‘The Molecular Biology of the Hamburger’

In 2010, McDonald's Corporation became a pioneer of private-sector sponsorship of higher education when it established its two-year Foundation Degree in managing business operations at Manchester Metropolitan University in the UK. The course combines academic studies with ‘e-learning’ and ‘workplace experience’, although it is unclear how much of the course is spent stooped over a hot griddle.

Imitating this delicious concept, the Jacobs University of Applied Sciences is now pleased to announce the world's first vocational degree course in fast-food biotechnology, ‘The Molecular Biology of the Hamburger’. In the spirit of the industry, the main course is served as a low-budget, non-refundable package, complete with garnishes and sauces to taste; beverages at the college bar are extra.

The course contains eight core modules. *MBH101*: the molecules of life. This introductory module will analyse the underlying biochemistry of the fast-food industry, focusing on the principles of starch and sugar metabolism, the importance of saturated fatty acids and cholesterol, the denaturation of proteins in high-salt conditions, and the complex glycation and oxidation products, such as malondialdehyde and acrylamide, that arise during cooking. Labs will teach basic cellular imaging techniques using thin cryo-sections of the major constituents of a burger meal. The presence of trace amounts of antibiotics in beef patties will be demonstrated using a simple bioassay.

MBH220: burger genomics. Not many people realize that more than 1% of the dry weight of a hamburger is, in fact, DNA. This lab-based module will use the latest molecular tools to demonstrate the range of plant, fungal and animal species used in the making of a hamburger, as well as test for common insect and microbial contaminants. Students will collect discarded hamburger meals from city-centre trash bins and bring them to the lab for DNA extraction. Using universal multiplex PCR primers we will

amplify and sequence ribosomal RNA genes from the sample and use bioinformatics to identify the source material.

MBH214: DNA repair. This course will teach the basics of DNA damage and repair mechanisms, using analogies from the burger kitchen. Topics to be covered include radiation damage, flippases, suicide pathways and mismatch detection. We demonstrate how the addition of ‘antioxidant spices’ to hamburger meat before cooking antagonizes free radicals, significantly decreasing the generation of potentially carcinogenic purine adducts in the final product.

MBH220: structural biology (lab). Starting from standard catering and cleaning materials found in any fast-food kitchen, we will detergent-treat mayonnaise and fractionate it into its chemical constituents. Students will purify the ovalbumin for trial crystallizations. The interpretation of X-ray crystallographic data will be taught by an e-tutorial. We will further process protein-free extracts for mass spectrometry, to teach the basics of lipidomics.

MBH240: diversity issues in human genetics. Many people lack the ability to enjoy hamburgers to the full, as a result of inherited predispositions to so-called life-style diseases. This course will examine the complex genetics underlying disorders such as chronic hypertension, juvenile obesity and bulimia, and discuss the tantalizing prospects for instant DNA analysis. On-site tests will enable the burger restaurants of the future to offer a customized product to satisfy an increasingly wide clientele.

MBH301: the GM-burger. Although genetic manipulation is also used for environmental and health improvement, this module will explain its applications to controlling the price of a burger meal. Examples of useful gene technologies will include cloning of beef and dairy cattle, the generation of herbicide-resistant soybeans and potatoes, and the microbial engineering behind the hundreds of chemical additives in carbonated soft drinks.

MBH324: prion biology. As this module will explain, despite all the scare stories from the 1990s, burgers are perfectly safe to eat and always have been. In a wider context, we will discuss how public health can be seriously endangered by vegetarian activists putting out false claims without any evidence from long-term studies.

MBH404: advanced hamburger biotechnology. Students will divide into teams in this self-taught group-study module. Each group will research the ways in which bio-engineering can enhance the burger experience of the future, selecting one from the following menu of topics: (i) the versatile diet hamburger—although a zero-calorie burger is still a far-away prospect, students will use their knowledge of nutritional physiology and genetic engineering to conceptualize a carbohydrate-free product; (ii) the bionic burger—building on their knowledge of synthetic biology, students will work on the design of a future hamburger containing no natural ingredients whatsoever; (iii) the ultimate taste sensation—as neuroscience has explained, the taste of food has nothing whatsoever to do with its nutrient composition. By using an empirical approach, students will select novel combinations of olfactory and gustatory agonists to realize the goal of maximizing taste over content in the burger meal.

Two optional side-modules are to be selected from the following list:

LAV204: advanced laboratory, workplace and washroom hygiene.

FRY101: basic culinary French.*

MRD101: introduction to waste marketing.

BLX222: high-throughput customer-interaction training.

TOM301: the history of ketchup.

*may be substituted by a six-week training placement in the campus restaurant, ‘Frites-Rapide’.

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