Abstracts

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Biochemistry and nutrition

LIPID OXIDATION: BIOLOGIC EFFECTS AND ANTIOXIDANTS—A REVIEW. M.K. Logani, and R.E. Davies, (Center for Photobiology, Skin and Cancer Hospital, Temple Univ. Health Sci. Center, Philadelphia, PA 19140) *Lipids 15*(6), 485-95 (1980). The detection and measurement of lipid oxidation in biological systems and some biologic effects of this oxidation are reviewed. The role of lipid oxidation in the process of photocarcinogenesis and the protective effect of antioxidants against this process is also discussed. The mechanism of such protection is unknown and studies directed at elucidating the mechanism of antioxidant effect in photocarcinogenesis and in some other pathological conditions believed to involve lipid oxidation are needed. In addition to this, epoxidation of lipids observed in monolayer studies requires further investigation, particularly in the presence of some other unsaturated molecules. The possible significance of such a study particularly in the presence of polycyclic aromatic hydrocarbon carcinogens, where formation of epoxides is generally accepted as active intermediates is also discussed. In addition, present knowledge on the role of lipid peroxides in the destruction of proteins and biomembranes, in chemically induced toxicity and in generation of singlet oxygen is presented.

EFFECTS OF SEVERAL TYPES OF DIETARY FIBERS ON LIPID CONTENT IN LIVER AND PLASMA, NUTRIENT RETENTIONS AND PLASMA TRANSAMINASE ACTIVITIES IN FORCE-FED GROWING CHICKS. Y. Akiba and T. Matsumoto (Dept. of Animal Sci., Faculty of Agr., Tohoku Univ., Sendai, Japan). *J. Nutr. 110*(6), 1112-21 (1980). Lipid content and lipid composition of liver and plasma, nutrient retention and plasma transaminase activity were determined in White Leghorn male chicks that were force-fed a purified high energy diet supplemented with or without dietary fiber for 13 days. Plasma lipid concentration was significantly reduced by the cellulose, alfalfa meal and polyamide diets but was not influenced by the rice hull, rice hull NDF and peanut hull NDF diets. Retentions of energy, nitrogen and lipid were not depressed by addition of the dietary fibers. These findings suggest that the depression of liver lipid content by feeding certain dietary fibers is independent of the reduction of nutrient absorption in the force-fed growing chicks. Activities of glutamate-oxalacetate transaminase and glutamate-pyruvate transaminase were elevated by force-feeding and were reduced by feeding the cellulose, rice hull NDF, alfalfa meal and polyamide diets. It is suggested that dietary fibers are effective not only in reducing the liver lipid content but also in alleviating liver dysfunction induced by force-feeding in growing chicks, although mechanism of action of each dietary fiber may not be identical.

EFFECTS OF METHIONINE SUPPLEMENTATION ON THE INCIDENCE OF DIETARY FAT INDUCED MYOCARDIAL LESIONS IN THE RAT. M.T. Clandinin and S. Yamashiro (Dept. of Nutr. and Food Sci., Faculty of Med., Univ. of Toronto, Toronto, ON M5S 1A8) *J. Nutr. 110*(6), 1197-203 (1980). Purified diets were prepared to evaluate the effect of methionine supplementation on the incidence and severity of vegetable oil-induced myocardial lesions in the rat. The unsupplemented basal diet fed was similar in nutrient composition to typical semipurified diets currently utilized for cardiopathogenic evaluation of dietary rapeseed oils and contained 1.276 mg of S-amino acid per kilocalorie. The methionine-supplemented diet contained an additional 0.27% (w/w) L-methionine or a total of 1.815 mg of S-amino acid per kilocalorie. Feeding trials were conducted in which weaning rats were fed either a diet containing 20% (w/w) soybean oil (SBO), low erucic acid rapeseed oil (LER) or high erucic acid rapeseed oil (HER) for 16 or 28 weeks. Dietary supplementation with methionine was found to reduce the incidence of focal myocardial lesions in SBO-fed animals to zero. These results suggest that marginal deficiencies in methionine may interact with the frequency and severity of myocardial changes reported for Sprague-Dawley rats fed various dietary oils. The results indicate that level of essential nutrients should be adjusted when the energy level of the diet is increased.

MOLECULAR SPECIES COMPOSITION OF PHOSPHATIDYLCHOLINES DURING THE DEVELOPMENT OF THE AVIAN EMBRYO BRAIN. J.M. Gonzalez-Ros and A. Ribera (Dept. of Biochem., Faculty of Bio., Universidad Complutense de Madrid, Madrid-3, Spain). *Lipids 15*(5), 279-84 (1980). A comparative approach has been used to investigate the molecular species composition of phosphatidylcholine (PC) and its age variation throughout several developmental stages of chick and duck embryo brains. The brain PC consist of 15 major molecular species which do not undergo appreciable variation in their relative abundance either during embryonic development or between equivalent stages of maturation in the 2 avian species. In fact, a highly invariable molecular architecture of PC is shown in the developing organ. Molecular species containing saturated or monounsaturated fatty acids were dominant in all stages of development of the avian embryo brain. Among these molecular species, 1,2,-dipalmitoyl-*sn*-glycero-3-phosphocholine, 1,palmitoyl-2-oleoyl-*sn*-glycero-3-phosphocholine accounted for 75-80% of the total PC.

SERUM AND LIVER LIPIDS IN GROWING RATS FED CASEIN WITH L-LYSINE. P. Hevia, F.W. Kari, E.A. Ulman and W.J. Visek (School of Basic Medical Sciences and Clinical Medicine, Univ. of Illinois, Urbana, IL 61801) *J. Nutr. 110*(6), 1224-30 (1980). Liver and serum lipid concentrations were studied in rats fed 7.5, 15 and 30% casein supplemented with 0, 2.5 and 5% lysine. Increasing dietary casein from 7.5 to 15% increased serum total lipids, triglycerides and cholesterol. When casein was increased from 15-30%, there was a further increase in plasma cholesterol and a decrease in triglycerides. Rats fed 7.5% casein alone developed fatty livers. Adding 5% lysine to 15% casein caused fatty livers but prevented them with casein at 7.5%. Lysine had no effect on total liver lipids with casein at 30%. The lipids of the fatty livers with 7.5% casein or with lysine were similar in composition. In both cases liver triglycerides increased fourfold and cholesterol twofold. Phospholipids remained unchanged and liver glycogen decreased. Excess dietary lysine did not change serum lipids and glucose significantly. The data show that excess lysine caused changes in lipid metabolism which varied with the quantity of casein fed. The hypercholesterolemia with casein feeding seen by others appears unrelated to the high lysine content of this protein.

UTILIZATION OF POLYUNSATURATED FATTY ACIDS BY HUMAN DIPLOID CELLS AGING IN VITRO. R.D. Lynch (Dept. of Bio. Sci., Univ. of Lowell, Lowell, MA 01854) *Lipids 15*(6), 412-20 (1980). Cultures of human diploid cell strain IMR-90 were supplemented with α-linolenic acid, 18:3ω6, by constant infusion over 72 hr. Cell growth was twice that observed when the same amount of fatty acid was supplied as a single dose at the start of a 72-hr incubation. The age of these cells in vitro was measured in terms of the culture mean population doubling level (PDL). The polyunsaturated fatty acid (PUFA) levels in cell phospholipids were reduced by exogenous oleic acid to half that of nonsupplemented cells at all PDL tested. Conversely, the PUFA levels in phospholipids were elevated by a factor of 1.6 at all PDL when cultures were infused with 18:3ω6. Triglyceride levels at the end of 72 hr were similar, but much higher than the controls, regardless of the fatty acid supplied. Growth inhibition, modification of phospholipid acyl group content and triglyceride levels were not appreciably affected when the amount of monoenoic or polyenoic fatty acid infused into the cultures was doubled. The elongation of 18:3, as well as the distribution of 18:3 and its elongation products, between triglyceride and phospholipid, was dependent on whether the 18:3 was of the ω3 or ω6 family.

CHANGES IN HOST ANIMAL PLASMA LIPIDS DURING HEPATOMA GROWTH. M. Matocha and R. Wood (Dept. of Biochem. and Biophys., Texas Agr. Experiment Station, Texas A & M Univ. System, College Station, TX 77843) *Lipids 15*(6), 421-7 (1980). The concentrations of the major neutral lipid and phospholipid

classes in the plasma of rats bearing hepatoma 7288CTC were determined at various times after transplantation. The fatty acid composition of each lipid class was also analyzed quantitatively as tumor growth progressed. Generally, most lipid classes exhibited a slight decrease between the third and sixth day after transplantation, returned to near normal levels by the 15th day, increased dramatically and peaked between the 24th and 27th days before plummeting sharply. At peak concentrations, triglycerides were increased 5 times the normal levels, whereas cholesterol, cholesteryl esters and phosphatidylcholines were increased 3-fold. In addition to monounsaturated fatty acids, lysophosphatidylcholines and phosphatidylcholines showed relatively large decreases in the percentages of polyunsaturated fatty acids with increased tumor growth. These results indicate that hepatoma 7288CTC can cause perturbation of host animal plasma lipids in the early stages of growth which precedes the massive hyperlipidemia. The interpretation of these results suggests that the early changes in plasma lipids may result from alterations in the normal lipid metabolism of the host, and the hyperlipidemia that develops later may result from the mobilization of lipids to compensate for the altered metabolism.

CHANGES IN PLASMA LIPIDS AND LIPOPROTEINS IN *MACACA NEMESTRINA* DURING PREGNANCY AND THE POSTPARTUM PERIOD. M.R. McMahan, T.B. Clarkson, G.P. Sackett, and L.L. Rudel (Arteriosclerosis Res. Center, Bowman Gray Schl. of Med. of Wake Forest Univ., Winston-Salem, NC 27103) *Proc. Soc. Exp. Biol. Med. 164*(2), 199-206 (1980). Plasma lipid concentrations and the relative distribution of lipoprotein fractions were examined in pregnant and postpartum female *Macaca nemestrina* while the animal consumed a control diet of Monkey Chow and again after the animals had consumed a diet of Monkey Chow-cholesterol-lard for 4½ months. Plasma high-density lipoprotein cholesterol (HDL-chol) concentrations decreased dramatically during the first 65 days of pregnancy and remained at a low level until parturition when there was a rapid increase to the level maintained throughout the postpartum period. Plasma low-density lipoprotein + very low-density lipoprotein cholesterol (LDL + VLDL-chol) concentrations increased slightly only in the latter days of pregnancy and did not change after parturition. Dietary challenge caused an increase in total plasma cholesterol and LDL + VLDL-chol concentrations, but did not override the changes in HDL-chol concentrations caused by pregnancy. Plasma triglyceride concentrations increased during the latter stages of pregnancy and were affected by diet only during the postpartum period. The net result of the lipoprotein changes during pregnancy was for the LDL to HDL ratio to increase significantly as a result of the decrease in HDL concentrations.

EFFECT OF LONG-TERM ANTIHYPERTENSIVE AND HYPOLIPIDEMIC TREATMENT OF HIGH DENSITY LIPOPROTEIN CHOLESTEROL AND APOLIPOPROTEINS A-I AND A-II. T.A. Miettinen, J.K. Huttunen, C. Ehnholm, T. Kumlin, S. Mattila and V. Naukkarinen (Second Dept. of Med., Univ. of Helsinki and public Health Lab. of Finland, Helsinki (Finland)). *Atherosclerosis 36*(2), 249-59 (1980). The concentrations of total serum cholesterol and triglycerides and serum HDL cholesterol, triglycerides and apoproteins A-I and A-II were measured in 119 men after 4 years of active participation in a multifactorial primary prevention trial of coronary heart disease. The levels of both HDL cholesterol and apoportein A-I were lower in the men treated with probucol than in the controls, whereas that of A-II was within the control limits. The ratio HDL cholesterol/apoprotein A-I was subnormal in all 3 groups treated with lipid-lowering drugs, as if the treatment had lowered the cholesterol saturation of the HDL fraction. The levels of HDL cholesterol and apoprotein A-I were negatively correlated with the length of the treatment in subjects treated with probucol but not in the other groups. These results suggest that in long-term use, probucol and possibly clofibrate lower both the concentration and the cholesterol/apoprotein ratio of the HDL fraction.

EFFECT OF DIETARY *LUNARIA* OIL ON CHICK GROWTH AND ORGAN LIPID CONTENT. A.J. Sheppard, J.C. Fritz, and T.S. Rudolf (Div. of Nutr., Food and Drug Administration, Washington, DC 20204) *Poult. Sci. 59*(7), 1455-9 (1980). An experiment was conducted to determine the effects of feeding *Lunaria* oil to chicks. A diet containing *Lunaria* oil produced poorer growth and lower feed conversion than one containing corn oil. White Plymouth Rock chicks had apparent digestibility values of 89.9% and 55.8% for corn and *Lunaria* oil, respectively. Gas-liquid chromatographic analysis of heart, liver, and body cavity lipids (fat) showed that more erucic and nervonic acids accumulated in the fat of the birds fed *Lunaria* oil than in the fat of those fed corn oil.

EFFECTS OF LINOLENIC ACID DEFICIENCY ON THE FATTY ACID PATTERNS IN PLASMA AND LIVER CHOLESTERYL ESTER, TRIGLYCERIDES AND PHOSPHOLIPIDS IN FEMALE RATS. J. Tinoco, G. Endemann, I. Hincenbergs, B. Medwadowski, P. Miljanich and M.A. Williams (Dept. of Nutr. Sci., Univ. of California, Berkeley, CA 94720) *J. Nutr. 110*(7), 1497-505 (1980). These experiments were performed to measure the effects of linolenate deficiency upon neutral lipids of plasma and liver, and to search for a metabolic interaction between dietary choline and linolenic acid. Rats were fed for two generations on a linolenic acid-deficient diet containing methyl linoleate as the only source of lipid. Control rats were supplemented with methyl linolenate. Second-generation linolenate-deficient rats and control rats were fed low-methionine, choline-deficient diets for 2 weeks. Half the animals in each group were given choline-supplemented diets. Plasma and liver total cholesterol, esterified cholesterol, triglyceride and major phospholipid classes, and the fatty acids of these classes were measured. Linolenic acid deficiency reduced the concentrations of plasma triglycerides in both choline-deficient and choline-supplemented rats. Evidence for a metabolic interaction between choline and linolenic acid was not obtained because the rats responded very weakly to the choline deficiency. Linolenate deficiency reduced the proportions of n-3 fatty acids, particularly 22:6n-3, in all the lipids analyzed.

SERUM LIPOPROTEINS AND CORONARY ARTERY DISEASE (CAD). COMPARISON OF THE LIPOPROTEIN PROFILE WITH THE RESULTS OF CORONARY ANGIOGRAPHY. H. Wieland, D. Seidel, V. Wiegand and H. Kreuzer (Dept. of Clin. Chem. and Cardiology, Med. Univ. Clinic, Robert Koch Strasse 40, D-3400 Göttingen (F.R.G.)) *Atherosclerosis 36*(2), 269-80 (1980). The presence or absence of coronary artery disease was established by coronary angiography in 181 male patients (aged 40-60 years). No marked differences were seen in the concentrations of serum triglycerides, pre-β-lipoprotein cholesterol or α-lipoprotein cholesterol. A combination of critical values for the concentrations of serum cholesterol and β-lipoprotein cholesterol and α-lipoprotein cholesterol and for the β-lipoprotein/α-lipoprotein ratio could be established. If exceeding at least two of the three critical values was used as the cut-off point between the two groups of patients, a maximum differentiation of 50% could be achieved (81% correctly classified patients vs. 31% incorrectly classified). Introduction of the β-lipoprotein/α-lipoprotein ratio as criterion shifts the range of differentiation favorably, increasing it by about 10%. This effect cannot be achieved by regarding the level of α-lipoprotein cholesterol as criterion.

DETERMINANTS OF HEPATIC UPTAKE OF TRIGLYCERIDE-RICH LIPOPROTEINS AND THEIR REMNANTS IN THE RAT. E. Windler, Y. Chao, and R.J. Havel (Cardiovascular Res. Inst. and Dept. of Med., Univ. of Calif., San Francisco, Calif., 94143) *J. Biol. Chem. 225*(11), 5475-80 (1980). The uptake and metabolism of lymphatic large chylomicrons from fat-fed rats, lymphatic small chylomicrons from glucose-fed rats, and hepatic very low density lipoproteins from perfusates of isolated livers, and of remnants produced from these lipoproteins in functionally eviscerated rats were studied in the isolated, perfused rat liver. All lipoproteins were labeled isotopically in their cholesteryl ester and triglyceride moieties. Uptake of the labeled lipids of large chylomicrons was slow and limited, but these lipids in small chylomicrons and hepatic very low density lipoproteins were taken up and metabolized progressively and at equal rates. Incubation with very low density lipoprotein-free plasma increased the content of C apolipoproteins in small chylomicrons and hepatic very low density lipoproteins and greatly retarded the hepatic uptake of their labeled lipids. In remnants from all sources, which are depleted of C apolipoproteins but not of apolipoprotein E, the labeled lipids were rapidly taken up and metabolized. These results are consistent with the hypothesis that one or more of the C apolipoproteins opposes and apolipoprotein E promotes recognition of triglyceride-rich lipoproteins by a hepatic receptor.

BODY FAT CONTENT AND SERUM LIPID LEVELS. S. Matter, A. Weltman, and B.A. Stamford (Exercise Physiology Laboratory, University of Louisville, Louisville, KY) *J. Am. Diet. Assoc. 77*,149 (1980). The relationship between the percentage of body fat and serum lipids was studied in middle-aged persons (112 men and ninety-two women) whose body fat levels were determined by hydrostatic weighing. Individuals classified as "overfat" exhibited significantly higher total serum cholesterol and total serum triglycerides than those classified as "normal fat." A trend for lower high-density-lipoprotein cholesterol levels in overfat women and higher low-density-lipoprotein cholesterol in both overfat men and women was observed. Overfat men and women had significantly higher very-low-density-lipoprotein cholesterol levels. These findings suggest that an accumulation of excess body fat may result in unfavorable serum lipid levels.

EXPERIENCE IN CHANGING FOOD HABITS OF HYPERLIPIDEMIC MEN AND WOMEN. M.L. Mojonnier et al., (Chicago Heart Association *J. Am. Diet. Assoc.* 77:140 (1980). In this study, the

following were planned and tested: Methods of changing adult eating habits to conform with dietary principles for lowering serum lipids; a method to assess adherence to dietary modifications; and use of nutrition aides as instructors. Six slide-tape units—tested by individual, group, and self-teaching methods, and a combination of these—were effective as judged by such indicators as lowered serum cholesterol, reduced intake of saturated fat and dietary cholesterol, and increased intake of polyunsaturated fat. The Diet Achievement Score is an effective tool for assessing adherence. Nutrition aides proved useful in this study, when effectively supervised by professional nutritionists.

STUDIES ON PLASMA LIPOPROTEINS DURING ABSORPTION OF EXOGENOUS LECITHIN IN MAN. F.U. Beil and S.M. Grundy (Dept. of Medicine, Veterans Administration Medical Center and University of California, San Diego, CA 92161). *J. Lipid Res. 21*(5), 525-36 (1980). Human subjects were infused intraduodenally with either lecithin (150 mg/kg/hr) or safflower oil (100 mg/kg/hr) of similar fatty acid composition, and plasma lipoproteins were studied when constant plasma lipid levels were reached. Both types of fat induced increases of lipoproteins of $S_f > 400$ (chylomicrons) and $S_f 20$ 400 (VLDL). Lecithin infusions produced increases predominantly in VLDL, whereas infusion of safflower oil induced mainly chylomicrons. Chylomicrons derived from lecithin were generally smaller and had a higher phospholipid:triglyceride ratio (mean 0.15) than those produced during safflower oil infusions (mean 0.08). The increases in VLDL from both lipids occurred mainly in larger particles of this density range. This "incremental VLDL" had a lower cholesterol:triglyceride ratio (0.098) than preinfusion VLDL (0.283) and probably represented "small chylomicrons" of gut origin. The differences in lipoproteins resulting from infusion of lecithin and safflower oil in human subjects were not observed in rats, in the latter, lecithin induced large chylomicrons to the same extent as did safflower oil. Lecithin absorption measured over 50- or 100- cm intestinal segments averaged 41%, but was probably greater over the whole of the small intestine. Lecithin infusion unexpectedly was found to decrease markedly the absorption of cholesterol in the upper part of the small intestine.

THE INFLUENCE OF UREA ON LIPOGENESIS IN RENAL PAPILLAE OF RATS. I.N. Bojesen (Inst. of Experimental Hormone Res., Univ. of Copenhagen, Nørre Alle 71, DK-2100 Copenhagen, Denmark) *Lipids 15*(7), 519-23 (1980). The osmolality has been determined for the papillary interstitial fluids obtained from the isolated papillae of rats in different states of water balance. Hypertonic buffers for in vitro experiments were prepared by addition of urea to regular Krebs-Ringer phosphate buffers (340 mosmol/kg H_2O) since urea is the most changeable solute of the renal papillary tissue in response to external influences. The effect of such hypertonic buffers on papillary lipogenesis was very pronounced. The fatty acid synthesis from acetate decreased by a factor of 7-9 in response to increased osmolality from 340 to 1370 mosmol/kg H_2O. In the physiological range of osmolalities (500-1800 mosmol/kg H_2O), the de novo synthesis of papillary glycerolipids from glucose decreased by a factor of ca. 5. A possible specific inhibitory effect of hypertonic buffers on the pentose phosphate cycle was studied with a negative result. It is concluded that the addition of urea causes a decrease of total energy metabolism in the tissue.

STIMULATION AND SUPPRESSION OF 3-HYDROXY-3-METHYLGLUTARYL COENZYME A REDUCTASE IN NORMAL HUMAN FIBROBLASTS BY HIGH DENSITY LIPOPROTEIN SUBCLASSES. W.H. Daerr, S.H. Gianturco, J.R. Patsch, L.C. Smith and A.M. Gotto, Jr. (Dept. of Med., Baylor College of Med. and The Methodist Hospital, Houston, TX 77030) *Biochim. Biophys. Acta 619*(2), 287-301 (1980). Plasma concentration of high density lipoproteins$_3$ (HDL_3), a subclass of HDL, are relatively constant, while those of HDL_2 are variable. We report that HDL_2 suppress, while HDL_3 stimulate 3-hydroxy-3-methylglutaryl-CoA reductase (EC 1.1.1.34) activity in normal human fibroblasts. HDL_3, which contained no detectable HDL_2 or low density lipoproteins, stimulated 3-hydroxy-3-methylglutaryl-CoA reductase activity 2-fold from 60 to 120 pmol/mg per min. HDL_2 consistently suppressed 3-hydroxy-3-methylglutaryl-CoA reductase in normal fibroblasts by 20-50% at 80 μg HDL_2 protein/ml. Mixtures of HDL_2 and HDL_3 suppressed when HDL_2 were greater than 35% of the total HDL. The suppressive effects of HDL_2 were abolished by treatment with 0.1 M cyclohexanedione and restored by regeneration of arginyl residues, suggesting an apolipoprotein-meditated suppressive mechanism. These results show that variations in culture conditions and differences in the proportions of HDL subclasses must be considered in the interpretation of studies investigating cellular responses to HDL.

FACTORS AFFECTING FATTY ACID OXIDATION IN BOVINE MAMMARY TISSUE. G.P. Dimenna and R.S. Emery (Dept. of Dairy Science, Michigan State University, East Lansing, MI 48824) *Lipids 15*(7), 497-503 (1980). Oxidation of fatty acids was studied in bovine mammary tissue slices in order to evaluate their potential contribution to energy metabolism. Rates of fatty acid oxidation decreased with increasing chain length: acetate > octanoate > palmitate or oleate. Rates of oxidation of long chain, but not short chain, fatty acids increased over time, which could not be explained by carnitine palmitoyl-transferase (CPT) activity. This phenomenon is not an artifact of the incubation system or caused by substrate solubility, as rates of palmitate oxidation were constant in rat kidney cortex slices. Glucose inhibited palmitate oxidation (67%) and stimulated esterification. Low palmitoyl-CoA levels would favor glyceride synthesis over oxidation, since the apparent K_m for palmitoyl-CoA of the glycerol-3-phosphate acyltransferases is lower than that for CPT. Thus, glucose presumably diverts palmitate from oxidation to glycerolipids. Clofenapate, a glyceride synthesis inhibitor, decreased triacylglycerol formation, and marginally increased palmitate oxidation. We estimated that long chain fatty acids can potentially account for 6-10% of the oxidative metabolism of mammary tissue.

ABNORMAL SUPPRESSION OF 3-HYDROXY-3-METHYLGLUTARYL-CoA REDUCTASE ACTIVITY IN CULTURED HUMAN FIBROBLASTS BY HYPERTRIGLYCERIDEMIC VERY LOW DENSITY LIPOPROTEIN SUBCLASSES. S.H. Gianturco, C.J. Packard, J. Shepherd, L.C. Smith, A.L. Catapano, H.D. Sybers and A.M. Gotto, Jr. (Dept. of Med., Baylor College of Med. and the Methodist Hospital, Houston, TX 77030). *Lipids 15*(6), 456-63 (1980). Our previous studies showed that hypertriglyceridemic very low density lipoproteins (HTG VLDL) are functionally abnormal. HTG VLDL, but not normal VLDL, suppress HMG-CoA reductase in cultured normal human fibroblasts. The VLDL abnormality is apparently associated with hypertriglyceridemia and not hypercholesterolemia, since VLDL from a homozygous familial hypercholesterolemia patient with a Type IIa pattern did not suppress whereas each of the VLDL subclasses from a Type IIb patient suppressed. There were no consistent major compositional differences between comparable normal and hypertriglyceridemic VLDL subclasses which could account for differences in suppression. All VLDL subclasses from Type III subjects were enriched in cholesteryl esters and depleted in triglyceride, relative to the corresponding normal VLDL subclasses. However, Type IV and Type V VLDL subclasses were normal in this respect. We conclude from these studies that small particle diameter is not required for suppression, since HTG $VLDL_1$ and $VLDL_2$ which contained few, if any, small particles were effective in suppression.

METABOLISM OF HYDROXY STEROLS BY RAT LIVER. G.F. Gibbons, C.R. Pullinger, T.A. Baillie and R.A. Clare (Med. Res. Council, Lipid Metabolism Unit, Hammersmith Hospital and Dept. of Clinical Pharmacology, Royal Postgraduate Med. Schl., Ducane Road, London W12 OHS (UK)). *Biochim. Biophys. Acta 619*(1), 98-106 (1980). 5α-[16-^{3}H] lanost-8-ene-3β,15α diol and 5α-[16-^{3}H] lanost-8-3β,15β-diol were both extensively metabolised by rat liver enzymes in vitro. Quantitatively, the most important product in both cases was a more polar compound, tentatively identified as a 5α-lanost-8-enetriol. In addition, 5α-[16-^{3}H] lanost-8-ene-3β,15β-diol gave rise to the corresponding 3β,15β-diol diester, whilst with 5α-[16-^{3}H] lanost-8-ene-3β,15α-diol only the 3β-hydroxyl group was esterified. The enzymes involved may normally be responsible for metabolising spontaneously produced non-enzymic oxidation products of dietary or cellular cholesterol. High concentrations of 5α-[16-^{3}H] lanost-8-ene-3β,15β-diol stimulated ester formation. With both substrates, carbon monoxide inhibited formation of the polar sterol metabolite but stimulated ester formation. Under all conditions, cholesterol was a relatively minor metabolic product of either of the 5α-lanost-8-ene-3β,15β-diols.

HYPERLIPIDEMIA AND ATHEROSCLEROSIS IN JAPAN. Y. Goto (Dept. of Med., Keio Univ. Schl. of Med., 35 Shinanomachi, Shinjuku-ku, Tokyo 160, Japan) *Atherosclerosis 36*(3), 341-49. Blood lipid levels have in general progressively increased in Japan over the years 1960-1978. Although the ischemic heart disease mortality is still low in Japan, it has been markedly increasing over this period. It could be that the increased IHD mortality reflects a greater proportion of fat and protein in the modern Japanese diet. However, at least a part of this increase could reflect the increasing age of the population. HDL cholesterol levels are higher in the Japanese than in the West: evidence is presented that this is environmental in origin rather than genetic.

CIGARETTE SMOKE AFFECTS LIPOLYTIC ACTIVITY IN ISOLATED RAT LUNGS. J. Hartiala, J. Viikari, E. Hietanen, H. Toivonen and P. Uotila (Dept. of Physiology and Dept. of Internal Med., Univ. of Turku, 20520 Turku 52, Finland) *Lipids 15*(7), 539-43 (1980). Isolated perfused rat lungs liberated fatty acids at a rate of 15 μmol/hr during perfusion of triglyceride-rich medium

through the pulmonary vascular bed. About 80% of this activity seemed to result from lipoprotein lipase and 20% to hormone-sensitive lipase. Ventilation of the lungs with cigarette smoke instead of air during the perfusion reduced fatty acid liberation by 23%. Pre-exposure of rats to cigarette smoke for either 1 or 10 days did not cause significant changes in lung lipolytic activity compared to sham-exposed controls.

SERUM LIPIDS OF RATS FED EXCESS L-LYSINE AND DIFFERENT CARBOHYDRATES. P. Hevia, E.A. Ulman, F.W. Kari and W.J. Visek (Schl. of Basic Med. Sci. and Clin. Med., Univ. of Illinois, Urbana, IL 61801) *J. Nutr. 110*(6), 1231-9 (1980). Liver and serum lipids were compared in male weanling rats fed 15% casein plus 5% lysine, threonine, valine or glutamic acid for 14 days. Lys increased liver total lipids, triglycerides and cholesterol 200, 600 and 200%, respectively without affecting serum lipids. Thr and Val also increased liver triglycerides but only about 200%. Val feeding was associated with hypertriglyceridemia whereas arginine and Glu produced a slight hypercholesterolemia. Neither glucose or fructose affected the liver lipid accumulation of 5% Lys but glucose with Lys reduced serum lipids. Rats fed 5% Lys for 6 weeks had no fatty livers. The data show that Lys but not Arg, Thr, Val of Glu altered lipid metabolism and caused accumulation of lipids in the livers. Liver lipid accumulation was less pronounced with dextrin sucrose versus sucrose alone. The effect of sucrose was apparently not due to either glucose or fructose nor to a lack of cellulose. The Lys-induced fatty liver was almost completely prevented by Arg and appears due to Lys-Arg antagonism.

EFFECTS OF DIETARY PROTEIN ON TURNOVER, OXIDATION, AND ABSORPTION OF CHOLESTEROL, AND ON STEROID EXCRETION IN RABBITS. M.W. Huff and K.K. Carroll (Dept. of Biochem., U of Western Ontario, London, Ontario, Canada N6A 5C1). *J. Lipid Res. 21*(5), 546-58 (1980). Rabbits fed a low fat, cholesterol-free, semi purified diet containing casein became hypercholesterolemic (∼300 mg/dl) after 5 weeks on diet. Rabbits on a similar diet containing soy protein isolate had low plasma cholesterols comparable to those on commercial feed (40-60 mg/dl). Cholesterol turnover, which conformed to a two-pool model, was determined by analysis of the decay of plasma cholesterol specific activity after a single intravenous injection of [26-^{14}C] cholesterol. Rabbits on the soy protein diet or commercial feed showed a much faster rate of cholesterol turnover and a reduced size of pool A compared to rabbits on the casein diet. They also oxidized [26-^{14}C] cholesterol to respiratory $^{14}CO_2$ at much faster rates. Analysis of fecal steroids by gas-liquid chromatography indicated that bile acid and neutral steroid excretion was increased on the soy protein and commercial diets, relative to the casein diet. Cholesterol was absorbed to a greater extent in the casein diet. Addition of 15% (w/w) butter to the semipurified diets had little effect on the above parameters of cholesterol metabolism. Comparison of cholesterol turnover measured by kinetic analysis, combined sterol balance, or anlaysis of fecal steroids by gas liquid chromatography, showed that all three methods gave similar results. Measurement of bile acid production by oxidation of [26-^{14}C] cholesterol to respiratory $^{14}CO_2$ also gave results comparable to those obtained by analysis of fecal bile acids.

BIOSYNTHESIS AND TURNOVER OF INDIVIDUAL MOLECULAR SPECIES OF PHOSPHATIDYLCHOLINE IN LIVER AND BILE. T. Kawamoto, G. Okano and T. Akino (Dept. of Biochem., Sapporo Medical College, Sapporo 060 Japan) *Biochim. Biophys. Acta 619*(1), 20-34 (1980). The individual molecular species of rat liver diacylglycerol and phosphatidylcholine, and bile phosphatidylcholine were analyzed and the metabolism of the individual molecular species of liver and bile phosphatidylcholines was studied using bile fistula rats. Bile phosphatidylcholine contained more palmitoyl-linoleoyl, and less stearoyl-linoeoyl and stearoyl-arachidonyl species than liver phosphatidylcholine. More rapid incorporation of [2-^{3}H] glycerol into palmitoyl-oleoyl and palmitoyl-linoleoyl species of phosphatidycholine in bile as compared with that in the liver was found. This result seems to support the concept that a specific subpool, termed a dynamic pool, of phosphatidylcholine in the liver appears to serve for bile phosphatidycholine. It was noted that liver phosphatidylcholine species in the dynamic pool have the same specific activity as that of bile phosphatidylcholine, and the size of the dynamic pool is about 5% of the total liver phosphatidylcholine. The turnover rate of palmitoyl-linoleoyl phosphatidylcholine in the dynamic pool was very rapid, and was almost the same as the formation rate of the phosphatidylcholine species for the corresponding species of diacylglycerol.

REGULATION OF CHOLESTEROL METABOLISM IN HUMAN LYMPHOCYTES. W. Krone and G. Schettler (Klinisches Institut für Herzinfarktoforschung and der Medizinischen Universitatsklinik, Bergheimer Strasse 58, 6900 Heidelberg F.R.G.) *Atherosclerosis 36*(3), 423-26. Freshly isolated human lymphocytes can be used to study the regulation of cholesterol metabolism in both normal and hypercholesterolaemic subjects. Experiments using cordycepin (a specific inhibitor of messenger RNA Synthesis) indicate that neither the induction of the rate-limiting enzyme of cholesterol biosynthesis (HMG-CoA reductase) by lipid-depleted serum nor the subsequent repression of the enzyme by low density lipoprotein accord with increased or decreased synthesis of messenger RNA. Thus, low density lipoprotein probably regulates HMG-CoA reductase at a post-transcriptional level. In familial hypercholesterolaemia, cells appear to lack effective high-affinity receptor for low density lipoprotein, and this prevents the lipoprotein from suppressing HMG-CoA reductase and cholesterol synthesis.

EFFECT OF DIETARY FATTY ACID COMPOSITION ON THE BIOSYNTHESIS OF UNSATURATED FATTY ACIDS IN RAT LIVER MICROSOMES. N. Kurata and O.S. Privett (The Hormel Inst., Univ. of Minnesota, Austin, MN 55912) *Lipids 15*(7), 512-8 (1980). A study was made on the influence of semisynthetic diets of low and high unsaturation on the fatty acid composition and desaturation-chain elongation enzymatic activity of the liver microsomal fractions of male Sprague-Dawley rats of different ages. Both the level and composition of the dietary fat supplements produced marked effects on the fatty acid composition of the liver microsomal lipids. In general, the fatty acid composition of the microsomal fractions reflected that of the dietary fat and was more unsaturated with the higher level of fat fed. The rate of conversion of linoleic to arachidonic acid in assays perfomed in vitro with liver microsomal preparations from animals of the different groups also showed marked differences. The data suggest that the activity of the 6-desaturase-chain elongation system is regulated by the fatty acid composition of the microsomal lipid as influenced by the composition of the dietary fat.

EFFECT OF A HIGH FAT DIET ON BODY COMPOSITION, CELLULARITY, AND ENZYME LEVELS DURING EARLY DEVELOPMENT OF THE RAT. R.J. Martin and J.H. Herbein (Dept. of Dairy and Animal Sci., The Pennsylvania State Univ., University Park, PA 16802) *Proc. Soc. Exp. Biol. Med. 164*(3), 341-6 (1980). A high fat (60%) and a low fat (50%) diet were fed to female rats during gestation and lactation and to their male and female offspring for 3 weeks postweaning. The cellular effects of feeding all combinations of the two diets during the three growth periods (gestation, lactation, and rapid growth) were determined in Wistar rats. "Nutritional imprinting" of earlier dietary regimes on enzyme profiles and adipose cell number was not observed after rats were fed a control diet to maturity. The high fat diet caused reduced fat deposition during gestation. During lactation, the high fat diet caused increased fat deposition. Postweaning rats had increased carcass fat, decreased protein, and lower carcass weight due to the high fat. Serum glucose was lower for fat-fed males during lactation and also for postweaning males and females. Fat feeding in lactation caused a decrease in adipose cell numbers which was not evident until rats were 6 weeks of age. The effect was only transient when rats were fed the chow diet until 21 weeks of age. Fat feeding for 3 weeks postweaning caused a significant decrease in liver DNA of 21-week-old male and female rats.

INTERACTION BETWEEN AN ORGANIC HYDROPEROXIDE AND AN UNSATURATED PHOSPHOLIPID AND α-TOCOPHEROL IN MODEL MEMBRANES. M. Nakano, K. Sugioka, T. Nakamura and T. Oki (Gunma Univ., College of Medical Care and Tech., Maebashi 371, Gunma Japan) *Biochim. Biophys. Acta 619*(2), 274-86 (1980). The behavior of an organic hydroperoxide in the presence of lipid and/or α-tocopherol in model membranes has been studied using ^{14}C-labeled cholesterol-5α-hydroperoxide as the organic hydroperoxide. Cholesterol-5α-hydroperoxide in saturated phospholipid micelles is rapidly isomerized to cholesterol-7α-hydroperoxide. The resulting hydrogen-bonded complex could be decomposed by iron-induced lipid peroxidation, accompanied by isomerization of the 5α-hydroperoxide and the further degradation to the 7-ketocholesterol and 7α-hydroxycholesterol. When three components, such as unsaturated phospholipid, 5α-hydroperoxide and α-tocopherol, are present in the same micelles, they form hydrogen bonded complexes. Such complexes could be decomposed by iron in the ferrous state, yielding mainly 5α-hydroxycholesterol without significant change in the structure of α-tocopherol and peroxidative cleavage of unsaturated phospholipid.

COMPOSITION OF PLASMA AND NASCENT VERY LOW DENSITY LIPOPROTEIN FROM PERFUSED LIVERS OF HYPERCHOLESTEROLEMIC SQUIRREL MONKEYS. R.J. Nicolosi and K.C. Hayes (New England Regional Primate Res. Center, Nutr. Div., Harvard Med. Schl., Southborough, MA 01722) *Lipids 15*(8), 549-54 (1980). The composition of circulating very low density lipoprotein (VLDL) was compared with the composition and secre-

tion of nascent VLDL from perfused livers of squirrel monkeys that were fed unsaturated or saturated fat diets to elicit different degrees of plasma hypercholesterolemia. All squirrel monkeys studied had cholesteryl ester-rich plasma VLDL, although greater enrichment occurred in hypercholesterolemic animals fed saturated fat. Livers from hypercholesterolemic animals were capable of secreting VLDL particles enriched in cholesteryl ester, suggesting hepatic origin for a portion of this circulating lipid moiety. Total VLDL lipid, but not protein output by perfused livers of hypercholesterolemic monkeys, was greater than that by livers from hypocholesterolemic animals. These results indicate that saturated fat-induced hypercholesterolemia is associated with changes in the composition of hepatic VLDL in the squirrel monkey.

LIPIDS OF MYOCARDIAL MEMBRANES: SUSCEPTIBILITY OF A FRACTION ENRICHED IN SARCOLEMMA TO HYDROLYSIS BY AN EXOGENOUS MAMMALIAN PHOSPHOLIPASE A_2. K. Owens, D.C. Pang, R.C. Franson and W.B. Weglicki (Dept. of Biophys., Med. Col. of Virginia, Virginia Commonwealth Univ., Richmond, VA 23298) *Lipids 15*(7), 534-8 (1980). A myocardial membrane fraction enriched in sarcolemma was used to determine the susceptibility of the lipids to hydrolysis by a phospholipase A_2 from granulocytes. After incubation (37 C, pH 7.0, 5 mM Ca^{2+}) with the phospholipase A_2 for 30 min, a more than 3-fold increase in unesterified fatty acids was found (up to 47 nmol/mg protein; $P<0.001$) relative to a control incubated without phospholipase A_2 or Ca^{2+}. This included a 10-fold increase in the arachidonic acid content (up to 42 mol%) and at least a 7-fold increase in lysophosphatidylethanolamine (up to 7.4 mol% total phospholipid-P). However, the exogenous phospholipase did not augment the quantity of lysophosphatidylcholine produced by endogenous phosphlipases in the presence of Ca^{2+} (5 mM). These results demonstrate the *in vitro* susceptibility of phospholipids of myocardial membranes, particularly phosphatidylethanolamine, to the neutral-active, Ca^{2+}-dependent phospholipase A_2 from granulocytes. This work may be relevant to myocardial inflammation and tissue damage during ischemia, where heterolytic injury of the myocardium may occur subsequent to the accumulation of granulocytes.

MECHANISM OF CHOLESTEROL EFFLUX FROM CELLS. M.C. Phillips, L.R. McLean, G.W. Stoudt and G.H. Rothblat (Dept. of Biochem. and Physiology, Med. College of Pennsylvania, 3300 Henry Ave., Philadelphia, PA 19129) *Atherosclerosis 36*(3), 409-22 (1980). Experiments have been conducted to gain information on the mechanisms underlying the surface transfer of free cholesterol between cells and extracellular cholesterol acceptors. The data obtained from these studies are compared to those obtained from studies using two populations of phospholipid vesicles; one contained labeled cholesterol, which served as a donor, while the second population acted as an acceptor. In the presence of phospholipid vesicles, the loss of cholesterol from the cells follows first order kinetics if the data are corrected for the changing specific activity produced by the initiation of cholesterol synthesis. Analysis and comparison of the parameters describing the kinetics of cholesterol transfer in these systems suggests that the mechanism involves diffusion of cholesterol molecules through the aqueous phase, with overall rate being influenced by the rate of desorption from the donor phospholipid-cholesterol bilayer membrane. The differences observed between the two experimental systems, particularly with regard to the influence of acceptor concentration, is attributed to the effects of the presence of a large unstirred water layer around cells which is not present around vesicles.

REGULATION OF LIPID METABOLISM IN CHICKEN LIVER BY DIETARY CEREALS SUPPLEMENTED WITH CULTURE FILTRATE OF *TRICHODERMA VIRIDE*. A.A. Qureshi, W.C. Burger, N. Prentice and C.E. Elson (USDA, SEA, Barley and Malt Lab., 501 N. Walnut St., Madison, WI 53705) *J. Nutr. 110*(7), 1473-8 (1980). The activites of acetyl-CoA carboxylase, fatty acid synthetase, and β-hydroxy-β-methylglutaryl-CoA (HMG-CoA) reductase were determined in subcellular fractions of livers from chickens fed a corn-, wheat-, or barley-based diet with or without supplementation with culture filtrate (0.008%) of *Trichoderma viride* for 4 days (at which maximal effect was observed). The results of these experiments indicate that the elimination of sticky feces and enhancement of gain in weight by the addition of culture filtrate to the barley-based diet of chickens were probably due to a different mechanism than the one for the suppression of hepatic cholesterol biosynthesis and elevation of fatty acid synthesis, and that some factor(s) in the culture filtrate is responsible for this drastic decrease in cholesterol biosynthesis which may provide a therapeutic approach to the control of cardiovascular disease.

EFFECT OF DIETARY WHEAT BRAN, ALFALFA, PECTIN AND CARRAGEENAN ON PLASMA CHOLESTEROL AND FECAL BILE AND NEUTRAL STEROL EXCRETION IN RATS. B.S. Reddy, K. Watanabe and A. Sheinfil (Naylor Dana Inst. for Disease Prevention, American Health Foundation, Valhalla, NY 10595) *J. Nutr. 110*(6), 1247-54 (1980). The effect of dietary wheat bran, alfalfa, pectin and undegraded carrageenan at a level of 15% on the composition of fecal bile acids and neutral sterols and on the plasma and liver cholesterol levels was studied in Fischer female rats fed a semi-purified diet based on soybean protein, cornstarch, dextrose and corn oil. The diets differed not only in type of fiber but also in amount of fiber. The daily excretion of deoxycholic acid, lithocholic acid and 12-ketolithocholic acid was increased compared to the control diet. Addition of pectin to the diet increased the concentration and daily output of fecal neutral sterols and bile acids compared to that of control diet. Carrageenan markedly increased the concentration and daily output of fecal cholesterol, deoxycholic acid and lithocholic acid, as well as the daily output of total bile acids. It is concluded that the plasma cholesterol-lowering effect and fecal bile acid and neutral sterol excretion vary with type and amount of fiber.

MOLECULAR STRUCTURE OF GLYCEROLIPIDS IN RATS FED PARTIALLY HYDROGENATED TRIACYLGLYCEROLS. I. Reichwald-Hacker, S. Grosse-Oetringhaus, I. Kiewitt and K.D. Mukherjee (Federal Center for Lipid Res., Piusallee 68/76, D-4400 Munster, Germany) *J. Nutr. 110*(6), 1122-9 (1980). The positional distribution of acyl moieties was studied in two major classes of glycerolipids, i.e. triacylglycerols and diacylglycerophosphocholines, of liver, heart and serum of rats that were fed either an unhydrogenated soybean oil (control group) or a partially hydrogenated soybean oil (experimental group) containing 12.3% *trans*-octadecenoic acids. In the experimental group very little of the dietary *trans*-octadecenoic acids was incorporated into either positions 1 or 3 or position 2 of tissue triacylglycerols. In diacylglycerophosphocholines of both groups, the dietary as well as endogenous palmitic and stearic acids were esterified predominantly at position 1, whereas dietary linoleic acid and the polyunsaturated fatty acids derived therefrom were esterified almost exclusively at position 2. Relatively large proportions of *trans*-octadecenoic acids were selectively esterified at position 1 of diacylglycerophosphocholines of the experimental group.

BILIARY AND PLASMA LIPIDS AND LIPID-LOWERING CHEMOTHERAPY. STUDIES WITH CLOFIBRATE, FENOFIBRATE IN HEALTHY VOLUNTEERS. G. Schlierf, M. Chwat, E. Feuerborn, E. Wülfinghof, C.C. Heuck, M. Kohlmeier, P. Oster and A. Stiehl (Klinisches Insititut für Herzinfarktforschung and Abteilung für Gastroenterologie, Medizinische Universitätsklinik Heidelberg, Bergheimer Strasse 58, D-6900, Heidelberg F.R.G.) *Atherosclerosis 36*(3), 323-9. The effects of the lipid-lowering drugs clofibrate, etofibrate and fenofibrate on plasma lipids and lipoproteins and on biliary lipid composition were compared with placebo in double-blind cross-over studies in healthy young male volunteers. Within two weeks, plasma total cholesterol and LDL cholesterol levels fell on clofibrate administration (by means of 9 and 16%) and on fenofibrate administration (by means of 17 and 16%). The "lithogenic index"—as a measure of biliary cholesterol saturation—rose significantly with clofibrate and etofibrate, but not with fenofibrate. These results suggest that drugs with similar effects on plasma lipids and lipoproteins may affect biliary lipid composition in different ways. The risk of cholelithiasis, therefore, must be evaluated separately for each drug in question, while the final answer can only come from long-term epidemiologic studies.

EFFECTS OF FEEDING OLEIC ACID OR HYDROGENATED VEGETABLE OILS TO LACTATING COWS. D.R. Selner and L.H. Schultz (Dept. of Dairy Sci., Univ. of Wisconsin, Madison, WI 53706) *J. Dairy Sci. 63*(8), 1235-41 (1980). In feeding trials to clarify the mechanism by which unsaturated oils depress milk fat percentage, oleic acid at 250 or 500 ml per cow per day did not reduce milk fat percentage significantly. At 500 ml these changes were significant (control, oleic): rumen acetate 61.6, 60.3%; rumen propionate 19.4, 21.0%; milk fat content of 18:1 *trans* fatty acid 3.0, 8.0%; and of 18:2 *cis* fatty acid 2.2, 1.4%. Feeding hydrogenated vegetable oil containing 13% *trans* acid 454 g per cow per day decreased slightly milk fat percentage and elevated plasma cholesterol 190 to 245 mg/100 ml and 18:1 *trans* fatty acid in milk fat 4.2 to 6.2%. Hydrogenated vegetable oil containing 49% 18:1 *trans* acid at 454 g daily decreased milk fat 3.9 to 3.1%. Milk fat triglycerides decreased in short chain fatty acids and increased in 18:1 *trans* 2.6 to 11.2%, 18:1 *cis* 22.9 to 29.0%, and 18:2 *trans* .2 to 1.8%. Milk phospholipids decreased 14.1 to 9.6% in 14:0 fatty acid and increased .3 to 3.1% in 18:1 *trans* and 20.5 to 31.4% in 18:1 *cis*. Blood cholesterol esters were increased 152 to 195 mg/100 ml. The data lend support to the concept that *trans* acids or compounds produced in the rumen during their formation from polyunsaturated fatty acids are responsible for the milk fat depression from unsaturated oils.

INHIBITION OF RAT HEPATIC STEROL FORMATION FROM SQUALENE BY PLASMA LIPOPROTEINS. M.V. Srikantaiah, D.W. Lew and R.J. Morin (Dept. of Path., Harbor-UCLA Med. Center, 1000 West Carson Street, Torrance, CA 90569) *Lipids 15*(8), 555-8 (1980). The conversion of ^{3}H-squalene to sterols by rat liver microsomes and cytosol was inhibited by individual rat and human plasma lipoproteins at various concentrations. This inhibition was also observed with added human high density apolipoprotein, but triglycerides, cholesterol or cholesteryl esters had no inhibitory effects. Lipoproteins and apo high density lipoprotein (HDL) were demonstrated to bind ^{3}H-squalene in vitro. The binding of ^{3}H-squalene by apo HDL could be reversed by increasing concentration of liver cytosol containing sterol carrier protein$_1$.

LOWERING OF SERUM CHOLESTEROL AND TRIGLYCERIDE LEVELS BY BALANCING AMINO ACID INTAKE IN THE WHITE RAT. G.M. Torre, V.D. Lynch and C.I. Jarowski (St. John's Univ., College of Pharmacy and Allied Health Professions, Jamaica, NY 11439) *J. Nutr. 110*(6), 1194-6 (1980). Earlier studies in rats have shown that serum cholesterol levels were significantly lower in rats fed an L-lysine-supplemented ration. This investigation was initiated to determine if the reverse was true. We reasoned that the addition of an incomplete protein to a complete rat ration would bring about an increase in serum lipid levels. This would result from the intermediary metabolic conversion of systemic amino acids not used in protein synthesis. We further postulated that supplementation of the imbalanced protein would obviate the hyperlipidemia. Gelatin was chosen as the incomplete protein since it is deficient in tryptophan, an essential amino acid. Adult male Sprague-Dawley rats fed rations with added gelatin (5, 15 and 25%) for 30 days showed significant increases in serum cholesterol and triglyceride levels. Lipid levels in rats fed L-tryptophan-supplemented diets containing the same levels of gelatin did not differ from those animals fed the control ration. The data indicate that hyperlipidemia results from the feeding of imbalanced protein. Such hyperlipidemia can be obviated by supplementation with the limiting amino acid.

THE RELATIONSHIP BETWEEN LIPOPROTEIN LEVELS AND XANTHOMAS DURING PROGRESSION AND REGRESSION OF ATHEROSCLEROSIS. D. Vesselinovitch, R.W. Wissler, L. Harris and L. Lusk (Dept. of Path. and Specialized Center of Res. in Atherosclerosis, The Univ. of Chicago, Chicago, IL 60637) *Atherosclerosis 36*(3), 351-64 (1980). Serum lipid profiles were studied and correlated with the occurrence of xanthomas in male rhesus monkeys during induction and regression of atherosclerosis. Appearance of cutaneous xanthomas was correlated with α-lipoprotein levels below 20% for 2-6 months' duration. Levels of α-lipoproteins, and consequently the length of time required for the appearance of xanthomas, was dependent on the diet fed. Conversely, the restoration of α- and β-lipoprotein levels to near normal resulted in the disappearance of xanthomas by a regiment consisting of cholestramine and/or therapy diet alone, in 9 and 6 months, while the same results were obtained in 3 months with a combination of both. In any case, a sustained decrease of serum cholesterol levels to below 180 mg/100 ml was necessary for xanthomas to disappear. Using a simple index, a direct relationship has been established between involvement by xanthomas and serum β-lipoproteins, on the one hand, while an inverse relationship has been established between xanthomas and serum α-lipoproteins, on the other. The latter accords with increasing evidence in man that α-lipoprotein levels may influence cholesterol turnover and deposition in tissues.

SERUM LIPOPROTEINS AND CORONARY ARTERY DISEASE (CAD): COMPARISON OF THE LIPOPROTEIN PROFILE WITH THE RESULTS OF CORONARY ANGIOGRAPHY. H. Wieland, D. Seidel, V. Wiegand and H. Kreuzer (Abteilungen fur klinische Chemie and Kardiologie, Medizinische Universitatsklinik, Robert-Koch-Strasse 40, D-3400 Gottingen FRG) *Atherosclerosis 36*(3), 427-39 (1980). The presence or absence of coronary artery disease was established by coronary angiography in 181 male patients (aged 40-60 years). The concentrations of cholesterol and triglycerides were determined in the sera of all patients. In addition plasma lipoproteins were quantified by a recently developed quantitative lipoprotein electrophoresis based on densitometric scanning of lipoprotein bands visualized by polyanion precipitation after electrophoretic separation. The most pronounced differences between these two groupds of patients were found in the concentrations of whole serum cholesterol, β-lipoprotein cholesterol and the β-lipoprotein/α-lipoprotein ratio. A combination of critical values for the concentrations of serum cholesterol and β-lipoprotein cholesterol and for the β-lipoprotein/α-lipoprotein ratio could be established. If exceeding at least two of the three criteria was used as cut-off-point between the two groups of patients, a maximum differentiation of 50% could be achieved. Introduction of the β-lipoprotein/α-lipoprotein ratio as a criterion improved the range of differentiation and increased differentiation by about 10%. This effect cannot be achieved by using α-lipoprotein cholesterol level as a criterion.

LECITHIN INFLUENCE ON HYPERLIPEMIA IN RHESUS MONKEYS. E. K. Wong, R. J. Nicolosi, P.A. Low, J.A. Herd and K.C. Hates (New England Regional Primate Res. Center, Nutr. Div., Harvard Med. Schl., Southborough, MA 01722) *Lipids 15*(6), 428-33 (1980). Previous studies in humans have shown that the ingestion of lecithin can alter plasma cholesterol and triglyceride concentrations by mechanism(s) that remain to be elucidated. To further explore this response to lecithin, hyperlipemic rhesus monkeys were selected from a group of animals fed a semi-purified diet containing corn oil, casein, sucrose and cholesterol (120mg/100 Kcal) for 10 years. As in other studies, manipulation of lecithin intake elicited a highly variable response, but significant changes were observed in plasma cholesterol and triglycerides as a consequence of supplementing or removing lecithin from the diet. Lecithin had no influence on the absolute plasma phospholipid level or LCAT activity. However, lecithin significantly reduced total lipids, increased the relative concentration of phospholipid and tended to increase the phospholipid/free cholesterol (PL/FC) concentration. While lecithin did not significantly affect triglyceride secretion rates, all animals were able to clear Intralipid® (triglyceride) more efficiently while fed lecithin. These data are interpreted to mean that the reduction in plasma lipids associated with lecithin ingestion may have been mediated via enhanced clearance of lipids transported in lipoproteins of lower density, whereas the rebound following lecithin removal reflected reduced clearance of these lipids.

CHANGES IN LYSOZYME DUE TO REACTIONS WITH VOLATILE PRODUCTS OF PEROXIDIZING METHYL LINOLEATE. J. Funes, S. Yong, and M. Karel (Dept. of Nutr. and Food Sci., Massachusetts Inst. of Technology, Cambridge, Massachusetts 02139) *J. Agric. Food Chem. 28*(4), 794-8 (1980). Previous studies have shown that lysozyme undergoes polymerization, loss of biological activity, and other deteriorative changes when exposed to incubation in air with methyl linoleate in a freeze-dried model system. In the present study we demonstrated that similar effects can be achieved by exposing protein to the headspace over peroxidizing methyl linoleate or to vapors of the volatile products of linoleate peroxidation, 2,4-decadienal, n-hexanal, and 2-heptenal. Changes in solubility, enzymatic activity, and polymer formation were studied. We also demonstrated, through the use of electron spin resonance (ESR), that volatile reaction products generate protein-centered free radicals when lysozyme is exposed to these products by being incubated over oxidizing linoleate. Water activity had a significant effect on the volatile-initiated changes in the protein. Cross-linking, loss of enzyme activity, and insolubilization increased with increasing water activity. ESR signal intensity was greatly diminished at high water activity, probably because of rapid recombination of free radicals.

PHOSPHATIDYLCHOLINE EXCHANGE PROTEIN CATALYZES THE NET TRANSFER OF PHOSPHATIDYLCHOLINE TO MODEL MEMBRANES. K.W.A. Wirts, P.F. Devaux, and A. Bienvenue (Lab. of Biochem., St. Univ. of Utrecht, NL-3508 RB Utrecht, The Netherlands) *Biochemistry 19*(14), 3395-9 (1980). 2-Stearoyl spin-labeled phosphatidylcholine (PC*) has been introduced into the phosphatidylcholine exchange protein from bovine liver and its electron spin resonance (ESR) spectrum determined. The spin-labeled group in the PC*-exchange protein complex was strongly immobilized. Addition of sodium deoxycholate micelles released PC* from its binding site, producing a mobile signal. This was also observed when micelles of lysophosphatidylcholine and vesicles of phosphatidic acid were added, indicating that the exchange protein can insert its endogenous PC* into interfaces devoid of phosphatidylcholine. The donor vesicles consisted of PC* and phosphatidic acid and the acceptor vesicles of phosphatidylethanolamine and phosphatidic acid. Addition of exchange protein catalyzed a net transfer of PC* from donor to acceptor vesicles. This transfer proceeded until the acceptor vesicles contained $\sim$2 mol % of PC*. A spontaneous transfer of PC* was not observed. As for the mode of action, it appears that the exchange protein, after insertion of its endogenous PC* into the acceptor, leaves the interface without a bound phospholipid molecule yet continues to shuttle PC* from donor to acceptor.

Fats and oils

SURFACE VISCOSITIES OF PHOSPHOLIPIDS ALONE AND WITH CHOLESTEROL IN MONOLAYERS AT THE AIR-WATER INTERFACE. R.W. Evans, M.A. Williams and J. Tinoco. (Dept. of Nutr. Science, University of California, Berkeley, CA 94270) *Lipids 15*(7), 524-33. Surface viscosities in lipid monolayers at the air-water interface were measured by the oscillating pendulum method. The logarithms of successive oscillations decreased linearly with time. Surface viscosity is reported here in terms of the rate constant, k, for decay of oscillation. Pressure-area curves are presented for the saturated phospholipids. Surface viscosities of most of the phospholipids were high and increased with increasing surface pressure. One mol % of cholesterol in monolayers of dipalmitoyl PC greatly reduced the surface viscosity of the film and, in mixed films containing 10% or more of cholesterol, surface viscosity was too low to measure. Cholesterol also reduced surface viscosities in monolayers of the other dipalmitoyl phospholipids. It is suggested that cholesterol functions in lung surfactant by reducing the surface viscosity of its highly saturated phospholipid components.

QUANTITATIVE ANALYSES OF HYDROXYSTEARATE ISOMERS FROM HYDROPEROXIDES BY HIGH PRESSURE LIQUID CHROMATOGRAPHY OF AUTOXIDIZED AND PHOTOSENSITIZED-OXIDIZED FATTY ESTERS. W.E. Neff and E.N. Frankel (Northern Regional Res. Center, Agr. Res., Sci. and Education Admin., U.S. Dept. of Agr., Peoria, IL 61604) *Lipids 15*(8), 587-90 (1980). A high pressure liquid chromatography (HPLC) method is described for the determination of the isomeric hydroxystearates from hydroperoxides of oxidized fatty esters. The samples are hydrogenated and the mixtures of hydroxystearates are concentrated by partial removal of unoxidized esters and complete removal of polar materials. Isomeric hydroxystearates are then separated on a porous microparticulate adsorption (10 μ) column and elution with 0.25% isopropyl alcohol in *n*-hexane is monitored at 212 nm. The 8-OH, 9-OH, 10-OH, 11-OH and 16-OH isomers were completely separated, but the 12-OH, 13-OH and 15-OH were only partly resolved by HPLC. The relative percentages of isomeric hydroxy esters were analyzed quantitatively by a computer integration method. Accuracy of the method was checked with known mixtures of synthetic hydroxystearates. The isomeric hydroperoxide composition of oxidized methyl oleate, linoleate, linolenate and soybean methyl esters determined by HPLC were in good agreement with previous analyses by gas chromatography-mass spectrometry.

AUTOXIDATION OF POLYUNSATURATED LIPIDS. FACTORS CONTROLLING THE STEREOCHEMISTRY OF PRODUCT HYDROPEROXIDES. N.A. Porter, B.A. Weber, H. Weenen, and J.A. Khan (Paul M. Gross Chemical Lab., Duke Univ., Durham, NC 27706) *J. Am. Chem. Soc. 102*(17), 5597-601 (1980). The mechanism of the autoxidation of linoleic acid and phospholipid esters of this acid was investigated. The products of autoxidation, 13-hydroperoxy-9-*cis*,11-*trans*-octadecadienoic (4), 13-hydroperoxy-9-*trans*,11-*trans*-octadecadienoic (5), 9-hydroperoxy-10-*trans*,12-*cis*-octadecadienoic (6), and 9-hydroperoxy-10-*trans*,12-*trans*-octadecadienoic (7) acids, were analyzed by LC after reduction to the corresponding hydroxy fatty acids. The ratio of trans,cis/trans, trans products, (4+6/5+7), formed during the initial stages of oxidation (<2% for the free acids) was dependent on temperature and the concentration of linoleic acid. This trans,cis/trans,trans ratio varied from 4.2 (with neat linoleic acid oxidations at 10 C) to 0.23 (0.24 M linoleic acid in benzene at 50 C). A similar product distribution was found in emulsion oxidation of mixtures of 1,2-dilinoleoylglycerolphosphatidylcholine and 1,2-dipalmitoylglycerophosphatidylcholine with the trans,cis/trans,trans product ratio depending on the ratio of dilinoleoyllecithin to dipalmitoyllecithin. Mixtures of linoleic acid and *p*-methoxyphenol give trans,cis/trans, trans product ratios dependent on the concentration of added phenol. A kinetic scheme consistent with these observations is presented.

SINGLET OXYGEN OXIDATION OF METHYL LINOLEATE: ISOLATION AND CHARACTERIZATION OF THE $NaBH_4$-REDUCED PRODUCTS. M.J. Thomas and W.A. Pryor (Dept. of Chem., Louisiana St. Univ., Baton Rouge, LA 70803) *Lipids 15*(7), 544-8 (1980). The mixutre of diene hydroperoxides from methylene blue-sensitized oxidation of methyl linoleate was reduced with $NaBH_4$ and the resulting alcohols were separated by high pressure liquid chromatography (HPLC). Four diene alcohols were isolated in approximately equal yields from adsorption and reversed phase HPLC; the isomers were identified as methyl esters of 9-hydroxy-10,12-, 10-hydroxy-8,12-, 12-hydroxy-9,13-, and 13-hydroxy-9,11-octadecadienoate. Formation of equal yields of both conjugated and nonconjugated diene alcohols from methyl linoleate is characteristic of singlet oxygen oxidations. The detection of the easily separated nonconjugated isomer methyl 10-hydroxy-*trans*-8,*cis*-12-octadecadienoate from methyl linoleate is proposed as a test to probe the involvement of singlet oxygen in biological oxidations.

STORAGE STABILITY OF α-TOCOPHEROL IN A DEHYDRATED MODEL FOOD SYSTEM CONTAINING NO FAT. W.A. Widicus, J.R. Kirk, and J.F. Gregory (Dept. of Food Sci. and Human Nutr., Univ. of Florida Gainesville, FL 32611) *J. Food Sci. 45*(4), 1015-8 (1980). Storage stability of α-tocopherol in a model food system containing no fat was shown to be a function of water activity (a_w), storage temperature, and the molar ratio of oxygen: α-tocopherol. The degradation rate of α-tocopherol increased as the water activity was increased in the range 0.10-0.65 a_w, as the storage temperature was increased from 20 to 37 C, and as the molar ratio of oxygen: α-tocopherol was increased from approximately 15:1 to 1450:1. Degradation data of α-tocopherol from all storage conditions best fit the first order rate kinetic model. Experimental activation energies ranged from 8.85-13.05 Fcal mol^{-1}.

REACTIONS OF TALL OIL FATTY ACIDS DURING SIMULATED OXYGEN DELIGNIFICATION. G.R. Mittet and N.S. Thompson. *Tappi 62*(11), 117-21 (1979). The possibility of tall oil fatty acid recovery during the oxygen/alkali delignification process was investigated. Of the variables examined (effects of temperature, reaction time, etc.) alkali was the most important. It was found that successful recovery of tall oil fatty acids would require some type of pretreatment, as wood exerted an inhibiting influence on fatty acid autoxidation in the presence of bicarbonate. (World Surface Coatings Abs. No. 456)

PAINTING OF WOOD: PENETRATION OF DRYING OILS AND EXTERIOR STAINS. J. Koskelainen. *Farg Lack 25*(11), 241 (1979). The penetration of stains and drying oils into wood substrates was studied by means of light and scanning electron microscopy. Increasing viscosity, molecular weight and wood density lessened the penetration, while at sufficiently high viscosity no penetration at all occurred. Acrylic systems showed no penetration, while that of alkyds was better, depending on the alkyd type. It was lower with pigmented than unpigmented systems. (World Surface Coatings Abs. No. 456)

SUCROSE ESTERS OF TALL OIL FATTY ACIDS: BIODEGRADABLE AND NON-TOXIC SURFACE-ACTIVE AGENTS. J. Broniarz, J. Jedraszczyk and J. Szymanowski. *Chemia Stosow. 21*, 235-49 (1977). Preparation and characteristics of the esters are described. (World Surface Coatings Abs. No. 455)

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