

CHEMISTRY

# Life in Plants and Animals May Exist Because of K41

## Rare Isotopes Liberate in Human Flesh Energy in Form of Beta and Gamma Rays; Speed Seed Germination

**K**<sub>41</sub> MAY be the reason your heart beats and you are alive today. This cryptic symbol, resembling the code signature of a wartime spy, is the chemist's designation of a variety, or isotope, of the element potassium. And it is already known that if this metallic element is removed from the blood stream the heart will stop beating.

Potassium is doubtless the most interesting of the metallic elements necessary to sustain life. This is true, not only because of all the vital elements potassium alone is radioactive, but because the potassium content of the organism is so closely associated with the development of embryonic tissue. The high potassium content in the blood and bone marrow of animals suffering from carcinoma has recently added interest to this element.

Organized potassium is now known to be made up of three parts, differing by units of one in mass—K<sub>39</sub>, K<sub>40</sub>, K<sub>41</sub>. A vastly more interesting difference, however, is that the rare isotopes K<sub>40</sub> and possibly K<sub>41</sub> emit two hard beta or negatively charged rays, and one gamma or X-ray.

### 225 Atoms

While the total amount of energy from these rays is small, it is interesting to note that in every gram of potassium in the human body—about one three-hundredth of an ounce—there are 225 atoms disintegrating each second. The amount of energy liberated in a gram of flesh in a second, due to the potassium present, is 500 times that necessary for the eye to see, were this energy in the form of green light. Whether these beta rays are in any manner associated with the life-giving properties of potassium is an interesting but little understood question.

At the meeting of the American Chemical Society in Chapel Hill, N. C., Dr. A. Keith Brewer of the U. S. Bureau of Chemistry and Soils in Washington described new research on the atomic weight of potassium in animal tissue which is another step forward in

determining potassium's role in life.

Dr. Brewer has determined the ratio of the two forms of potassium called K<sub>39</sub> and K<sub>41</sub> in plants, minerals and a large number of animals; also in fast-growing embryonic tissue, in bone marrow and other body tissues including the heart.

The fundamental importance of studying the role of potassium in living things can better be appreciated by recalling that the German scientist Zwaardemaker found the removal of potassium from the blood stream would

stop the heart beat. Moreover, he found that if radioactive material were substituted for potassium in the blood, the heart would again start to beat. Also he found that if the heart were merely radiated by radioactive material it would start to beat. This finding was substantiated by Dr. Jacques Loeb of the Rockefeller Institute for Medical Research, but it was also found that the metallic element caesium would similarly start the heart to beat. This seemed to be the only exception to the general rule that radioactivity could equal the element potassium in causing heart beats.

### Life-Giving?

The next step was the speculation—and admittedly it still is such—that perhaps it was the radioactive kind of potassium, the K<sub>41</sub> form, which was the crucial factor, the life-giving role of this element.

Moreover, and lending weight to speculation that radioactive potassium was



### MARIGOLD LOSES ODOR

*To many the odor of marigold stems and leaves is disagreeable. Now a new hybrid variety has been originated that has no foliage scent at all. Its flowers are sweet-scented—their perfume resembles that of honeysuckle. To secure it, an odorless dwarf marigold found in Tibet was crossed with larger and showier kinds already in cultivation. David Burpee, plant breeder, is here testing the scent of a handful of flower-heads with an osmoscope.*

important to life, experiments at Prague had shown that seed germination was markedly speeded by the presence of  $K_{41}$ . In seeds where perhaps 20 out of a hundred would germinate naturally, the number was increased clearly beyond any experimental error in the presence of radioactive potassium.

Dr. Brewer's report to the chemists indicates that a high proportion of the radioactive kind of potassium appears to be associated in animals with embryonic tissue. Bone marrow, for example, is rich in  $K_{41}$  compared with other tissues of the body, and the concentration grows less with the maturity of the animal. Interesting too is the fact that a mature animal which had developed cancer and therefore had more than normal abundance of embryonic tissues in its body showed an increase in the  $K_{41}$  content, of its tissues.

The heart, he reported, is relatively low in its  $K_{41}$  content and has relatively more of the non-radioactive  $K_{39}$  kind of potassium present.

Dr. Brewer's studies were made with the aid of a large atom "scale" known technically as a mass spectograph which determines the weights of the atoms in an element.

His present studies on animal tissues are the culmination of a similar line of research on potassium which has included the analysis of seawater for the element, down to a depth of two and one half miles; a study of the ratio of the two kinds of potassium in minerals from all over the world and an investigation of the same thing in plants.

The ratio of the two varieties, and hence the average atomic weight, is sensibly constant, Dr. Brewer told the writer, in seawater and in minerals. Constant it is too in plants with the exception of kelp which seems to have the ability to concentrate the radioactive form, and in potato vines where the older vines show more of  $K_{41}$  than do the younger ones.

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## ENGINEERING

## Mystery Mine in Blue Ridge Revealed as U. S. Test Tunnel

### Tunnel of 175 Feet Into Mountain Will Be the Proving Ground for Bureau of Mines Experiments

By ROBERT D. POTTER

See Front Cover

**I**NHABITANTS of the Virginia town of Bluemont, neighboring farmers and hilldwellers on the nearby Blue Ridge mountain range have a new mystery to supplant a local murder of some months back. They have been watching strange out of state automobiles, and trucks with little-seen government license plates, take men and machines into the gravel ridge road that meanders some five miles off the main highway and finally reaches Mt. Weather.

These men and their equipment, they know, are for a mine that has been pushed by drilling and blasting through the hard Blue Ridge rock all winter. The local mystery comes in the supposed purpose of the mine; a purpose which in local rumor circles runs all the way from gold mining to the search for some nameless blue-green mineral highly useful for Navy battleships in a way which no one will venture to explain.

On the trail of this Blue Ridge mine mystery, Science Service photographer Fremont Davis and the writer bounced over the twisting ridge road until the U. S. Weather Bureau's abandoned kite-station at Mt. Weather was reached. Still no mine. The caretaker, however, pointed to a still more torturous road carved through rock and between giant trees on a timbered ridge. Fifty feet down that road we stopped and backed up in haste to a safe place and went ahead on foot. Finally, down the slope perhaps a quarter mile, we came to the local "mystery" mine.

From deep under our feet we could hear a pneumatic drill battering the hard rock. The exhaust of the motor-driven air compressor was the only other sound in the quiet mountains. The mine, we knew, was the test adit of the U. S. Bureau of Mines, so we searched out the genial resident engineer, Wing G. Agnew.

"Why was the mine? Where was it going? What for? How deep was the



#### SETTING THE BLAST

*Experimental test adit of the U. S. Bureau of Mines at Mt. Weather, Va. Wing G. Agnew, resident engineer, left, tamps dynamite into drill holes with his wooden pole and the miner prepares to hand him the primer stick with its wires and detonating caps. The box of dynamite can be seen in the foreground.*

tunnel into the mountain side?" The questions poured out as Mr. Agnew grinned and settled back with his cigar in his old farmhouse office.

#### Mine For Tests Only

"Pick yourself one of these 'hard' miner's hats and come on down into the adit," replied Mr. Agnew. Adit, it should be explained for those who are neither miners nor cross-word puzzle fans, is a nearly horizontal entrance to a mine open only at one end, whereas a tunnel has both ends open.

The mine, he explained as we walked down the hillside to the entrance, is truly a test mine where the Bureau of Mines can have command of all controllable conditions in experiments on the efficiency of drill bits, dust production and its relation to the silicosis problem, the efficiency of different kinds of dynamite and blasting agents, mine ventilation and other problems.

But because it is a test mine, it creates the local mystery. To the layman it seems senseless to mine without mining anything, not to care too much where the mine is going, or how fast it goes there.

The Bureau of Mines, pointed out Mr. Agnew, could perform some of its tests in commercial operating mines by arrangement with the owners. But such