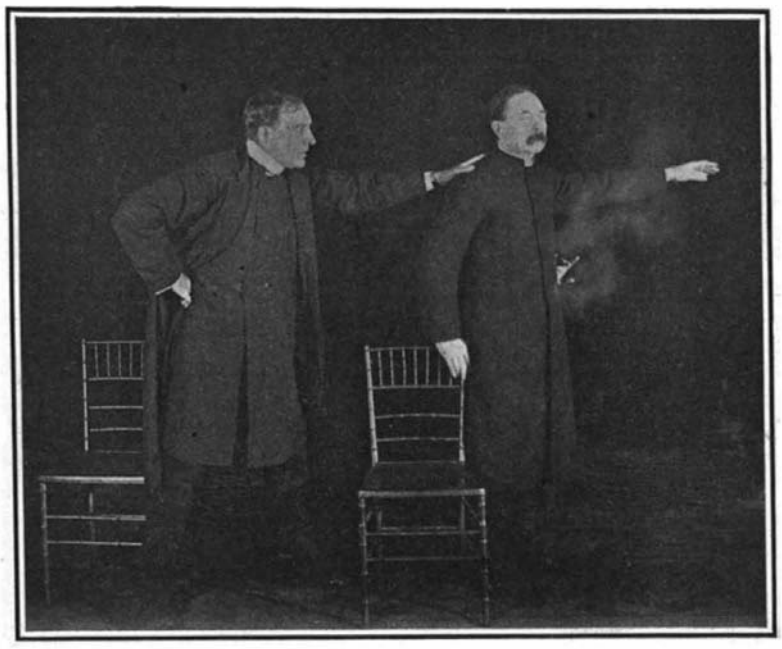
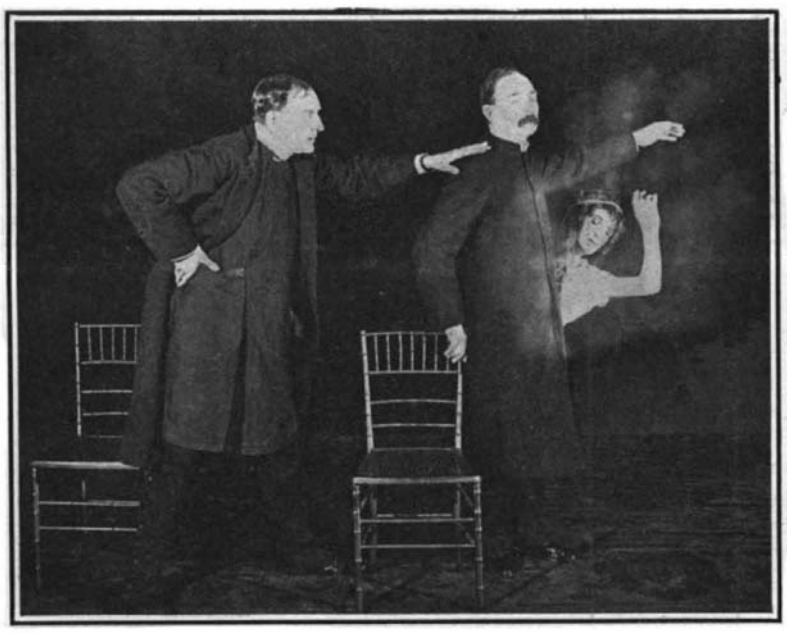
"BLACK ART" REDIVIVUS.

From time to time various identical stage illusions crop up with a regularity that seems to be dependent only upon the bad memory of the show-goer. We have recently had a revival of the mysterious and uncanny "black art" in this country in the "Wizard of Oz," and in London, under the direction of Mr. J. N. Maskelyne, the well-known magician, "black art" has always lent itself to spiritualistic purposes as in the present case. When the curtain rises the stage is empty. Mr. Maskelyne enters with a friend, who is introduced to provide the usual scene associated with spirit mediums. The actor in the course of a few minutes appears to go into a trance, and almost immediately a filmy cloud of vapor is seen to be issuing from his left side. In a few seconds a human hand appears followed by a head and body, until at last the complete figure of a woman clad in light draperies apparently in a trance is visible. The woman walks across the stage to the footlights, opens her eyes in apparent wonder, exclaims, "Where am I?" The illusion has produced a profound sensation in London, and many were the theories which have been put forward. The true solution is however found in the so-called "black art."

In this illusion the entire stage from the first groove to the rear is hung with black velvet, the floor covered with black felt, and the top also, thus forming a room lined with black. The woman is garbed entirely in black and is provided with a black mask. The garments are made in sections adapted to be pulled away piecemeal until she is completely exposed in light raiment. Black cords manipulated by attendants behind the black back cloth pull away the black covering in detail or all at once. The number and style of tricks performed in the mysterious black chamber are almost unlimited. This is one of the most expensive of stage illusions, costing several hundred dollars to properly stage it with the best drapery and accessories, and unless such are used the proper illusory effect is lost. In magic as well as in other business, cheap apparatus is dear at any price.



A Startling Apparition.—The Figure Begins to Appear.



The Figure Emerging from Chaos.

The Apparition Completely Unveiled.

The Limits of Life.

BY DR. VICTOR GRAFF.

In general, life is closely dependent upon external conditions. Plants, for example, retain their vitality only within a narrow interval of temperature. But the limits of life recede as we descend in the scale of creation, adaptability being inversely proportional to evolutionary development.

Algæ are found growing in the hot springs of the Yellowstone, at a temperature of 176 deg. F., at which albumen coagulates. A bath in boiling water actually increases the germinating power of the spores of *Bacterium subtilis*.

Most of the organisms that are not killed by drying endure very high temperatures when dry. Yeast and the seeds of many plants germinate after exposure to dry heat of the temperature of boiling water.

Many organisms resist extremely low temperatures still better. Parts of many higher plants can be frozen without suffering the slightest diminution of the power of growth. According to Charpentier, Alpine clover (*Trilphium alpinum*), mountain areus (*Geum montanum*) and other Alpine plants live and grow after being covered by ice for four years. In experiments with liquid air Pictet exposed diatoms for a long time to a temperature of —390 deg. F., and Macfadyen cooled bacteria to —480 deg. F. without killing them. It is not yet known whether this astonishing resistance to cold is due to an entire arrest of the vital process or merely to its reduction to a minimum. It is certain that frozen fishes and frogs and completely desiccated rotifera and worms can be restored to normal life by heat and moisture, respectively, unless the abnormal condition has continued for a very long time. Beijerinck has discovered that chlorophyll-bearing parts of plants retain the power of assimilating carbonic acid when exposed to light even after they have been pulverized, and Molisch has obtained the same result with spinach leaves that had been dried, pulverized and mixed with water.

Buchner's discovery of cell-free fermentation and the isolation of zymase, the chemical compound to which fermentation is due, have thrown a new light upon the vital process in plants. Many processes which were formerly explained by the vital activity of living plasma are now regarded as purely chemical transformations due to enzymes, the production of which substances by living organisms constitutes the only connection between life and the processes in question.

This theory has recently been extended to the assimilation of carbonic acid, for Friedel and Regnard claim to have effected "photosynthesis" (assimilation of carbonic acid under the influence of light) with lifeless vegetable extracts, outside of the vegetable cell and in the absence of living protoplasm. Friedel's experiments have not yet been confirmed.

Molisch has also asserted that life is not necessary for carbonic acid assimilation, basing his assertion on the ability of desiccated spinach leaves, which had certainly lost the power of growth, to absorb carbonic acid and evolve oxygen. But to the writer it does not appear legitimate to assume that this is a case of assimilation by a dead organ, as we can not assert that an organism is dead merely because it is incapable of continuing a vital existence. Wiesner has pointed out that leaves in perfect health may be caused to fall by rain and frost following a drought. These leaves cannot grow, but they cannot properly be called dead.

I have proved by an extensive series of experiments that the respiration of lowly organisms like yeast and also that of the leaves of higher plants is a very complex process which involves several distinct stages and various factors which can replace each other to some extent and exhibit different degrees of sensitiveness to external influences. Dried yeast was heated to various temperatures and then added to solutions of sugar. Now yeast not only causes sugar to ferment but it completely oxidizes a portion of it. Carbonic acid is evolved in both processes, but fermentation also produces alcohol in definite proportion to the carbonic acid of fermentation. The excess of gas above this proportion must be ascribed to oxidation, or respiration. In fermentation, furthermore, sugar is simply resolved into alcohol and carbonic acid, while in oxidation a measurable quantity of oxygen is absorbed. In the cultures of heated yeast fermentation and oxidation took place simultaneously and in the same proportion for all temperatures of preliminary heating up to 120 deg. F. At this point there was a transient increase in oxidation, but with increasing temperature the oxidation decreased very gradually up to 230 deg. F., while the activity of fermentation remained constant. Heating, furthermore, diminishes the general vital activity, for, while yeast at normal temperature consumes by fermentation and oxidation all the sugar offered to it, after it has been heated to 230 deg. F. it is able to consume only 29 per cent of the sugar. Up to this point the ratio between fermentation and oxidation remains nearly constant, about 10 per cent of the *consumed* sugar being oxidized. Above 230 deg. F. the proportion of the *consumed* sugar that is oxidized rises very quickly to 67 per cent, because of the rapid decrease in fermenting power, which is destroyed entirely by heating to 266 deg. F.

There can be no "life" after exposure to such a temperature. The oxidation, to which I have given the name "dead oxidation," is caused by lifeless organic products or oxidases. But even the activity of these oxidases is diminished by heating. Heating the yeast to 340 deg. F. greatly diminished the evolution of carbonic acid, and the amount of oxidation that remained was proved to be due to inorganic substances, the activity of which was finally destroyed by heating the yeast to 480 deg. F.

These experiments prove that the production of carbonic acid is due to three factors—living protoplasm, lifeless organic enzymes, and inorganic "catalyzers"—which differ in their ability to withstand higher temperatures. At a comparatively low temperature the activity of the protoplasm is destroyed and the rapidity of oxidation falls. At a higher temperature there is a second fall caused by the failure of the enzymes, and at a still higher temperature oxidation by inorganic substances also ceases. The same law applies to higher plants. Similar results have been obtained by Palladin, in St. Petersburg.

It seems fair to assume that under ordinary conditions all these factors work together but that the lifeless factors become recognizable only when life is arrested or reduced to a minimum. Probably the living cell can employ all or only part of its vital energy, according to its need. These considerations suggest a plausible explanation of the tenacity of life under unfavorable conditions within certain limits.—Translated for the Scientific American from Umschau.

R. I. Phelps contributes an article to the Mining and Scientific Press of San Francisco on the furnace plant erected at Héroult, Shasta County, Cal., to treat the magnetic ores found on the divide between the Pitt and McCloud rivers. The current available is three-phase 60-cycle alternating current, which has not hitherto been used in electric smelting. Three carbon electrodes are used, each 18 x 18 x 72 inches. The water-cooled stepdown transformers deliver to the electrodes 30,000 amperes at 50 volts 60 cycles from the 22,000-volt potential of the power transmission line. The first heat was started on July 4, but after a few hours' work trouble developed, and the heat had to be stopped. After several hitches smelting has now been resumed, and the first heat tapped.