absence of a simple, reliable, accurate and long-lasting system of manure handling were used in the industry, which assumed that manure would be held for some time in the barn. The Enterprise tendency to lager livestock production, with a concern for the quality of food in an efficient environment, requires a number of radical changes and development of new methods for proper and efficient manure management. I have devoted years to research, development, design and construction of livestock production (manure handling) in Russia and would like to share my approach to manure management. The barn environment has a major impact on animals and the objective is to provide an environment in the barn, which will allow achievement of optimal utilization of feed and highest production. In order to provide the livestock industry with adequate manure handling systems, which will be both technically and economically competitive. It is necessary to apply plumbing technology principles by excluding manure storage from being in close proximity to animals in the barn. This technology requires a manure reception structure with a flushing system in the pen and piping system for transportation of liquid manure. The plumbing technology approach offers proper sanitation and facilitates the barn being kept clean. My proven technology solves many existing problems:
1. Improved barn design eliminates odor in and around the barn. This will eliminate the odor nuisance with much less ventilation. I also allows for the ability to design a multi-level barn for wean-to-finish production. 2. Significantly improved environment increases productivity (pigs have higher rates of growth). Since the new system excludes retention of manure in the pen, it results in pigs being dry and clean. 3. Prevents spreading of diseases. Pigs will not have contact between pans through manure. This will allow for reduction in medicine consumption. 4. Rational use of water reduces the volume of liquid manure by 4-5 times and brings the moisture to 92-95selection of proper treatment and utilization technologies. 5. The technology reduces capital and maintenance cost and does not require special expertise to operate. The system requires a lesser degree of farmer's attention and can be incorporated into a computerized plant system. A completely new engineering design approach is a superior alternative in the design for livestock production. New and existing livestock producers will highly benefit from implementation of this technology.

Ruminant Nutrition
Fat

559 Use of the CPM-Dairy fat sub-model to predict absorption of total and individual LCFA from different fat supplements. P.J. Moate*, R.C. Boston, and W. Chalupa, *University of Pennsylvania, Kennett Square, PA.*

There is growing interest in the non-caloric effects of feeding fat to dairy cows. Improved fertility is associated with increased absorption of linoleic acid (C18:2) and low milk fat syndrome is associated with increased absorption of vaccenic acid (C18:1trans). Until now, no ration formulation programs have predicted the absorption of the major LCFA in dairy cows. CPM-Dairy has a new fat sub-model that describes intake, ruminal lipolysis, ruminal biohydrogenation, de novo synthesis of LCFA in the rumen and intestinal absorption of C12:0, C14:0, C16:0, C16:1, C18:0, C18:1trans, C18:2 and C18:3 acids. In this simulated comparison, a 650 kg cow was fed 25 kg of a basal diet (26% alfalfa silage, 26% corn silage, 22% steam-flaked corn, 14% soybean, 2% blood meal and 10% mineral mix/LCFA supplement). The basal diet provided 500 g of LCFA. In addition, supplemental LCFA (400 g) were provided in the mineral mix in the form of Megalac (M), Megalac R (MR), Energy Booster (EB), Tallow (T), Roasted Soybeans (RSB) or Whole Cotton Seed (WCS). Intestinal digestibilities of M and MR were predicted to be higher than the basal diet because rumen non-lipolysed fatty acids in the form of calcium salts have higher intestinal digestibilities than rumen non-lipolysed fatty acids in the form of glycerides. To increase amounts of C18:2 absorbed, C18:2 must either be in a form that protects it from ruminal lipolysis (MR) or the feed ingredient must contain high amounts of C18:2 (RSB). However, with RSB, there is also an increase in absorbed C18:1trans which might lower milk fat test.

Parameter	Basal	M	MR	EB	T	RSB	WCS
LCFA †							
Intake (g/d)	500	400	400	400	400	400	400
Rumen Escape (g/d)	15	54	54	0	2	16	1
Duodenum (g/d)	659	400	400	400	400	404	404
Absorbed (g/d)	479	327	337	291	293	298	300
Intest. Digestion (%)	73	82	84	73	73	74	74
C18:1 trans †							
Intake (g/d)	0.1	0.0	0.0	1.6	5.2	0.0	0.0
Duodenum (g/d)	37.0	2.3	11.0	1.9	5.6	39.7	30.3
Absorbed (g/d)	29.0	1.8	9.1	1.5	4.4	31.2	23.8
C18:2 †							
Intake (g/d)	225	28	127	7.2	18.8	230	157
Duodenum (g/d)	58	17	77	0.7	2.2	54	12
Absorbed (g/d)	48	17	76	0.6	1.8	43	10

† from basal diet or supplement

Key Words: Cattle, Fatty Acids, Digestion Model

560 Effects of feeding raw and micronized flaxseed on yield and composition of milk form Holstein cows. Arif Mustafa*[1], Yvan Chouinard[2], and David Christensen[3], [1]*McGill University,* [2]*Universit Laval,* [3]*University of Saskatchewan.*

Nine multiparous Holstein cows were used in three 3 x 3 Latin squares to investigate the effects of feeding raw and micronized flaxseed on milk yield and milk fatty acid composition. Three diets were formulated to meet nutrient requirement of dairy cows in early lactation: A control diet with no added flaxseed (C); a raw flaxseed diet (RFS); and a micronized flaxseed diet (MFS). The level of flaxseed in RFS and MFS was 7% of the diet DM. Feeding flaxseed to dairy cows had no effect on DMI or milk yield. However, energy- corrected milk was higher for cows fed MFS than for those fed RFS or C. Supplemental flaxseed reduced milk fat percentage without affecting the concentration of milk protein or milk lactose. However, yield of milk components was not affected by feeding flaxseed. Concentrations of short-and medium-chain fatty acids were decreased while the concentrations of long-chain fatty acids were increased in milk of cows fed RFS and MFS compared with cows fed C. Feeding flaxseed to dairy cows can alter milk fatty acid composition, but only minor effects on milk fatty acid composition can be expected by feeding micronized versus raw flaxseed.

Key Words: Flaxseed, Micronization, Milk fatty acids

561 Influence of barley grain variety on fatty acid synthesis and the expression of fat metabolism genes in bovine adipose tissue. E. Okine*, E. Norberg, D.R. Glimm, G.R. Khorasani, and J.J. Kennelly, *Department of AFNS, University of Alberta, Edmonton, Alberta, Canada.*

Our hypothesis was that ruminal rate of DM and starch degradation of grain varieties influence expression and protein abundance for genes encoding fatty acid synthase (FAS) and acetyl-CoA carboxylase (ACC) in subcutaneous bovine adipose tissue. Hulled (Falcon), hulless (Oxbow) barley varieties and corn were used in this experiment. Fifteen lactating Holstein cows were blocked into 5 groups according to parity, calving date, and milk yield. Cows in each group were randomly assigned to 3 dietary treatments following a 2-wk covariate period and were fed the test diets for 8 wks. Diets contained 55% concentrate and 45% forage (DM basis) and were fed once daily as a TMR. Milk yield and milk composition were not affected ($P > 0.05$) by grain type, but DMI (19.3 vs. 22.9 kg/d, $P < 0.05$) and DMI as percentage of BW (3.0 vs. 3.5%, $P < 0.05$) were lower for animals fed barley compared to corn-based diets. Levels of C18:0, C18:1 in adipose tissue were similar ($P>0.05$) for hulled barley and corn but different ($P<0.05$) for hulless barley fed cattle. There were no differences ($P>0.05$) in mRNA expression of ACC and FAS in cows fed different diets. FAS protein abundance in adipose tissue was 1.9 and 1.7x lower ($P<0.05$) for cows fed the hulled than for cows fed the hulless variety or corn. ACC protein abundance was 2.1 and 2.6x lower ($P<0.05$) in adipose tissue of animals fed hulless compared to hulled and corn fed cows. However, activities of these enzymes were not

affected by any of the dietary treatments. It was concluded that de novo synthesis and uptake of dietary fatty acids may be affected by the rate of ruminal degradation of grain fed to lactating cows. However, lack of kinetic differences precludes any conclusions about effects of ACC and FAS on fatty acid composition in subcutaneous adipose tissue of cows fed different grain types.

Key Words: Barley variety, Dairy cow, Adipose tissue, Fatty acids synthesis

562 Effect of feeding calcium salts of soybean or palm oils on milk yield and composition, and on selected reproductive parameters by high producing dairy cows. P. Mandebvu*[1], C. S. Ballard[1], C. J. Sniffen[1], M. P. Carter[1], H. M. Wolford[1], T. Sato[1,2], Y. Yabuuchi[2], E. Block[3], and D. L. Palmquist[4], [1]*W. H. Miner Agricultural Research Institute, Chazy, NY,* [2]*Zen-Noh National Federation of Agricultural Co-operative Associations, Tokyo, Japan,* [3]*Church & Dwight Co. Inc., NJ,* [4]*Ohio State University, Wooster, OH.*

Calcium salts of soybean oil (Ca-Soy) or palm oil fatty acid distillate (Megalac®) were compared. Forty high producing Holstein cows housed in a free-stall barn were blocked and assigned to one of two TMR containing 1.7% Megalac® or Ca-Soy (DM basis) and group-fed for ad libitum intake. Fatty acid profiles of Megalac® and Ca-Soy, respectively, were C16:0: 48.1, 12.1; C18:1: 35.7, 23.9; and C18:2: 8.9, 51.2. The TMR (DM basis) were 50:50 forage to concentrate ratio for both the fresh group (FG; wk 1 to 6 postpartum) and high producing group (HG; wk 7 to 10 postpartum) cows and contained 28% NDF and 18% CP (DM basis). Results are shown in table. There were no treatment differences in milk yield and components and no treatment effect was realized for the reproductive parameters measured. Cows fed Ca salts of soybean oil produced milk containing a higher content of C18:1t and C18:2.

Item[1]	Megalac®	Ca-Soy	SE	*P*
Milk, kg	43.3	43.4	2.87	1.000
Fat, %	4.24	4.22	0.121	0.909
Lactose, %	4.83	4.86	0.04	0.630
CP, %	2.81	2.88	0.05	0.332
MUN, mg/dL	12.7	11.5	0.5	0.078
SCC x 1000	266.9	191.6	80.3	0.512
BCS	3.26	3.25	0.11	0.948
DMI FG, kg/d	20.3	20.9		
HG, kg/d	26.4	27.6		
Milk FA-FG[2]				
C14:0	6.79	7.27	0.339	0.297
C16:0	26.7	25.4	0.38	0.004
C18:0	14.0	15.4	0.36	0.008
C18:1	0.79	0.73	0.034	0.351
C18:1t	2.78	3.00	0.157	0.178
C18:2	2.89	2.93	0.108	0.682
CLA9c11t	0.55	0.59	0.028	0.273
Milk FA-HG[3]				
C14:0	9.00	9.32	0.280	0.347
C16:0	29.6	26.8	0.45	<0.001
C18:0	12.7	14.1	0.37	0.014
C18:1	22.7	21.8	0.66	0.366
C18:1t	2.72	3.27	0.07	<0.001
C18:2	2.91	3.32	0.08	0.001
CLA9c11t	0.59	0.64	0.02	0.057

[1]Measurements were taken from FG and HG cows from wk 1 to 10 postpartum unless specified otherwise; [2]Milk fatty acids for FG cows reported as a % total fatty acids; [3]Milk fatty acids for HG cows reported as a % total fatty acids.

Key Words: Dairy cow, Ca salts, Milk yield and composition

563 Effects of long chain fatty acids on lipid metabolism in monolayer cultures of bovine hepatocytes. D. G. Mashek* and R. R. Grummer, *University of Wisconsin, Madison.*

Previous studies in our laboratory showed that different long chain fatty acids influence hepatic lipid metabolism in short term (3 h) cultures. To test the long-term effects of specific long chain fatty acids, we used monolayer cultures of bovine hepatocytes from 7-14 d old Holstein bull calves. From 16 to 64 h after plating, hepatocytes were exposed to the following treatments: 1 m*M* palmitic acid (1m*M*16), 2 m*M* palmitic acid (2m*M*16), or 1 m*M* palmitic acid plus 1 m*M* stearic (18:0), oleic (18:1), linoleic (18:2), linolenic (18:3), eicosapentaenoic (20:5), docosahexaenoic (22:6), or .5 m*M* each of eicosapentaenoic and docosahexaenoic acids (20:5/22:6). Metabolism of [1-^{14}C] palmitic acid to cellular triglycerides, phospholipids, fatty acids, cholesterol, and cholesterol esters or acid-soluble products was measured. The effect of increasing palmitic acid concentration from 1 to 2 m*M* was analyzed and Fisher's LSD was used to compare all treatments containing 1 m*M* palmitic acid. Increasing palmitic acid concentration from 1 to 2 m*M* increased total incorporation into all metabolic products measured ($P < 0.05$). Specifically, palmitic acid metabolism to acid-soluble products and triglycerides increased from 8.76 to 27.32 and from 18.79 to 45.54 *u*moles/*u*g DNA/48 h for the 1 and 2m*M* palmitic acid controls, respectively. Addition of 18:0 resulted in a nearly 2-fold increase in palmitic acid oxidation to acid-soluble products compared to the other treatments, which were not significantly different from each other. Incorporation of palmitic acid into cellular triglycerides was increased by 90% over 1m*M*16 for treatment 22:6, whereas 18:2 yielded the lowest rates of palmitic acid incorporation into cellular triglycerides (21% increase over 1m*M*16). The 22:6 and 20:5/22:6 treatments increased palmitic acid metabolism to phospholipids (97% and 88% above 1m*M*16), and to cholesterol (234% and 222% above 1m*M*16), respectively, while the other treatments were similar to 1m*M*16. Overall, the effects of fatty acids on lipid metabolism by monolayer cultures of bovine hepatocytes differed among the fatty acids tested.

Key Words: long chain fatty acids, liver metabolism, bovine

564 Effects of conjugated linoleic acid on lipid metabolism in monolayer cultures of bovine hepatocytes. D. G. Mashek* and R. R. Grummer, *University of Wisconsin, Madison.*

To determine the effects of unconjugated and conjugated linoleic acid isomers on hepatic lipid metabolism, we isolated and cultured hepatocytes from 7-14 d old Holstein bull calves. The monolayer cultures were exposed to treatments from 16-64 h after plating. The treatments included 1.0 m*M* palmitic acid plus either 0.1 or 1.0 m*M* of cis-9,cis-12 (c9,12), cis-9,trans-11 (c9,t11), or trans-10,cis-12 (t10,c12) linoleic acid. Metabolism of [1-^{14}C] palmitic acid to cellular triglycerides, phospholipids, fatty acids, cholesterol, and cholesterol esters or acid-soluble products was measured. Reported values are pooled across concentrations of linoleic acid unless otherwise noted. Metabolism of palmitic acid to cellular triglycerides was decreased ($P < 0.05$) from 23.51 to 20.98 *u*moles/*u*g DNA/48 h when the media contained c9,t11 compared with t10,c12. The conjugated isomers of linoleic acid (c9,t11 and t10,c12) at a concentration of 1.0 m*M* increased palmitic acid incorporation into phospholipids compared to c9,t12 (6.37 and 5.93 vs. 3.54 *u*moles/*u*g DNA/48 h; $P < 0.0001$). Similarly, c9,t11 and t10,c12 increased palmitic acid metabolism to cholesterol, especially at the 1 m*M* concentration when compared with c9,t12 (1.68 and 1.64 vs. 0.51 *u*moles/*u*g DNA/48 h; $P < 0.0001$). Palmitic acid incorporation into cellular triglycerides was increased for t10,c12 compared with c9,t11 (23.51 vs. 20.98 *u*moles/*u*g DNA/48 h; $P < 0.05$). Increasing the concentration of the treatment fatty acids from 0.1 to 1.0 m*M* decreased oxidation of palmitic acid to acid soluble products (8.69 vs. 6.80 *u*moles/*u*g DNA/48 h), but no effects of fatty acids were observed. There were no differences among the linoleic acid isomers on palmitic acid incorporation into the cellular fatty acid pool or to cholesterol esters. Overall, the conjugated linoleic acid isomers elicited changes in palmitic acid metabolism to cellular triglycerides, phospholipids and cholesterol, but had little or no affect on other metabolic fates of palmitic acid.

Key Words: conjugated linoleic acid, liver metabolism, bovine

565 Saturation effects of rumen-inert fat sources on feed intake, milk production, and feeding behavior in lactating cows varying in milk yield. K. J. Harvatine* and M. S. Allen, *Michigan State University, East Lansing.*

Effects of saturated (SAT) and unsaturated (UNSAT) rumen-inert fat sources were evaluated using 31 multiparous Holstein cows (144 ±70 DIM, 2.35 ± 0.38 BCS) in a crossover design experiment with 14 d periods. Milk yield of cows averaged 43.7 kg/d (range 34.0-57.5 kg/d) for 14 d immediately prior to initiation of the experiment when they were offered a diet intermediate in composition to the treatment diets. Treatments were 2.5% added fatty acids (FA) from rumen-inert fat sources

varying in saturation of FA; SAT (prilled FA#s, Energy Booster 100®) or UNSAT (calcium soaps of palm oil, Megalac®). Diets were formulated to 18.5% crude protein and 27.8% NDF and contained 5% FA from forage, grains and whole cottonseeds. UNSAT reduced DMI by 0.72 kg/d compared to SAT treatment ($P < 0.01$). No treatment effect was observed for 3.5% FCM, SCM or milk energy output although UNSAT tended ($P = 0.09$) to increase milk yield by 0.62 kg/d. SAT increased milk protein (3.07 vs. 3.02%; P=0.02) and lactose (4.80 vs. 4.75%; $P < 0.01$) concentrations. Response in milk protein concentration for SAT compared to UNSAT was positively correlated with pretrial FCM yield and pretrial milk fat yield ($r^2 = 0.46$, $P < 0.05$ and $r^2 = 0.52$, $P < 0.01$, respectively). Treatment response for milk, FCM, DMI and ruminating were not significantly related to pretrial FCM, milk fat yield or DMI. Yield of milk components were not affected by treatment. Efficiency calculated as the sum of milk and retained tissue energy per kg DMI was not affected by treatment. UNSAT reduced time spent ruminating by 25 min/d ($P < 0.01$) and increased time spent idle by 25 min/d ($P < 0.01$) but did not effect time spent eating. Decreased DMI and rumination time for UNSAT are consistent with reports of duodenally infused unsaturated fat increasing satiety and decreasing gut motility.

Key Words: Rumen-inert fat, Saturation, Hypophagic effects

566 Metabolic clearance rate of progesterone and estradiol-17 β is decreased by fat. S. Sangsritavong, D.G. Mashek, A. Gümen, J.M. Haughian, R.R. Grummer, and M.C. Wiltbank*, *Department of Dairy Science University of Wisconsin-Madison*.

The circulating concentrations of progesterone (P_4) and estradiol-17β (E_2) regulate a variety of reproductive processes and depend upon both synthesis and metabolism of these steroids. Previous studies have shown that feeding fat can alter follicular growth, progesterone metabolism, and reproductive efficiency in dairy cattle. We hypothesized that fatty acids can decrease metabolism of steroids by direct effects on liver cells. Exp.1 was designed to test this hypothesis by incubating bovine liver slices with P_4 or E_2 in the presence or absence of various fatty acids in the media (n = 6 different liver preparations with each treatment evaluated in triplicate with each preparation). Linoleic acid increased the half-life of both progesterone (31.7 ± 3.3 vs. 50.7 ± 2.7 min; $P \leq 0.001$) and estradiol-17β (25.9 ± 1.9 vs. 37.3 ± 5.8 min; $P \leq 0.05$). Exp.2 tested the effects of fat on steroid metabolism *in vivo*. Non-lactating Holstein cows (n=6) were continuously infused for 6 h with P_4 and E_2 in the presence or absence of a soybean oil emulsion using a crossover experimental design. Blood samples were taken every 15 min for the first 120 min and every h for another 4 h. Soybean oil dramatically increased serum concentrations of both P_4 (2.42 ± 0.24 vs. 3.83 ± 0.24 ng/ml; $P = 0.002$) and E_2 (287 ± 28 vs. 379 ± 28 pg/ml; $P = 0.005$) even though the infusion rate of steroids was identical in both groups. Thus, fatty acid and/or triglyceride can increase circulating P_4 and E_2 concentrations by directly inhibiting liver cell metabolism of these steroids. This may be an important functional link between fat feeding and reproductive function.

Key Words: liver, fat, steroid metabolism

567 Influence of diet on conjugated linoleic acid content of milk, cheese and blood serum. R. C. Khanal*[1], T. R. Dhiman[1], D. J. McMahon[2], and R. L. Boman[1], [1]*Department of Animal, Dairy and Veterinary Sciences,* [2]*Department of Nutrition and Food Sciences*.

An experiment was conducted to study the influence of diet on conjugated linoleic acid (CLA) content in milk, cheese and blood serum. Eighteen dairy cows with an initial average milk yield of 33 ± 7 kg and 184 ± 37 days in milk were blocked according to initial milk yield and assigned to one of three treatments. Cows were either fed a total mixed rations containing 50:50 conserved forage to grain ratio (TMR), or grazed on predominantly rye grass pasture (PS) and pasture supplemented with 2.5 kg/day of full-fat extruded soybeans (ES). Experiment was conducted for a period of six weeks. Measurements were made on dry matter intake (DMI), milk yield and composition and fatty acid profile including CLA in milk, cheese, and blood serum during the last 3 weeks of the experiment. Cows in PS treatment had lower DMI and milk yield ($P < 0.01$) compared with cows in ES and TMR treatments. Milk fat, protein, and lactose content did not differ among treatments. The milk CLA contents were 5.0^b, 17.0^a, and 15.0^a mg/g of fat in TMR, PS, and ES cows, respectively. The cheese CLA contents were 4.7^b, 14.7^a, and 14.6^a mg/g of fat in TMR, PS, and ES cows, respectively. Cows in PS and ES treatments had 300% more CLA in milk and cheese compared with milk and cheese from cows in TMR. Supplementation of full-fat extruded soybeans to cows grazing on pasture had no influence on CLA content of milk and cheese ($P > 0.05$). The CLA contents of blood serum were 0.95^c, 2.14^a, and 1.82^b mg/g of fatty acids in TMR, PS, and ES treatments ($P < 0.05$), respectively. The results suggest that diet can influence the CLA content of blood serum and its contribution to milk. Supplementing feeds rich in linoleic acid such as full-fat extruded soybeans to cows grazing on pasture did not increase the CLA content of milk and cheese but decreased blood serum ($P < 0.05$) CLA content in the present study.

Key Words: Conjugated linoleic acid, milk, pasture

568 Effect of fat source on microbial fermentation in continuous culture of rumen contents. G.I. Crawford*[1], M.D. Stern[1], R.L.K. Hulbert[1], K.A. Caperoon[1], and B.L. Miller[2], [1]*University of Minnesota,* [2]*Land O'Lakes Farmland Feed*.

Eight dual flow continuous culture fermenters were used to study the effects of fat source on fermentation by rumen microbes. Four dietary treatments were formulated to meet the requirements of a lactating dairy cow. The four dietary treatments were: 1) a control with no supplemental fat (C), 2) free fat supplemented as choice white grease (WG), 3) bypass fat supplemented as Megalac® (M), 4) bypass fat supplemented as a porcine fat-bloodmeal combination (PBM). The control was formulated to contain 3.4% fat, while the diets with supplemental fat were formulated to contain approximately 5.0% fat. The experiment consisted of two 10-d experimental periods, including a 7-d stabilization phase followed by 3 d of sampling for each period. Fermenter dilution rates were set at .10 and .055/hr for liquid and solids, respectively. Each dietary treatment contained approximately 17.5% CP, which supplied 2.1 g N/d. The treatments were fed at a rate of 75 g DM/d throughout the experimental periods. Fermenter pH was maintained from 6.0 to 6.5 throughout the experiment. Average pH for all treatments was 6.11, and did not differ ($P > 0.05$) among treatments. Concentrations of ammonia N were not affected ($P > 0.05$) by treatment, averaging 16.4, 13.8, 11.3, and 17.7 mg/100 mL for the C, WG, M, and PBM treatments, respectively. Non-ammonia N and bacterial N flow averaged 1.62 and 0.39 g/d, respectively, and were not affected ($P > 0.05$) by treatment. Efficiency of bacterial synthesis (g of N/kg OM truly digested) and CP degradation (%) did not differ among treatments ($P > 0.05$), averaging 12.1 and 41.4, respectively, for all treatments. Digestion of OM, NDF, and ADF averaged 47.4, 33.6, and 50.0%, respectively, and were not affected ($P > 0.05$) by treatment. Results from this experiment indicate that supplemental fat source had no effect on microbial fermentation.

Key Words: Fat, Digestion, Continuous Culture

569 Effects of esterification, degree of saturation, and amount of fatty acids infused into the rumen or abomasum in lactating dairy cows. N.B. Litherland*[1], A.D. Beaulieu[1], and J.K. Drackley[1], [1]*University of Illinois, Urbana*.

Our previous experiments showed that abomasal infusion of soy free fatty acids (FFA) decreased DMI and milk yield more than did soy triglycerides (TG); saturated FA infused abomasally did not suppress DMI or milk yield. Our hypothesis was that increasing amounts of unsaturated FFA infused postruminally would more potently inhibit DMI than equivalent amounts of unsaturated TG or saturated FA infused ruminally or postruminally. Six multiparous Holstein cows with ruminal cannulas were used in a 6×6 Latin square with 21-d periods. During d 1-14, 250 g/d of FA and during d 15-21 500 g/d of FA were infused continuously into the rumen or abomasum. Treatments were infusions of 1) control; 200 g/d of meat solubles plus 12 g/d of Tween 80 in 10 L of water; 2) control plus mostly saturated FA abomasally (SFAA); 3) control plus mostly saturated FA ruminally (SFAR); 4) control plus soy FFA abomasally (UFAA); 5) control plus soy TG abomasally (TGA); and 6) control plus soy TG ruminally (TGR). Cows were fed a TMR (17.5% CP, 21.3% ADF) of (DM) 20% alfalfa silage, 30% corn silage, 27% ground corn, and 16% soybean meal. DMI was decreased more by increasing UFAA than by TGA (esterification×level, $P < 0.001$). Both SFAR and TGR decreased DMI. Milk production followed a similar trend to DMI. Interactions of site of SFA×level ($P < 0.01$) and site of

TG×level (P<0.03) showed that SFAR and TGA decreased milk production at the higher infusion amount. Milk fat yield was decreased by UFAA (P<0.01). Unsaturated FA decreased milk fat yield to a greater extent than did saturated FA (P<0.03). All FA treatments decreased short and medium chain FA in milk, with greatest decreases for UFAA. Both UFAA and TGA increased C18:2 in milk. Milk CLA 9,11 was increased by TGA and TGR (P<0.001). Plasma NEFA were higher for UFAA than for TGA (P<0.03). Unsaturated FFA infused abomasally potently decreased DMI in a dose dependent manner. Unsaturated TG and saturated FA depressed DMI to a lesser extent; TG infused abomasally decreased DMI more than saturated FA infused ruminally or abomasally.

Key Words: dry matter intake, fattty acids, triglycerides

570 Fish oil inhibits the biohydrogenation of fatty acids in the rumen causing an increase in milk trans-octadecenoic and conjugated linoleic acid content. K. J. Shingfield*[1], S. Ahvenjärvi[2], V. Toivonen[2], A. Ärölä[2], P. Huhtanen[2], and J. M. Griinari[3], [1]*The University of Reading, School of Food Biosciences,* [2]*MTT Agrifood Research Finland, Animal Production Research,* [3]*The University of Helsinki, Department of Animal Genetics.*

Evidence from animal model and human intervention studies suggest that consumption of milk and dairy products enriched with conjugated linoleic acid (CLA) has the potential to confer significant benefits to human health. Milk fat CLA content can be enhanced through feeding vegetable oil supplements but greater increases have been attained using fish oil (FO). The current study was conducted to identify the mechanisms underlying FO stimulated increases in milk CLA content. Five lactating cows fitted with rumen cannula were used in a continuous-design with two 14 d experimental periods. Cows were offered 18 kg DM/d of a basal (B) diet formulated from grass silage and a cereal based-concentrate (60:40; forage:concentrate ratio, on a DM basis) followed by the same diet supplemented with 250 g FO/d. The flow of fatty acids leaving the rumen was assessed using the omasal sampling technique and the triple indigestible marker method. FO decreased (P=0.06) DM intake (17.7 and 15.7 kg/d for B and FO, respectively) and milk yield (P<0.01; 18.6 and 14.1 kg/d), but had no effect (P>0.05) on milk fat content (46.0 and 42.8 g/kg). Milk fat trans-11 C18:1 (vaccenic acid), total trans-C18:1, cis-9 trans-11 CLA and total CLA content increased in response to FO from 1.80, 4.51, 0.39 and 0.56 to 9.39, 14.39, 1.66 and 1.85 g/100g total fatty acids, respectively. Furthermore, FO caused a shift (P<0.05) in rumen fermentation towards propionate and butyrate, at the expense of acetate, decreased (P<0.001) the amount of C18:0 entering the omasal canal (283 and 47 g/d for B and FO, respectively), increased (P=0.001) total trans-C18:1 fatty acid flow (38 and 182 g/d), but had no effect (P>0.05) on ruminal CLA synthesis (4.36 and 3.50 g/d). Flows of trans-C18:1 acids with double bonds in positions from 4 to 16 entering the omasal canal were all enhanced, but the effects of FO were primarily associated with an increase in the flow of vaccenic acid leaving the rumen (17.1 and 121.1 g/d for B and FO, respectively). FO supplements enhance milk fat cis-9, trans-11 CLA content due to increased trans-vaccenic acid production in the rumen.

Key Words: Fish Oil, Conjugated Linoleic Acid, Trans Fatty Acids

571 Biohydrogenation shift and milk fat depression in lactating dairy cows fed increasing levels of fish oil. A. Ärölä[1], K.J. Shingfield[2], A. Vanhatalo[1], V. Toivonen[1], P. Huhtanen[1], and J.M. Griinari*[3], [1]*MTT, Agrifood Research Finland,* [2]*University of Reading, UK,* [3]*University of Helsinki, Finland.*

Previous studies have demonstrated that milk fat conjugated linoleic acid (CLA) content can be increased with fish oil supplements (FO). Feeding diets to enrich milk CLA concentrations often result in milk fat depression (MFD) and a shift in the ratio of trans-10 to trans-11 C18:1 concentration in milk fat, both of which limit mammary CLA secretion. A 4x4 Latin Square study with four cows was conducted to examine the effects of increasing levels of FO (0, 75, 150, and 300 g/d) on milk fat synthesis and fatty acid (FA) composition, and the threshold for the trans C18:1 isomer shift and MFD. Basal diet consisted of grass silage and a cereal based-concentrate (forage:concentrate ratio 58:42 on a DM basis). Increases in FO dose resulted in linear decreases (P<0.01) in DM intake (19.7, 19.6, 18.8 and 16.4 kg/d, for 0, 75, 150 and 300 g FO/d, respectively), milk fat concentration (39.5, 40.5, 33.1 and 28.8 g/kg) and milk fat yield (960, 987, 848 and 593 g/d). Concentration of total trans-C18:1 fatty acids in milk fat was increased (P<0.001) through dietary FO (4.1, 6.3, 11.4 and 14.3 g/100 g total FA). Both the concentration of trans-10 and trans-11 C18:1 increased (P<0.001) linearly in response to FO (0.29, 0.46, 1.11 and 4.15 and 1.46, 2.52, 5.51 and 6.11 g/100g total FA, respectively). The ratio of trans-10 to trans-11 increased at the highest level of FO (0.20, 0.19, 0.21 and 0.78; quadratic effect P=0.001). Consistent with this, concentration of CLA in milk fat increased linearly only up to the 150 g/d dose level (0.77, 1.26, 2.63 and 2.61; cubic effect P<0.05). Cis-9, trans-11 isomer accounted for proportionately 0.79, 0.84, 0.90 and 0.90 of total CLA. Milk FA responses suggest that the highest level of FO resulted in a shift in rumen biohydrogenation of long-chain FA towards the trans-10 C18:1 pathway. Therefore, in this study 150 g/d of FO was the optimal dose for CLA enrichment of milk.

Key Words: CLA, Fish Oil, Milk Fat

572 Effect of milk urea nitrogen level on probability of conception of dairy cows. K. Guo*, R. Kohn, E. Russek-Cohen, and M. Varner, *University of Maryland, College Park.*

The objective of this study was to evaluate the association between milk urea nitrogen (MUN) and the probability of conception of dairy cows. The data were retrieved from Lancaster DHIA. Cows that were first bred between June 1, 2000 and May 31, 2001 were included in the study (total of 182 dairy herds and 4200 dairy cows). Over all, the mean days from calving to first breeding was 91 days, the mean interval between first and second service was 55 days. Nominal Logistic Regression was used to determine the effects of different MUN levels, test-day milk production, and breeding season on the probability of conception for several services. MUN and milk production data were used from 60 to 90 days post partum for effect on probability of pregnancy at first service, and data from 120 to 150 days post partum were used for probability of conception at second service. Milk production level, seasonal effects, and season by MUN interaction affected (P<0.05) the probability of conception at first service. MUN recorded 90 to 120 days post partum did not affect probability of conception at first service when used as the MUN input. In the regression model for the second and third service, only milk production and seasonal effects remained significant (P<0.05). Probability of conception averaged 27.2, 30.4 and 31.8% at first, second and third service respectively. For all the seasons except spring, cows that had higher MUN were less likely to conceive at the first service. However, in spring, cows that had higher MUN were more likely to conceive at first service.

	HH	HL	LH	LL		HH	HL	LH	LL
Winter	0.28	0.30	0.31	0.33	Summer	0.29	0.32	0.32	0.35
Spring	0.45	0.41	0.48	0.45	Fall	0.15	0.20	0.17	0.23

HH: High Milk Production (45kg/d) and High MUN (16mg/dl), HL: High milk production (45kg/d) and Low MUN (16mg/dl), LH: Low milk production (31kg/d) and High MUN (16mg/dl), LL: Low milk production (31kg/d) and Low MUN (16mg/dl)

Key Words: milk urea nitrogen, probability of conception, reproduction

Contemporary and Emerging Issues
Critical Perspective of Animal Agriculture

573 Livestock, ethics and quality of life. J Hodges*, *European Association for Animal Production.*

Livestock played a key role in development of human societies. This role goes beyond lifting the physical conditions of human life; livestock have also shaped values with the concept of Community of Life. Consequently in pre-modern societies the normal and acceptable standards for caring for livestock were extended to many areas of life and linked with sustainability. In agricultural societies, the derivation of values and ethical behavior emphasizes the common interests of various sectors of society and decision-making processes generally enhance the overall quality of life. In the modern era changes in Western agriculture and in the food chain have been prime factors in reshaping society from a rural to an