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# CaribXplorer

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Life & Science of the Caribbean

## Volcano Fury

Perception  
and Reality of  
Corruption

The Nuclear  
Option

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as a Cure

Pumpkin Seeds  
Prostate Cancer  
& Menopause



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# Volcano Fury

## Survival and Resilience

By Wayne Bowen

**Carib Xplorer senior writer and photographer, Wayne Bowen, travelled to the beautiful and fascinating Caribbean island of Montserrat for this story. Since his visit some things in Montserrat have changed — including the government — but many others remain the same.**

Montserrat has a volcano. And it's been exhaling. Scientists say volcanic eruptions formed the island millions of years ago. Now it's rumbling again. Ash and lava flows have created new fans of land, extending the coast into the sea at the volcano's base. Ever since July 1995 when this new cycle started, volcanic activity has been ongoing, even leading to loss of life. By 1997 the eruptions forced the large scale evacuation of sections of the island. Could there be a 'big one' any time soon? No one really knows for sure. Not even the scientists working at Mont-

serrat's Volcano Observatory can be sure when the next big eruption will occur. Then, such is the case with volcanoes everywhere.

Although peaceful and beautiful, living here can sometimes be difficult. The stresses caused by the uncertainty can be tremendous. In spite of this, Montserratians are generally very warm and welcoming. Perhaps even more so than people on several other Caribbean islands where tourism is the number one industry. Montserrat too is trying to attract more visitors, but it's not an easy sell. True, the island is safe to visit and there

are no immediate threats from the volcano. Also, travelling there to see the volcano and other parts of the island can be an extremely rich and rewarding experience. However, access to the island is limited to travel by small planes, boats and perhaps, very soon, a ferry.

The former capital, Plymouth, was one of the Caribbean's most picturesque towns. Today it's like a disaster movie set, an uninhabitable ghost town covered in ash. It lies in a direct path downhill from the Chances Peak volcano, which is also called Soufriere. Rivers of lava and ash — called pyroclastic flows — have buried some buildings up to their roofs. Where people used to live, breathe, play dominoes and follow West Indies cricket, is now ash covered and still. And it's not the only part of the island with abandoned properties. Sometimes ash fell daily, spreading over the entire island and even over the islands nearby. Volcanic ash is hard to clean up. The fine particles seep into everywhere. Dirtying clothes. Damaging lungs. When it falls heavily, it's like snow, blanketing everything with cement coloured uniformity. Thousands have lost everything — houses, land, crops, livestock, cars, other prized possessions and jobs — to encroaching ash. More than half of the estimated 12,000 people who lived here before the 'first eruptions' have left the country. Most are unlikely to return. Two-thirds of the island is considered dangerous and is declared an 'exclusion zone', though some restrictions have eased in recent years.

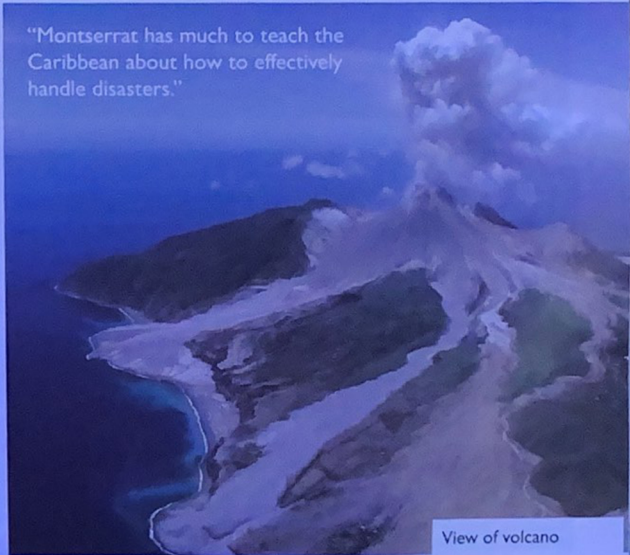
On a typical day, Montserrat seems just like any other island — beautiful and easy-going. But the dislocations caused by volcanic activity have been difficult to bear. Things got really bad on Boxing Day (26th December) 1997. Most people were shaken and

scared. Evacuation from vulnerable areas was ordered. Many more decided that this time staying was not viable. There was understandable chaos and panic. Shelters were overwhelmed. Families were sometimes separated and forced to share accommodation with others. This caused major personal and domestic upheavals — leading to an increase in conditions of mental stress and mental breakdown as well as in marital and family rifts, sometimes leading even to violence. People lost their jobs. Money was scarce. Landlords were accused of price gouging and charging unreasonable rents. There was a lot of finger pointing. Eventually things calmed down and some of the people who left returned. The public services which were initially overwhelmed started to recover and have been reorganized. Health services are now considered much better than they were before the eruptions started. A new hospital was built in the north of

the island, which has been designated the safest area. Clinics in the 'safe zone' have also been rehabilitated. Well publicized disaster response protocols have been put in place in case there needs to be a sudden and total evacuation in the future.

Montserrat is a British dependency. Britain's handling of events has drawn quick criticism. The decision against forcible evacuation of the island even after scientists found the air quality below British legal minimums has been particularly contentious. Yet many of the estimated 4,000 people still on island say they will never leave. Some believe the 'Mother Country' prefers not to have too many island immigrants anyway, so why leave to suffer in the cold — better to suffer where you know. There's dissatisfaction with the pace of infrastructure recovery and economic options.

"Montserrat has much to teach the Caribbean about how to effectively handle disasters."



View of volcano





## Fancy Indians of Trinidad and Tobago

By Clinton Hutton

Photographer, artist and UWI political historian, Dr Clinton Hutton, travelled to Trinidad and Tobago to experience Carnival. He shares his fascination with the Fancy Indians with you our readers.

These photos depict fancy indians in Trinidad and Tobago Masquerade or Mas. This tradition pre-dates the 20th century, constituting part of the history/aesthetic of texturing in the artistic and metaphysical culture of the Caribbean and the African Diaspora in the Americas generally. Africans who were enslaved in the Americas established relationships with First Nation Peoples in a joint endeavour to resist European genocide, enslavement and

colonial subjection.

There is, for example, the case of the relationship between Africans and the Seminole people in Florida as well as that between Africans and the First Nation People of St Vincent which produced the so-called Black Caribs, the Garifuna people living in Belize and other Central American countries. They were defeated by the British and evicted to Roatan island off the coast of Central



America in the 18th century. In other cases, Africans established social/genetic, political, economic and cultural relationships with First Nation Peoples in Haiti, Jamaica, Suriname, Brazil, Trinidad among other places.

An important consequence of this contact can be found in African diasporic spirituality and art such as the Fancy Indian character in Mas. Trinidad's Mas artists have been celebrat-

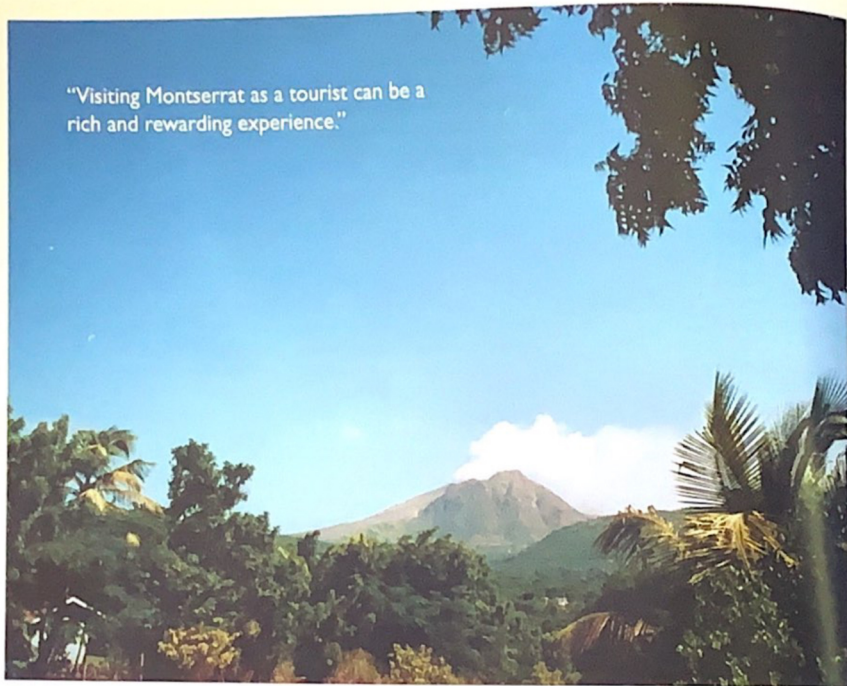
ing First Nation Peoples in the Fancy Indian and other Ol' Mas Indian traditions before the 20th century. Fancy Indian masqueraders denoting royalty as a metaphor of being, as well as priestly characters/ medicine men and warriors, etc. play Mas in the streets of Port of Spain, San Fernando, Arima and other communities. **CK**



Clinton Hutton



"Visiting Montserrat as a tourist can be a rich and rewarding experience."



Britain's internal investigations have given the disaster response efforts a fair grade, while suggesting tweaks.

New housing has also been built although some locals say the units are too small. As inadequate as some argue British aid has been, it's doubtful that most Caribbean governments would have been able to do as much in a similar time span. The truth is that rebuilding the sort of infrastructure Montserrat requires will be costly.

In 2009 the volcano started behaving dangerously again. It coincided with political eruptions which led to the Legislative Council being disbanded and new elections being called a full

two years before they were due.

A mountain of rebuilding work still needs to be done. The volcano itself may eventually be targeted to generate energy and economic opportunities. A similar operation has started in nearby Nevis. The plans are ambitious but if they work it could be a way for Montserrat and other Caribbean islands to gain more financial freedom. What is being done in Nevis is an attempt to generate electricity from the volcano. This can then be used to power the island but even more interestingly, the energy can be sold to other islands as well via undersea cables! It should also be possible to store the energy in batteries for sale anywhere in the world. These could

take the form of huge power barges that could be towed into place and returned for recharging later. If such a plan proves workable it could be revolutionary.

Events on Montserrat seem to have some lessons for the rest of the region. They show how critical it is to have well oiled disaster response units. It may also be useful to have similar protocols, training and equipment in use throughout the islands. Are there any teams

**"At least 16 volcanoes exist in the Caribbean, some of them under the sea"**

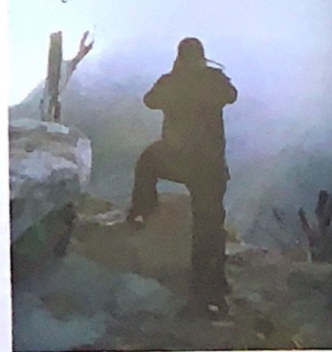


View from a hill in Montserrat. Some abandoned modern wind generating propellers can be seen on the hillsides.



Montserrat Volcano Observatory

Here a photographer gets a shot while steam (probably ash) spews from the volcano and blankets everything like fog.





with sniffer dogs to locate people still alive but buried after earthquakes? Can they be moved quickly to different locations? Is enough machinery in place to remove debris after earthquakes or floods? Can they work quickly and safely and are they mobile? The Montserrat volcano, also known as Soufriere or Chances Peak, was thought to be extinct. It had not erupted since Christopher Columbus' invasion of the region in the late 15th century. It means that other islands with dormant or 'extinct' volcanoes may one day find themselves facing events like those in Montserrat. At least 16 volcanoes exist in the Caribbean, some of them under the sea. Long-term planning needs to be done and constantly updated about how to treat those affected not just by future volcanic eruptions, but by all other natural disasters.

The Caribbean is potentially one of the most disaster prone regions in the world. Annual hurricanes are usually seen as the greatest threats, but extreme flooding, landslides and droughts are not uncommon, while tsunamis and earthquakes are also real possibilities. In November 2007 an earthquake described as one of the strongest ever to hit the region was felt from the Virgin Islands in the north, all the way down through the islands to Barbados and Trinidad and then south to Guyana and Venezuela. One day such an event might trigger terrifying disasters in several islands simultaneously. In foresight regional governments have come together and a tsunami early warning system for the region is presently being developed. Each island also has its own disaster preparedness teams that share ideas with each other. Flirting with disaster is not unique to the Caribbean, as many of the world's biggest cities are situated in areas that also make them extremely vulnerable to natural disasters. The Caribbean, though, is

home to six of the ten most disaster prone countries in the world!

What can be learnt from Montserrat's experiences to ensure as quick response and recovery as possible after disaster strikes? In Montserrat and the wider Caribbean people hope their leaders will take the decisions that bring happiness, security and economic prosperity. These are universal desires, and people everywhere are waiting to exhale. **OX**

**"The volcano may eventually be targeted to generate energy and economic opportunities."**

Born in Jamaica Wayne Bowen qualifies through descent to be a citizen of five CARICOM countries. He is a writer, photographer, filmmaker, songwriter and currently lives in the USA.



Above: Plymouth, the former capital, covered by a river of lava and ash. Some buildings have been buried up to their roofs.



Interior of an abandoned house. It was a beautiful house situated on a hillside opposite the volcano. On one side was a lovely view of Plymouth. On the other side a view of the Chance's Peak volcano also known as Soufriere.

Right: MILE HIGH CLUB Flying over Montserrat.



Left: SAFE LANDINGS - Small planes provide scheduled services in and out of Montserrat. The service is operated by WINNAIR, a small carrier based in St Maarten.





## The Nuclear Option

By Kayanne McCook-Russell

Currently, the demand for oil is greater than its supply and so alternative energy options need to be obtained. One such option is nuclear energy.

The issue of nuclear energy has received much attention worldwide in recent years but hardly so in the Caribbean. Simply put, nuclear energy is the energy associated with an atom that can undergo fission (splitting), fusion (mixing with another atom) or decay, more specifically radioactive decay. An atom is a particle that consists of protons (positively charged), neutrons (no charge) and electrons (negatively charged). Every atom contains a nucleus or a core where the protons and neutrons reside.

These sub-atomic particles determine the mass of a particular element. Outside this core the electrons are found orbiting at different energy levels. When a nuclear reaction occurs, it does so within the nucleus of the atom or atoms involved. A large amount of energy is released from this reaction which can be properly harnessed to drive other systems.

The most common type of nuclear reaction is nuclear fission. This is the

The advent of fossil fuels as a viable energy source for humankind was one of the most important discoveries ever made. However, increased population growth and development have put a strain on the demand for oil. Oil is generated

from fossil fuels which do not provide a convenient renewable energy source. It is believed that these fuels were formed from the remains of plants and animals which have undergone compression and have been subjected to heat over millions of years.

method currently used to generate nuclear energy. Uranium is a highly radioactive element and the choice of 'fuel' for this reaction. Two main isotopes of uranium exist – U-238 (99.2%) and U-235 (0.71%), the former being more common. U-234 also exists but is extremely rare. Each sample of uranium found contains these percentages of each isotope. U-235 is preferred for nuclear reactions because it is the most naturally occurring fissile isotope, i.e. it quickly undergoes a splitting chain reaction. Uranium naturally undergoes decay emitting radiation, but this occurs relatively slowly. The time taken for it to decay to half its concentration is referred to as its half-life and this is what makes uranium such a dangerous element. U-238 and U-235 possess half-lives of approximately 4 billion and 700 million years respectively. As it decays heat and radiation are emitted.

When nuclear fission (induced) occurs, U-235 is bombarded with neutrons, one of which becomes accepted by the nucleus of the atom converting U-235 to U-236. This is a highly unstable system and it quickly undergoes fission producing two

other elements while releasing a few neutrons. Heat and gamma radiation are also produced and the two new atoms formed later on emit beta radiation. The neutrons produced from the initial reaction can also 'attack' other U-235 nuclei once they are present, producing a series of events described as a chain reaction. The decay of one uranium atom produces approximately 200 million electron volts (MeV) per reaction and thus much more energy than a regular chemical process. One uranium pellet produces as much energy as 150 gallons of gas. The shape of the uranium fuel used is critical and it is believed that a spherical shape maximizes the chances of the neutrons bombarding other U-235 nuclei. This process is continuous until all the fissile atoms are expended or suspended by the manual insertion of neutron absorbing materials. This is the principle upon which almost all nuclear reactors operate making use of enriched uranium which contains a higher percentage of U-235 than that found naturally, i.e. greater than 0.71% (some reactors can use natural uranium while using heavy water, D<sub>2</sub>O as the moderator). Most nuclear power reactors use uranium that is enriched to at least 3.5% U-235 which is sufficient to maintain the chain reaction.

An example of one of the many reactions in the uranium-235 fission process.

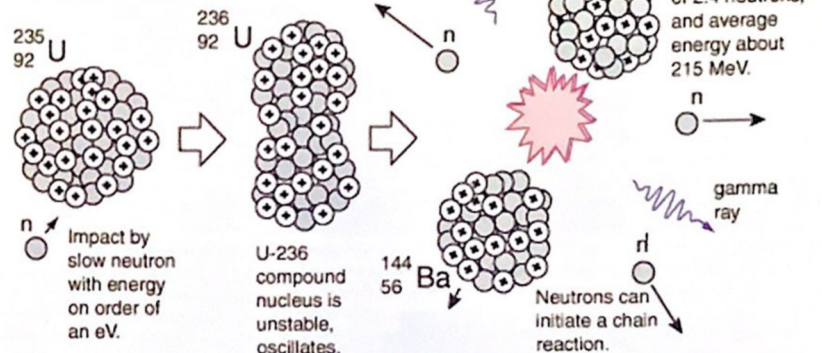
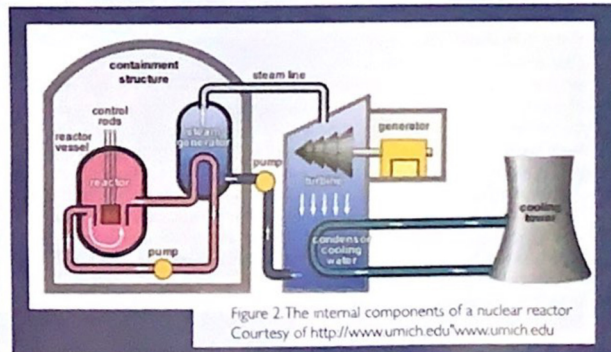


Figure 1. The fission of a U-235 atom following neutron absorption  
Courtesy of hyperphysics.phy-astr.gsu.edu

The heat produced is used to boil water into steam which turns a turbine generator to produce electricity. Control rods made of material which can absorb neutrons can be used to control the rate of the nuclear reaction. These rods may be made of graphite or the metal cadmium. As the neutrons are produced from the chain reaction, when the rods are lowered into the core of the reactor, rather than being absorbed into other U-235 nuclei, the neutrons are absorbed by the rods, hence decreasing their concentration within the system and slowing the reaction. To reverse the process the rods are simply raised out of the reactor core.

Nuclear reactors are so designed to optimize the efficiency of the reactions whilst minimizing exposure to harmful consequences such as radiation. Advantages of this alternative energy source include minimal CO<sub>2</sub> emissions into the atmosphere,



as opposed to fossil fuels. This would undoubtedly decrease the greenhouse effect and lessen the extent of global warming. Another pro for nuclear power is that a small amount of the uranium 'fuel' is needed to produce very large quantities of energy. One pound (0.45 kg) of uranium can emit as much energy as one million gallons of gasoline. There is evidence of a 1 GW nuclear power

plant consuming 30 tonnes of fuel/year while a coal-fired plant of the same magnitude operates on 9,000 tonnes of fuel/year. Also, doubling a uranium market price would hike the fuel cost of a reactor by 26% and electrical cost by 7%, while doubling the price of natural gas would add ~70% to the price of electricity. Unlike hydro-powered systems, nuclear



## FEATURE

energy will not strip a country of a natural resource thereby altering the ecosystem.

The waste produced from this reaction is very minimal, yet it must be handled efficiently and effectively. This is due to the extremely long half-life of the uranium and so the spent material is not easily disposed of. This is one of the primary worldwide concerns of turning to nuclear power as an energy source as the waste also generates radiation and heat. The amount of waste that a plant generates is dependent on what it is used for and the type of waste produced. One of the current methods of waste removal is cooling the material for many years in large supervised pools of water. This cools the radioactive isotopes and protects the environment from radiation. The material can then be reprocessed yielding 96% reusable uranium, 1% fissile plutonium and 3% high level waste that is then mixed with borosilicate glass and stored in a cooled concrete structure. There is also the possibility of geological disposal in which mined tunnels with deep holes are used to store waste canisters. The idea of disposing waste in outer space and on the Antarctic ice sheets has also been raised, but has been dismissed due to the unpredictable and hazardous repercussions. In the USA, the Yucca Mountains in Nevada were targeted as an ideal storage area; however, citizens have strongly resisted this proposal as an earthquake could lead to leakage of the material into the underground water sources. In the USA, nuclear plants charge US\$0.11/kWhr for waste disposal while Sweden charges US\$0.13/kWhr. Some of the funds collected are used to pursue research into geological disposal. According to Nuclear Engineering International and Management of Spent Fuel and Radioactive Waste, the disposal of low-level waste

(contaminated clothes, tools, materials used to build the reactor) costs £2000/m<sup>3</sup> in the UK while high-level waste disposal costs £201,000/m<sup>3</sup>. It is believed that one reactor produces 12 m<sup>3</sup> of high-level waste annually.

Due to the increasing popularity of this energy source, international efforts are being made to develop long-term storage solutions. The International Atomic Energy Association (IAEA) is a body which seeks to ensure that all safety measures are maintained by all countries which employ nuclear energy. In August 2009 the body reinforced the peaceful use of the atom in commemoration of the bombings which occurred in Hiroshima and Nagasaki in August 1945. Currently the United States provides 19% of the electricity it consumes through nuclear energy while approximately 78% of France's electrical energy is dependent on power generated from nuclear reactors, as of 2006.

Within the Caribbean, nuclear energy is currently not a viable option. For nuclear energy to be sustainable within any country, a few factors must be taken into consideration. These include costs associated with construction, operation, waste disposal and decommissioning of the plant. Discussions with John Preston,

senior engineer at the International Centre of Environmental and Nuclear Science (ICENS), UWI, Mona, Jamaica, revealed that construction costs would be the most expensive. Once the plant is up and running, all other costs can be taken care of by considering them when pricing commodities which are driven by the reactor. Essentially, the plant can pay for itself over its lifetime, which is typically 40 to 60 years. Design flaws must be completely absent to avoid previous accidents such as those which occurred at Chernobyl, Russia and on Three Mile Island, Pennsylvania. On the downside, nuclear power is not a renewable energy source. Although much uranium can be "reused" through the reprocessing of spent fuel, uranium is not an infinitely existing substance and when all the ores are mined, we will eventually run out of this material. Its average crustal abundance is 2.7 ppm (parts per million) which is roughly the same as that of zinc and tin. There is an estimated 40 trillion tonnes of uranium in the earth's crust and less than 1/10 million has already been mined as opposed to 1/2 of the world's conventional crude oil resources that have already been consumed. Uranium mining countries include Australia (22%), Kazakhstan (11%), USA (10.3%), Canada (10%), Russia, South Africa and Namibia. In 2007, over 3 million tonnes of uranium were mined and this is believed to be sufficient for all the 436 nuclear power

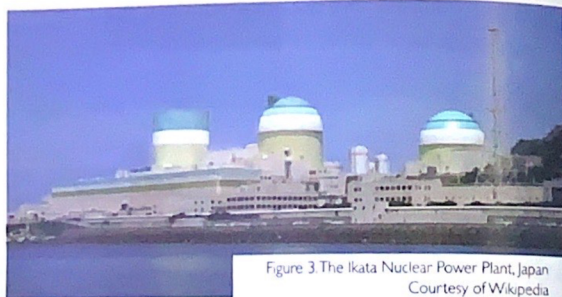


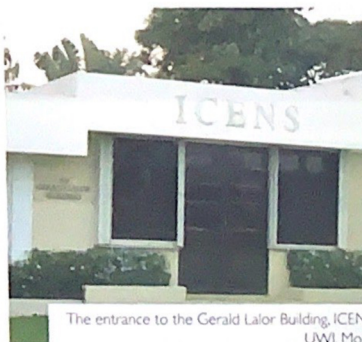
Figure 3. The Ikatu Nuclear Power Plant, Japan  
Courtesy of Wikipedia

plants worldwide for many decades.

Although all nuclear reactors operate using the same principles, they are not all used for energy purposes. One such is the research reactor located at ICENS, UWI, Mona Campus, Jamaica. This instrument produces far less energy (~20 kW) when compared to a typical power reactor which can emit up to 1600 MW of energy. It is used for analytical purposes and has been used for ground-breaking research in Jamaica. Dubbed 'Slowpoke', the reactor has been used for geochemical work such as the testing for cadmium in yams, trace element constituents in foods and as a spin off technology the radiation monitoring of many workers within x-ray and oncology departments in hospitals and other users of radiation in the Caribbean. One main advantage of having such an instrument, even though it was not intended to be a power reactor, its operating principles are the same, it could therefore be used as a training tool for those people who would eventually handle a power reactor, should one be bought. The reactor is highly sensitive with a very low detection limit for many chemical elements – favourable characteristics for an analytical tool. Many other methods of analysis are specific to certain elements and are not as sensitive. The machine is checked at regular intervals by the IAEA to ensure that operating standards are up to par. Slowpoke was built with inherent safety mechanisms and so when the reactor temperature gets to 70°C, the machine automatically shuts down. This built-in mechanism is only advantageous for this type of system as the heat energy generated from larger reactors is what is converted to other forms of energy. As with all other models of reactors, no changes are made to the core and so radioactive waste disposal only arises when




Senior Research Scientist, Charles Grant, and Scientific Officer Craig Boyd, of ICENS examine an instrument.



The entrance to the Gerald Lalor Building, ICENS, UWI, Mona

the useful life of the reactor has ended. This is estimated to be within the next 15-25 years. An agreement made with the Laboratory of Atomic Energy of Canada Limited (AECL) states that the spent core must be returned to Canada. Slowpoke therefore poses no threat to the staff, neighbours or immediate surroundings. The building itself is equipped with radiation monitors with audio alarms and sample points for checking radiation to ensure that no harmful levels are attained. If this does happen, the reactor is immediately shut down.

ICENS essentially has paved the way for

Jamaica as well as the Caribbean to become more fully informed about the proper use and potential of nuclear reactors. Jamaica is currently the only Caribbean territory (and one of few in the entire hemisphere) with a functional reactor. 

\*Figures on uranium reserves were obtained from the European Nuclear Society

Dr Kayanne McCook-Russell is an Organic Chemist with a background in Food Chemistry.



Fighting prostate cancer and menopause with

# Pumpkin Seeds

By Maxine Gossell-Williams

Pumpkin, *Cucurbita* species, is grown and eaten in North America, China, Hungary, Austria, Mexico, Yugoslavia and several Caribbean countries including Jamaica.

The fruit graces our diet in many delightful culinary options, for example as pumpkin soup, pumpkin bread, pumpkin rice, pumpkin fritters. The seeds are also quite edible; in many countries, such as Germany, Australia, Belize and Jamaica the seeds are eaten raw or roasted. Additionally, health food stores in Jamaica supply refreshing juices containing blended pumpkin seeds.



## Pumpkin seed oil

The oil extracted from the seeds makes a tasty salad dressing, providing a rich source of vitamins A, B and E, omega-3 and omega-6, zinc, selenium, carbohydrates, cholesterol-like molecules called phyosterols (Figure 1) While studies on the pharmacological benefit of pumpkin seed oil in humans are limited, most of its contents have been proven to have significant health benefits. Pumpkin seeds are therefore a good nutraceutical source (food in the medicinal form – in this case, capsules). Consuming omega-3 and omega-6 fatty acids provides protection from strokes and heart attacks; the vitamins A, B and E are well established as essential in many metabolic processes of the body; but what are the proven medicinal benefits of consuming pumpkin seed oil?

## Pumpkin seed oil and men's health

European studies have reported that eating a handful of pumpkin seeds is beneficial for the treatment of prostatic hyperplasia. In this condition there is enlargement of the prostate, an organ found encircling the urethra of males. As men age, their prostate normally goes through periods of growth; however, excessive enlargement produces significant compression of the urethra and therefore causes difficulty in passing urine, thus the associated Jamaican term, 'stoppage of water'. The recommended daily consumption of German monographs is one handful of pumpkin seeds daily. But this dose has no scientific documentation of proof. Documented scientifically studies involve using the oil extracted from the seeds. In one clinical trial, over two thousand men suffering from prostate enlargement were treated with capsules containing pumpkin seed oil and it



was found that there was significant improvement in ability to pass urine. So effective are the actions of pumpkin seed oil that GlaxoSmithKline currently produces a pharmaceutical pumpkin seed oil preparation called "ProstaFink" that is marketed mainly in Europe. But what exactly is the effect of the oil? Animal studies conducted by researchers in the Pharmacology Section of The University of the West Indies, Mona have shown that pumpkin seed oil can inhibit the growth of the prostate. In the investigations, an animal model of prostate enlargement was created using rats given excessive amounts of testosterone. When rats were fed an oral daily dose of the oil similar to that recommended for men, it was found to prevent the enlargement of the prostate. Therefore the researchers concluded that the effect of pumpkin seed oil was directly influencing prostate growth.

## Pumpkin seed oil and women's health

As women age, they experience decreased availability of the female hormones (oestrogen and progesterone) and this lack of hormone availability increases their risk of developing elevated blood cholesterol, high blood pressure, heart attacks and strokes. Standard therapy for intolerable complications involves synthetic female hormone

replacement. Alternative therapy has included the addition of certain hormone-like compounds called phytoestrogens to their diet. Phytoestrogens have similarity to female hormones, and pumpkin seeds contain approximately 265 mg of phytoestrogen per 100g of seeds. Therefore scientists in the Pharmacology Section of The University of the West Indies hypothesized that the phytoestrogens in pumpkin seeds could provide an alternative to hormone replacement.

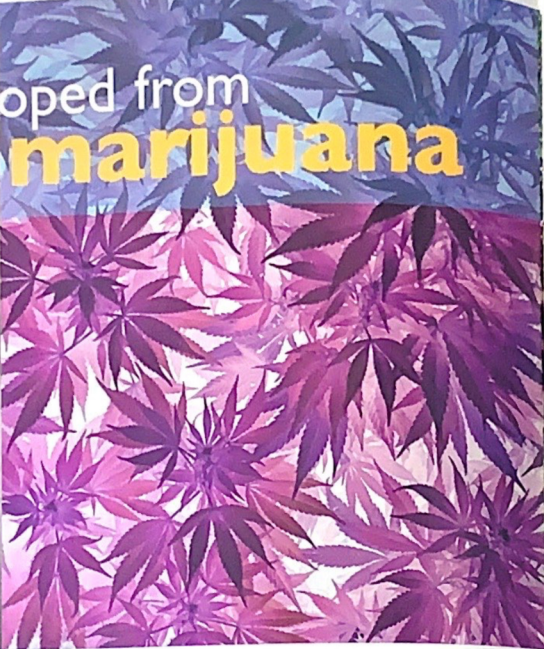
The researchers used a suitable animal model involving making female Sprague-Dawley rats oestrogen deficient. When female rats were made oestrogen deficient, there was a significant elevation in blood cholesterol and high blood pressure. But when oestrogen deficient rats were fed one-tenth of a teaspoon of pumpkin seed oil daily these elevations were prevented. These results suggest that adding pumpkin seed oil to the diet of menopausal women can prevent some of the health risks associated with oestrogen deficiency. With this in mind the focus of the researchers is now on recruiting menopausal women into a clinical trial of pumpkin seed oil supplementation in order to assess them for changes in blood pressure and blood cholesterol.

So the next time you're throwing out the seeds from that pumpkin, think about starting a plant in your garden; the seeds may be the dietary supplement that you need for your own health or a good potential source of additional income. **OX**

Dr Maxine Gossell-Williams is a researcher in the Department of Basic Medical Sciences, The University of the West Indies, Mona.



# Glaucoma drug developed from marijuana



By Kathleen Lobban

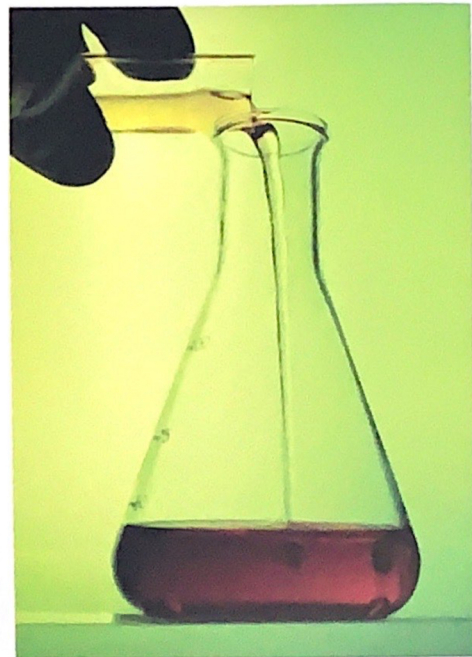
**Marijuana has long been known for its recreational use as a powerful stimulant and hallucinogen and its medical uses have been explored for the past 12,000 years.**

Among the important medical applications of marijuana are its use to stimulate appetite and alleviate cachexia (wasting as a result of an underlying pathology such as cancer), to control nausea and vomiting associated with chemotherapy, its analgesic properties, its ability to improve neurological and movement disorders and its use in reducing intraocular pressure. Research has shown that persons with raised intraocular pressure are at higher risk of developing glaucoma. Glaucoma refers to a group of diseases that affect the optic nerve and involves a loss of retinal ganglion cells of the eyes which results in visual disturbances and even blindness. Sadly, an estimated three per cent of Jamaica's population is afflicted with this illness.

Given the high incidence of the disease in the island, it seems appropriate that Canasol, the first drug to be developed for glaucoma from the Caribbean region, was developed by UWI Mona's Professor Manley West, a pharmacologist, and Dr Albert Lockhart, a medical doctor associated with the teaching hospital. Ironically, this drug was developed from marijuana, a herb that has been grown illegally on the island for decades. Canasol is an eye drop that works by improving the integrity of the optic nerve, hence improving the vision of affected persons. The Professor would not disclose the active compound in his formulation because of sensitive patent issues, though he was quick to highlight that the drug relieves the symptom of glaucoma without inducing the negative side effects that are associated with synthetic counterparts developed to treat the disease.

Professor West first became interested in using marijuana to treat the eye disease upon hearing accounts of locals whose vision improved after they used eyewash made from the marijuana plant, and after reports from fishermen that drinking a beverage made from steeping the marijuana plant improved their night vision. The collaboration with Dr. Lockhart seemed fated as his interest in the marijuana plant was piqued by the low incidence of glaucoma among his Rastafarian patients. Both doctors worked together and were able to isolate the active ingredient, develop the drug and complete pharmaceutical trials within ten years.

Canasol is not the only drug developed by Professor West from marijuana. In the early 1990s, just two years after the release of Canasol, he developed Asmasol, indicated in the treatment of asthma, colds and flu. Asmasol is a derivative of Canasol and relieves respiratory illnesses by causing the dilation of the bronchioles of the lungs. Asmasol is effective in treating both late and early onset asthma and is prescribed throughout the Caribbean region. **CK**



Kathleen Lobban lectures in Molecular Biology and Microbiology in the Faculty of Science and Sports at the University of Technology, Jamaica. She is currently pursuing a Doctor of Philosophy degree in Biotechnology at The University of the West Indies and a Master's in Forensic Science at Staffordshire University, England. She is an avid gardener.



Professor Manley West in his laboratory at the UWI, Mona.



**“Canasol, the first drug to be developed for glaucoma from the Caribbean region, was developed by Professor Manley West, a pharmacologist, and Dr Albert Lockhart, a medical doctor.”**



# RUM

## the Spirit Of the Caribbean

By Andrew Pearson

Rum, the main spiritous liquor of the Caribbean, is made by microbial fermentation of sugar cane juice or molasses, and the subsequent distillation of the alcoholic "dead wash" after fermentation has ended, in order to concentrate the alcohol and eliminate most of the water and micro-organisms.

Wines and beers are also fermented brews derived from plant material, but are not regarded as spirits since they are produced without distillation.

Spirits are all made in the same general way, differing from each other in the source of the starting material, which contains the sugar to be converted to alcohol, and the distillation method, which removes more or less of the flavours extracted from the original plant material and generated during fermentation. Most spirits are matured in oak casks for a few years before being ready for the market.

There are strict laws governing the spirits business for two main reasons: Governments make a lot of money taxing consumers of beverage spirits – usually based on the alcohol content, and small errors in the distillation process can result in spirits that often kill those drinking the spirit. There are also laws to try to protect



the region best known as the original source of the spirit from "unfair" competition.

Fermentation of sugars by yeasts to produce ethanol and the gas carbon dioxide is the oldest, and still by far most important, biotechnological process known: the gas causing dough to "rise" or "leaven" during bread-making, and beer-brewing and wine-making appears to pre-date (human) written history. The fermentation of wind-fallen fruits by the yeasts normally resident on their skins gives rise to alcohols during natural rotting. This is believed to be an important factor in plant propagation: alcohol is volatile and its odour can be sensed by many animals over long distances. The odour thus signals the presence of fruits to eat containing carbohydrates for energy, and any seeds that get ingested are spread by the wandering animals.

Ethanol fermentation is the breakdown of sugars to extract energy; the ethanol and the carbon dioxide are just waste products to the yeast. Most of the carbon dioxide bubbles

away; before long all of the sugar in the fermenter is consumed and the alcohol concentration rises to the point that the yeast is now swimming in so much of its own waste that it dies. This is now "dead wash" which contains dead and dying yeast cells, alcohols and all the stuff that went into the fermenter that didn't get itself converted to either new yeast cells or alcohol and carbon dioxide. All of this lot now goes to be distilled.

John Taylor, an English observer who wrote a description of Jamaica after spending some months here in the 1680s, had this to say about our subject: "Now after 'tis become clear and sower like vinegar, then they distill it in a still with a copper head and a worm, and it produces a strong fat spirit, having a sweet burnish taste, and this spirit is called here rum and at Barbados killedevil."

Distillation is a process whereby heat is used to evaporate the alcohols out of the watery mixture of the dead wash and into vapour, and cooling is used to condense the now vaporized alcohols back into liquid form.

The simplest type of distillation used for rum is the traditional system that was developed for whisky, brandy, etc.: the dead wash is transferred to an enclosed vessel with a swan neck which then passes into a condenser. The earliest forms of vessels and condensers were of copper because it is easily worked and very durable. The condensate dribbled from the end into a receptacle. The coiled tube, hence the condenser, was called a "worm" because of its shape and appearance. By a stroke of luck, copper turns out to be perfect for distillation of beverage spirits because it reacts with some of the unwanted vapours, neutralizing them and thus improving the qualities of the distillate. The large vessel in which the dead wash is heated to evaporate the volatiles is called a "pot still", and it is the direct technological descendant of the "alambic" which got its name from the language of the great scientific and engineering Arabic peoples of the Mediterranean and Middle East, as did "alcohol" and also "alkali", to name just two others.

The dead wash produced by most yeast fermentations contains 5-13% alcohol (beers are usually about 3.5-5.5%; wines: 12-15%); this is concentrated up to about 30-50% in one pass through a simple pot still. This can be increased by redistilling the first distillate to about 50-65% alcohol. A third pass raises it further to 75-85%. A cunning invention allows all three passes to proceed simultaneously by using the hot vapour from the first vessel to heat the liquid in the second vessel and so on: one source of heat and a product of 85% alcohol. Other molecules with boiling points close to that of ethanol accompany it through the distillation, and these impart flavours, some of which are altered by interaction with air and the wood in the matura-

### Nomenclature:

"Alcohols" are a class of organic chemicals all having a characteristic structure. The simplest alcohol is methanol (a.k.a. methyl alcohol - very poisonous!) and the next one in the series is ethanol (ethyl alcohol), followed by propanol, butanol, etc. When non-chemists say "alcohol" they usually mean "ethanol".



"Live wash" in an open fermenter: carbon dioxide bubbles up while the sugars are being converted to ethanol. Some of the ethanol evaporates and gives a "heady" atmosphere downwind!



In the foreground three pot stills with copper heads and swan necks leading to their respective "low wine retorts" from which the heated vapours then travel through the next set of copper heads and swan necks to the "high wine retorts". From there the final 85% alcohol distillate is collected.




## CLASS ACTS

tion casks. Indeed some rum makers go out of their way to render the fermentation more flavourful, leading to what are termed "high ester" marks, which are then blended with larger volumes of more bland marks to make the characteristic products found on the market.

Having found that three distillations can reduce the water content progressively, how many passes would it take to get rid of all the water? It turns out that an infinite number of steps would not do the trick because simple distillation will not remove the last 4.4% of water, and other means have to be used to produce "absolute alcohol" at 100%.

Another type of distillation is performed in a column whereby the dead wash is poured into the top of a column into which perforated plates are fixed at intervals. Hot steam is let in at the bottom and a temperature gradient establishes itself up the column; at a certain interval between two plates alcohol could be drawn off. Increasing sophistication of column distillation systems has resulted in the possibility of producing ethanol with barely detectable traces of contaminants, such that, for example, producers of vodkas and gins add some flavours back.

The colours, flavours, ages, alcoholic strengths and marketing and distribution of the rums produced in the Caribbean vary widely, as does their reputation. The original seventeenth century mass producers of rum were the New England distillers using West Indian sugar and molasses exchanged for food provisions, but even then the American colonists were prepared to pay much more for the genuine article: Caribbean rum. 



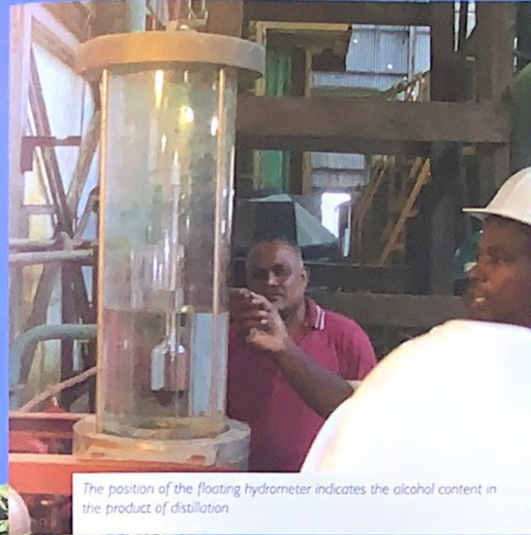
The removable porthole of one of the sections between two plates of a copper column still in operation. Volatile vapours pass upwards with the heat; the watery, depleted dead wash passes downwards.

### To make absolute ethanol (100%)

The method currently used is to pass the 95% alcohol through what is called a molecular sieve, which is like a sponge with pores small enough to trap the water molecules but too small to allow the ethanol molecules to enter. When the sieve is full of water, the 95% alcohol stream is stopped and the sieve is heated to drive out the water, ready for another round of sieving. Previously, the common method was to add benzene to the 95% mixture and redistill. This left minute traces of the carcinogen benzene in the alcohol which meant that it was not safe for human consumption.

**"Tropical temperatures mean that considerably more rum evaporates during maturation – the angels' share."**

Dr Andrew G.M. Pearson lecturers in the Biochemistry Section, Department of Basic Medical Sciences, The University of the West Indies, Mona.



The position of the floating hydrometer indicates the alcohol content in the product of distillation.



A set of three distillation columns for producing "clean" ethanol.