

1. AND DEVELOPMENT PROJECT CARD (NEW PROJECTS)		2. SEC U	3. PROJ NO NR-115-000
4. TITLE PSYCHOLOGICAL BASIS OF TREATMENT AND REHABILITATION			5. REPORT DATE 1 July 1950
6. FIELD OR SUBJECT		7. SUB FIELD OR SUBJECT SUB GROUP PO-16402	
8. COGNIZANT AGENCY ONR	12. CONTRACTOR AND/OR LABORATORY		CONTRACT/W. O. NO.
9. DIRECTING AGENCY ONR Research Group Code 441	10. REQUESTING AGENCY		11. PARTICIPATION AND/OR COORDINATION
13. RELATED PROJECTS		17. EST. COMPL. DATES	
14. DATE APPROVED		RES	
15. PRIORITY		DEV.	
16. MAJ. CAT.		TEST	
19.		OP EVAL.	
20. REQUIREMENT AND/OR JUSTIFICATION		Fy 18. FISCAL EST'S.	
a. No change			
b. No change			
21. BRIEF OF PROJECT AND OBJECTIVE			
(a) through (e) No change			
(f) See task progress report for future plans.			
(g) See task progress report for complete bibliography of reports and articles			
22. J R D B	SN.	FC.	IC & P.
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JRDB FORM 1A, 1 APR 1947

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NR-115-070: (Continued)

- (5) Waters, L. L. and G. I. deSuto-Nagy, "Lesions of the Coronary and Visceral Arteries of Dogs Following Large Intravenous Doses of Adrenalin. Their Prevention by Dibenamine," Science, III, 634 (1950)
- (6) Waters, L. L. and G. I. deSuto-Nagy, "Circulatory Factors in the Pathogenesis of Experimental Arteriolar Necrosis," Yale J. Biol. & Med. 22, 751 (1950)

Manuscripts:

- (1) Waters, L. L., "The Pathogenesis of Experimental Arterial Necrosis in Dogs."

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NR-115-097: Physiological Disturbances Attending Bodily Injury (Unclassified)
 CONTRACTOR: Medical College of Virginia, Richmond, Virginia
 CONTRACT: N6ori-25401 (12/1/46 to 11/30/50)
 INVESTIGATOR: E. I. Evans

OBJECTIVE: The purpose of this task is to determine the fundamental alterations in body physiology following acute trauma such as surgical operation, accidental trauma, and burns. Emphasis is largely on the fluid, ionic and red cell requirements following trauma.

PROGRESS THROUGH 30 JUNE 1950: Fluid and Ionic Exchange in the Post-operative and Post-traumatic State: Because of serious discrepancies between red cell volume calculated by the dye and tagged red cell methods, it was necessary to first establish the validity of these methods in the post-traumatic state. Accordingly, a serious study was made of the tagged red cell method (F₃₂). This was completed and showed an approximate error of 20 per cent in calculation of red cell volume by T1824. Then serious studies were made on the validity of urine chloride estimation as a method for studying body chloride needs. Patients' chloride needs can be followed by simple estimation of urine chloride excretion except in the earliest period following trauma or operation. A study was made on the paradox of aciduria in the presence of alkalosis. These studies indicated

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NR-115-097: (Continued)

serious depression of body potassium levels following restoration of body fluid and salt with simple chloride infusions, so the past year has been spent in the serious study of body potassium following losses by the gastric route, utilizing radioactive potassium as a tracer. Concomitant studies of humans indicate a serious discrepancy between findings in an experimental animal and human.

During the past six months the laboratory has been occupied with an attempt to correlate plasma levels of sodium and potassium with those found in the patients muscle cell. In approximately 35 patients in essentially normal condition analyses have been made of the plasma and rectus or pyramidalis muscles for sodium potassium, chloride, CO₂ and water. These data were necessary to establish a base line for further studies. In approximately 10 other patients added information was gained on muscle nitrogen as well because of the extreme paucity of such data in the literature. There is now fairly accurate data on the normal human patient for these ions.

Attempts are now being made to study plasma and cell ions in patients in potassium deficiency with alkalosis but too few studies have been made so far to warrant any conclusions. Also studied was a large number of surgical patients (after operation) in an attempt to better correlate treatment of sodium and potassium with clinical and chemical findings. There were four patients in whom alkalosis persisted after correlation of all known ionic imbalances and an effort is being made to find a solution to this problem. Sodium and potassium balances have been run on a series of burned patients and several instances of moderate potassium deficiency in acute burns have been found.

FUTURE PLANS: An attempt will be made to correlate ionic changes in the post-traumatic patient with 11-oxysteroids and 17-ketosteroids excretion in the next few months.

LIST OF TECHNICAL REPORTS AND PUBLISHED ARTICLES:

Publications:

- (1) Van Slyke, K. K. and E. I. Evans. "The Paradox of Aciduria in the Presence of Alkalosis Caused by Hypochloremia," Ann.Surg. (1947)
- (2) Van Slyke, K. K. and E. I. Evans. "The Significance of Urine Chloride Determination in the Detection and Treatment of Dehydration with Salt Depletion," Ann.Surg. (1948)

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PHYSIOLOG. BASIS OF TREAT. & REHABIL.—CODE 441

PROJECT NO. NR-115-000

PHYSIOL

NR-115-104

NR-115-097: (Continued)

(3) Nachman, H. M., V. Crawford and I. A. Bigger. "Radioactive Iodine (1131) in the Diagnosis of Lingual Thyroid," J.Am.Med.Ass., 140, 1154-1156 (1949)

(4) Evans, E. I. "Potassium Deficiency in Surgical Patients: Its Recognition and Management," Ann.Surg., 131 (1950)

Manuscripts:

(1) Nachman, H. M., G. W. James, J. W. Moore and E. I. Evans. "A Comparative Study of Red Cell Volumes in Human Subjects with Radioactive Phosphorus Tagged Red Cells and T-1824 Dye," J.Clin.Invest. (in press)

(2) Evans, E. I. "The Validity of Urine Chloride Estimations," Ann.Surg. (in press)

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NR-115-104: Shock Associated with Toxic Proteins (Unclassified)

CONTRACTOR: Indiana University, Indianapolis, Indiana

CONTRACT: W6ori-18001 (12/1/46 to 11/30/50)

INVESTIGATOR: D. E. Bowman

OBJECTIVE:

The purpose of this task is: (1) The investigation of the mechanism of shock associated with toxic proteins, particularly as related to enzyme systems, such as trypsin or the trypsin-like protease of plasma; (2) a study of the relation of the same enzymes to the process of blood coagulation and its deceleration or acceleration through the experimental use of enzyme inhibitors or enzymes modified to eliminate their shock effect.

PROGRESS THROUGH 30 JUNE 1950: In regard to blood coagulation, particular attention has been given to a trypsin inhibitor of soy beans which differs from the other bean enzyme inhibitors to which the author first called attention. The new inhibitor has the characteristics of a protease or small "protein". It has been found that this inhibitor and the other bean trypsin inhibitors are effective in greatly reducing pulmonary embolism in rabbits

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Clinical and nutritional biochemistry.

31 Dec 1949

PO 15402

ORR

See 21:

Research Group Code 442

- a. No change
b. Block 12 changed.

(a) (b) (d) no change.

- (c) One subtask has been added.
NRJ 20 975 Protein nutrition; St. Luke's Hospital, A. A. Albanese
Another subtask was mis-stated.
NRJ 20-019 (instead of 120-017) Chemistry of protein, J. H. Howard,
University of Cincinnati.

(e) Background and Purposes.

The general objective of this project is to elucidate the biochemical aspects of clinical and nutritional problems in order to maintain Naval personnel at the highest degree of alertness and efficiency under any and all Naval operating conditions.

Details of subtask progress are given in the attached subtask progress reports.

(f) See subtask progress reports for future plans.

(g) See subtask progress reports for complete bibliography of reports and articles.

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SUBTASK PROGRESS REPORT (C)

REPORT NO: W700-000

REPORT DATE: 31 Dec 1949

NR120-307: Distribution of gases, electrolytes, and water in the body.

CONTRACTOR: University of California, Berkeley, California.

CONTRACT NO: W700r-29504 (1 February 1947 - 30 June 1950)

INVESTIGATOR: Nello Pace

OBJECTIVES: The objectives of this study are: (a) to determine the distribution, retention, and elimination of inhaled carbon monoxide; and (b) to elucidate the physiological processes involved in the distribution of intravenously administered substances throughout the body fluids, cells, and cell accretions.

PROGRESS TO 31 DECEMBER 1949: (a) Studies of the tissue distribution of inhaled radioactive carbon monoxide ($C^{14}O$) reveal, in addition to the known fast and slow distribution components, a very fast component (half-time of 0.28 to 0.88 minute) which is believed to represent the mixing of carbon monoxide with blood. No liver retention of the labelled carbon monoxide has been observed, which suggests that the temporary liver retention sometimes is the result of liver engorgement during transient local anoxia. The rate of release of carbon monoxide by human subjects has been found to decrease with age, the half-time increasing 1% with each year. The rate of carbon monoxide elimination from the blood has been found to be a simple function of the alveolar oxygen partial pressure and the administration of pure oxygen in a recompression chamber at 2.5 atmospheres has been found to double the rate of elimination. Women have been found to eliminate carbon monoxide 30% faster than men, under comparable circumstances. (b) A technique for studying the distribution dynamics of intravenously administered substances has been perfected and applied to radioactive sodium (Na^{24}), radioactive sulfate (S^{35}), radioactive water (Tr_2O), and red blood cells labelled with radio phosphorus (P^{32}). Individual components of the distribution curves for these substances have revealed a relationship, of diagnostic interest, between the distribution time and cardio-vascular disease. The distribution curve components (from very fast to slow) are believed to represent such phases of mixing as: intra-vascular blood mixing, extra-vascular fluid mixing, penetration into cells and cell accretions (such as bone), and elimination (through the lungs, kidneys, sweat, feces, etc.). As an aid to the distribution studies, the estimation of total body water, fat, and bone has been attempted. Body density appears to be an index of total body fat, and total extra-vascular body water has been quantitated by measuring the dilution of radioactive water, administered intravenously.

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FUTURE PLANS: It is planned to study the distribution and uptake of radioactive isotopes by body tissues using a Geiger-Muller counter. The bone uptake of radioactive calcium (Ca 45) may aid the measurement of total body bone. Additional studies with radioactive sulfate, water, sodium, potassium, and red blood cells will be conducted. Sodium studies may offer a measurement of the true extra-cellular space; potassium studies, of the intra-cellular space. The effects of age on fluid transfer will be studied in normal young and aged test subjects. Radioactive blood cell studies should provide a means of observing the dynamics of intra-vascular mixing, and an attempt will be made to label the erythrocytes with a gamma emitting radio-isotope rather than the beta emitting radiophosphorus so that body surface measurements of blood mixing may be made. The mechanism of the sex difference in the carbon monoxide elimination rate will be studied by comparing the properties of hemoglobin and carboxyhemoglobin taken from men and women. The technique of estimating total body fat will be revised to include a correlation of the body density measurements with foreign inert gas (helium) distribution measurements.

LIST OF TECHNICAL REPORTS AND PUBLISHED ARTICLES:

Publications:

1. Pace, Nello; Loewinger, Robert; and Strajman, Enrique. In vivo Geiger-Muller gamma-ray counter for radioisotope distribution studies. Science, 107: 21-23, 1948.
2. Pace, Nello; Strajman, Enrique; and Walker Elaine. Influence of age on carbon monoxide distribution in man. Federation Proceedings, 7:89, 1948.
3. Pace, Nello; Strajman, Enrique; and Walker, Elaine. Acceleration of carbon monoxide elimination in humans by high pressure oxygen. Science, 111: In press, 1950
4. Warner, George F.; Pace, Nello; Strajman, Enrique; Siri, William E.; Johnston, Muriel E.; and Walker, Elaine L. Dynamics of the distribution of substances when introduced acutely into the human circulation. I. Arterial blood concentration of radiosodium 24 as a criterion of distributive events in normal individuals. In preparation.

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