Second, the bound particles are held in oriented fashion (oriented adsorption), so that they present to the other reacting particles, fields most favorable to adherence to or combination with them.

Third, the electromagnetic or electrostatic fields of the reacting particles thus joined react on each other in such a way that the bond between the inner particle and the catalyst is broken, while that between the two reacting particles persists (synthesis).

This scheme demands a fitting together of the fields of the catalyst and those of one of the reactants, which may well serve as the basis of the "lock and key" comparison of Fischer, and the specificity of many biological, enzyme and catalytic reactions. It is also consonant with Professor Hugh S. Taylor's demonstration of selective points of activity, for it is not to be expected that all areas of the catalyst surface will be equally effective in holding particles arriving there with the criteria of successful fixation at an area of properly distributed charges—*i.e.,* proper presentation and proper velocity.

When a particle is fixed or adsorbed at an interface or effective catalyst area, the fields of the particle adjacent to the surface are largely balanced by the opposing surface fields. This neutralization should lead to a redistribution of the remaining charges of the particle, with the result that the exterior portion of the particle exposed to the solution then has a different electromagnetic or electrostatic configuration from what it had before fixation. It may now make attachments previously not possible.

If this new configuration is such that it permits the attachment of another kind of particle, there will be another readjustment of fields, with the following two possibilities: (1) If the bond between the two particles persists while that between the catalyzer surface and the now duplex particle breaks, we will have set free into the solution a new duplex particle which will undergo a readjustment of fields as soon as it breaks loose. The active catalyst area will then be free to begin the operation over again. (2) If the duplex particle sticks to the active area, activity there ceases. The same result follows if a non-reactive particle sticks to the active area (poisoning of catalyst), and it is conceivable that the fields of an active area may be so distorted as a result of conditions during use, that their activity diminishes and the catalyst becomes "worn out."

If the readjustment of fields following the fixation of a particle *at* an interface, or following the separation of composite particle *from* an interface, is such that the particle in question splits up, *decomposition* is catalyzed. The nature of the split determines the kind of products formed thereby. If a composite particle persists on liberation, we have a *synthesis.*

Consider now the effect of an increase in temperature upon a system of reactants, both in the absence of a catalyst and in the presence of a catalyst.

On the reactants the effect of heat is twofold: (1) the kinetic activity of the particles, as units, is increased; and (2) their internal activity is also increased, that is, their electrons rotate more rapidly and probably move to exterior quantum positions. Practically, the particles move more rapidly, and they swell. As a consequence, their fields may change both in strength and in location. Bonds heretofore potent may become weakened, and bonds previously impossible may be formed. The increased kinetic activity of the particle as a unit results in an increased probability of actual *number* of encounters, but beyond a certain temperature limit, which should vary in each case, the number of encounters *which are successful* will diminish. These considerations apply equally to the meeting of the fixed particle with the active catalyst area, and to the union of the particle so bound with the other reactant.

Catalysts are similarly affected by increase of temperature. Catalyst surfaces may develop effective areas not previously present, and, if finely dispersed, the catalyst will show increased kinetic or Brownian motion, which means increased probability of successful encounters. Too high a temperature may melt or cause surface flow and ruin the catalyst. Increased pressure would, in most cases, speed combination, because of increased concentration of molecules. Besides, pressure favors closer approach. When the effect of temperature on reactants and on catalyst weakens the fields, or increases velocity so that combination is no longer possible or sufficiently lasting, then the increase in number of encounters will cease to register an effect in producing increase in *successful* combination. That is, each system of reactants and catalysts will show a thermal optimum for combination.

JEROME ALEXANDER

50 EAST FORTY-FIRST ST.,
NEW YORK CITY

MERCURY AND AMMONIA VAPOR AN EXPLOSION HAZARD

IN a small manufacturing process, strong aqueous ammonia was elevated through piping into a reaction tank, using the carboy containing the ammonia as a montejus operated by compressed air from the shop lines. In order to guard against excessive pressures in the carboy a safety-valve consisting of mercury in a U-tube was used. This was connected with the carboy by about six feet of iron pipe. The U-tube was also of iron—standard 3/4″ wrought iron pipe bent to the required form. Enough mercury was used to limit the pressure approximately to that of a four inch column of the fluid.

This arrangement had been in daily service for ten years. A new charge of mercury was last put in about one year ago.

During the night of November 19th a violent explosion occurred, fortunately limited to a small area at the surface of the mercury on the ammonia side of the U. The 3/16″ iron of the pipe was opened out at this point over an area of about four square inches and a piece about one inch square was driven out with great force. There was no damage or evidence of high pressure elsewhere in the system.

The presence together of metallic mercury and ammonia vapor is not recorded as an explosion hazard, and the ten-year record of the installation herein involved would appear to support this implication of safety.

It would seem that a special combination of circumstances must have existed in the present instance, but a search of the literature has given no positive indication as to what these might have been. There is, however, a suggestion.

Several violently explosive compounds of mercury with nitrogen are known. Mercury fulminate is one of the more stable of these. Among the less stable are recorded certain compounds of mercuric oxide and ammonia, some of which are formed by union of the gas with the solid, but none, reputedly, at temperatures below 100° C. These compounds, however, come nearer to what might conceivably have been formed in the present instance than any others. If we assume that (1) the mercury had a layer of mercuric oxide on its inner surface and that (2) the explosive mercuri-ammonium oxides can in reality form in course of time at a temperature but slightly in excess of what we term "room" temperature, we have a good explanation of what may have happened in the case before us.

It is possible to say further only that the formation of anything more than minute traces of oxide is at least improbable here, and that, as before stated, there is no record of the combination taking place at any but much higher temperatures than could have been reached in this installation.

It remains, however, almost beyond a doubt that a mercury-nitrogen compound was responsible for the explosion; and in the absence of any definite knowledge of the necessary contributing conditions, it would seem the part of safety to class the co-presence of ammonia, in any form, and mercury as an explosion risk.

CHARLES VAN BRUNT

RESEARCH LABORATORY,
GENERAL ELECTRIC COMPANY,
SCHENECTADY, NEW YORK

OBSERVATIONS ON SCORPIONS

THE life history of one of the European scorpions, *Scorpio occitanus* Lat., has been known since Fabre published the results of his investigations in his "Souvenirs." Regarding the life history of American species of scorpions, very little has been published as far as I know. Comstock states in "The Spider Book" that the scorpion does not lay eggs, while Fabre has observed that the European species does lay eggs and that it breaks the eggs and devours the shells.

The scorpion *Centruroides vittatus* Say is fairly common in northwest Arkansas. It is most frequently found on dry hillsides, where it hides under stones and similar shelter.

A study of the life history of this species was undertaken during the summer of 1925. A number of pregnant females were collected and placed in an observation cage. The first young were seen on the morning of September 5. Later, careful watch was maintained through about twenty-four hours of the day, with the result that the actual arrival of several litters of young was observed. They were fully developed in the body of the female. Each young one was born in a very thin and transparent envelope from which it freed itself in about fifteen minutes time. If the young succeeded in freeing themselves, they were assisted by the mother in getting on her back. They molted here after three to six days, and remained on her back for from five to fifteen days.

The mating dances have been observed in the American scorpion; they correspond very closely to those observed by Fabre in the European species.

Judging by the rate of growth in scorpions kept in the laboratory and by various sizes secured in the field, our scorpion probably attains maturity in three or four years.

Scorpions are easily kept in captivity if provided with water and food. They will eat small insects such as grasshoppers and roaches, but refuse caterpillars. They will also eat raw lean beef. Young scorpions feed readily upon termites, apparently in preference to anything else.

FRANK R. SMITH

DEPARTMENT OF ENTOMOLOGY,
UNIVERSITY OF ARKANSAS

A CONFUSION OF TERMS

As shown in the discussion which follows, there is a confusion as to the meaning of the terms *dialyze*, *dialyzable* and *dialyzate*. Does the substance which passes through a semi-permeable membrane *dialyze*, and is it therefore *dialyzable?* Is the *dialyzate* the material which passes through the membrane or is it the material which remains in the dialyzer? Different authorities and usages do not agree.