AS a result of a joint research program with the Veterinary Research Institute, Monash zoologists and physiologists believe they are close to understanding the underlying cause of infertility among Phillip Island koalas.

This infertility results from a disease of the female reproductive tract, but until now zoologists have not understood either the cause of the disease or the reason why it is so common on Phillip Island, where at least 80 per cent of female koalas are currently infertile.

The Monash team, Associate Professor Tony Lee, senior technical officer Roger Martin, and physiologist Kath Lithgow, together with Dr Ken McColl, of the Veterinary Research Institute, now have evidence that the bacterium Chlamydia is involved.

There are two species of Chlamydia, and, as yet, it has not been determined which of these is causing the problem in koalas.

Chlamydia psittaci has previously been identified as the causative agent of a type of conjunctivitis which is common in koalas in NSW. A related organism, Chlamydia trachomatis, causes both the eye disease trachoma, and diseases of the reproductive tract, such as urethritis and salpingitis, in humans. It is now thought that Chlamydia psittaci is responsible for koala reproductive tract disease.

The evidence for the involvement of a Chlamydia species was obtained by McColl who tested blood serum collected by the Monash team from koalas on Phillip Island and French Island. Unlike Phillip Island, the French Island koalas have very high fertility.

McColl found moderate to high levels of Chlamydia antibodies in the Phillip Island samples but virtually none in the French Island group. This was an odd result as there is very little eye disease among the Phillip Island koalas.

The role of Chlamydia in the reproductive tract disease was later confirmed when it was cultured from the tracts of several animals.

However, the bacterium is not the whole story.

Martin points out that while reproductive tract disease is present in a number of koala populations, it is nowhere as common as it is on Phillip Island. Also, it seems to be absent altogether from close-by French Island which provided the bulk of the koalas for the Phillip Island colony back in 1937.

“We are trying to understand why the Phillip Island koalas are so susceptible to this disease,” Martin says. “We suspect there is something in their environment which makes them vulnerable. One possibility is plant oestrogens in the diet which may act on the female’s reproductive tract to make it more prone to infection.”

In an attempt to find out what it is that makes Phillip Island koalas so susceptible, Lithgow, a Ph.D. candidate working with Dr. I. R. McDonald in the physiology department, is comparing health and fertility in several groups of koalas on Phillip and French Islands. These animals have been fitted with radio-collars which enable them to be easily located but do not cause them any harm.

By studying these koalas Lithgow hopes to find out when and at what age they contract the disease, whether or not they regain fertility and the circumstances which make them susceptible to infection.

The research, which is expected to take several years to complete, is financed jointly by the Phillip Island Shire Council and the Victorian Ministry for Conservation. Papers on the results to date are being prepared for publication in the Journal of Wildlife Diseases.
DURING the early ‘70s, the concept of cluster housing, was typically seen as a way of counteracting the worst features of contemporary society: its anonymity and lack of social involvement.

Cluster housing, it was hoped, would generate well-knit communities. Shared facilities would bring people together and shared common green spaces would provide ideal playing areas for children.

The reality seems to be quite different, according to a comparative study of Melbourne and Canadian cluster developments by Monash sociologists, Dr William Foddy and Marion Norbury.

Their study, which has just been completed, was funded by the Australian Housing Research Council. It updates an earlier study in 1976.

According to the latest study, cluster housing developments do not appear to be very different in terms of friendliness than the traditional single family home estates.

The study found that most of the people in the developments had well established social networks outside of it, and felt they had enough friends.

Almost one third (30 per cent) reported that they had quarrelled with neighbours. The most commonly mentioned complaints concerned noise/stereo (nine per cent), pets (eight per cent) and children (six per cent). Untidy neighbours were also a source of friction, and speeding in the driveways was a common complaint.

“Apart from swimming pools which did seem to be used in hot weather other facilities were underused,” the authors say.

“Most people had a proprietary view of the land immediately in front of their units, and children were discouraged from playing on common green areas.

“The fact is that most of the people had bought into the cluster style developments either for economic reasons or for the freedom from maintenance that the developments offered.”

Foddy and Norbury confined their Melbourne study to 26 cluster developments in eastern and south-eastern regions of Melbourne. The sample was divided equally into developments with 20 to 40 units and developments with more than 40 units.

Canadian project

In the Canadian part of the project, four large-scale cluster developments in Vancouver were studied. Two were classified as low-priced developments and two as medium-priced. The low-priced developments each contained 130 units. The medium-priced developments each contained 100 units.

The Melbourne developments were sorted into four categories which ranged from what most sociologists would call working class to upper middle class housing. The classification was based on variables such as social standing of the suburb, the average market value of the units, average income, education and occupational prestige levels of the people who occupied the units.

Foddy and Norbury say their initial impression was that “by and large most developments seemed to be working quite well”.

Eighty per cent of all respondents felt that the advantages outweighed the disadvantages. However, only 63 per cent said they would buy into a similar development, and 43 per cent, when asked, they would advocate more housing like this, said yes but not for children.

Reasons for buying

Giving their reasons for buying into a cluster style development, 52 per cent of the people interviewed said their unit had cost them less than a traditional detached quarter-acre block home would have cost; 34 per cent cited either a design feature or some general feature of the suburb; 48 per cent said either friends were near when needed or they felt more secure; 45 per cent mentioned freedom from maintenance and 21 per cent mentioned some other quality of the development.

Those who mentioned freedom from maintenance as the reason for buying were mainly people in the upper social classifications. In many cases the development “fell short of the promise of freedom from maintenance.”

Continued on Page 3

NOVEMBER, 1982
The report's Melbourne findings are similar in many respects to its Vancouver findings.

The main reason the Canadians gave for buying into cluster units was that they were cheaper than traditional housing. The Canadians' usage patterns for the common facilities were similar to those in Melbourne. As in Melbourne, only the pools seemed to be reasonably successful.

Developments in the two cities differed in some respects. For example, there was a much greater percentage of younger couples with children in the Vancouver developments than in the Melbourne developments.

Because of this, perhaps, vandalism was a greater problem there and the percentage of people bothered by pets and children was much higher than in Melbourne.

Possibly, because the Vancouver residents bought for economic rather than social reasons, the report says, a greater percentage than in Melbourne expressed satisfaction with their developments — even though a smaller percentage claimed that their developments were friendlier than other places in which they had lived.

Renting and managerial problems were a sore point in Vancouver as in Melbourne, and all four developments investigated in Vancouver had trouble enforcing their rules.

Committees of management

Foddy and Norbury believe that the way the committee of management functions is of crucial importance in determining whether a cluster housing development will be successful.

The more expensive developments appear to be the most successful, they say. This is partly due to better design and construction, but also, the authors believe, because the more affluent residents "tend to bring more business acumen to bear on committee of management issues and are more easily able to afford a realistic level of maintenance fees."

"Both these factors are critical to the successful working of a cluster development," they say.

As the situation stands, they say, the laws relating to cluster developments in both Canada and Victoria are "legal skeletons."
The Victorian Strata Title and Cluster Title Acts, they say, pay scant attention to the following problems:

- There are no special requirements or standards regarding construction.
- There are no controls over developers. (There is nothing, for example, to stop a company being formed just to build a development and then being wound up. Also owners are not safeguarded against structural defects of units of more than one storey).
- There are no guidelines for Councils to set their city rates for individual units — so that residents often feel that they have to pay rates for services that they have to provide for themselves.
- There are no licensing procedures or controls over property management companies.
- There are no provisions for the institutionalisation of properly worked out dispute procedures.
- There are no restrictions on the renting of units.
- There are no government guidelines or regulations regarding public liability. (This problem was highlighted, the authors say, by the outcome of a court case in Melbourne this year in which 18 unit owners each had to pay $3800 to meet the portion of a damages award not covered by the insurance policy that the body corporate had taken out. The insurance policy in fact covered up to $500,000).

In their report, which has now been sent to the Australian Housing Research Council, Foddy and Norbury question whether the construction of multi-owner-your own unit complexes is the best way of providing low cost housing.

The answer to rising house prices may be the building of smaller houses on separate blocks, they argue.

However, if governments see fit to encourage common interest housing as part of their housing policy, they say, they should also pay more attention "to educating people about the advantages and disadvantages that they can realistically expect of them."

Monash plans major heart study

**THE traditional Greek way of life was kind to the heart. Even today Greeks are less likely to die of heart attack than the citizens of any other country in Europe.**

Researchers at the Monash department of social and preventive medicine at the Alfred Hospital plan to take advantage of the large scale migration of Greeks to Melbourne to explore how changes from a traditional Greek way of life have affected the risk of heart attack.

Dr Dimitri Ktenas, a research associate, and Dr John Powles, a senior lecturer, plan to make a detailed study of heart disease in persons who have migrated from the island of Levkas in the Ionian Sea.

Ktenas, who comes from Levkas, says that Levkadians had emigrated in search of better economic and career prospects for themselves and their children. But it appeared the economic success in the new world of Australia often brought with it new risks to health. Changes in diet, physical activity and possibly stress appear to have increased the risk of several diseases — especially heart disease.

Whereas the death rate from heart attack has been falling among Australian-born men since the late 1960's, it has been rising among Greek migrants in Australia. Among women, heart disease is much less common — and the rate has been falling at least as fast among immigrant women as among the Australian-born.

Powles says that while a good deal is known about how the modern way of life causes heart attacks much remains unexplained. By taking advantage of the natural experiment created by migration, researchers can examine how the adoption of a new way of life affects the risk of disease.

The island of Levkas

He says the study, which is being funded jointly by the National Heart Foundation of Australia and the National Health and Medical Research Council, will involve fieldwork in Melbourne and on the island of Levkas.

"We will be seeking to compare the relatives who stayed behind with those who migrated — brother with brother, sister with sister and cousin with cousin," he says.

"In this way it should be possible to separate the effects of common inheritance from those of a changed way of life and environment.

"We will be looking especially at things like blood pressure, blood cholesterol levels, weight and the things that we suspect determine these — diet, activity, stress, smoking and so on.

"There will be a special interest in the kind of fat in the diet. Traditional Greek diets make liberal use of olive oil. This is predominantly a monounsaturated fat; it doesn't tend to raise the blood cholesterol level like saturated animal fats or to lower it like polyunsaturated vegetable fats."

The study group is now compiling lists of persons who might like to be included in the study. All Levkadians living in Melbourne are urged to contact the study so that it can be as representative as possible.
Detecting early machine failure

WITH the increasing demand for higher productivity, the task of detecting and dealing with early signs of failure in modern machinery is becoming more complicated and costly.

Machinery must meet stringent performance, economic and safety requirements, and any likely failure must be promptly detected, preferably without interfering with the machine's operation. Machine shutdowns, whether the result of machine failure or of the need for regular maintenance, add to the cost of a firm's product and affect its competitive position.

The principle of prevention rather than cure is the basis of a large-scale "on-line" machine monitoring program which is being conducted for the Australian Minerals Industries Research Association by a group within the Monash Engineering Faculty.

Funding

The two-year research program is being funded to the extent of $94,500 by eight resources-based companies — Bougainville Copper Ltd, Comalco, Energy Resources of Australia Ltd, BHP, Hammersley Iron Pty Ltd, the Shell Company of Australia, Renison Ltd and Mt Isa Mines.

Its aim is to develop specialised low-cost microprocessors which can be used by the minerals industry for continuous "on-line" monitoring to detect early signs of machine failure.

Taking part in the research are experts from three Monash departments — the departments of mechanical, materials and chemical engineering.

Project co-ordinator is Dr Robin Alfredson, a senior lecturer in mechanical engineering. Other members of the group are Mr Jacek Stecki, Mr Bruce Kuhnell and Dr Robert de Laine, of the mechanical engineering department; Associate Professor Reg McPherson and Dr Zbigniew Stachurski, of materials engineering, and Associate Professor John Agnew, of chemical engineering.

The condition-monitoring techniques which the Monash group are using involve mainly measurement of changes in machinery vibration levels and analysis of the composition of machine oil and the presence in it of minute metal particles (mainly iron particles) which have flaked off from the machine's moving parts.

Changes in vibration. Alfredson says, can alert the user to impending machine failure. The rate of change in the vibration level gives an indication of how soon the failure is likely to occur.

Ferroscope technique

The main interest in particle detection, he says, centres around the ferrous (iron) particles, which can be detected by a recently-introduced device called a ferroscope.

The ferroscope technique, called ferrographic oil analysis, is capable of providing comprehensive information about the severity and mode of machinery wear.

The wear particles analysed by the technique are precipitated from the fluid by a strong magnetic field. They arrange themselves in a precipitator tube or on a glass substrate according to particle size.

Alfredson says that although the technique is primarily intended to provide information about ferrous particles it can also provide information about other particles, for example, friction polymers.

Alfredson's role in the condition-monitoring project is concerned mainly with noise and vibration measurement. He plans to evaluate some of the more advanced condition monitoring techniques, such as kurtosis, coherence, cepstra and rate of change of spectra.

Kurtosis, he explains, is a measure of how sharp a change there is in the vibration signal. Coherence is a means of comparing two signals (one from a machine in good condition, for example, and one from a machine that is about to fail). Cepstra is the name for the technique of detecting the periodic nature of signals. It is particularly useful for detecting damage to gear box components.

Stecki is conducting the ferrographic oil analysis, and Kuhnell is investigating the application of a new device, nephelometry to the problem of wear-particle and contamination analysis. Nephelometry determines the turbidity of the oil by measuring the scattering of light. A more viscous fluid will scatter light in a different way from a less viscous fluid. Suspended wear particles will also affect the scattering of light.

Alfredson says the purpose of condition-monitoring is to get the earliest possible warning that the machine is beginning to fail. The techniques have to be sufficiently discriminating to differentiate between impending failure and the normal random variation in performance of a machine.

The group, which has been working on the project now for six months, has made good progress in understanding how to detect failure in rolling metal bearings. They are now looking at gear vibration. Gear boxes, which contain two components (gear and bearings) are used extensively in the mining industry.

"We have investigated the simplest role element bearings and now have a very good understanding of how to detect bearing failure," Alfredson says.

"Once we've sorted that out we will start looking at gear vibration and the added complication that gear vibration and bearing vibration occur simultaneously.

"We will examine ways of extracting from the total vibration signal those vibrations that belong to the gears and those that belong to the bearings.

"There are more complicated pieces of equipment to be considered as well." The group is confident that within two years they will be able to develop relatively cheap microprocessors capable of carrying out the half-dozen most sensitive tests for condition-monitoring of machinery in the minerals industry.

Once this is done, they hope to extend the research into the manufacturing industry. They hope that initial sponsorship for such research will be provided by the Federal Government as a public interest project through the Department of Science and Technology.

Monash mechanical engineer Mr Jacek Stecki uses a ferroscope to examine contaminated oil from an aircraft gearbox. (Inset) a microscope picture of a wear debris particle.
Monash team plans major nerve study

**Monash biophysicists**, in collaboration with the biochemistry department, are planning a major research project in neurochemistry — a study of protein movement in the living nerve.

It is hoped the information obtained will help to provide a better understanding of the mechanisms involved in nerve damage.

The project, which would not have been possible two years ago, is feasible now because of technological developments which put Monash in the 'box-seat'.

The physical aspects of the research, which will be done by Dr John Pilbrow, a reader in the physics department, and Monash post-doctoral fellow, Dr Geoffrey Dougherty, is expected to begin early next year.

The project is part of a collaborative program involving a number of people under the direction of Dr Laurie Austin, a reader in biochemistry. Associate Professor Barry Preston and Dr Wayne Comper (also of the biochemistry department).

It originated from discoveries by Preston relating to the movement of macromolecules in matrices and extensive studies by Austin into the mechanisms involved in the movement of macromolecules in nerves.

The Monash laboratory is believed to be the only one in the world apart from the Medical College of Wisconsin and the Johnson Foundation at the University of Pennsylvania which is equipped to carry out the difficult work.

Key to the research project is a tiny metal cylinder, four to five millimetres in diameter, with a narrow slit along its length, called a "loop gap resonator", which makes the research possible and can be manufactured in the department for $50.

The "loop gap resonator" was originally developed in 1980 for use with nuclear magnetic resonance (NMR), a powerful investigative tool used for determining the chemical structure of various substances.

Its application to the technique of electron spin resonance (ESR), the technique that the Monash group wish to use in its nerve research, had its genesis in a collaborative program between Pilbrow's laboratory and Professor James S. Hyde of the Medical College of Wisconsin. The collaboration began in 1979 when Pilbrow was appointed a Visiting Professor at Wisconsin while on study leave there.

Pilbrow says the electron spin resonance technique, or electron paramagnetic resonance technique, as it is sometimes called, is based on the principle that every electron, like most atomic nuclei, behaves like a tiny magnet, having a spin and magnetic moment.

In metal ions such as copper, the ion behaves like a tiny magnet (usually called a paramagnet) while radicals can be made which have a spare electron. In many studies on biological systems small paramagnetic labels (nitrooxide spin labels) are attached to the molecule under investigation. The aim is to use as low a concentration of the foreign spin label as possible.

Physicists know that when a paramagnetic substance in solid, liquid, or gas phase is placed in a magnetic field it becomes slightly magnetised. The spin of both electron and nuclei partially aligns with the field.

**Signals**

If this slightly polarised sample is exposed to microwave radiation of the right frequency (in Pilbrow's research, either the microwave frequency used in microwave ovens, or the major radar frequencies), some of the electrons absorb the radiation and become excited and more energetic. This absorption of energy is detected in an ESR spectrometer.

The ESR equipment converts the emitted energy to a graph that shows the emitted signals as peaks. Each peak is characteristic of the electrons affected and provides information about the molecule's structure and its behavior.

The increasing sensitivity of such equipment has enabled physicists and chemists to study phenomena such as structural defects in crystals and the behavior of electrons in metals.

In Pilbrow's case it has enabled him to probe more deeply into the structure and behavior of crystals, metal ion complexes and the oxygenation of cobalt compounds and bio-molecules such as Vitamin B12 (with Dr Tom Smith, of Monash chemistry department) and the chemistry and biochemistry of molybdenum (with Dr Tony Wadd, of La Trobe University).

"The major thrust of our work," he says, "has been to find computer simulation methods for dealing with the spectra of powders, frozen solutions, or biological systems where one cannot obtain a single crystal.

"Even if one could find single crystals they would not necessarily mimic in all respects what is going on at the active site of a protein or an enzyme."

Much of Pilbrow's success is due to low-frequency ESR equipment, which he has been able to develop with the help of his collaborators at the Wisconsin Medical School. His equipment cost $8000 to build. If it were available on the commercial market, he estimates, it would cost about $25,000.

Low frequencies are particularly valuable for studies of metal ions such as copper, cobalt and iron, not only in crystals and chemical compounds but, particularly, in proteins and enzymes.

"Loop-gap resonators" provide an increase in signal strength from 20-200 times higher than with conventional spectrometers. Added to which they are particularly suited to samples containing water and, therefore, to experiments on whole nerves.

Pilbrow says one of the problems which will be studied in next year's nerve experiments is the action of blocking agents. It is known that if certain substances are injected into a nerve, they block its action. But how do they do it?

As part of the nerve study, a blocking substance will be injected into the nerve and its effect on the various components of the system will be measured.

Other problems which the groups in both the physics and biochemistry departments are confident of solving are the velocity of information in the nerve and what kind of motion it undergoes as it moves.

Fundamental knowledge such as this is needed if nerve malfunction is to be understood.

As well as the nerve study, Dougherty next year will use ESR techniques to study the effect of a new class of dyes, called porphyrinazones, on DNA, the genetic component of the cell. Later he will extend the research to a study of the effect on DNA of tumour destroying drugs.

This year the group is engaged in background research to prepare them for next year's study.

Most of Pilbrow's ESR work since 1965 has been supported by ARGC grants. His grant for 1983 includes the upgrading of his spectrometer to enable motion in biological systems to be monitored.
Endorphin link with mental illness?

ONE of the rapidly expanding areas of brain research concerns the nature and function of the endorphins and enkephalins, collectively known as opioids.

These opiate-like substances are produced in the brain, pituitary and adrenal glands, as well as in other organs.

Amongst other functions, the opioids probably play an analgesic role, inhibiting some types of pain, in much the same way as morphine, heroin and other narcotics.

The drug, naloxone, which blocks the analgesic effect of the endorphins and enkephalins.

The discovery of these peptides in 1975 raised hopes of developing a new generation of analgesics with the potency of morphine but without its addictive properties.

The initial optimism was short lived. It was found that endorphins, or modified endorphins, are rapidly broken down when taken by mouth, and when injected into a vein they are unable to reach the brain because of the "blood-brain barrier."

Subsequent studies have shown that if endorphins are injected into the spinal area of cancer patients they can provide prolonged and very powerful pain relief by acting at both a spinal cord and brain level. But the cost of synthesising endorphins for this purpose at present is prohibitive, though developments in genetic engineering may make their use economically feasible in the future.

In recent years, interest in the endorphins and enkephalins has switched to their possible role in mental illness, particularly schizophrenia.

Among those working in this area are Dr David Copolov, Associate Professor Graeme Smith and Mr Jay Jethwa, of the Monash psychological medicine department, Associate Professor John Funder and Ms Judith Clements, of the Medical Research Centre at Prince Henry's Hospital.

They are using radioimmunoassay techniques to measure opioid and other hormone levels in patients with schizophrenia and severe depression. The hormone and peptide levels are being compared with those of normal patients.

Copolov says that because most anti-schizophrenic drugs seem to act by blocking the neurotransmitter dopamine, it had been assumed that schizophrenic symptoms are caused by an excess of dopamine in the brain.

But, obviously, the story is not as simple as that, he says. Dopamine inhibits the hormone prolactin, so if there was generalised overactivity of the dopamine system in the brains of schizophrenic patients, such patients should have lower concentrations of prolactin in their blood. But people with schizophrenia do not have lower than normal levels.

It could be that an endorphin, or perhaps some other peptide is involved in schizophrenia, he says. Many of the 16 or 17 known types of endorphins and enkephalins are produced in the central nervous system.

Schizophrenia link

Copolov says interest in a possible link between endorphins and enkephalins and schizophrenia arose soon after their discovery. It was found that if a particular endorphin (beta-endorphin) was injected into a rat's brain it produced a temporary catatonic stope. The opiate blocker, naloxone, reversed the catatonic stupor.

This led to the hypothesis that schizophrenia might be an "endorphin excess" disease.

Many negative studies have been reported since then, he says, but interest has been rekindled with a series of World Health Organisation studies which used the morphine blocker naloxone as an adjunct to major tranquilisers in the treatment of schizophrenic patients. Naloxone appeared to be effective when used with the tranquillisers but had no effect when used alone.

Other psychiatric research centres have reported less success with this form of treatment and this may have to do with the type of patient investigated as well as the use of differing drug dosages and regimens, he says.

The Monash group hopes in the long-term to undertake similar trials of modified endorphins in patients with serious psychiatric illness. In the meantime they are obtaining baseline information with their radioimmunoassay studies. To do this they have worked with Dr Steven Joshua, of Larundel Hospital and Dr Manjula O'Connor, of Footscray Psychiatric Centre. Over a two-year period the researchers have collected and are currently assaying blood from more than 30 newly-admitted drug-free psychiatric patients before and after treatment.

In a recently completed anxiety study Copolov, Smith and Dr John Tiller demonstrated that endorphin levels were no higher in people suffering from generalised anxiety than in those who were not anxious.

A surprising finding concerns the dexamethasone suppression test. In psychiatric populations abnormalities in this test are usually regarded as a biochemical sign of severe depression. The Monash study, however indicates that these abnormalities

**Correction**

In Monash Review 3-82, the incorrect picture was used to illustrate the article entitled "Frenetic marsupial aids ecological research". The picture showed Dr Hami Frey examining a fat-tailed dunnart. It should have shown Dr Andrew Cockburn examining the tiny shrew-like marsupial, antechinus. Our apologies to all concerned.

MONASH REVIEW
may not be as specific to depression as believed.

Dexamethasone switches off some hormonal output of the pituitary gland in normal individuals. It fails to do so in about 50 per cent of patients with depression, and this was thought to be the only major psychiatric condition in which the abnormal result occurred. In fact, the Monash group found that dexamethasone failed to switch off the pituitary in 25 per cent of anxious, non-depressed patients.

Copolov and colleagues in the Monash department of psychological medicine are also engaged in a number of collaborative studies in which they are investigating the possible role of endorphins in a wide range of physiological functions and conditions.

In collaboration with Doctors Gary Warne and Winston Rickards at the Royal Children's Hospital, and with Professor Peter Beumont, of Sydney University, Copolov is measuring endorphin levels in patients with anorexia nervosa — an assocaiting condition affecting young women.

With Mr Gary Hulse, of the Brain Behaviour Research Institute at La Trobe University, he is investigating the possible role of endorphins in the menstrual cycle. There is some evidence that opiate blockers such as naloxone increase the levels of certain hormones, including luteinizing hormone, a key hormone in the menstrual cycle.

In collaboration with Mr Don Jefferys, also of La Trobe University, and Funder, the Monash group has also found that enkephalins appear to be involved in memory.

"If you put a rat in a tub of water for 15 minutes it will swim rapidly at first, but towards the end of the 15-minute session it will float," Copolov says.

"One view of this is that the rat has adapted. If it is placed in the tub again 24 hours later — this time for just five minutes, it will float 75 per cent of the time. You could postulate this to be an indication of an intact memory of an adaptive response.

"If however, its adrenal gland (which contains high concentrations of enkephalin) is removed it will float for only 25 per cent of the second five-minute session. It appears to have 'forgotten'.

"Memory' is restored, however, if the adrenalectomised animal is given an enkephalin-like substance called DAMME immediately after the first test.

These findings, which implicate enkephalins from the adrenal glands in learning, may be related to the common observation in humans that a little anxiety improves performance.

As part of the on-going research, Copolov plans to spend six months at the Brain Metabolism Unit in Edinburgh to study the latest methods of hormonal analysis in psychiatric patients — an essential procedure in understanding the biological basis of mental illness. There is no metabolic ward in Melbourne where psychiatric patients are routinely monitored, he points out.

The Monash research is supported by an NH and MRC grant.

HOT peppers, a culinary delight or a culinary disaster, depending upon the point of view, are providing researchers with clues to the way in which pain is transmitted in the peripheral and central nervous system.

The research could open the way for the development of a new class of pain-killing drugs.

European researchers have found that if newborn rats are treated with capsaicin, the active ingredient of hot peppers, they show a reduced response to some types of pain when they reach adulthood. The animals also appear to show a selective depletion of a peptide called substance P in part of the spinal cord known as the dorsal horn.

The animals appear to develop a tolerance to the pain-causing properties of capsaicin. The tolerance appears to be accompanied by a reduction in the concentration of substance P.

Monash researchers at Prince Henry's Hospital have found that this effect on substance P can be shown in adult animals treated "acutely" with capsaicin or with alcohol, and this may underlie some of the acute effects of peppers in causing pain and flushing.

The Monash findings are part of a growing body of circumstantial evidence which appears to implicate substance P in the transmission of pain.

Neurotransmitter

Dr Rob Helme, who is conducting the research in the department of medicine at Prince Henry's Hospital, with Ph.D student Debbie White, believes that substance P may act as a neurotransmitter, conducting the pain impulse from the periphery (the skin, for example) to the central nervous system.

The hypothesis, he says, is supported by immunohistochemical studies which show that substance P is concentrated in the dorsal horn of the spinal cord and in peripheral nerve terminals. It seems to be made in a cluster of nerve cells in the region called the dorsal root ganglion.

It is released into the cerebrospinal fluid but also in the fluid of the eye and in the tooth pulp when nerve fibres involved in pain are stimulated. However, it has not yet been found to be released in the skin, although this seems likely from the results of the research at Prince Henry's Hospital.

If substance P is a neurotransmitter, it may not be as specific to depression as believed.

Dexamethasone switches off some hormonal output of the pituitary gland in normal individuals. It fails to do so in about 50 per cent of patients with depression, and this was thought to be the only major psychiatric condition in which the abnormal result occurred. In fact, the Monash group found that dexamethasone failed to switch off the pituitary in 25 per cent of anxious, non-depressed patients.

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The Monash research is supported by an NH and MRC grant.

HOT peppers, a culinary delight or a culinary disaster, depending upon the point of view, are providing researchers with clues to the way in which pain is transmitted in the peripheral and central nervous system.

The research could open the way for the development of a new class of pain-killing drugs.

European researchers have found that if newborn rats are treated with capsaicin, the active ingredient of hot peppers, they show a reduced response to some types of pain when they reach adulthood. The animals also appear to show a selective depletion of a peptide called substance P in part of the spinal cord known as the dorsal horn.

The animals appear to develop a tolerance to the pain-causing properties of capsaicin. The tolerance appears to be accompanied by a reduction in the concentration of substance P.

Monash researchers at Prince Henry's Hospital have found that this effect on substance P can be shown in adult animals treated "acutely" with capsaicin or with alcohol, and this may underlie some of the acute effects of peppers in causing pain and flushing.

The Monash findings are part of a growing body of circumstantial evidence which appears to implicate substance P in the transmission of pain.

Neurotransmitter

Dr Rob Helme, who is conducting the research in the department of medicine at Prince Henry's Hospital, with Ph.D student Debbie White, believes that substance P may act as a neurotransmitter, conducting the pain impulse from the periphery (the skin, for example) to the central nervous system.

The hypothesis, he says, is supported by immunohistochemical studies which show that substance P is concentrated in the dorsal horn of the spinal cord and in peripheral nerve terminals. It seems to be made in a cluster of nerve cells in the region called the dorsal root ganglion.

It is released into the cerebrospinal fluid but also in the fluid of the eye and in the tooth pulp when nerve fibres involved in pain are stimulated. However, it has not yet been found to be released in the skin, although this seems likely from the results of the research at Prince Henry's Hospital.

If substance P is a neurotransmitter,
Making better protective coatings

HIGH temperature plasma spraying is widely used in industry for metallic and ceramic coating of metals, especially steel.

The use of a coating allows superior surface properties to be achieved on a base material chosen for its bulk properties and perhaps lower cost.

Coatings may be used for example to increase a material’s resistance to wear or corrosion, or protect it against very high temperatures.

A good example of the use of these coatings is in protecting the parts of a jet engine. Various engine components are sprayed with special alloys or other materials to protect them against erosion, corrosion or the high temperatures generated within the engine.

Considerable research effort is now concerned with the use of special ceramic coatings which, it is hoped, will increase the temperature resistance of the turbine blades and so improve the jet engine’s fuel economy.

Trial and error

Although plasma spraying has been used for many years, its use has been based mainly on trial and error experiments.

Researchers in the Monash materials engineering department are now investigating the scientific basis of the process and have made considerable progress in understanding why the coatings have the structure they have and why this structure influences their adhesive properties.

Object of the research, which is backed by grants from the ARGC, Australian Welding Research Association and CSIRO, is to find better ways of making protective coatings and to improve existing ones. Other aspects of structural changes of materials produced by plasma treatment are also being studied.

Associate Professor Reg McPherson, who is leading the Monash research, says electric arcs have been used extensively since the nineteenth century for high temperature processing of materials. An arc, he says, consists of a volume of ionised gas maintained at high temperature by passage of an electric current.

The Monash team, in its research, is using a plasma, a very high temperature arc, with an effective temperature of up to 10,000 degrees C. The plasma flame is made by blowing a gas through an arc in a special torch.

If a powder is injected into the plasma flame, the molten particles produced strike the material to be coated at high velocity, forming a thin coating.

Using aluminium oxide as a spray material, McPherson and his colleagues have unravelled the puzzle of why the coatings have the structure they have and why this structure influences their adhesive properties.

“When you spray aluminium oxide on to a substrate you don’t get the crystal structure (sapphire) you expect,” McPherson says. “You get another which is usually observed only in processes involving low temperature treatment of aluminium salts.”

“The aluminium oxide structure formed is metastable in the thermodynamic sense but stable in the practical sense. The metastable aluminium oxide coating will transform to the stable structure on heating to 1100 degrees C, with a volume change which causes cracking.

Millions of tiny plates

The Monash team has been able to explain why these peculiar structures form. The particles hit the substrate at very high velocity. McPherson says, and form millions of very thin plates about a micron or so thick.

The little plates, which make up the coating, cool at an enormously fast rate — about one million degrees a second. The unusual structures form because of the cooling conditions during the crystallisation process.

Structures such as this, he says, are a common feature of coatings and materials melted and resolidified in a stream to form spherical particles.

Using a technique called fracture mechanics, the Monash researchers have explained also why a metal-ceramic composite coating adheres better than a ceramic coating alone.

McPherson’s group has been able to show that when you have a metal coating beneath a ceramic coating a crack will run between the interface and the ceramic. However, plastic deformation of the millions of little plates that make up the metal coating increases the energy needed to force the crack to propagate. The result is better adhesion.

Spherical droplets

Another associated line of research is concerned with the processing of high melting point materials by passing them, in powder form, through a plasma. The particles melt to form spherical droplets each of which freezes rapidly, under isolated conditions.

This leads to the formation of unusual structures which may have potential industrial applications.

A good example of this process conceives the mineral zircon (zirconium silicate), the major source of the metal zirconium. Australia has the world’s largest deposits of zirconium, which occurs in beach sands in NSW and Queensland.

Plasma treatment of zircon results in the formation of particles which contain very fine crystals of zirconium oxide, in the form of sphericalites, dispersed in glass as shown in the photograph on this page. The zirconium oxide can be readily separated from the glass by treatment with caustic soda.

The plasma dissociated zircon also has uses in the ceramic industry because reheating of the compacted powder allows the formation of zircon components with useful refractory properties.

Work along similar lines is being carried out on other materials to determine whether plasma treatment will make subsequent processing to extract valuable metals easier, or to produce products which may have applications in the ceramic industry.