

tradition has been a strong influence in our ready acceptance of changes wrought by science, the noted physicist continued:

"Throughout history man's cultural growth has followed the gradual growth of his scientific knowledge. Even before the outbreak of the present wars, America had become the leader in most fields of scientific endeavor. The tradition of the pioneer has made it relatively easy for the American to alter his habits as required by the introduction of new techniques, with the result that in this country social changes have gone ahead with the speed not found elsewhere.

"As long as such rapid changes are occurring, we cannot hope to adapt the art of living as completely to our technological surroundings as was done in the case of the classical culture initiated by the Greeks and refined through the centuries to fit an essentially stable world. Yet we are shaping our lives on a more heroic scale."

Prof. Compton laid special stress on the necessity for cooperation in making the fruits of scientific endeavor available to mankind. He said:

"Without cooperation, scientific knowledge cannot be made effective. If men divide into antagonistic groups it becomes terribly destructive. Thus in the technological society of which American culture is the supreme example, science emphasizes as never before the need of a will toward cooperation, that is, of the love of our neighbors.

"Science thus plays a three-fold role in American culture. First, it supplies a direct outlet for man's creative instinct in building the permanent structure of scientific knowledge. Second, it supplies the means of living a life richer in health and in its variety of experience. And third, it creates a world setting in which man must rapidly adapt himself to live as a part of a more extensive and more highly coordinated society."

Science News Letter, April 27, 1940

Spectra Synthesized

A THEORETICAL synthesis of the spectra, or light-mixtures, of super-novae, enormously energetic exploding stars, was presented by Drs. Cecilia Payne-Gaposchkin and Fred L. Whipple of Harvard College Observatory. These vast bursting stars seem to have less hydrogen than is found in the atmospheres of ordinary stars, but are richer in helium and particularly in gaseous iron. Carbon and nitrogen also appear to play an important role in the production of super-novae.

Super-novae are not particularly hot when they are giving off their greatest amount of light. Their temperature then is on the order of 12,000 degrees absolute. Two hundred days after greatest light they are much hotter, probably between 30,000 and 50,000 degrees absolute.

Science News Letter, April 27, 1940

Earliest Musical Instrument

FIRST of all musical instruments was the flute, and the number of notes in the various musical scales the world has known was fixed by the number of fingers used in playing various types of this instrument, Prof. Dayton C. Miller of the Case School of Applied Science told the American Philosophical Society.

Primitive flutes made of hollow bones have been found in cave dwellings of the Stone Age, and primitive peoples still use flutes of the same kind made out of bamboo or hollow reed. The simplest flute plays only one note. To get a series of tones it is necessary to use a number of them bound together—the "pipes of Pan" kind of instrument.

Then it was discovered (probably by accident) that a pipe or flute with a hole in its side could be made to produce two notes, as the hole was stopped or left open. By boring more holes, up to the total of fingers available, a whole series of notes—the musical scale—could be played on the single tube.

Flutes have always been of three general types, Prof. Miller said. The earliest ones were sounded by blowing across the open end; classic Greek flutes were of this variety. Later, a blow-hole was made in the side near one end; this "cross flute" was the ancestor of the modern orchestral instrument. The third flute type added a sort of artificial mouth in the shape of a whistle; of this type were the "recorders" mentioned by Shakespeare and Milton.

Having been the deciding influence in molding the musical scale, the flute itself came in for some revolutionary changes when Johann Sebastian Bach fixed that scale in essentially its present form, filling it up with half-tones. The simple tube with seven finger-holes could no longer meet the demands upon it—human hands lacked the necessary additional fingers. The problem was solved in 1832, when Theobald Boehm of Munich invented the modern keyed flute, which permits eight fingers to do the work of a dozen or more.

Prof. Miller, who owns one of the most notable collections of flutes in the world, illustrated his lecture with an

exhibit of fifty of his instruments, playing selections on some of them.

Science News Letter, April 27, 1940

Tree Ring Records Sought

TREE ring records of big stumps and also of heavy timbers in old houses in the Philadelphia region are being sought through cooperation of interested scientific amateurs, by a special committee on education and participation in science of the American Philosophical Society. The committee is working under the direction of Dr. Edward E. Wildman.

It is hoped to obtain from these tree ring data a connected story of climatic fluctuations in the Delaware Valley. To supplement these records "written in wood," the committee is also broadcasting a request for dated mentions of notable weather phenomena in old diaries.

Eight years ago, notable success was scored in a cooperative search by amateurs for unusually large and old trees. More than 400 trees that were standing during the time of William Penn were located. Since then, some of these trees have been cut or blown down, so that cross-sections giving tree ring records will be available.

Science News Letter, April 27, 1940

RESOURCES

Scandinavian War Cuts U. S. Paper Supplies

WAR in Scandinavia will create new, and possibly serious, problems for book and magazine publishers in the United States. So it appears, as experts check on this country's imports of wood in pulp form.

Over one-fifth of the pulp used in the United States is regularly imported, and Scandinavian countries have been depended on to supply the greater quantity of this imported pulp. Sweden has led in this trade with the United States. Chief use of the Scandinavian pulp is for books, magazines, and writing paper. Some is also used in making brown paper and board.

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Caviar, rich in Vitamin D, is a possible substitute for cod liver oil.

Not dreaming of a scientific era of discovery to come, Geneva's citizens in the sixteenth century decreed: "For once and forever, in no branch of learning shall any one stray from the philosophy of *Aristotle*."