducing Fire Hazards

Living rooms, kitchens, bedrooms are all separate, but joined by paths or covered passageways. If a fire breaks out a unit may burn down, but the other rooms can be saved. There are no chimneys. All cooking is done by electricity, which considerably reduces the fire hazard.

The houses are streamlined so that they offer the least possible resistance to the wind. Units weigh only two tons, against the present standard twenty tons per room, which means that they can be easily transported to the building site and erected without powerful cranes. The cost of these igloos represents what Professor Wagner calls "the pitch of cheaper housing." The capital investment is only $500 a room, against the present $1,000 to $1,500 for something much less comfortable in Summer or Winter.

To Professor Wagner a dwelling should be as flexible as life itself. If the family and its income increase or decrease in size, the house should expand or shrink in unison. So it becomes possible to add or



Plan of a dwelling according to Professor Wagner. A house consists of prefabricated, single-room units, which are connected by short passageways. Both privacy and family life are assured.

the steady blow at heights of perhaps 20,000 feet when it comes to high-flying, long-range projectiles.

Guns are often laid by "sound-ranging," which means that distances are calculated by allowing for the time that it takes sound from an enemy's gun to reach different points. But the speed at which sound travels is affected by both temperature and wind, and these are not uniform over all parts of the battlefield. The proper corrections must be made by some one who knows his meteorology.

Rains That Helped the Allies

In the present war the meteorological odds are about evenly balanced so far as the weather is concerned. In the last war it was otherwise. The Germans did their utmost to strike decisive blows during the Summer when the weather was fine and the terrain good. Every downpour spelled salvation for the inadequately prepared Allies. Water-filled shell craters and mud made it difficult to advance and to retreat. We see, then, why the Germans were so eager to finish the Polish campaign in the Summer.

With forces about equally matched on the Western front the Allies are in a far better meteorological position than they were in 1914. During the last war the dispatches of the correspondents dwelt heavily on

The New Picture Butte Sugar Factory

The new beetroot sugar factory at Picture Butte, Alberta. A beautiful view of the refinery including the huge cement bulk silos on the left. Note the field of thrifty beets in the foreground.

SUGAR BEETS TREATED IN NEW FACTORY

Picture Butte Plant Said Most Modern On Continent

(By F. STEELE)

ALBERTA'S second beet sugar factory has begun its initial run. This plant, situated at Picture Butte, in the Lethbridge northern irrigation block some 15 miles north of Lethbridge, was built by the Canadian Sugar Factories Ltd., Alberta subsidiary of the B.C. Sugar Refining Company of Vancouver. E. T. Rogers, of Vancouver, is the president. It is perhaps the finest beet sugar mill in North America.

The opening of the factory is a new landmark in the history of the Lethbridge Northern for it means that farmers on the big government-backed reclamation scheme, will have a factory at their back door making them independent of the Raymond plant. Seven thousand acres of beets grown on the L. N. will be processed at the new mill and many residents of the district will find employment in the industry.

Result of Agitation

The new factory resulted from strong representations made to the provincial and Dominion governments over a period of years on behalf of the Alberta Beet Growers' Association. They pressed resolutely for expansion, seeing in sugar beets the "way out" on their high priced irrigated lands. Phil Baker, of Raymond, president of the association, is authority for the statement that more than $3,000 was spent by the association in its campaign for factory expansion. Naturally the growers are pleased that their efforts bore fruit. Nineteen thousand acres of beets will be marketed this year as against 14,000 acres last season. Beets are now rolling into the sheds of both factories and a crop of a ton or more average to the acre than last year is forecast. Sixty million pounds of pure, granulated sugar will be manufactured by the two factories. Beets are testing 17 per cent sugar, but this will be increased from now on as the sharp frost will stop top growth and store up sweetness in the roots.

$1,500,000 Investment

The plant complete represents an investment of $1,500,000 and will have a rating capacity of 1,500

Science In The News

By WALDEMAR KAEMPFFERT

Biologists Meet

The outstanding scientific event of the week was the meeting of the Federation of American Societies for Experimental Biology at New Orleans. A few new discoveries were announced, more light was thrown on the working of the human engine and a little progress made in the better understanding of such baffling diseases as cancer, arthritis and endocarditis.

One of the major disgraces of medicine is the absence of any progress in conquering arthritis. Some forms of the disease are the result of bacterial infection. These are the most vulnerable to attack. And so Drs. Albert B. Sabin (Cincinnati College of Medicine) and Dr. Isabel M. Morgan (Rockefeller Institute) proceeded to attack them.

The two experiments succeeded in giving mice arthritis with a pleuropneumococcus, a germ which is still much of a mystery because it cannot be classified. A vaccine can be made which protects healthy mice from this particular form of arthritis. But it does not follow that the same vaccine is good for human arthritis.

Not all streptococcus infections yield to sulfanilamide and its derivatives. One is streptococcus viridans. Dr. C. M. Gruhzit reported at New Orleans that a new chemical remedy, sodium paranitrobenzonate, has been discovered—a remedy, that is, for mice. The next step is to find out if it works equally well in the clinic. If it does, the type of heart disease known as malignant endocarditis may be conquered. Dr. Gruhzit says that his new chemical compound has hardly any toxic effects. On the other hand, it is of no use in pneumonia.

Anemia is widespread in the South, especially in children. Hookworm disease is generally regarded as the cause. When Dr. Oulda Abbot of the Florida Agricultural Experiment Station found that children free from hookworm were nevertheless anemic, she investigated.

From Nova Scotia to the Dry Tortugas came reports of deficiency diseases in cattle, all traced to poor soils. It turned out that these soils lack iron. Dr. Abbot gave iron to children with hookworm. She did not cure them, but she did rid them of their anemia—their pallor, weakness and fatigue.

Moral: Even the best of home-grown food is not so good as it seems to the eye and the palate. Be sure your vegetables contain iron.

What was once called Vitamin B is a complex of five vitamins, known as B; riboflavin, nicotinic acid, Vitamin B_6, pantothenic acid. Drs. A. G. Hogan and L. R. Richardson (Missouri) announced a sixth at New Orleans. They call it B_c. It controls the form and development of bones. Hogan, Richardson and Patrick experimented with their vitamin on chicks. Without the vitamin, chick bones are short and thick. A condition known as slipped tendon also results.

Pantothenic acid was recently synthesized by Dr. J. C. Keresztesy of the Merck Laboratories. It is still much of a mystery. Because it is so widespread it is already called "the acid of life." At New Orleans Professor Williams, discoverer of the acid, did not hesitate to indulge in a little speculation on its role. "People who are on a diet deficient in other B vitamins are liable to be deficient in pantothenic acid also," he remarked. "While nicotinic acid (another member of the B family) is effective in pellagra

The Westinghouse "atom-smasher," showing a section of the forty-foot vacuum tube which has an outside diameter of seventeen inches and is the largest tube of its kind in the world. It has been exhausted so completely that it contains only 1-760,000,000 as many air molecules as are in the same volume of normal atmosphere.

spleens is the result of two diseases.

A vaccine obtained from an influenza-stricken animal does not cure influenza. Nor is distemper vaccine any good against influenza. But when the double vaccine is injected into ferrets they become immune. Thus far only ferrets have been protected in this way. Hoxsfall and Lennette are not willing to take the risk of experimenting with human beings.

Cure for Skin Disease

Psoriasis is a resistant disease of the scalp which causes the dermatologist more worries than any other. It looks now as if it has at last been conquered. At least Dr. Lester R. Dragstedt (University of Chicago) told his colleagues at New Orleans that lipocaic, a hormone recently discovered by him in the pancreas, clears up psoriasis.

Twelve patients were given the hormone by mouth and observed from five to fourteen months. Three failed to improve, but half were cured. Best effect was obtained when local treatment with salves supplemented the action of the hormone.

It was suspected long ago that there is some relation between psoriasis and the way the body uses fat. Now there is hope that physicians may be able to cope with fatty degeneration of the liver and early arteriosclerosis.

Insulin and Cancer

It may be that Drs. Richard H. Steckel and John R. Murlin (University of Rochester) have hit on something much more important than freezing the body in the treatment of cancer. The two told their fellow-scientists at New Orleans

process of using up sugar was checked and the oxidation or burning-up process accelerated. This is a step in the right direction. Further than that Steckel and Murlin will not commit themselves.

Synthetic Starch

Dr. Charles S. Hanes of Cambridge University announced in Nature that he has synthesized starch from glucose, a form of sugar. This is an achievement of the highest importance because he has duplicated in the laboratory a process which has hitherto occurred only in plants. Only twenty grams of synthetic starch have thus far been made, enough, however, to convince biochemists that another successful attempt has been made to fathom the mystery of life.

Dr. Hanes succeeded in performing his difficult feat only with the aid of an enzyme, which is called phosphorylase and which breaks down phosphorus-containing glucose and then rebuilds the molecules into starch.

The word enzyme is Greek—en, in; zyme, leaven or yeast. An enzyme is an organic catalyst. And a catalyst is a substance which accelerates chemical reactions without taking part in them. A minute quantity of a catalyst (enzyme in living organisms) is often enough to bring about extensive chemical change.

There are innumerable enzymes. Each governs a specific chemical reaction. The late Emil Fischer, perhaps the greatest organic chemist of our time, likened them to keys which fit corresponding locks. For example, ptyalin, an enzyme in saliva, acts on starch but not on protein. Pepsin, an enzyme in the stomach, breaks down protein (beefsteak, eggs, milk) but has

Electrical "Ceiling" Is Over Earth

Scientists Discover 3-Mile Atmosphere Layer at 11 Miles on Top of World.

By THOMAS R. HENRY
(Copyright, 1936, by the North American Newspaper Alliance, Inc.)

ATLANTIC CITY, Jan. 9.—Discovery of a new ceiling of the world, a three-mile-thick layer of atmosphere about eleven miles above the earth's surface, was announced here by the National Geographic Society in an exhibit prepared for the annual meeting of the American Association for the Advancement of Science.

In this narrow band of attenuated air, three things reach their greatest intensity, decreasing above and below:

First, the intensity of cosmic rays, mysterious radiation particles shot into the earth's atmosphere with energies of billions of volts from the vast spaces beyond the stars.

Second, the protecting layer of ozone gas, a form of oxygen, which shields the face of the planet from a bombardment of ultra-violet light from the sun, which probably would mean the extermination of all living things.

Third, the electrical conductivity, or ionization, of the air.

The discovery was made by examination of correlations of the data gathered during the society's stratosphere flight last November.

The ceiling begins, the records show, at approximately ten and three-fourths miles, and extends roughly to 13.71 miles, the highest point reached by the balloon. In this region, the number of cosmic rays recorded by instruments is fifty-one times the number at sea level, because they are augmented by the secondary rays shot out when the primary rays strike atoms of the air gases. Below this height, the air is so much thicker that it absorbs many of them.

The air is approximately eighty-one times better as a conductor of electricity than at sea level. This is a corollary to the fact that the cosmic rays are tearing electrons off so many atoms of the gases, thus changing their electrical charge and making them electrically conducting.

The society also presented evidence, gathered from the stratosphere flight, that extreme cold may have played a part in evolution. Dr. Victor Jollos, of the University of Wisconsin, shot sixty a number of fruit flies, favorite animals of the experimental biologists, to see whether the increased intensity of cosmic radiation bombarding them at high altitudes would result in changes in their offspring. A frequently advanced theory is that mutations from species to species in the scale of life may have been produced by cosmic rays striking the genes in the germ cells.

The cold in the stratosphere was so great, however, that all the adult flies died. But the eggs and larvae produced during the flight survived. They showed five times as high a rate of mutation, or change, as did the offspring of flies remaining in the laboratory. The number of such mutations which could possibly be produced by a certain intensity of cosmic ray bombardment of germ cells can be mathematically calculated. This was far beyond what was possible from the four-hour exposure. The only explanation is that the genes were altered by the extreme temperature. All the mutations produced were such as resulted in the death or serious disablement of the animals.

An important result of the observations was the determination that the composition of the air is slightly different at big altitudes. There is more nitrogen and less oxygen, but the difference is less than had been predicted.

Uncle Ray's Corner

A Little Saturday Talk

By Ramon Coffman
(Copyright by Publishers' Syndicate and Calgary Herald)

EACH year a day is picked out as "the shortest day," but the truth is we have a series of short days so close in length that almanacs give the same number of minutes between sunrise and sunset in each one of them. For five days—from December 18 until December 22, the daylight lasts the same number of minutes, though experts may be able to find a slight difference in seconds.

The amount of daylight during this period of short days depends on the distance a person lives north of the equator. Along a line stretching from Charleston, S.C., to San Diego, Calif., the daylight lasts almost exactly 10 hours.

Along a line from Washington, D.C., to San Francisco Bay, the time between sunrise and sunset is a little less than nine and one-half hours.

People in New York City, Philadelphia, Pittsburgh, Cleveland, Toledo, Chicago, Omaha and Salt Lake City will enjoy only about nine and one-quarter hours of daylight today, and for the next few days to come.

Along a line stretching from Vancouver east through Winnipeg to the Gulf of St. Lawrence, the daylight time is about eight and three-quarter hours.

If we kept going farther north, we should find the time of daylight less and less. Up around the North Pole we should have no daylight at all, for this is the time of the long Arctic night. Weeks go by in the Arctic zone without any sight of the sun.

The story would be the other way around if we flew southward, and poured each day long enough to measure the time between sunrise and sunset. In Peru, Bolivia, Chile and Argentina, people are now enjoying the year's longest days. That is true of Australia and South Africa as well. The summer season is about to start in the southern hemisphere, just as our winter is close at hand.

The reason for all this is the strange thing called "the tilt of the earth's axis." An imaginary axis stretching from the North to the South Pole of our spinning earth is tilted as compared with the sun. The tilt gives us less daylight than darkness.

Some persons might like to have the same amount of daylight all through the year, but I like the change of the seasons. This change seems to give more of a spirit of adventure to life on it great old earth.

Uncle Ray

Uncle Ray's Corner

A Little Saturday Talk

By Ramon Coffman
(Copyright by Publishers' Syndicate and Calgary Herald)

A MONTH or so ago I wrote several stories about coal, and in one of them I told the names of some of the world's leading coal-producing nations. The list was based on the average over a period of years, and in it I did not include the name of Russia.

A reader has written to ask about Russia's rank in coal production, so I shall speak of it today. Until the last few years, Russia has ranked far behind some other nations, but the late figures have shown big gains.

If we take late figures for a single year, the rank of the nations remain almost the same as the average over a period of years — except for Russia. Russia has risen from seventh place to fourth place, with only the United States, Great Britain and Germany ahead of her. France, Poland and other countries have been left behind. The Russian coal output has more than doubled in the past five years.

Russia has made even greater gains in the iron and steel industry. In the last six years her iron and steel production has increased to about three times what it was at the beginning of that period. The United States still ranks first in this field, but Russia and Germany are running a hard race for second place, with Great Britain a strong fourth.

* * *

Are you saving the stories we are having about China? There will be more of them next week, and if you save them all you will have a short history of that old, old nation. It is not easy to obtain historical facts about China. Chinese histories are likely to be filled with names of kings and emperors, the Mings, the Chings, the Chows, the Hans, the Tangs and other dynasties. In our stories, we have some names but not a great many. I am trying to tell special things about Chinese history and everyday customs.

Next week we shall have stories about the end of the Chinese empire, and the beginning of the republic. In some lines a great deal of progress has been made in China since 1912. The most important is in education. In 1912 the number of pupils in Chinese elementary schools was only 2,796,000. In 1935 this number had grown to 11,867,000. A great increase in the number of high school students also has taken place.

If you would like to join the 1937 Scrapbook Club, you will be welcome. Adults as well as boys and girls can be members; many adults write me that they save the stories for scrapbooks. There are no dues for the club, but each new member sends me a stamped, self-addressed envelope to be used in sending back a leaflet telling how to make and keep a scrapbook, along with a membership certificate and a small printed design which can be placed on the scrapbook cover. When you write, address your letter to me in care of this newspaper.

Uncle Ray

The Chambered Nautilus Roves the Depths of the Warm Part of the Western Pacific Ocean. Only the Female Carries the Shell, Which Contains Eggs, and Which She Holds Close With Her Tentacles. These Are Modified at the Tips With Wing-like Expansions.

Gorgeous Colors of Ocean Dwellers

By WILLIAM CROWDER,
Naturalist and Marine Artist.

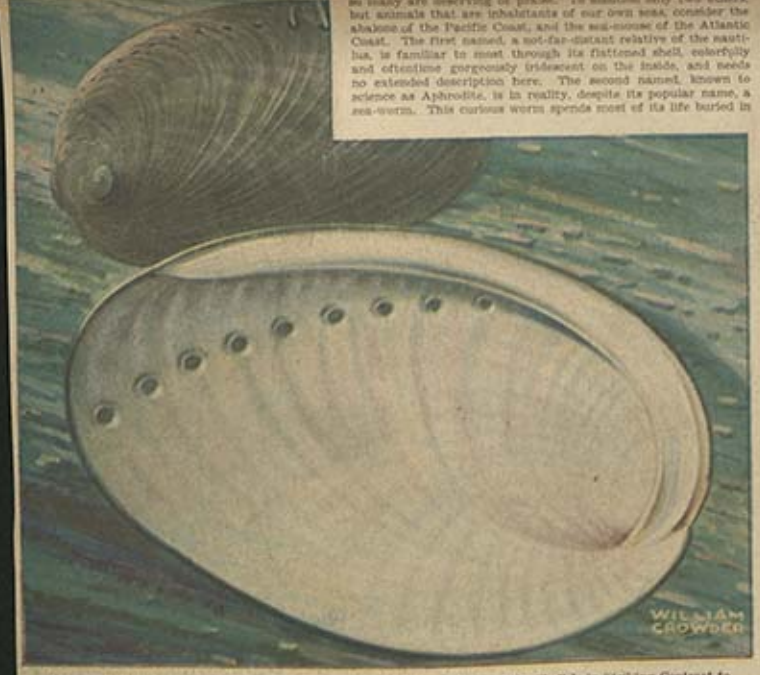
THE chambered nautilus, or "ship of pearl, which, poets feign, sails the unshadowed main," in no way deports itself as the bards would have us believe. Living, as it does, in the warm part of the Western Pacific Ocean, sometimes hundreds of feet beneath the surface, and apparently always on the bottom, it never comes to the top unless from the result of injury or disease. But there is one detail of the poet's description of this animal with which naturalists never disagree. This is the beauty of the nautilid's shell.

Unlike the shell of most other mollusks, which is a protective case permanently attached to its owner, the shell of the nautilus is separate from the body and is used merely for carrying the eggs of the female. The male does not build a shell. It was Thomas Huxley who first pointed out that the shell of the nautilus was not to be compared with a ship or a boat, but with a perambulator. Externally, the shell of the chambered nautilus is not without considerable beauty, both in form and color; but for sheer, breath-taking loveliness, the pearly iridescence of the internal lining of the shell stands almost alone.

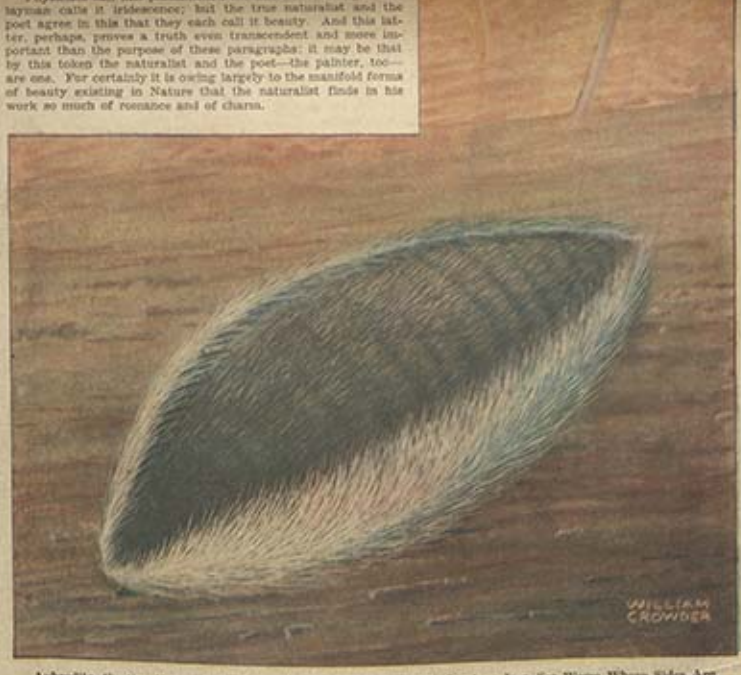
I say "almost," for it is dangerous to make distinctions in this subject of beauty among the creatures of the sea, where so many are deserving of praise. To mention only two others, but animals that are inhabitants of our own seas, consider the abalone of the Pacific Coast, and the sea-mouse of the Atlantic Coast. The first named, a not-far-distant relative of the nautilus, is familiar to most through its flattened shell, colorfully and oftentime gorgeously iridescent on the inside, and needs no extended description here. The second named, known to science as Aphrodite, is in reality, despite its popular name, a sea-worm. This curious worm spends most of its life buried in the sand or secreted under stones along the seashore, often with its eyes showing at the ends of short stalks and hiding its beauty away from the light and human sight. Its back, for the most part, is covered with a soft, fur-like covering; its sides, however, are adorned with a thick growth of long bristles which reflect with startling brilliancy all the hues of the rainbow. As the position of the animal changes, or with every least movement of its body, a hundred tender tints and nuances of color undulate along the length of its iridescent sides.

That the colorful appearance of these three sea creatures, and of numberless others that could be named, is derived by virtue of an absence of pigment or other inherent coloring matter, is a common phenomenon of undersea life. The beautiful iridescence betrayed by mother-of-pearl and similar products of the sea is caused by the peculiar microscopic character of these substances. Under the microscope these are shown to be constituted of numerous thin translucent layers of material. So thin are they that when light, such as ordinary daylight, strikes the outermost layer, or film, the light passes through and is reflected by the layers underneath, but in being reflected is split up into the various primary colors of which white daylight is composed.

Physicists call this phenomenon the diffraction of light; the layman calls it iridescence; but the true naturalist and the poet agree in this that they each call it beauty. And this latter, perhaps, proves a truth even transcendent and more important than the purpose of these paragraphs: it may be that by this token the naturalist and the poet—the painter, too—are one. For certainly it is owing largely to the manifold forms of beauty existing in Nature that the naturalist finds in his work so much of romance and of charm.



Abalone Shell From the California Coast. The Colorful Nacre Lining of the Shell Is in Striking Contrast to the Drab Exterior. The Row of Holes in the Shell Are Perforations Through Which Water Gains Access to the Gills.



Aphrodite, the Sea Mouse of the Atlantic Coast. This Beautiful Creature Is a Sea-Worm Whose Sides Are Decorated With Long, Highly-Iridescent Hair-like Bristles. It Spends Most of Its Life Buried in the Mud or Secreted Under Stones.