Furthermore, the chronically infected patients failed to demonstrate delayed hypersensitivity to 2,4-DNFB, Candida, OT, SKSD, mumps and Trichophyton, whereas controls reacted to at least two of the antigens. Since IgA is the predominant salivary immunoglobulin, these patients may present another example of IgA deficiency in association with abnormalities of cellular immunity. Similar observations have been reported in ataxia-telangiectasia and thymectomized rodents. (SPR)

- 69 *Modification of Graft-Versus-Host Reaction with Anti-Lymphocyte Serum.* VINAI SUVATTE* and JOHN H. GITHENS. Univ. Colo. Med. Ctr., Denver, Colo.

The serious mortality and morbidity of the graft-versus-host reaction (GVHR) is a deterrent to the clinical use of bone marrow transplantation. In the present study, the GVHR has been significantly modified in mice by using anti-lymphocyte serum. A model of GVHR was produced in Balb/c newborn mice by injection of 6×10^6 viable adult C57B1 spleen cells intraperitoneally within the first 24 hours. Antilymphocyte serum was prepared by giving 3 intraperitoneal injections of 300×10^6 washed lymphocytes from adult C75B1 (mouse) lymph nodes and thymus into rabbits at weekly intervals. The antiserum was inactivated and absorbed with washed mouse red cells until free from hemagglutinins. The effectiveness of rabbit antimouse lymphocyte serum (RAMLS) was tested in vitro by cytotoxic and indirect fluorescent antibody tests, and in vivo by production of persistent lymphopenia. Thirty-one newborn Balb/c mice were treated with 0.1 ml. RAMLS intraperitoneally after the injection of 6×10^6 adult C57B1 spleen cells by 2 schedules: group I was started on day 3 and group II on day 1. The same dose was then administered every other day through the first 21 days. The incidence of runting and the mortality rate were compared with a spleen cell injected group of 26 newborn mice which received normal rabbit serum by the same dose schedule. In group I the were reduced from 88 % in the controls to 35 % in the anti-lymphocyte serum treated group. In group II the incidence of runting and the mortality rate at 21 days were reduced from 90 % in the controls to 0 % in the treated group. The results in both groups were statistically significant and indicate that the GVHR can be completely blocked by the early administration of anti-lymphocyte serum in mice. (SPR)

- 70 *Macrophage Formation from Isolated Lymphocytes in Tissue Culture.* HAROLD W. LISCHNER*, Temple Univ. Sch. of Med. and St. Christopher's Hosp. for Children, Philadelphia, Pa. (introduced by Victor C. Vaughan, III).

Circumstantial evidence for the conversion of lymphocytes into macrophages has accumulated for half a century, but attempts to demonstrate this change in tissue cultures of isolated lymphocytes have met with failure. In these latter studies lymphocytes were exposed in columns to glass, silicon, cotton or nylon surfaces during their separation from granulocytes and monocytes. Other data suggest that either contact with a foreign surface is injurious to lymphocytes or an important minor population of lymphoid cells sticks to such surfaces. For example, column-separated lymphocytes are not agglutinated by isoantisera to leukocytes, and they transform poorly into blastoid cells upon specific stimulation in tissue culture.

Lymphocytes were therefore purified, without significant surface contact, by magnetic removal of iron-laden phagocytes after incubation of whole defibrinated blood with micro-filings of iron. Erythrocytes were sedimented with the aid of gelatin. The resulting lymphocytes were agglutinated well by isoleukoagglutinins, and they underwent blastogenesis as readily as unseparated lymphocytes. One to 3 % macrophages regularly appeared in suspension cultures of these lymphocytes even though the preparations initially contained less than 0.2 % nonlymphoid nucleated cells. In monolayer cultures varying proportions of the lymphocytes attached to the surface and began to enlarge soon after culture. Other lymphocytes never did adhere to the glass. After one week most of the adherent cells had the typical morphologic features of macrophages and were phagocytic. It is apparent that at least one class of lymphocytes is capable of conversion into macrophages in the absence of nucleated cells. (Supported by NIH Grants AM-9112, AM-6469 and T1 HD-66) (SPR)

- 71 *Experimental Fetal Growth Retardation.* WILLIAM A. BLANC, Columbia Univ., Babies Hosp., Col. of Physicians and Surgeons, New York, N.Y.

Reduction of uteroplacental blood flow in one uterine horn of pregnant rats was achieved by Wigglesworth's technique (ligation of uterine vessels at lower end of one horn on the 17th day of pregnancy). Cesarean section was performed on the 21st day. Fetal death or stunting occurred in fetuses located near the ligation. The most stunted fetus was compared with the corresponding fetus in the normal horn and a statistical analysis of 35 such pairs was carried for fetal weight and organ/fetal weight ratio of all organs. Stunted newborns had a mean weight of 2.77 g vs. 4.76 for controls. The liver, lungs, and kidneys, were the most stunted, and were affected more than the fetus as a whole, whereas the brain, placenta, and heart were least affected. The ratios for thymus, spleen, pancreas, and submaxillary gland were not statistically different from those of controls. These observations are, in part, comparable with those made in human newborns in maternal hypertension and 'placental insufficiency'. Histologically the organs differed little from those of control fetuses, except for lack of glycogen in livers of stunted fetuses. Even very stunted organs appeared to have matured normally. These experiments extend and confirm Wigglesworth's data on the weight of liver, brain, and placenta. They support the suggested relationship between uterine blood flow and fetal growth. They show an interesting discrepancy in the effect on growth and on maturation. (SPR)

- 72 *Phenylalanine Hydroxylase Activity in Hyperphenylalanemia.* MARGARET E. O'FLYNN*, PARVIN JUSTICE* and DAVID Y.Y. HSIA*, Children's Memorial Hospital and Northwestern, Chicago, Ill. (introduced by Robert B. Lawson).

The recent widespread screening for phenylketonuria among newborn infants has lead to the recognition that not all instances of hyperphenylalanemia is caused by phenylketonuria (PKU). This paper describes enzyme studies in four patients with hyperphenylalanemia.

Case 1 is a patient with 'classical' PKU. Case 2 is an infant who was found to have a plasma phenylalanine (PPA) of 17 mg % at three weeks who showed 'mild' PKU. Case 3 is a 35y-year-old retarded female with

PPA values ranging from 6.6 mg % to 11.6 mg % on a regular diet. Case 4 is an infant with a PPA value of 45 mg % at 4 days and 76.4 mg % at 2 ½ weeks. She was treated with low-phenylalanine diet for 15 months and then returned to a regular diet. For the past 7 months on a regular diet, the PPA has ranged between 4.6 mg % and 10.7 mg %. Cases 3 and 4 may be viewed as hyperphenylalanemia without PKU.

Phenylalanine hydroxylase was determined by the method of LaDu and Zannoni and fresh liver obtained by biopsy. The results expressed as μM tyrosine¹⁴C formed/Gm protein/45 minutes were as follows:

	6 controls	Case 1	Case 2	Case 3	Case 4
Without DMTHP*	3.0 ± 1.6	0	0	1.6	0.6
With DMTHP*	57.0 ± 10.0	0	0	24.7	6.0

These data suggest that the 'classical' and 'mild' form of PKU probably have the same basic metabolic lesion. They show that hyperphenylalanemia without PKU is not caused by cofactor deficiency and represents a true 'partial' PKU as reflected by slightly elevated PPA, delayed clearance of phenylalanine by tolerance test and decrease of phenylalanine hydroxylase in liver. (APS)

* 2-amino-4-hydroxy-6,7-dimethyl-tetrahydropteridine

- 73 *The In Vitro Control of Calcification in Osteogenesis Imperfecta.* CLIVE C. SOLOMONS*, Univ. of Colo. Med. Ctr., Denver, Colo. (introduced by Donough O'Brien).

Previous work has implicated bone collagen obtained from patients with osteogenesis imperfecta as a potent inhibitor of the *in vitro* formation of bone mineral. The present investigation further examines the mechanism of inhibition and suggests a possibility for therapy. It was observed that the citrate-soluble fraction of bone collagen from two patients with the disease had a pyrophosphate content of 1.4 μm /mg collagen which is four times the normal value. Urinary excretion of pyrophosphate was also elevated. As pyrophosphates are thought to be inhibitors of calcification both *in vitro* and *in vivo* (FLEISCH, H. *et al.* Nature 212: 903-3 [1966]), the abnormal collagen was treated with the enzyme pyrophosphatase in the presence of Mg as cofactor during the *in vitro* mineralization procedure. It was found that Mg alone significantly increased the catalytic properties of osteogenesis imperfecta collagen and this effect was doubled when pyrophosphatase was present. These results suggest that collagen-bound pyrophosphate is partly responsible for the failure of bone matrix to calcify. The possibility that these patients need a high level of Mg as cofactor for their pyrophosphatase activity is being investigated. (Supported by U.S.P.H.S. AM 08757-03) (SPR).

- 74 *Hyperexcretion of Urinary Amino Acids and Phosphorus in the Vitamin D-Deficient Holtzman Rat.* JOHN GROSE*, CHARLES SCRIVER and JOHN FAWCETT*, McGill Univ.-Montreal Children's Hosp. Res. Instit., Montreal, Canada.

Hyperexcretion of urinary phosphorus, and free amino acids, resulting from diminished net tubular absorption, occurred in rats fed for 6 weeks or more, from weaning, on low calcium diets (0.02 %) and normal phosphorus intakes. The intensity of renal dysfunction was proportional to the degree of hypocalce-

mia below 6.5 mg %; the Vitamin D content of the diet was immaterial to the relationship; controls paired on 0.4 % calcium diets did not develop renal dysfunction. Intrapetitoneal calcium injected and parathyroidectomy suppressed the urinary hyperexcretion of amino acids and phosphorus; injection of parathyroid extract (LILLY) enhanced it. Rickets and bound hyperaminoaciduria also occurred in hypocalcemic animals; hydroxyproline, proline and glycine were particularly prominent in the bound fraction. Parathyroid glands showed increased mitoses and cellular hypertrophy, proportional to the severity of hypocalcemia, and irrespective of Vitamin D intake. The data imply that excess circulating parathyroid hormone, rather than Vitamin D deficiency itself, accounts for the bound aminoaciduria and impaired membrane transport of amino acids and phosphorus in Vitamin D deficiency. (Supported by M.R.C. Grant, MT-1085, and N.I.H. Grant, AM-05117) (SPR)

- 75 *Effect of Copper on Serum Ceruloplasmin Concentration.* NEIL HOLTZMAN*, GEORGE GRAHAM*, PATRICIA CHARACHE* and ROBERT HASLAM*, Johns Hopkins Univ. Sch. of Med., Baltimore, Md. (introduced by Robert E. Cooke).

The effects of the oral administration of copper were studied in 1. infants with nutritionally induced copper deficiency; 2. children receiving copper sulfate as an emetic after toxic ingestions. 1. Seven marasmic infants were rehabilitated with a high calorie-adequate protein-low copper diet. In 2 of them where initial determinations were performed, serum ceruloplasmin concentration was normal. With recovery and rapid growth, copper deficiency developed, and all 7 exhibited hypoceruloplasminemia. The intact metalloprotein was deficient both by oxidase and immunochemical assays. Apoceruloplasmin could not be detected immunochemically. Thus both the copper prosthetic group and the apoprotein were deficient. In each of the 7, ceruloplasmin levels rose after the administration of copper, 0.10-0.30 mg/kg/day. 2. Copper sulfate, 250 mg, was administered orally as an emetic to 4 children after toxic ingestions. Although vomiting occurred within 5 minutes, a rise of serum copper of 14, 22, 30 and 71 μg % was observed. Serum ceruloplasmin concentration increased significantly in 3 of the children within 12 hours. Thus it appears that copper either stimulates *de novo* synthesis of ceruloplasmin or combines with apoceruloplasmin in the liver to form the metalloprotein which is then released into the peripheral blood. It is possible that in Wilson's disease this mechanism may be impaired. Because copper is corrosive and absorbed, even after prompt emesis, it does not appear to be a safe emetic, as recently advocated, particularly when the agent ingested has the same effects as toxic doses of copper. (APS)

- 76 *Energy Substrates in the Normal Premature Newborn.* DHARMAPURI VIDYASAGAR*, JOHN J. DOWNES*, LOIS JOHNSON and THOMAS R. BOGGS, Section on Newborn Pediatrics, Penna. Hosp., Philadelphia, Pa.

Recent studies indicate the importance of lipid substrates in normal premature infants (VAN DUYN, 1959; PERSSON *et al.*, 1966). To determine the relationship of acid-base status to energy substrates, sequential arterialized pH, PaCO₂, BE (mEq/L) and venous FFA (mEq/L), ketones (mEq/L), and glucose (mg %) were determined in 36 newborns (1250-2500 gm)