

molecular structure and content to explosive properties conducted under the Independent Research Program. It is now possible to predict *a priori* many of the properties of an explosive before it is synthesized. This has led to the synthesis of high-energy materials capable of withstanding temperatures much higher than was previously considered possible. The first two explosives to stem from this program are capable of withstanding temperatures above 500 degrees F. Both have been used in explosive cutting devices in the Gemini space capsule and are contained in the mild detonating fuses and flexible, linear, shaped charges used to separate the crew module from the F-111 aircraft in emergency situations. It is now reported that these systems are capable of lasting the lifetime of the aircraft eliminating the frequent maintenance and replacements required when explosives of lesser temperature capabilities are used. It is estimated that use of these explosives will save the Government nearly \$90,000,000 during the life span of the aircraft now on order. Three more, promising, high-temperature explosives have been developed. The first two are able to withstand temperatures 35 to 40 degrees higher. These are currently being screened for applications by the military, NASA, and AEC.

Biomolecular variations induced by stress

Observations at the Navy Air Development Center (Johnsville) on animals exposed to different lethal stresses such as ionizing radiation and high acceleration stress have shown chemical changes in the blood. After these observations on animals, the experiments were extended to humans. Volunteers were subjected to accelerations of from 3 to 4½ G, sufficiently long to produce grayout or blackout. All the men exposed to this stress showed a significant increase of the phosphatidyl glycerol level in the blood plasma. Correlations of the control levels of phosphatidyl glycerol with anxiety about the acceleration procedure directed attention to the effects of emotional factors on the chemical changes induced in the blood. As an example of extreme emotional stress, blood samples from schizophrenic patients hospitalized for a long time at a psychiatric institute were analyzed and also showed high concentrations of phosphatidyl glycerol accompanied by changes in the levels of other phospholipids that distinguished the stress in schizophrenia from the physical stress of acceleration. Extension of the study to volunteers who had been deprived of sleep for 36 hours confirmed the previous findings relative to phosphatidyl glycerol and again revealed changes that differentiated this fatigue stress from the others. After these results were made public, the experimental approach was included in a joint Navy, NASA, and Air Force study of combat pilots. Data were taken on Navy carrier pilots flying high-risk, active combat missions during a 22-day line period, near the end of a 7-month deployment. These studies were repeated again when the pilots were returned to the United States to non-combat duty. The concentration levels of phosphatidyl glycerol and other phospholipids again made possible the statistical separation of the combat stressed pilots from normal individuals and from the other stressed populations. After the pilots returned to the United States, the phospholipid levels began to return toward normal, but the reversal was not as complete as was found in acceleration or sleep deprivation. The data obtained with humans coupled with the information found in the tissues of stressed animals suggest that some center of the brain can interpret certain sensory inputs as threats to survival and reacts by mobilizing biochemical factors at a molecular level to meet the threat. Techniques are now being developed so that analyses for these plasma components can be made in the field. It is expected that the onset of combat fatigue in fighting men may then be anticipated by these procedures.

Cartography by computer

The time will come when most maps will be printed with the aid of a computer and a cathode-ray printer. Based upon work at the Naval Weapons Laboratory, it will be possible to print in a few seconds a map which now requires days to trace by hand. Essential to mapping by cathode-ray printer is a collection of data which contains the geographic coordinates of points on coast lines and boundaries. There is available at a Navy Laboratory a collection which includes 10,000 points for the United States itself and 8,000 points for the world as a whole. The points were selected to portray the salient features of coast lines and boundaries without exceeding prescribed limitations on accuracy. Once the latitude and longitudes of the points had been recorded on magnetic tape, it became possible to construct maps by connecting the points in any automatic plotter which is under the control of a digital computer. Any desired mapping transformation may be used in the conversion of geographic coordinates to map coordinates. The data