ZAHRANIČNÁ PRACOVNÁ CESTA DO USA 16. – 27. 8. 2011

Ing. Milan Zúbrik, PhD.

Ing. Ingrid Krišťáková

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Buzzards Bay, MA 02542
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- Otis Laboratory – Buzzards Bay, MA
- Mission is to develop, refine, and transfer technology for pest survey,
- exclusion, control, and risk assessment for APHIS

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- Karanténna služba
- Chov mníšky veľkohlavej (Anoplophora, Agrilus, Operophthera, ...)
- Chov vírusu v húseniciach mníšky veľkohlavej
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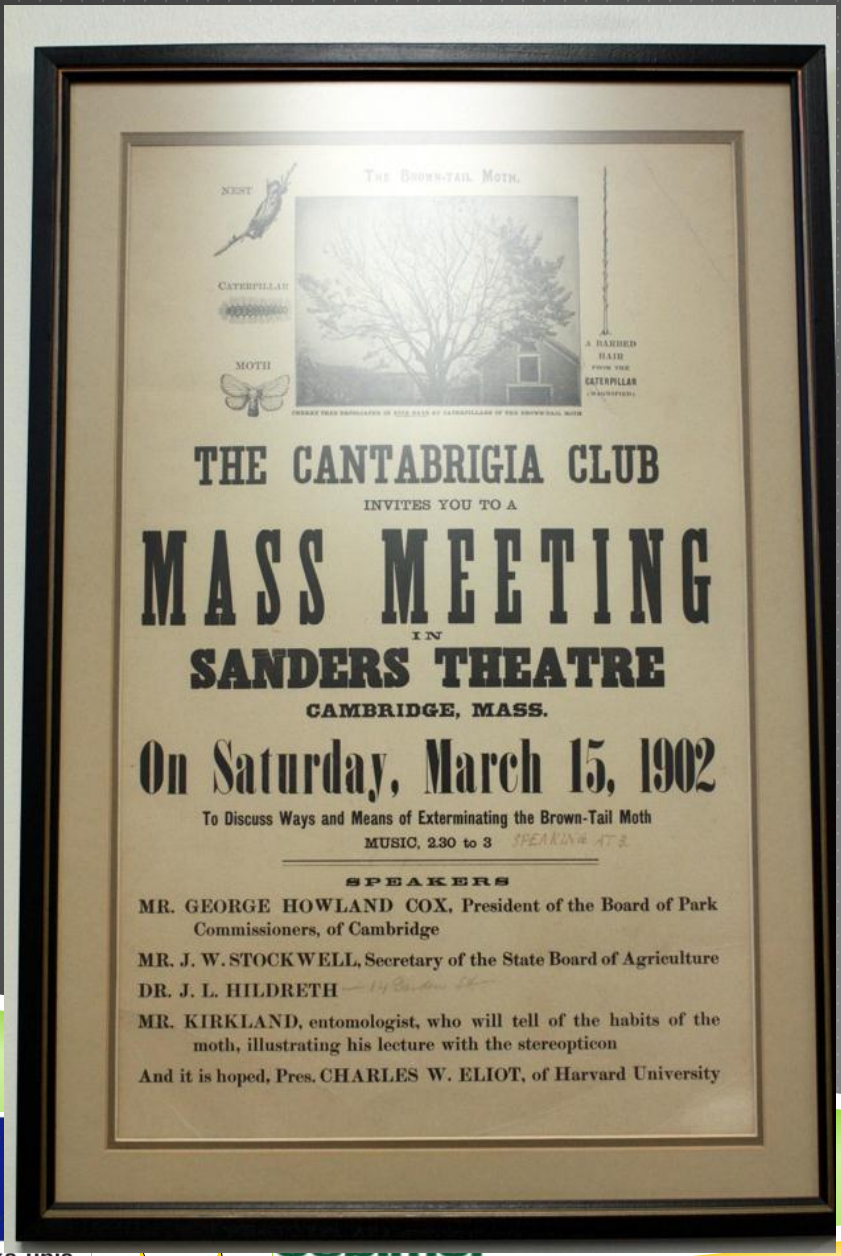


NEST

CATERPILLAR

MOTH

THE BROWN-TAIL MOTH.

A BARBED HAIR FROM THE CATERPILLAR

THE CANTABRIGIA CLUB

INVITES YOU TO A

MASS MEETING

IN

SANDERS THEATRE

CAMBRIDGE, MASS.

On Saturday, March 15, 1902

To Discuss Ways and Means of Exterminating the Brown-Tail Moth

MUSIC, 2.30 to 3 SPEAKING AT 3.

SPEAKERS

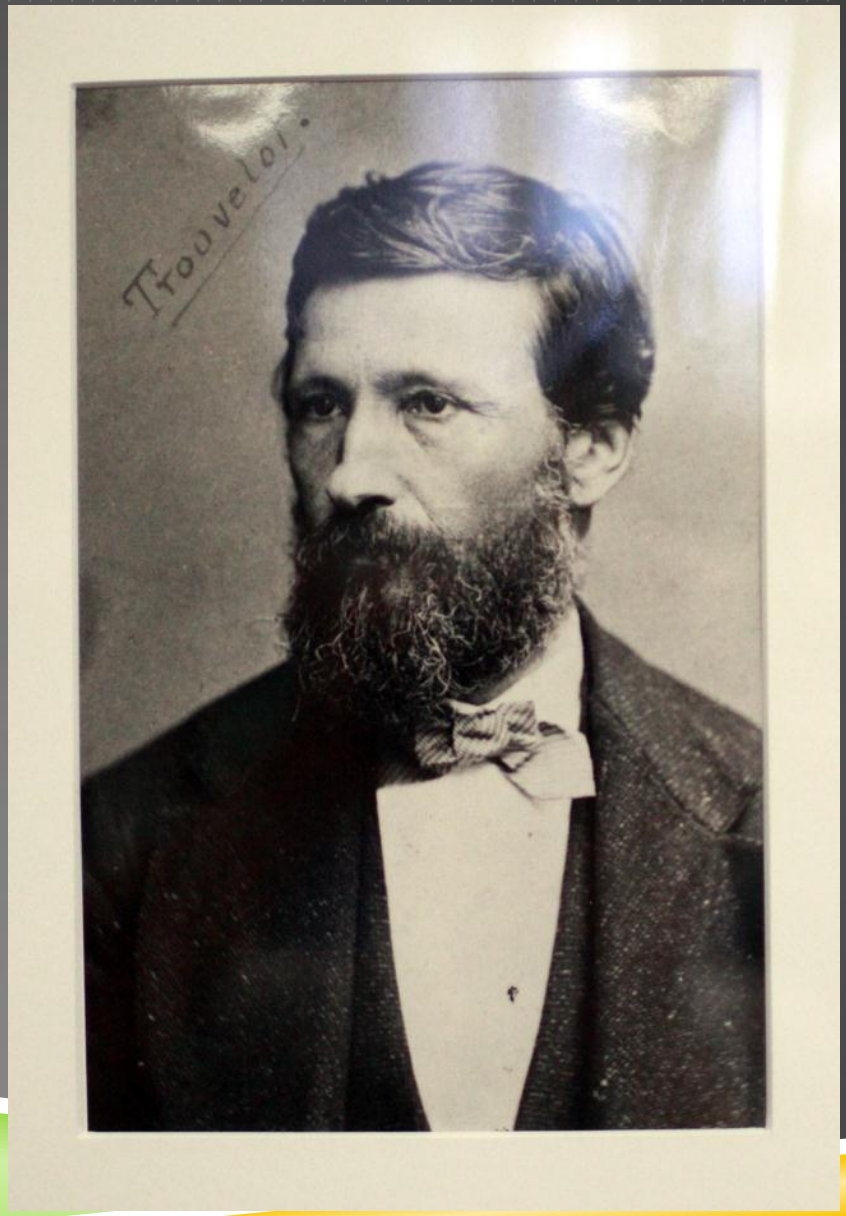
MR. GEORGE HOWLAND COX, President of the Board of Park Commissioners, of Cambridge

MR. J. W. STOCKWELL, Secretary of the State Board of Agriculture

DR. J. L. HILDRETH

MR. KIRKLAND, entomologist, who will tell of the habits of the moth, illustrating his lecture with the stereopticon

And it is hoped, Pres. CHARLES W. ELIOT, of Harvard University



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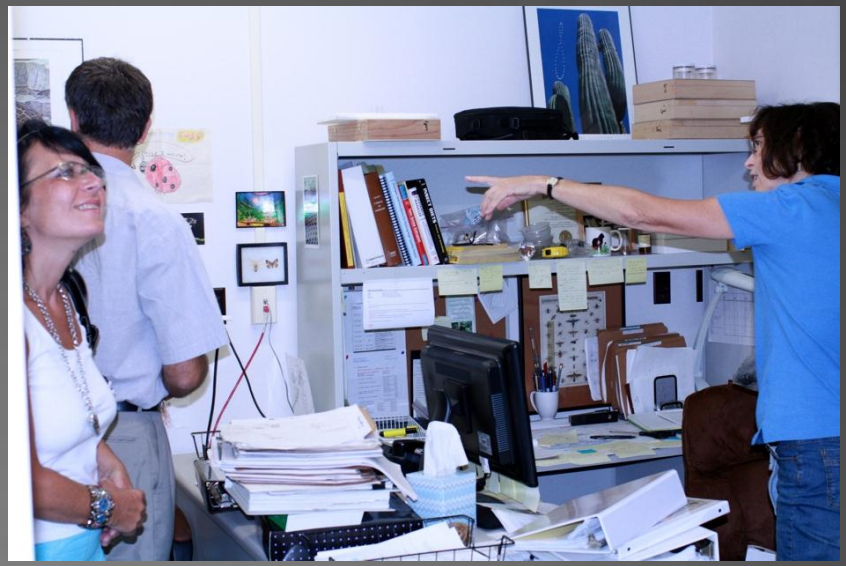

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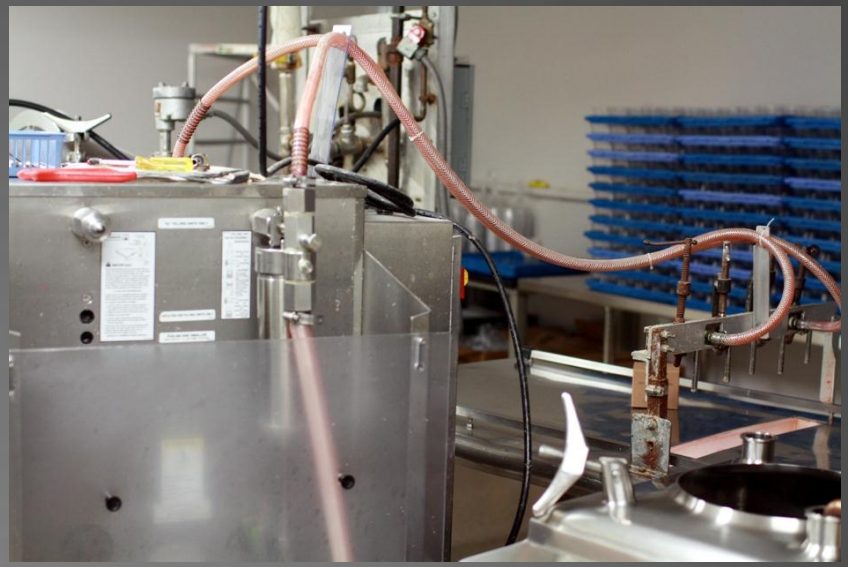

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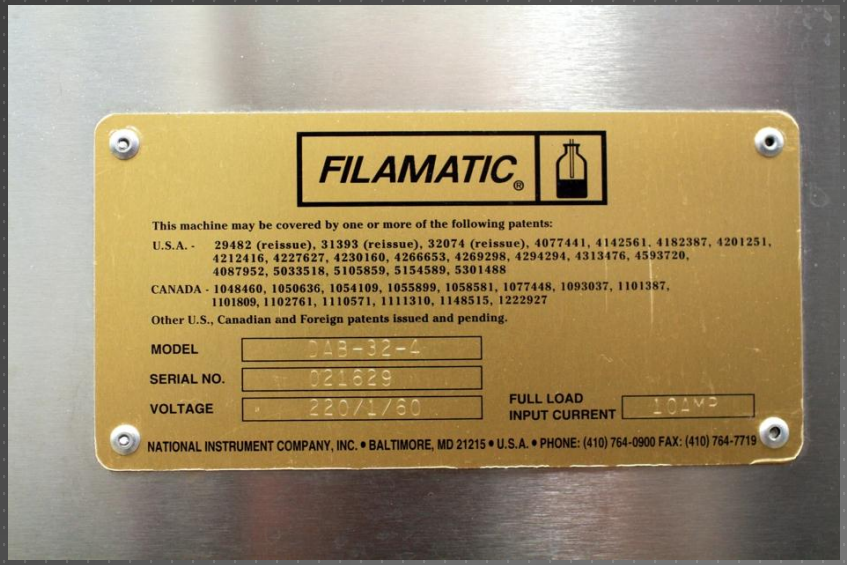

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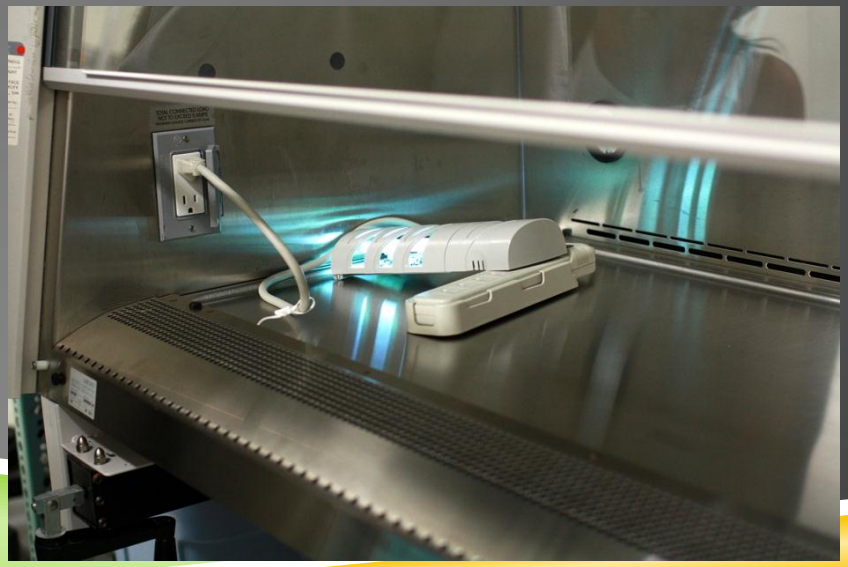

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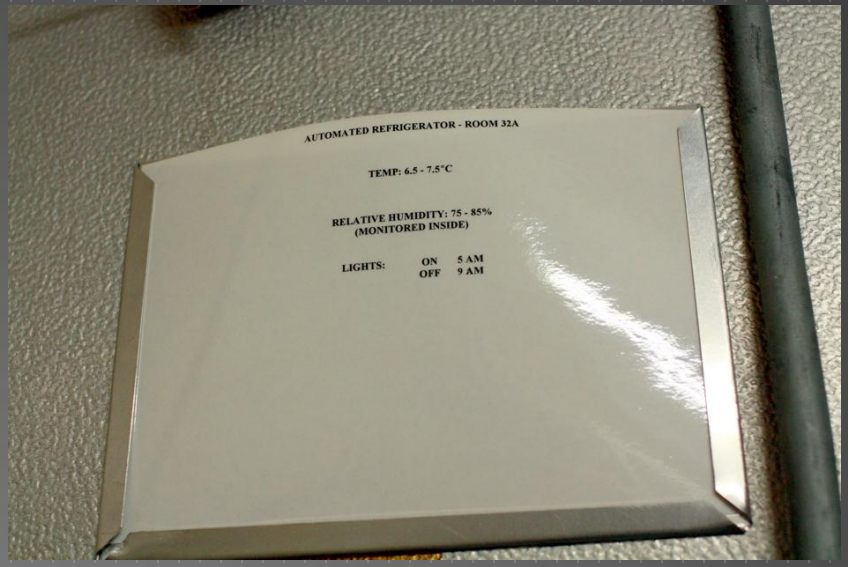

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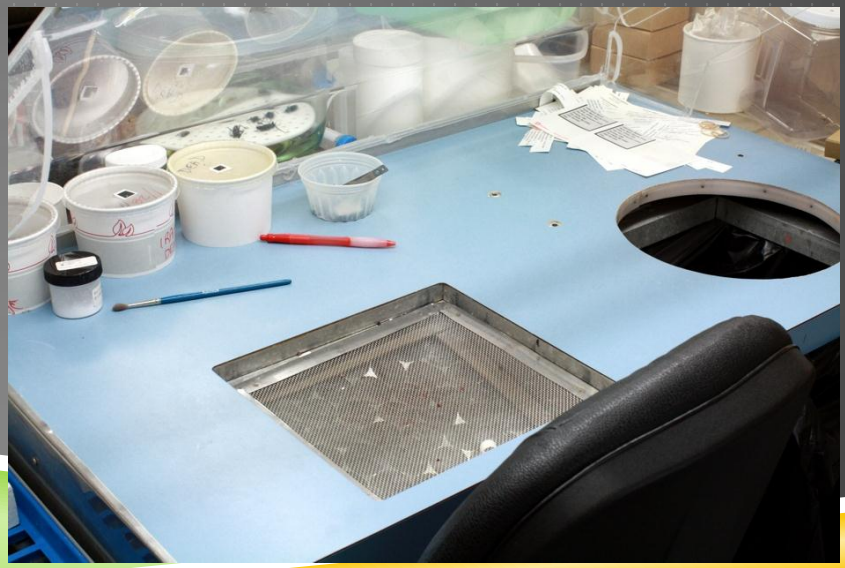

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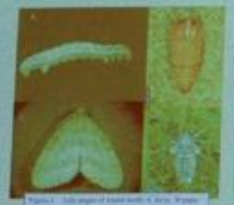
Development of an Artificial Diet for Winter Moth, *Operophtera brumata*

Emily Hibbard[1], Joseph S. Elkinton[2], and George H. Boettner[2]
1/ USDA, APHIS, PPQ Bldg. 1398, W. Truck Rd. Otis ANGB, MA 02542
2/ Dept of Plant, Soil and Insect Science, University of Massachusetts, Amherst, MA 01003



The winter moth, *Operophtera brumata* L is an invasive forest defoliator that has recently invaded New England. We tested four artificial diets against larval survival, pupal weight, and adult emergence. Results of percent hatch at various temperatures indicated that eggs need a 70-95 day chill period for best hatch, and the ideal incubation temperature is 18C. Of the four diets tested, a soybean modified gypsy moth diet resulted in:1) the greatest larval survival over 21 days, 2) the largest pupae, and 3) the greatest percentage of adult emergence. Pupal weights of larvae reared on this diet was comparable to, and number of eggs laid was greater than, that of field collected pupae from red oak and red maple hosts.

Introduction

The European winter moth, *Operophtera brumata* L. (Fig. 1) is an invasive pest that was first introduced to North America in the 1930's via Nova Scotia (Embree 1965). Beginning in the 1990s a new outbreak of winter moth has occurred in New England, where it has caused extensive defoliation of deciduous trees and shrubs. Massachusetts has begun a biocontrol program using an introduced European tachinid fly *Cyzenis albicans* (JSE unpublished).

Development of a successful artificial diet for the winter moth would accelerate laboratory mass production of *C. albicans* for biocontrol releases. We tested various diets and diet ingredients to arrive at one that gave the best performance in terms of larval survival, pupal weight, and adult emergence. We can now rear large numbers of winter moths from egg to adult on this diet. We have also investigated various ways to shorten the winter moth generation time in order to produce a year round culture.

Materials and Methods

Hatch of winter moth Eggs. Eggs were collected from wild winter moth females using flowfit bands on the boles of trees in November 2007. Bands were brought into the lab in January and all eggs were chilled in a 3.5 C holding chamber. Eggs were pulled from chill at 14 day intervals and placed in one of three temperature treatments for incubation, 18.3, 19.4 and 25.5. Eggs were monitored daily to determine percent hatch in comparison to their incubation date (Fig. 2).

Culturing: Once an optimal incubation time was determined, cohorts of eggs were pulled from chill and neonate larvae were placed onto four different diets. Larvae were maintained in environmental chambers controlled at 21C +- 3C with a 16.8 hr L:D photoperiod (Fig. 3, 4). All diets were prepared in a commercial blender. The Gypsy moth (GM) diet is composed of 66% wheat germ and 34% vitamin mix, salt mix, and antimicrobials (Bell et al. 1981). The Pinto bean diet is composed of 28% wheat germ and 26% ground pinto beans (Greene, 1976). The modified Gypsy moth diet (GM+soy) is composed of 63% wheat germ and 8% soy flour. The Bioserv general Lepidoptera (Gen Lep) diet is composed of 50% soy flour and 50% wheat germ, vitamins, salts, fiber, and antimicrobials.

Feral pupae were collected under host trees (oak and maple) using peat filled catch buckets at the time of pupation.

Winter moth performance was measured in terms of larval survival after 21 days, pupal weight, and adult emergence. Larvae that reached 5th instar were transferred to peat moss and allowed to pupate (Fig. 5). Pupae were then sexed, weighed, returned to their pupal cell and then held at 19°C until adult emergence. Emergence was recorded over a 20 day period. (Table 1).

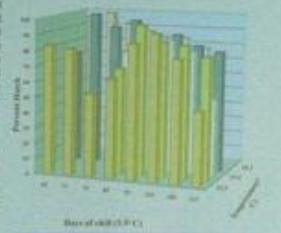


Table 1. Performance of winter moths on four diets in comparison to field-collected (feral) pupae.

Diet	Larval survival at 21 days	Female average pupal weight (in mg) MN ± SE	Average # eggs laid per female MN ± SE	Adult emergence
Gypsy Moth Diet	39%	26.8 b (± 1.7)	242 b (± 15.08)	60.23%
Pinto bean diet	2%	N/A	N/A	N/A
GM + Soy diet	46%	37.5 a (± 2.6)	317 a (±8.1)	71.33%
General Lep. Diet	19%	N/A	N/A	N/A
Feral winter moths Red oak	N/A	35.9 a (± 1.4)	26[illegible]	N/A
Feral winter moths Red maple	N/A	39.6 a (± 1.7)	217 [illegible]	N/A

Various techniques have been investigated to reduce the generation time of the lab reared winter moth. In nature eggs hatch at approximately 140 days. We found the that eggs need a 70-95 day chill period for best hatch. Pulling eggs from 3.5°C after only 70 days has allowed us to generate a year round lab colony of winter moth after several generations. The eggs incubated at approximately 19°C had the greatest percent hatch.

Larvae reared on the GM and GM+soy diets were the most successful. A mean of 39% and 46% of larvae on the GM and GM+soy diets respectively, reached the pupal stage. Pupal weights and number of eggs laid by females reared on GM+soy diet were higher than weights for field collected female pupae (Table1). Adult emergence was also greater from the larvae reared on GM+soy diet. Larvae placed on Pinto bean and Gen. lep diets experienced the highest mortality, and most died within 14 days.

The effect of temperature on pupal eclosion was also examined. Neither we, Holliday, or Nilssen found a way to reduce the pupal period by altering the temperature regime or changing the light dark cycle. (Peterson and Nilssen 1998, Holliday 1983).

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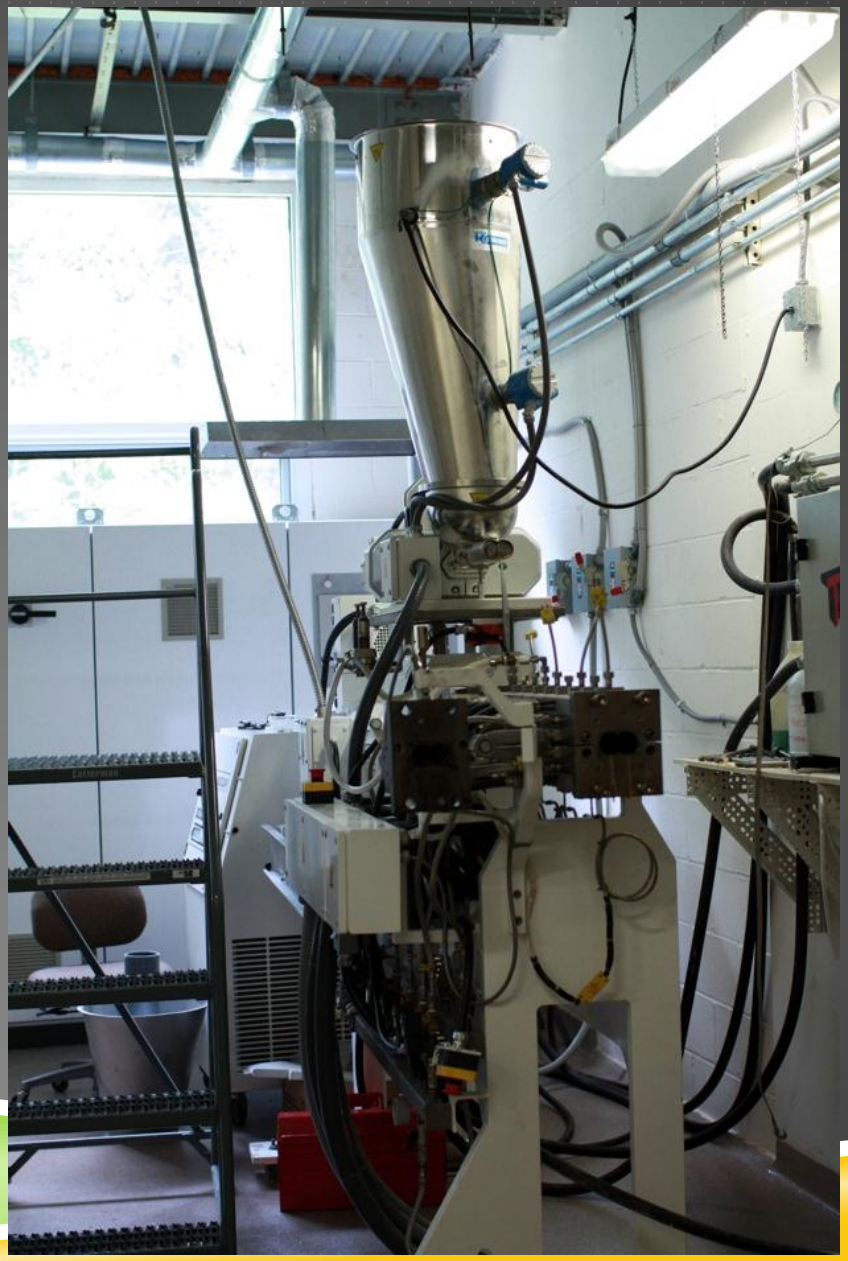

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