

PHYSICS—PHYSIOLOGY

# Voice of Adolescent Boys Drops or Rises an Octave

## Acoustical Society of America Hears Reports on Human Voice and How to Amplify It for Audiences

**T**HE VOICE breaks of adolescent boys that commonly put a high-pitched squeak into the otherwise low but immature adult voice are now being studied, it was reported to the meeting of the Acoustical Society of America at Iowa City by Grant Fairbanks of the State University of Iowa.

With scientific apparatus it is found that almost as many voice breaks occur at 10 years of age as at the age of 14. Very frequently the voice will break downward although upward breaks are more frequent. The average break represents a change of pitch of 8 tones, or one octave.

Other studies at the University described by Mr. Fairbanks showed that trained actors can simulate the emotion of contempt with a pitch range of 10.5 tones. Anger was simulated with a range of 10.3 and required a very rapid change of pitch.

The highest average pitch and the greatest range of tone (11.2) was required to express fear. Grief needed only a tonal range of 9 and indifference had the lowest range of all, only 7.8 tones.

### Photograph Vocal Cords

**W**ITH high speed motion picture photography Dr. John C. Steinberg of the Bell Telephone Laboratories showed movies of the vibrations in the

human vocal cords taken at the rate of 4,000 pictures a second.

When projected at the normal speed of only 16 a second speed reduction ratio of the pictures was 250 to one so that when the cords were vibrating 250 times a second (essentially the tone of middle C—256) the cords in the movie vibrated only once a second.

For low-pitched sounds the cords appeared relaxed completely. As the tension in the vocal cords increased the pitch went up.

These vibrations of the cords, emphasized Dr. Steinberg, do not possess the distinguishing characteristics of different speech sounds. The latter characteristics are produced by the passage of the sound waves through the throat, nose and mouth cavities.

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### Amplifiers Aid Theater

**T**HE USE of microphones, amplifiers and other acoustical apparatus is now bringing to the theater the whole gamut of sounds which the human ear can hear, Harold Burriss-Meyer of Stevens Institute of Technology told the meeting.

While formerly it was possible to have complete control only over the lighting of the stage, and the actors had not only to interpret their parts but to overcome bad architectural acoustics, it is now pos-

sible to achieve added dramatic value through sounds.

"It is possible to use sound," explained Mr. Burriss-Meyer, "as an arbitrary independent means for stimulating predictable involuntary audience reaction; to engender by auditory means that emotional flux which will make it easy for the audience to suspend disbelief, to laugh at, weep for, or believe in something which would have seemed absurd when first the curtain went up."

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MINING

### Japan Plans Exploitation Of Iron and Coal Deposits

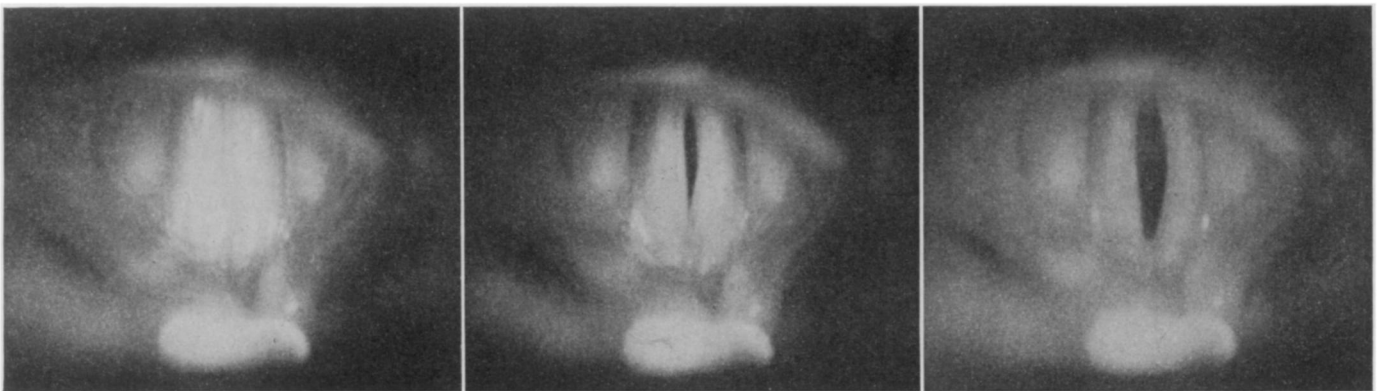
**J**APAN plans the exploitation of immense iron ore and coal deposits in Manchukuo, in the still wild and inaccessible Tungpientao district near the Korean boundary. The deposits of high-grade iron ore are estimated at 100,000,000 metric tons.

The Tungpientao Development Company has a project which calls for the production, by the end of 1941, of 1,300,000 metric tons of iron ore, 1,300,000 metric tons of coal, and the construction of an iron and steel works with a capacity of 500,000 tons of pig iron and 100,000 tons of steel. A railroad into the district is now under construction.

John S. Stewart, discussing the project (*Far Eastern Survey*, Oct. 25), remarks:

"Whether the Japanese plan of a new heavy industry zone in a hitherto undeveloped area will be realized, depends, of course, on several vital factors. The steps outlined above merely break the ice. Assuming that the discoveries can be substantiated by later findings, the real test will come in raising the capital and equipment to get under way on a large scale."

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PHYSICS—PHYSIOLOGY

# Living "Glass" Described At Temperature Symposium

## Athletes During Severe Exercise Have Fever Body Temperatures; Dogs Are Trained to Withstand Cold

**B**Y TURNING their cells into a kind of living "glass" some microorganisms are able to withstand immersion into liquid air at temperatures of 190 degrees below zero Centigrade, it was reported to the symposium on temperature sponsored by the American Institute of Physics in New York.

Prof. Basil J. Luyet, St. Louis University's professor of biochemistry, told the scientists that matter can exist in four physical states: as a gas, as a liquid, as a crystal and as a glass.

Death by freezing comes because the temperature is lowered slowly. If an organism can be dipped into liquid air and pass on to the so-called vitreous state, some living tissues can be returned to a degree of vitality by quick warming to make them pass again through the danger stage of crystallization.

Prof. Luyet reported that he, and his collaborators, had used this rapid cooling to chill tissues from the epidermal cells of plants, moss leaves, frog's spermatozoa, isolated muscle fibers and myxamoebae. All these regained vitality on rewarming.

"Other protozoa or tissues experimented upon did not survive," Prof. Luyet said. "One of the reasons for the lower resistance of the latter seems to be their too-high water content and the impossibility of sufficiently dehydrating them.

"These observations and those of other investigators . . . favor the theory that

the structure required for vital activities is such that it is not destroyed by a lowering of molecular motion while it is destroyed by the withdrawal of some water molecules as when crystallization takes place."

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## Athletes at Fever Heat

**A**THLETES in severe muscular exercise can show body temperatures that normally would mean high fevers, Dr. Eugene F. DuBois of the Russell Sage Institute of Pathology, Cornell University Medical School, told the symposium.

Dr. DuBois, reviewing studies of the body's temperature, showed that the familiar 98.6 degrees Fahrenheit the clinical thermometer registers normally, is only one single spot between internal temperature and skin temperatures of 93.2 and lower.

In severe exercise the temperature may run up to 104 degrees Fahrenheit.

Just as the earth has broad zones of temperature so, too, does the body have its temperature levels, or zones. The torrid zone in man might be classed as that with temperatures of more than 105.2 degrees F. which can only be obtained by artificial fevers or when the body's temperature-regulating mechanism fails.

Just below this, in what might be called the semi-tropics, is the familiar

"fever" zone that is higher in temperature than normal and which comes from illness. With fever the skin temperature is warm. Here, too, come the higher temperatures of severe exercise which are accompanied, however, by cool skin.

The body's normal temperature zone, corresponding to the temperate zone on the earth, is fairly wide.

Below it come those body temperatures which are restored to normal values by shivering.

And finally, analogous to the polar regions on earth, is the body's zone of semi-hibernation where temperature regulation fails.

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## Trained Dogs Endure Cold

**F**ROM Harvard's four-man research team of the Fatigue Laboratory—Drs. M. Nielsen, W. H. Forbes, J. W. Wilson and D. B. Dill—came reports of Harvard's four trained dogs which will lie quietly on a net in a cold room at temperatures of from 32 to 53 degrees Fahrenheit and wear oxygen masks.

Exact physiological studies were made of their body activity as scientists tested skin temperatures, respiratory rate, pulse rate and did blood tests on them.

Three of the four dogs withstood the chilling tests well. They lay quietly, though not narcotized, in a semi-conscious condition most of the time.

At these low temperatures the dogs shivered moderately while breathing room air and thus increased their heat

## VIBRATING VOCAL CORDS

*Super-fast photography made possible the series of pictures taken at 4,000 a second from which these six representative views were selected. In them, the cords were vibrating at about 120 cycles in a high frequency note.*

