Inbreeding can lead to increased uniformity within the inbred stock, increased prepotency in outcrosses, production of abnormal types, and symptoms of decline in vigor.

Since some of these results are desirable and others undesirable, it would seem appropriate that experiments be conducted to yield reliable information on this subject which could be of help to the dairyman in formulating his breeding plans. With such an aim in mind an inbreeding experiment with Jersey and Holstein cattle was initiated.

This brief summary of some of the findings may be of value to dairymen.

Several types of hereditary defects have been brought to light in the experimental herd. In connection with these defects it should be stressed that the foundation stock consisted of purebred animals of normal type and it was not the program of inbreeding itself that produced these defects, but rather the inbreeding brought them to light thus offering a method with which to purge the stock of the undesirable gene from his herd.

The commercial dairyman can not afford to use inbreeding for this purpose but he can obtain from the University of California Division of Animal Husbandry a list and description of the known hereditary defects that might occur in his herd.

The effect of inbreeding upon calf mortality prior to four months of age has been studied and the results indicate that the frequency of calf mortality tends to increase with the amount of inbreeding.

An investigation has been made of the effect of inbreeding upon the size and rate of growth of Jersey females. The size of the animal, other things being equal, is related to its vigor and general well being. Many dairymen take size into consideration when selecting cattle for breeding purposes. For this reason it is important for the dairyman to be able to recognize a hereditary defect as such. It saves him from the futile expense of medication or changes in management procedures. Furthermore, to the extent that he has kept breeding records, he can often devise a plan to eliminate the undesirable gene from his herd.

Inbreeding investigations with dairy cattle indicate that inbreeding can lead to desirable or undesirable results.

### Some Hereditary Defects in Dairy Cattle

<table>
<thead>
<tr>
<th>Defect</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Congenital cataract</td>
<td>A defective lens present at birth becomes more pronounced with age.</td>
</tr>
<tr>
<td>Congenital imperfecta (hairless)</td>
<td>Affected calves have defective skin on the lower legs and mucous membranes of the mouth and nostrils, large hairless patches over the body, deformed ears, dew claws, and hoofs. (Found in Jerseys and Holsteins)</td>
</tr>
<tr>
<td>Congenital dwarfism</td>
<td>Deforms the head and may also affect other parts of the axial skeleton.</td>
</tr>
<tr>
<td>Achondroplasia (bulldog condition)</td>
<td>Calves have a palsylike condition at birth and live only a few weeks or less. (Found in Jerseys)</td>
</tr>
<tr>
<td>Congenital spasms</td>
<td>Male sterility Males are sterile. (Found in Jerseys and Holsteins)</td>
</tr>
<tr>
<td>Female sterility</td>
<td>Heifers are sterile. (Found in Jerseys and Holsteins)</td>
</tr>
<tr>
<td>Male sterility</td>
<td>Heifers are sterile. (Found in Jerseys and Holsteins)</td>
</tr>
<tr>
<td>Digital anomaly</td>
<td>Toes are malformed and standing on them causes considerable discomfort as animals advance in age. (Found in Jerseys)</td>
</tr>
<tr>
<td>Prolonged gestation</td>
<td>Pregnant females carry calves far beyond term. Resulting large calves cause difficult deliveries which are usually fatal to both the dams and the calves. (Found in Holsteins)</td>
</tr>
</tbody>
</table>

*Approximately thirty known lethals (hereditary defects resulting in death) have been reported for cattle by various investigators.

### Decrease in Size of Jersey Females Due to Inbreeding

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Age</th>
<th>Average loss in heart girth, weight, and height due to the intensity of inbreeding indicated*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart girth</td>
<td></td>
<td>6%</td>
</tr>
<tr>
<td>(in inches)</td>
<td></td>
<td>0.6</td>
</tr>
<tr>
<td>1 Mo.</td>
<td></td>
<td>0.3</td>
</tr>
<tr>
<td>1/2 Yr.</td>
<td></td>
<td>0.4</td>
</tr>
<tr>
<td>1 Yr.</td>
<td></td>
<td>0.8</td>
</tr>
<tr>
<td>2 1/2 Yrs.</td>
<td></td>
<td>1.0</td>
</tr>
<tr>
<td>4 1/2 Yrs.</td>
<td></td>
<td>1.3</td>
</tr>
<tr>
<td>Weight</td>
<td></td>
<td>0.2</td>
</tr>
<tr>
<td>(in pounds)</td>
<td></td>
<td>0.3</td>
</tr>
<tr>
<td>Birth</td>
<td></td>
<td>0.5</td>
</tr>
<tr>
<td>1/2 Yr.</td>
<td></td>
<td>1.0</td>
</tr>
<tr>
<td>1 Yr.</td>
<td></td>
<td>1.4</td>
</tr>
<tr>
<td>2 Yrs.</td>
<td></td>
<td>1.8</td>
</tr>
<tr>
<td>4 1/2 Yrs.</td>
<td></td>
<td>2.2</td>
</tr>
</tbody>
</table>

*Geneticists use a scale of inbreeding that runs from zero to 100 per cent and can be applied to irregular pedigrees. Some landmarks on the scale for the dairyman are: offspring resulting from one generation of first cousin matings are 6% inbred; offspring resulting from one generation of half brother and sister matings are 12% inbred; and those from one generation of full brother-sister or parent-offspring matings are 25% inbred. Those from two generations of full brother-sister or parent-offspring matings are 37% inbred.

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INBREEDING

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sideration in deciding at what age a heifer should be bred. Furthermore, research in nutrition and genetics suggests that size tends to be related to milk yield.

In this study measurements of body weight, heart girth, and height at withers were considered jointly as an indication of muscular and skeletal development.

It was found that inbreeding caused a decrease in all three of the measurements considered. The inbred calves were smaller at birth than the outcrossed calves and grew more slowly up to about six months or a year of age. Subsequent to that period the inbred animals tended to grow more rapidly than the outcrossed. At 4½ years of age the inbred animals were proportionally closer in size to the outcrossed than they were as yearlings.

The effect of inbreeding presented here is an average effect; not every inbred animal is smaller than every outcrossed animal, but the average size of an unselected group of inbred animals is likely to be less than that of an unselected group of outcrossed animals.

W. C. Rollins is Instructor in Animal Husbandry and Holstein cattle mentioned in the above article was initiated by W. M. Regan, Professor of Animal Husbandry in the Experiment Station, Berkeley.

DONATIONS FOR AGRICULTURAL RESEARCH

Gifts to the University of California for Research by the College of Agriculture accepted in January, 1950

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Division of Plant Nutrition
Beet Sugar Development Foundation ................................................. $5,000.00
Division of Plant Nutrition
The Dow Chemical Company .......................................................... 5# sample DL-Methionine feed grind
Division of Poultry Husbandry
Nopco Chemical Company ............................................................. 1 kilogram cholesterol, U.S.P.
Division of Poultry Husbandry
Producers Cotton Oil Company ....................................................... 5 samples of special cottonseed meal
Division of Poultry Husbandry
U. S. Industrial Chemicals, Inc. ...................................................... 1 lb. DL-ethionine
Division of Poultry Husbandry
The Wilson Laboratories ................................................................. 10 lbs. liver fraction 1
Division of Poultry Husbandry

DAVIS

Canners League of California ......................................................... $294.23
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Division of Botany
Paul J. Howard ................................................................. 5 plants and shrubs of standard varieties
Division of Botany
Mr. Walter J. Husband, Rochcliffe Nursery ................................. 18 exotic plants
Division of Botany
Los Angeles Country Club ......................................................... 150 sets of annual plants
Division of Botany
Mr. Ludwig Merger ................................................................. 6 drug plants
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Keith Patton ................................................................. 1 shrub—Ruscus hypoglossum
Division of Botany
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Division of Botany
Mr. R. Townsend ................................................................. 5 species of exotic plants, 5 cuttings of exotic plants;
Division of Botany
Mr. Eric Walthers, Strybing Arborenum ...................................... 18 exotic cuttings
Division of Botany
Fritz Wassman, Westminster Nursery ............................................. 1 orchid plant
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Donald P. Woolley ................................................................. 2 plants—Sanziveria procumbens; 1 climbing fern; 1 cymbidium orchid
Division of Botany
Shogo Yamaguchi ................................................................. 2 trees Sapidus ninkurosi
Division of Botany

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