

mation of a measurable amount of water. If however we place a piece of platinum sponge into it the formation of water immediately begins, and is as suddenly terminated when we remove the sponge. The platinum sponge has moreover undergone no change and is able to exert this action for an unbounded space of time.

At first it seems as if we had here the first proposition of our later natural science, to rudely dispute "causa arguat effectum," since we have here a cause which can bring forth extended and large effects at pleasure without becoming exhausted. If we ask however what this proposition means by cause and effect we find it to be degrees of energy. No energy of any kind can be created without the consumption of an equal amount of energy, and no difference in the potential of energies can be called forth without the simultaneous disappearance of equivalent differences in the potential of other energies. The truth of these propositions is not cast in doubt by the experiment with the mixture of oxygen and hydrogen, since the heat of combustion remains the same both when combination is effected by an electric spark and when it is brought about at the ordinary temperature by means of platinum sponge. While therefore the law of cause, clothed in the form of a principle of energy, regulates the final result of the action in an unchangeable manner, the time during which this action takes place remains absolutely independent of this principle, and we have side by side with the absolute necessity of this law of cause, the freedom with reference to the time during which it ex-

erts its influence. Therefore we see that all possible phenomena which, originating from the same substances, reach the same products, arrive at these with a very different rapidity. The object to be arrived at is unchangeable; whether it is however to be accomplished in a second or in several thousand years is a circumstance over which we have full control.

The name "catalytic bodies" has been given to substances which cause chemical reactions without experiencing any change themselves. We will now change this definition so as to read thus: Catalytic substances are those which modify the rapidity of a definite chemical reac-

tion without changing their own content of energy. To place a catalytic substance into the reacting bodies and to remove it requires theoretically no work. This proves that within the strict province of the law of energy there still remains room for the greatest variation in the temporal extent of the phenomena.

This peculiar circumstance has its foundation in the fact that in the expression of most degrees of energy time is not mentioned, and that therefore the equation of energy does not determine the extent of time involved in the phenomena.

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ARCHAEOLOGY

## Shakespeare's Knowledge Defended by Archaeologist

**N**EW TRIBUTE to Shakespeare as a historian is paid by an archaeologist of the British Museum, Christopher Hawkes, who is in charge of excavations at the city of Shakespeare's King Cymbeline.

Ruins on the edge of the modern city of Colchester are identified as the capital of the British King Cymbeline. The reign of Cymbeline lasted 40 years while Roman Emperors laid their plans to conquer the barbarian Britons.

"The more we come to know of Britain on the eve of the Roman conquest, the clearer it becomes that Shakespeare, searching among the chronicler's welter of fact and fiction for the outlines of the play he was conceiving, brought out the main features of it with the instinct of genius for truth," declares Mr. Hawkes in a report of the excavations at Colchester, in *Art and Archaeology*.

Latest excavations have unearthed some of the homes in Cymbeline's capital city. The excavations were undertaken, speedily, when the site was threatened by road building and real estate developments. Some years ago, archaeologists had dug into a mound on the land and discovered a Celtic burial so magnificent that it may be that of King Cymbeline himself. The palace of the king is still being sought. Cymbeline's mint, which issued coinage of great historic interest, is another future discovery.

Cymbeline's capital, the metropolis of southeastern Britain, covered a huge area, Mr. Hawkes explains. Excavations

reveal the foundations of homes made of timber framework with walls of wattle and daub. Houses and town changed somewhat during Cymbeline's reign, and Mr. Hawkes suggests that Cymbeline may have made an early effort at town planning in his capital.

Showing primitive features of the Celtic capital, Mr. Hawkes tells of a great ditch which was dug with shovels made of the blade bones of oxen.

"Thirty or forty of these crude tools—the type was in use as long ago as the Stone Age—were found discarded in a heap on the gravel bottom," he writes.

The huddled mass of primitive dwellings may give place to more ambitious structures, Mr. Hawkes believes, when the excavations approach nearer the heart of the city. Here the king himself must have resided. In this section, the archaeologist also is prepared to find tools more serviceable than bone shovels. The town was far from being wholly primitive, he explains. Among the objects already discovered are pottery of graceful profile and metal work of amazingly high standard.

Cymbeline's capital is a site of unparalleled importance in British archaeology, Mr. Hawkes states. Not only is the native civilization of Cymbeline's subjects shown at its highest, but the archaeologist can study what happened when Roman civilization met British. The city was not abandoned for seven years after the Roman legions captured it in 43 A. D.

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▼ The Science Service radio address next week will be on the subject of

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**POISON IVY AND WHAT TO DO ABOUT IT**

**Dr. James B. McNair**

botanist of the Field Museum of Natural History, Chicago, will be the speaker.

**FRIDAY, MAY 6**

at 2:45 P. M., Eastern Standard Time

Over Stations of The Columbia Broadcasting System