# THE SCIENCE NEWS-LETTER

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No. 88

Saturday, December 16, 1922

#### CIVILIZATION MUST FAIL UNLESS SOLAR ENERGY IS UTILIZED

Our great civilization is "a most squandrous and profligate one and is using the principal of its legacy in numberless new Ways," Dr. H. A. Speehr declares in und current issue of the Journal of Industrial and Engineering Chemistry. Dr.Speehr has been working for many years at Carmel, California, in the Coastal Laboratory of the Carnegie Institution of Washington, on the question of how plants are able to make use of the energy of the sun's rays and he has come to the conclusion that the solution of this problem is the task of the twentieth century and demands the cooperative effort of scientists in all fields.

"The destiny of civilization is guided by and reflects the amount of available energy," Dr. Spochr says. "When coal and oil are exhausted the daily ration of solar energy will represent almost the entire means of livelihood; our mushroom civilization must pass like the historic empires of the past and we may expect the reappearance in the world once more of galley slaves and serfs."

There is as yet no adequate substitute known for the fossil fuel that we have been using so lavishly during the last half century, he points out. A year's consumption of coal at the present rate represents the accumulation of hundreds of years. The date of depletion of the petroleum supply of the United States is clearly in sight. Water power would be insufficient, even if we could use every drop that fell in the country for running machinery. Alcohol seems the most promising substitute for mineral oils as a motor fuel and this can be made in any quantity by the fermentation of various kinds of vegetable matter. But this in any case requires the setting aside of large areas of land for the purpose. If, for instance, corn were to be used for the manufacture of fuel alcohol it would require more than four states the size of Ohio to grow the corn necessary to produce the seven and a half billion gallons of alcohol that would be needed to replace the five billion gallons of gasoline now consumed annually. But we cannot afford to reduce our food to furnish our fuel.

Nature's method of utilizing solar energy by means of the green leaf is, as Dr. Spochr points out, "exceedingly inefficient and wasteful". But "it is the duty of the scientist to learn the precise manner in which this is accomplished. He need not be timid about competing with nature. He has many cases to his credit of surpassing the processes of nature both in efficiency and reliability. The most promising outlook for success in this field would be offered through an organization by which information from the various allied fields can be collected and focussed on the chemical and energy changes taking place in the process of photosynthesis." December 16, 1922

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(A Chat on Scionce)

#### THE WASTEFULNESS OF AGRICULTURE

By Dr. Edwin E. Slosson

To those superstitious people who hold that Nature is perfect in all her works it must come as a shock to learn that one of the most wonderful of all natural processes and the one on which all life depends, that is, the storing up of solar energy in the green leaf, is far more inefficient than any of man's machines. It is a poor steam engine that cannot turn into mechanical work at least twelve per cent of the heat energy that is fed into it in the form of coal. But a green leaf is not able to catch and hold more than one per cent of the radiant energy that falls upon it from the sun.

What solar energy is caught and held is stored up, so to speak, in the form of starchy and woody stuffs from which the energy can be released in the form of heat when the stuff is burned. But if it is food we want from the plant instead of fuel its yield is still more limited, for we human beings with our restricted digestive apparatus cannot get nutriment out of the woody fiber as we can out of the sugar and starch. How much then of the solar energy that falls, say, on a wheat field can we get out in the form of the edible grain to furnish us with muscular energy?

Dr. H. A. Spochr of the Carmel Coastal Laboratory of the Carmegie Institution of Washington has been figuring on this and reaches some startling results. An acre of ground receives in six hours of sunshine as much heat energy as would be produced by the combusion of 16.4 tons of coal. In a growing season of ninety days at this rate per day the total income of energy would amount to 1476 tons of coal.

Now what is the yield, likewise calculated in terms of heat units derivable from coal? Taking the very large crop of 50 bushels of wheat per acre and calling it all starch, we get an energy equivalent of only less than two-thirds of one ton of coal.

That is to say, the farmer has received as free bounty from heaven 2,300 times as much energy as he has been able to market in the shape of food.

But don't call the farmer an inefficient fellow. He only began the cultivation of wheat in the New Stone Age, say seven thousand years ago, and see how much he has improved upon Nature in the matter of yield.

And don't blame Dame Nature. She is quite indifferent to our slame or praise but is very ready to cooperate with us when we take the trouble to learn her ways and show how they can be improved. This chlorophyll process for the fixation of solar energy, this green leaf laboratory, was one of Nature's first inventions, made perhaps sixty million years ago, and she was so well satisfied with it that she made it the foundation stone of all earthly life and has kept it substantially unchanged to this day.

And man is not yet able to imitate Nature in this particular process, let alone surpass her. Chemists have found it possible to make some of the simpler sugars, but only in very small amounts after long and expensive labor in the laboratory. Nothing like the neat and noiseless way that any leaf can carry it out. An effort is being made to get chemists and biologists to cooperate in working out the solution of the secret of photosynthesis - which is Greek for the constructive process December 16, 1922 The Science News-Letter

of light. A "photosynthesis symposium" is scheduled for the Boston meeting of the American Association for the Advancement of Science, the last week in December, and it is hoped that this may stimulate research in this vital problem.

READING REFERENCE- Abbot, Charles G. The sun. N.Y. D. Appleton & Co., 1911. Long, Frances Louise. The quantitative determination of photosynthetic action in plants. Baltimore, Williams and Wilkins Co. 1919. Spoehr, H. S. Photosynthesis and the Possible Use of Solar Energy. Journal of Industrial and Engineering Chemistry, Dec. 1922. Thatcher, R. W. Progress toward the Artificial Synthesis of Carbohydrates and Proteins. Journal of Industrial and Engineering Chemistry. Dec. 1922.

#### ALL STARS PROBABLY HAVE SAME COMPOSITION

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Contrary to what has formerly been supposed, hot stars and cool stars probably are very nearly the same in chemical composition, Dr. Henry Norris Russell, director of the Princeton University Observatory and research associate of the Mount Wilson Observatory, declared in an address on Dec. 5 before the Carnegie Institution of Washington at Washington.

"Recent physical research has told us so much about the properties of atoms that we have come to a new understanding of what we observe in the stars," said Dr. Russell." "Our knowledge of the composition of the stars depends upon the lines which we observe in their spectrum and which show the presence of many of the familiar chemical elements,

"The atmosphere of the cooler stars are full of the vapors of metals, while in the hottest stars the metals seem almost to disappear and to be replaced by gases such as nitrogen and helium. It has been supposed that this means that the stars differ in chemical composition, or that atoms of one kind are changed into those of another kind at such high temper tures; but in the laboratory we can subject atoms to far more violent treatment than they receive in the atmosphere of the stars without the least sign of their changing into atoms of other sorts. We can, however, knock one or two electrons off the atoms, and each time an electron is removed the spectrum of the light given by the atom changes entirely. After two or three such changes there are practically no lines left in the accessible part of the spectrum, though there may be strong radiations of ultra violet light or X-rays."

Dr. Russell said that in the hotter stars the atoms of the metals are in this condition and though still present, do not reveal themselves to the spectroscope. On the other hand, he said, gases like helium are so hard to set shining that it is only in the hotter stars that we can tell that they are there. The most abundant elements, such as hydrogen, show their presence when less abundant ones would disappear.

"This theory of ionization makes it probable that all the stars are very similar in actual composition - the observed differences arising from differences in the state in which the atoms find themselves in their atmospheres," he concluded. "On these principles it is already possible to reach conclusions about the temperature and pressures in the atmospheres of the stars. The pressures seem almost always to be very low and the gas so rarified that we would almost call it a vacuum in the laboratory. The temperature in the hottest stars probably reaches 25,000 degrees."

Deep in the interior of the stars the temperatures are enormously higher and

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are probably millions of degrees, Dr. Russell estimated. Here it is possible that once in a while atoms of one element do become changed into atoms of another kind. There is reason to believe, he said, that if hydrogen atoms are changed into others an enormous amount of heat would be set free, which would suffice to keep the stars shining for billions of years.

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#### WAR ON INSECTS RAGES; MAN WINS SLOWLY

Warfare against insect pests grows in intensity, and despite the efforts of scientists, the damage mounts as new kinds of these enemies multiply and spread throughout the country, it was revealed by the annual report of the Secretary of Agriculture just issued. Although the direct insect attack on crops has not been stopped, great progress has been made in the control of the indirect attacks made by these pests in carrying infectious diseases from plant to plant.

"Much of the failure in controlling some of the physiological disease of potatoes and other cultivated crops," the report of Secretary Wallace says, "is now known to be due to failure to recognize the fact that plants might be infected and capable of transmitting the diseases without showing external symptoms. Researches have now thrown much light on a field in which scientific workers were previously almost helpless."

The direct attacks by the corn borer, the Japanese beetle, the cotton boll weevil, and the pink bollworm have not been combatted with such success, the report revealed. The corn borer holds the ground previously gained, although a benevolent parasite has been introduced from France which laboratory studies indicate may prove of immense value in destroying various species of borers.

The Japanese beetle continues to spread at the rate of five miles a year and larger jumps may be made any time. It attacks different kinds of fruits and vegetables and it is expected that it will spread throughout the United States despite control measures. Using the airplane to spread poisons is a method that gives promise in the fight against the boll weevil.

But the pink boll worm which has gained a foothold in Texas, Louisiana, and New Mexico is regarded as an evon more serious pest. In all probability it would have won the fight, but for the vigilance of a Baltimore inspector of the department. A passonger from Brazil landed with fifty packages of Brazilian cotton seed which he intended to take to the cotton section of Mississippi for planting. The Baltimore official, however, discovered these seeds and found that living pink boll worms infosted every package. If they had been let loose in Mississippi, officials believe that they would have quickly covered that portion of the cotton-belt.

READING REFERENCE- Hyslop, J. A. Summary of insects condition throughout the United States during 1921. Washington, Govt. Print. Office Bulletin 1103. Wheeler, W.M. Social life among the insects. Scientific monthly 14:497 - 15:68,119, 235, 320. June - Oct., 1922.

The Kamoi, the fuel ship built in this country for the Japanese navy, has the most elaborate radio equipment of any ship alloat.

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## PEAT MAY SERVE AS LOCAL EMERGENCY FUEL

Facing a cold winter with many consumers none too certain of their coal supply, the country has had its attention called to the fuel resources of the country as never before. People who have thought of peat as a product of the bogs of Ireland and a poor substitute for wood and coal are beginning to learn that this excellent fuel lies in rich deposits in New England and the Lake States, the very regions expected to be hardest hit by the present coal shortage.

About 20,000,000 tons of peat are used in Europe every year, but in the United States there are deposits estimated to contain 14,000,000,000 tons, an amount sufficient to supply Europe's present annual rate of use of this material for 700 years, it has been estimated by geological experts.

A large part of this peat is well adapted to power production or for use at the bog for the generation of electricity. The enormous deposits in New England could be used by the lime and textile industries cheaper than coal, experts believe, while those private consumers living near the peat fields could be economically supplied with peat for open grate fires, fall and spring furnace fuel, kindling and auxiliary fuel for use with coal during the severe winter months, and cooking range fuel.

Peat represents the arrested decay of vegetable matter. When plant remains fall upon drained soil they are promptly attacked by bacteria and soon disappear, but when the plant falls into water the change is different from decay when exposed to air. The acids formed slow up the decay by destroying the bacteria.

Peat is produced by this arresting of the decomposition of roots, trunks of trees, twigs, shrubs, mosses and other vegetation saturated or covered with water. It contains a large proporition of the carbon of the original plant material. It is almost always a surface deposit. Formed under conditions favorable to luxuriant growth of plants and their incomplete decay.

Most coals were once peats, but it does not follow that the peats will necessarily become coal in course of time. When the peat is formed, carbonization is largely stopped; unless it starts again and the peat bed is buried beneath muds, sandstones, limestones, or other deposits of sediment and subjected to heat and pressure, coal will not be created.

A twelve or fourteen inch seam of coal is equivalent to a good peat bog twenty feet deep. The largest peat deposit in this country is in Minnesota and covers nearly 4,000 square miles or about 2,500,000 acres.

This fuel has a higher heat value than wood, is more easily ignited than coal, requires less draught. Peat burns freely when dry, and makes a hot fire. It is lower in heat value per pound than coal but it gives out proportionately more heat, due to its relatively higher oxygen content.

There is no soot from a peat fire, but if not handled properly a light smoke carrying the odor of burning leaves may get into the room. Peat makes fine kindling for a hard coal fire and is especially good to wake up such a fire quickly without shaking down the furnace. If a few blocks of peat are thrown on top of the fire and the draughts opened, surprising results are obtained.

Too much of this fuel should not be put on at a time. Peat is about twice as

bulky as coal and can not be transported long distances at a price that is economical, but it does offer a good emergency substitute for coal and is especially useful as a supplementary fuel for use with coal.

READING REFERENCE- Dachnowski, Alfred P. Quality and value of important types of peat material. Washington, Govt. Print. Office. 1919. (U. S. Dept. of Agriculture Fulletin 802.) Hausding, A. Handbook on the winning and the utilization of peat. Tr. from 3d German ed. Great Britian Fuel research board. 1921.

#### WOULD REQUIRE PEDESTRIANS TO SIGNAL AUTO TRAFFIC

Signals by pedestrians to show automobile drivers their street crossing intentions are proposed by Dr. Raymond Dodge, chairman of the psychology section of the National Research Council, as a means of making city traffic more safe.

"It is often quite impossible for a driver to determine when a pedestrian is going to start across the street, when he is going to retreat, or what direction he is going to take," Dr. Dodge said, and suggests that it would be a great help to drivers if pedestrians were required to indicate their intentions in some such way as the chauffeur is required to do in making turns.

"A simple scheme for the most desirable starting time and duration of signals can be worked out by any psychologist who knows the limitations of attention and reaction time and will familiarize himself with the traffic situation," he said.

"It is possible that there also ought to be tests for pedestrians as well as drivers, with distinguishing marks for incompetents. It would be some help if the driver could know that the man trying to cross the street was partially paralyzed, partially blind or deaf, had a wooden leg, or some other disability which made it difficult to take care of what he had left. As it is now, youth and old age are the only clearly marked incompetents.

"Much has already been done to diminish the sources of confusion, such as the introduction of traffic signals and the establishment of zones or islands of safety where pedestrians can take their probelms in smaller doses. But, if I am correctly informed, a systematic analysis of confusion of pedestrians or drivers has yet to be made. Such a study would involve the practical limits of attention and the facts of human variability. The sudden appearance of an unheralded vehicle coming around the corner, the convergence of vehicles on a pedestrian and even the blatant automobile horns themselves are worth considering as sources of confusion.

"Advantages would be derived from one-way traffic. Confusion would be diminished by uniformity of traffic rules, and signals, by better lighting of cars, and a better system of street lighting. Most street lighting involves decrease of the visual acuity by glare. Pedestrians should also have training in time and space estimation.

"In addition to the possible services of psychology in the regulation of the highway, there is undoubtedly need for the services of expert educationalists," Dr. Dodge said. "The pedestrian must be trained as well as the driver of motor vehicles and the proper place for that training is in the school. It seems reasonable to suppose that one of the most important school functions in fitting the child for his environment is the ability to take care of himself on the highway. This task can be undertaken only when the regulations of the highways have reached a

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point where it is uniform in all the states and uniformity should only be aimed at when we are sure that from the standpoint of space and time as well as from the standpoint of the human mind the proposed regulations have been thoroughly scrutinized and revised."

"Newspaper and movie campaigns by cartoons, advice and stories," Dr. Dodge added, "should be continuous and not limited to one week in the year."

READING REFERENCE- Dimmich, F. L. Experimental study of visual movement and the Phi phenomenon. Am. J. of psychology 31; 317-32, Oct. 1920. Titchener, E.B. Functional psychology and the psychology of act. American J. of Psychology 32: 519. 33: 43. Oct. 1921 - Jan. 1922.

### PLAGUE RATS MENACE HAWAII; DUT POISON CAKES COMPAT THEM

Lives and fortunes are the stake in a tremendous war against field rats now being conducted by the territorial board of health and the sugar plantations of the Hawaiian Islands. The results of this war are likely to be of assistance throughout the world in campaigns against the rat, one of the worst enemies of mankind.

It is stated by those who have studied the problem at the experiment station of the Hawaiian Sugar Planters' Association that the common field rat destroys sugar cane on these islands valued at \$100,000 each year, and probably the damage is in excess of this sum.

Worse than this huge tax on the industry, however, is the ever present danger of bubonic plague from infected rats. Twelve deaths among Japanese and Filipino plantation laborers occurred within the past few months on the Hamakua coast, Island of Hawaii.

A new and successful method for wholesale killing of rats has just been discovered. Poison rat-cakes are being manufactured by the millions at Honokaa plantation and are spread broadcast through more than ten thousand acres of cane fields and waste areas, resulting in the death of so many rats that where the board of health previously trapped over two thousand rats a month, it now catches only about fifty,

The poison used is barium carbonate, deadly to rats and fieldmice, but only slightly poisonous to human beings, livestock, and poultry. The poison is mixed with flour dough and made into small round cakes less than an inch in diameter and about one-fourth inch thick.

A new and very important feature, for which patents have been applied, is the coating of paraffine over the cakes to protect them from dampness and moulding, thus insuring their effectivenessfor many months. A very small nibble at one of these poison cakes will kill a mouse, while a piece as large as a small pea will kill a rat. Honokaa sugar company is manufacturing these rat-cakes chiefly for its own use, but it is also selling some at nominal cost for trial use on other plantations.

A man on horseback, dropping a rat-cake about every ten feet, can cover an area of 35 acres in one day, at a total cost of sixteen cents per acre. This done two or three times a year is sufficient to control thoroughly this very serious pest.

Other poisons have been tried at Honokaa. The best of these is strychnine wheat placed in small bamboo tubes and wrapped with paraffine paper. The usual

methods of poisoning are intended for use on a small scale and no effective system has been evolved previously which is cheap enough to use over large areas and impervious to the weather.

Many efforts were made along other lines before poisoning was decided upon as the one effective plan. The U.S. army stationed in the islands had offered assistance in the way of poison gas experiments as it realized the seriousness of the plague situation.

C. E. Pemberton, assistant entomologist at the sugar planters' experiment station, was assigned to investigate this possible means of control, but he reported:

"The use of gas in any form for combating rats in the cane fields is wholly impracticable. Rat burrows, deep, extensive, and permanent are common, but extremely difficult to find until the cane has been cut and the trash burned. By then the rats have left the burrows. A minute search in any field, before harvesting, would reveal most of the rat burrows present, but the time required for such work would be far too great to warrant such a procedure."

Trapping was also experimented with and found unsuitable for use over so large an area.

The board of health is leaving the experimental work to the sugar planters, and is using its energies in cleaning up rat infested places in the labor camps. The people of Hamakua are giving the board every assistance in ridding the district of the menace. Camps are being cleaned up, rubbish is being burned, and intensive trapping is conducted around houses and barns. All stray dogs and cats have been killed as it has been found that they also are capable of carrying the plague.

READING REFERENCE- Creel, Richard H. Bubonic plague; its eradication and prevention in urban communities. Washington, Govt. print. office. (Reprint 209 from Public Health Reports. v. 29 no. 28, July 17, 1914.) Froggatt, W. W. Domestic rats; with suggestion for their control in field and barn. Agricultural gazette of New South Wales 33: 505, 595. July - August. 1922. Toxicity of Barium Carbonate to Rats. Department of Agriculture Bulletin No. 915.

### TO PREVENT SEASICKNESS BY TREATMENT ON LAND

Mal de mer, the ocean's greatest terror for the landlubber, may be swept from the sea. By whirling the prospective voyager in a revolving chair, such as is used in testing aviators in the army, he may be made in effect a seasoned sailor, Dr. Coleman R. Griffith, psychologist, pointed out in a bulletin giving an historical survey of vestibular equilibration just published by the University of Illinois.

Old salts and globe trotters are not sick at sea because their many trips have made them used to the ship's motion, Dr. Griffith said. Persons repeatedly twirled around in a turning chair also gradually become adapted to the turning and lose the dizziness, twitching of the eyes, and nausea which the inexperienced suffer. This adaptation to the unusual motion, it is held, might be so controlled that no actual sickness would be produced on land, yet the individual made a good sailor before he puts out to sea.

These seasickness effects are largely governed by the tiny semicircular canals situated in the inner ear. Just as a man standing in the aisle of a moving streetcar continues to move when the car is suddenly stopped, so the inert fluid in the semicircular canals continues to move, producing the sensation of motion or dizziness. Nerves from the inner ear run to the same small part of the medulla or lower brain as do nerves from the eye and from the stomach. When the fluid in the canals presses upon the nerve leading to this part of the brain the eye is in turn affected with a twitching and the stomach nerve also responds and causes the typical disturbances in that region.

The fact that these organs become adapted to the motion after repeated trials and no longer show the effects, throws doubt upon the advisibility of the use of the turning chair as a test for normality in aviators, Dr. Griffith declared. At present, the twitching of the eyes after a certain number of revolutions is taken as an indication that the aviator is normal, but according to the facts discovered in connection with the adaptibility of the semicircular canals, the best and most experienced aviator might appear to be least normal in such a test.

READING REFERENCE- Griffith, Coleman R. An Historical Survey of Vestibular Equilibration. University of Illinois weekly bulletin Vol. XX, No. 5. Urbana, University of Illinois.

#### DO YOU KNOW THAT

The total production of bituminous coal for the first nine months of this year was nearly nine per cent less than for the corresponding period last year.

It is estimated that the earth receives 160 tons of light from the sun every year. -----

The male fur seal has a harem of from thirty to one hundred females. -----

Stumps of the earliest known trees, which rose to a height of forty feet and are believed to have been seed forns, have recently been unearthed by the New York Board of Water Supply.

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It is estimated that as much as 200 pounds of blood may be sucked from one cow in a single season by cattle ticks.

Class room lectures on history will soon be broadcasted by radio from the University of Washington.

Hairs on the human body are the dwindling vestiges of the warm fur coat of hair which animals developed to meet the conditions of the Ice Age.

It has been estimated that sparrows save the farmers in the United States \$3,5,000,000 every year by destroying weed seed.

#### TABLOID BOOK REVIEWS

ASTRONOMY FOR YOUNG FOLKS. By Isabel M. Lewis, author of "Splendors of the Sky". New York. Duffield & Company. \$1.75.

Mrs. Isabel M. Lewis whose "News of the Stars", syndicated by Science Service, is welcomed weekly by hundreds of thousands of readers, has written this "Astronomy" "for young folks" but older people, who may know as little to begin with as young folks and who may want things made easy and interesting quite as much, will find the volume equally useful. More than balf of the volume is devoted to the stars about whose size, distance and composition more has been learned in the last few years than in all the centuries before. These new facts and theories are found in few books on astronomy and rarely in such intelligible style. Mrs. Lewis is not afraid to run in a bit of poetry once in a while.

THE HISTORY OF MEDICINE IN ITS SALIENT FEATURES. By Walter Libby, M.A., Ph.D., University of Pittsburgh; author of "An Introduction to the History of Science". Cambridge, Mass. Houghton Mifflin Co., The Riverside Press. \$3.00.

A remarkably interesting account of the development of medicine from the time of the priest-physician of ancient Egypt to the end of the World War. Dr. Libby has succeeded in concentrating a wonderful amount of material within the compass of a little over four hundred pages - and that without once dropping into the drabness of generalities. The book is bristling with facts and warm with the breath of biography. In the most concise fashion the leading figures of medicine seem to live again in these interesting pages. Hippocrates, Galen, Harvey, Pasteur, and many others may be almost seen going about their work. But such biographical brevities are only introduced in so far as they carry the story of the development of medical science forward.

#### DO YOU KNOW THAT

Small tides are caused in the solid crust of the earth by the pull of the moon.

Swatow, China, where thousands were killed by the recent typhoon, manufactures eight million pounds of potato starch by a very primitive process.

The average cost of keeping one rat in the United States is about twenty-five cents a year.

Hippocrates, the father of medicine, was not permitted to dissect human bodies, but gained much of his knowledge by a comparative study of animals.

The young shoots of bamboo, the grass which we use for fishing poles, may be eaten like asparagus tips. -------

Algerian sheep are comparatively immune to anthrax, while all other sheep seem extremely susceptible to it.

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