MONASH physiologists have produced a model of asthma in normal people which could lead to improved non-drug methods of alleviating the distress associated with the disorder.

Chronic obstructive disease of the air passages affects one in 10 people in Australia, the most prevalent of these distressing conditions are asthma and emphysema. Common symptoms are sensations of choking and increased effort in breathing.

Physiologists have suspected from many fragmentary clinical and research observations that the choking sensations and the person's awareness of increased effort in breathing arise mainly from signals received by the brain from sensory receptors in the many muscles which come into play when the airways are obstructed.

The problem is to identify the most important receptors and their location. With their model of asthma, the Monash physiology team, led by Dr Rod Westerman, has taken the first step towards this goal.

The research so far has been done with equipment developed in the physiology department at Monash, but will be transferred soon to the lung function unit at the Alfred Hospital, where Westerman will continue it under clinical conditions.

Once the muscles most responsible for signalling the distressing information to the brain are identified, he says, it should be possible to partly alleviate the patient's distress by suitable physiotherapy, relaxation or bio-feedback techniques. Such physiotherapy could also enhance the effectiveness of currently used drugs.

Westerman says research results so far show that normal people subjected to breathing obstructions that mimic asthma are aware of even small changes in muscle length and force brought about by the body's attempt to maintain air flow into the lungs. The threshold for perception of increased effort in breathing in these conditions is very low. However, awareness of the sense of increased effort is less when the person uses his diaphragm in breathing than when he uses his thoracic muscles.

"Unfortunately," Westerman says, "an asthma sufferer, fighting to breathe through constricted bronchi during an attack, tends to breathe with his thorax rather than with his diaphragm, and a whole host of accessory muscles, including neck muscles, come into play as well."

In his experiments, normal healthy subjects were asked to breathe through a variable valve which the experimenter could preset to a given resistance, to mimic the constricted bronchi and the increased effort needed to breathe during an asthma attack. The most important part of the equipment used in the experiment was a matching resistance valve which the subject of the experiment could manipulate to control his own resistance level.

A two-way tap enabled each test subject to switch back and forth between the preset resistance and the matching resistance he controlled. Breathing data of volume and flow were recorded throughout while the subject was trying to match the two resistances by adjusting the controlled valve until its resistance seemed identical to the preset valve.

In one group of trials, subjects used the diaphragm as far as possible, in breathing during the effort matching task. Then the same subjects performed another group of matching trials breathing mainly with the thorax.

The aim of these tests was to establish a model of asthma, compare the results of diaphragmatic and thoracic breathing, and determine how accurately a normal person appreciates increased effort when breathing is obstructed.

People are surprisingly inaccurate, even though very slight changes in resistance of the airways is perceptible to normal healthy
When guns trigger violence

IS the sight of a gun or a knife an incitement to violence in an angry person? Does it increase aggression? Is the effect likely to be greater if the person has had prior experience with weapons?

These questions are important in view of the alarming number of firearms reported to years suggests that the sight of a weapon is person. He may not use the weapon, but the likely to be greater if the person has had prior experience in handling them.

Research in the United States over recent years suggests that the sight of a weapon is enough to heighten aggression in an angry person. He may not use the weapon, but the sight of it is likely to trigger some form of aggressive behavior.

However, an area not adequately researched until recently is the effect of weapons on people who have had some experience in their use.

Dr Kenneth Jones, a lecturer in the Monash department of psychological medicine at Prince Henry's Hospital, has gone some way to filling that gap in knowledge with an experiment which he conducted at Tulane University in Louisiana during recent study leave.

Ninety-six male psychology students took part in the experiment which was conducted by Jones with Professor Edgar O'Neal, chairman of the university's psychology department, and Jaime Epstein, a graduate student.

Their findings show, surprisingly, that people experienced in the use of weapons are less aggressive when angered in the presence of weapons than those with little or no previous experience.

There was little difference between the two groups when they were not angry. The sight of firearms then appeared to have little effect on them.

"It seems that fairly long-term use of firearms enabled the students to develop better control of their anger, particularly in the presence of firearms," Jones says.

But he cautions against generalising from this study to the community at large.

There are too many differences, he points out. Those taking part in the Tulane study were university students who might not be typical of people generally. And they were all young — members of the post-Vietnam generation, who might have different attitudes towards firearms than their elders.

He warns also that his study should not be used as an argument against gun control. It simply suggests that if people are to have access to firearms, there is some value in training them in how to use them.

"It is very likely that the best way to decrease violent acts in society is to limit the number of firearms," he says. "It won't stop aggressive acts altogether. People still have fists and can throw ashtrays. But it may help in reducing violence."

The complicated Tulane experiment was designed to ensure that students had no idea of the purpose of the experiment. Those with previous experience with weapons were chosen by means of a sporting questionnaire given to all psychology students at the first lecture of the year.

Buried in the questionnaire were questions concerning hunting and target shooting experience.

Asthma research

Continued from Page 1

subjects, Westerman says. However, the accuracy is greater when thoracic muscles are used in breathing.

Westerman then set out to determine what happens when sensory receptors in breathing muscles called muscle spindles are excited to a greater extent than normal. To do this, he applied a 100 Hz vibrating stimulus to the sternum (the breastbone).

Such vibratory stimuli are known to powerfully excite muscle spindles, the tiny "length-monitoring" systems embedded in skeletal muscle. These tiny structures consist of stretch receptors made up of nerve endings wrapped around modified muscle cells, both partially enclosed in a fibrous capsule.

When a muscle contracts or is passively stretched it pulls on the spindle fibres, stretching them and activating the receptors, which send sensory impulses to the brain, informing it of what is happening to the muscles.

Having established an asthma model in normal subjects in these experiments and having obtained indirect data suggesting a large contribution of the muscles of the thorax to the sense of breathing effort, Westerman and his team now plan to probe the intercostal nerves supplying the muscles to the rib cage, muscles that lie between the ribs.

Sensory receptors in the spindle fibres of these muscles could provide the key to the conscious awareness of the body's adaptive response to an obstruction of the airways, the most distressing symptom of obstructive air-passage disease.

Those taking part in the experiment have agreed to have tiny microelectrodes inserted into the intercostal nerves to record the information which the experimenters need to isolate the relevant muscles and sensory receptors. They will be paid a sessional fee.

Because there is some minor discomfort involved, and there is the need for medical safeguards, the work will be done at the Alfred Hospital. The ethics of the experiment have been discussed by the Monash Committee on Human Experiments and the work has been given the "go-ahead."

"As well as muscle spindle receptor signals from the microelectrode, we will be recording various other parameters routinely during the brief airway obstructions," Westerman says.

"It may well be that some of the things that we will be recording will prove to be crucial signals for more accurate control of breathing by the model asthma subject."

"If so, it should be possible to develop physiotherapy techniques and, perhaps, new patterns of breathing to ease the genuine patient's distress. Biofeedback might also be a help, but you have to know first which bits of 'bio-signal' to feed back."

The Monash research is being funded from three sources — the National Health and Medical Research Council, Monash University, and the Asthma Foundation.
The 96 students were divided equally into two groups -- one group consisting of those with prior weapons experience, the other, those without this experience. The students in both groups were asked by phone to participate in the study and were later randomly assigned to either “anger” or “non-anger” conditions.

To disguise the nature of the experiment, each student was told, after entering the waiting room, that the experiment was designed to look at the stress involved in knowing one’s behavior was to be monitored by a peer — in this case, another student in the room. This student was the experimenter’s confederate.

Blasts

The experimenter explained that one of the students would be subjected to “low stress conditions.” The other student, the experimenter said, would be subjected to high stress. His behavior would be evaluated by loud blasts from a sound box.

Each student, as he took part in the experiment, was asked to draw a card from a hat to determine which group he would be in. But the draw was so arranged that the real subjects always believed they were in a “low stress condition.”

On the pretext that the equipment for the experiment was not functioning properly, the genuine subject, in each case, was taken into an experimental room where he was told he would have five minutes to write a brief essay on a prepared topic. The essay would be evaluated, the experimenter said, by the student remaining in the other room (the confederate).

Jones says

After this was done, each student was randomly assigned to either “angered” or “non-angered” groups. Those in the “angered” groups were given a low mark for their essay. The students in the “non-angered” group received a high mark. A short time later the essays were returned so they could see their mark.

Having, in this way, established an “angered” and “non-angered” group, the experimenter then arranged that each student should be asked to take part in another experiment, elsewhere in the building, on the pretext that the subject in that experiment had not shown up.

Agreeing to help out, the students, unaware of the “deception,” were shown one of three sets of 10 slides — one showing various types of firearms ranging from handguns to machine guns, another, weapons of other types, such as knuckle dusters, and the third, innocuous household objects.

Each student was then asked to fill out “a short rating of their feelings on a number of dimensions”.

The “deception” was used to ensure that the students did not “catch on” to the real nature of the experiment.

On the way back to the experimental room, the student was met by the experimenter who announced that everything was now set to continue the original experiment. Each student was shown an essay said to have been prepared by the other student (the confederate) and was asked to evaluate it on a one to 10 scale by operating a sound box.

This box, which had 10 switches, gave bursts of sound, ranging from “very quiet” when switch one was operated to “very loud” when switch 10 was used. Very good essays were to receive one blast; very poor essays were to receive 10. The student’s response was measured.

“The assumption was that an angered subject, after seeing the weapon slides, would be cued to give a high number of loud noise signals to a relatively mediocre essay,” Jones says.

“All the subjects received the same essay to rate. It was handwritten in pencil, written with obviously considerable speed and not particularly exciting or interesting.

“The upshot was that the subjects who were not angry (who had received a good mark for their earlier essay) were less aggressive in general than the angered ones (those who had received a low mark).

“However, angered subjects who had had prior experience with weapons tended to be significantly less aggressive after having observed weapons than subjects who had not had that experience.

“It appears that, in the university students at least, previous experience with firearms helped them to control their response to weapons when they were angry.”

No racial differences

The researchers were unable to detect any racial differences. Black students at Tulane behaved much the same as whites, supporting previous research which suggests that there are no fundamental differences in aggressive responses between blacks and whites.

Jones says it is very difficult to do this sort of research “in the real life field”, particularly in Australia, where there is not the same hunting tradition as in Louisiana, which is “very much hunting country”.

“It is relatively difficult these days,” he says, “to find people who hunt or target shoot and have relatively high levels of experience.

“One thing that stands out from research into aggression,” he says, “is that the biggest source of violence is learning to be violent.

“The more you are hit as a child, the more likely you are to hit back, and the more likely you are to respond with violence in later life.”
A postgraduate student in the Monash department of classical studies has reconstructed a tentative "map" of Late Minoan Crete from tablet records that survived the destruction of the Palace of Knossos.

The Palace was destroyed by fire sometime between 1400 and 1200 BC.

The records, in the form of day-to-day accounts and inventories related to internal administration, were inscribed on clay tablets which were baked by the fire that destroyed the Palace.

Preserved in this way, they were discovered by Sir Arthur Evans during his excavations at Knossos at the beginning of this century.

Evans named the script "Linear B", to distinguish it from "Linear A", the Minoan script widely used throughout Crete between the eighteenth and fifteenth centuries BC.

Reconstruction

Some 3000 of these Linear B tablets (including fragments) from the Knossos archives are now safely preserved for posterity in the Archaeological Museum of Herakleion in Crete, the Ashmolean Museum, Oxford, and the British Museum and University College, London.

Dr Jenny McArthur, a former Monash Graduate Scholarship student, used these tablets to reconstruct a "map" of Late Minoan Crete. The reconstruction forms part of her Ph.D. thesis.

The Linear B script was deciphered in 1952 by Michael Ventris, assisted by John Chadwick of Cambridge. It was found to be an early form of Greek, Mycenaean Greek.

"The text provides documentary evidence of the earliest Greek civilization which is otherwise known only from archaeology and the vague traditions of the classical period," she says.

"The tablets comprise signs having a syllabic value, ideographic signs, and signs representing numerals, weights and measures."

McArthur says that for the student who wishes to work on the texts each syllabic sign is replaced by a conventional alphabetical form, which gives an approximation to the sound as we can reconstruct it. "For example, the sign-group 'ko-no-so' can be reconstructed to represent 'Knossos'," she says.

"But because of the scribal conventions believed to have been followed in reducing spoken Greek to a syllabic spelling, a number of sounds are omitted by the script and it is left to the reader to supply them."

"Examples are the sounds for the letters i, m, n, r, and s. which are omitted from the spelling when final or preceding another consonant."

Furthermore, syllabic spellings are only approximate because the script does not make distinctions which are important for Greek.

"Such a system leads to ambiguity when spelling rules allow for more than one interpretation of a Linear B word or sign-group."

"It is not surprising that when a tablet is fragmentary or the context is unclear we find Linear B words whose meanings are disputed."

The aim of McArthur's research was twofold:

She was attempting also to relate to a map of Crete these Linear B place-names and the activities with which they were associated (for example, production of textiles and perfumed oil; growing of wheat, barley, olives, figs, cypress, coriander; breeding of sheep, goats, pigs and oxen).

McArthur was attempting firstly to identify Linear B words as place-names.

She was attempting also to relate to a map of Crete these Linear B place-names and the activities with which they were associated (for example, production of textiles and perfumed oil; growing of wheat, barley, olives, figs, cypress, coriander; breeding of sheep, goats, pigs and oxen).

"While this has been a concern of the small group of scholars working in the field there remains disagreement and dispute over both the identification of some words as place-names and their possible location," she says.

McArthur established a definitive list of 81 Linear B words which could be plausibly identified as place-names in the Knossos tablets and provided a computerised index of their occurrences.

She then subjected the index of place-name occurrences to statistical analyses which included non-metric multidimensional scaling, a technique in which a computer is used to produce "maps" from Knossos place-name associations.

The analyses enabled her to identify four main groups of place-names which could be interpreted as being geographically based and related to two major zones in Crete - the central zone with three sub-divisions, and the western zone.

"This suggests that the control exerted by Knossos may not have extended to the east," she says.

As a check, she studied archaeological reports to see whether a site could have been occupied in Crete in Mycenaean or Late Minoan times, and visited all major accessible sites.

McArthur cautions that any conclusions drawn from her computer "map making" must remain "very tentative."

"In addition to the incomplete and fragmentary nature of the Knossos tablet data, one can make suggestions only about the location of groups of place-names with reference to the fixed points provided by certainly identifiable place-names, Amnisos, Knossos, Kydonia, Phaistos and Tylissos," she says. "Positioning within a group can allow for the consideration of archaeological sites in a particular area."

McArthur's thesis will be published by the University of Salamanca in the form of a monograph and articles in Minos (Revista de Filologia Egea).
Adoption law — changes urged

ADOPTED people appear to have an "almost inbuilt need" to know the identity of their natural parents.

The need is just as strong in those who have had good relationships with their adopted parents as it is in those whose relationships were not so good. And it is in no way related to the age at which the person learnt that he or she was adopted.

These striking findings have emerged from a search by Mr Cliff Picton, a senior lecturer in the Monash department of social work, and Mrs Mia Bleske, a research assistant.

A progress report on their research appeared last year in the September issue of Monash Review. The research is now complete, and their report will be presented soon to the Attorney-General and the Minister for Community Welfare Services.

It argues that adopted people should have the unqualified right to information about their natural parents and the right to seek contact with them.

This recommendation is in sharp contrast to the findings of the Statute Law Revision Committee which discussed the question in 1978 and came down strongly in favour of only qualified access — at the discretion of a Judge in Chambers.

The Committee rejected a submission that legislation be made retrospective, arguing that this would be a breach of confidence.

Picton says the Monash research has shown that the Statute Law Revision Committee had been overcautious, basing its findings on false assumptions, and underestimating the rapid change in public opinion.

Picton and Bleske interviewed 86 members of Jigsaw, an association of adults adopted in childhood, adoptive parents and natural parents, formed to lobby for the repeal of the present restrictive legislation.

Of those interviewed, 48 were adults who had been adopted in childhood. Twenty-two of them, by various means, had made contact with their natural parents. Thirty-two of those interviewed were mothers, who, many years before, had given up a child for adoption.

"The Committee, in rejecting the principle of unqualified access, had accepted the widely-held belief that by changing the law to allow adult adoptees to have access to information about their natural parents you would be opening some sort of Pandora's box," Picton says.

"They believed that you would have people prying into relationships which had been established for many years and bringing distress to people who had made a mistake earlier, but, in the passage of time, had been able to put it out of their mind.

"Our research shows that this is not the case."

"The 22 people in our study who made contact with their natural parents were not disadvantaged. Disturbed people seeking, in a relationship with a lost parent, something they didn't have with their adoptive parent.

"They regarded the adoptive parents as their real parents, and, in some cases, were assisted by them in their search for their natural parents.

"In all cases, they went about the search in a very careful, concerned way, in most cases using intermediaries. The outcome was generally successful, and, in most cases, contact has continued, either in person, where geography allows, or by letter or telephone where the distance is too great."

Picton says the need of adopted people to know about their natural parents is not related, apparently, either to whether the relationship with the adoptive parents is good, or not, or to the age at which they were told they were adopted.

This finding contradicts earlier research which suggested that adopted people who sought out their natural parents were usually those who had not had very good relationships with their adoptive parents.

"It seems to be an almost inbuilt need to know a perfectly normal, natural need — which we believe should be gratified by a change in the present law," he says.

One of the most startling findings of the Monash study, he says, is the traumatic effect that adoption appears to have on women who give up their children.

Grief reaction

"It is not apparently something that they can put out of their mind," he says. "They relive the loss almost daily.

"Of the 32 women we interviewed we found a universal wish either to find the child they had relinquished 20 or 30 years ago, or to be found by that child.

"In the report, I described the effect to an unresolved grief reaction. The mothers become very distressed on the anniversary of the child's placement, or on its birthday. They wonder whether the child is still alive and are constantly looking at people of the same age as the child, wondering whether that person is their lost child.

"Obviously, we don't know how representative these women are, but the findings are a strong indication that giving up a child for adoption is seen by the natural parent as a very traumatic event."

As well as recommending unqualified access to information, Picton and Bleske's report recommends the establishment of a formal contact register, staffed by an experienced counsellor, which would enable natural parents to "signify whether they wished to be contacted." The counsellor would be available to help adopted people who wanted to make contact.

Similar recommendations have been made to the NSW parliament by the NSW Standing Committee on Adoption.

"This approach to the problem," Picton says, "would take away the ad hoc uncertain nature of the present system and would replace it with something more likely to safeguard people's privacy."
Repairing the damage of alcohol

RESEARCHERS in the department of medicine at the Alfred Hospital and the department of biochemistry have made an important advance in the management of ascites, a serious condition, caused, in many cases, by alcoholic liver damage.

In ascites, fluid accumulates in the peritoneal cavity. Typical symptoms are a swollen abdomen and difficulty in breathing. Liver function is affected, and kidney failure is often present in advanced cases.

A recent advance in treatment of intractable cases is the Le Veen shunt, an operation in which a catheter is inserted in the peritoneal cavity and the fluid is drawn up through it into the venous system.

Although this operation reduces the swelling and improves kidney function, it also produces a severe disturbance in the blood clotting mechanism resulting in bleeding both under the skin and internally. The frequency of this complication is such that the shunt is only considered in life or death situations.

Monash researchers, Dr Hatem Salem, a lecturer in medicine at the Alfred Hospital, and Dr Chris Handley, of the biochemistry department, have now isolated a protein from the fluid which, they believe, is responsible for the bleeding.

The protein is collagen, normally found in the connective tissue and tendons which form the fibrous framework for the attachment of muscles and bones.

Salem and Handley are hopeful that they will be able to neutralise the effect of collagen in ascites by the prophylactic use of aspirin, or similar drug. Trials with aspirin will begin soon on rabbits.

Salem says that ascites — accumulation of fluid inside the peritoneal cavity — occurs in a number of diseases, including kidney disease, heart disease and cancer. But the commonest cause in Australia is alcoholic liver disease.

"Although our ward is not specifically a gastro-enterology ward, we have an average of one case a week of ascites caused by excessive drinking," Salem says.

The familiar "beer pot" is part of the ascites syndrome, but it is not the same thing as ascites, he says. The "beer pot" is largely due to excessive intake of calories from beer drinking. Ascites — accumulation of fluid — is a step further on. It occurs in very heavy drinkers — men who often drink more than 30 pots a day.

"In these people the accumulation of fluid in the peritoneal cavity is so great that they look like pregnant women," he says.

"In severe cases, their kidneys fail completely and they are unable to form urine."

Salem says that in the initial stages treatment includes bed rest, restricting salt and fluids, and the use of diuretics to get rid of the accumulating fluids. Some patients reach the stage where this form of treatment no longer works. The only treatment left then is the Le Veen shunt.

Theoretically, the Le Veen shunt, named after its inventor, Dr Harry Le Veen, of the Downstate Medical Centre, State University of New York, should relieve the condition, Salem says. Excess fluid is drawn from the peritoneal cavity to the veins in the neck where it enters the venous system, relieving the abdominal pressure. Proteins and other substances in the fluid are not lost. They are conserved in the body.

"Unfortunately, in practice, patients who undergo this operation develop what is known as disseminated intravascular coagulation," he says.

"That basically means that clotting proteins in the blood are rapidly activated with diffuse clotting all over the body. Clotting proteins are thus rapidly consumed and their levels fall accordingly."

"As the platelets, corpuscles in the blood which play a critical role in the formation of blood clots, are also involved in this process, their count in the blood falls too."

"The depletion of both platelets and clotting factors results in widespread bleeding."

"Usually necessitating ligation (the tying off) of the shunt. This operation has been carried out on 14 patients at our hospital and in all of them the same complication arose."

Using sophisticated platelet and biochemical tests on samples of ascitic fluid from alcoholic liver disease patients, and also from some with malignant ascites, Salem and Handley were able to identify the factor in the fluid which they believe is responsible for the rapid consumption of platelets and clotting proteins which precipitates the bleeding.

Collagen

The factor, they found, was collagen. They believe it acts by causing platelets to clump.

"It is known from test tube experiments that collagen can aggregate platelets," Salem says. "It is also known to activate other clotting factors."

"We also know that collagen's activator of platelets in the test tube can be blocked — aspirin."

"We hope that by using aspirin we will be able to block the effect of collagen in Le Veen shunt patients. If the action of collagen is blocked in these patients, the infusion of ascitic fluid should have no untoward effect on their clotting mechanism, and the problem of bleeding, which forces the physician to ligate the shunt, will not occur."

Salem hopes to begin trials soon with aspirin as a collagen blocker. But because of the element of uncertainty and the present hazardous nature of the Le Veen shunt operation, preliminary trials will be carried out on rabbits.

If the trials are a success, aspirin will be used as pre-operative treatment for patients with ascites.

Salem is hopeful that one aspirin a day for a week before the operation should be enough to prevent this complication.

"If aspirin doesn't work, I'm sure we will find other agents that do," he says. "The most important thing is we have found the cause. It should not be difficult to find a cure."

JUNE 1980
Good news for hi-fi buffs

MONASH electrical engineer, Associate Professor E. M. Cherry, has good news for hi-fi buffs concerned by distortion in existing high-fidelity amplifiers.

The typical distortion level for commercial high-fidelity amplifiers is a fraction of one percent at middle frequencies, perhaps even 0.01 percent. But distortion increases at low and high frequencies, the deep bass and high treble sounds.

Cherry has built an amplifier which uses standard transistors and other components, in which distortion is only a few parts per million over the entire range of audible frequencies. To do this, he invented a new mathematical principle.

A paper describing the principle has won for Cherry the 1978 Norman Hayes Medal. This medal is awarded annually for the "most meritorious paper published in the Proceedings of the Institution of Radio and Electronics Engineers Australia during the preceding year." Adjudication alternates between the Institution of Electrical and Electronic Engineers (New York) and the Institution of Electrical Engineers (London).

Patent

Monash has applied for a patent, and through J. H. Reproducers (Australia) has licensed the giant Pioneer Corporation of Japan to manufacture audio amplifiers using Cherry's principle.

Cherry's interest in audio dates back to a "noobboy hobby, although his concern with the problem of amplifier distortion began four years ago in an atmosphere of scepticism. He questioned, and still questions, the claim of some hi-fi buffs that they can distinguish differences in distortion in the best hi-fi equipment.

"It's fairly well known that the loudspeaker and pickup between them introduce something of the order of one percent distortion under loud signal conditions," he says. "Yet some high-fidelity enthusiasts claim to hear the difference between amplifiers which introduce only an additional 0.1 percent distortion."

New principle

To do this, he invented a new principle which enables negative feedback far in excess of the formerly accepted theoretical limit (known as Bode's limit) to be applied to an amplifier.

Negative feedback involves a loop around an amplifier which feeds part of the output back to the input, as in Figure 1 (below), so that the signal which goes into the amplifier proper (called the "error") is the difference between the input to the system and the feedback signal. Negative feedback reduces the effect of the distortion in the amplifier in the ratio of this "error" to the system input. The smaller the error the less the distortion.

"What I found, in a sense, is a way of cheating on this limit of Bode," Cherry says. "If you stick to Bode's rules the limit is unshakable, but you can 'cheat' by altering the boundary conditions.

"I apply not one feedback loop, as in Bode's theory, but instead have a 'nest' of feedback loops, one inside another. It also turns out that the inner loops need to feedback signals which depend not on the output signal itself but on the way the output is changing with time."

The obvious application of the idea is to improve traditional hi-fi power amplifiers used to drive loudspeakers. But there are other potential uses, Cherry says. One is the field of integrated circuits.

"There is a certain amount of prejudice against integrated circuits for high fidelity audio use," he says. "Hi-fi enthusiasts believe their sound is poor.

"There is no reason why pre-amplifiers used with pick-ups and tape recorders could not be replaced by integrated circuits incorporating my idea. The sound would be good with a minimum of distortion."

Improver

Another application in the high fidelity field is an "amplifier improver" - a "black box" that could be added to an existing amplifier to upgrade its performance. Figure 2 (below) shows how the improver could be connected and is also a good illustration of Cherry's principle of nested feedback loops.

"Because the 'improver' contains none of the high-power electronics needed in a power amplifier," Cherry says, "it could be manufactured comparatively cheaply. A typical 'improver' would reduce the distortions in an existing amplifier by about a factor 30 and give a cheap amplifier, equivalent in performance to a very expensive amplifier."

The new principle also applies to amplifiers used at present to strengthen telecommunication signals.

Existing amplifiers — those used in connection with coaxial cables, for example — are "perfectly adequate for the purpose", but they need expensive transistors which need special characteristics.

"There is no reason why amplifiers using my idea and ordinary transistors should not be made for telecommunications use," he says. "They would be cheaper, perhaps only a dollar per amplifier cheaper, but it would be a dollar each in a very large number of amplifiers."
MONASH physiologists, using a special strain of mice, are making headway in understanding the complex interaction of muscles, nerves and hormones involved in Hirschsprung's disease.

Hirschsprung's disease, a potentially fatal disease of the lower bowel, affects about one in 5000 babies.

Children with the disease are unable to defaecate because of a severely constricted lower bowel. The part nearest the anus is constricted: the portion above is distended. The condition is diagnosed promptly and almost balloon-like.

The children are "at grave risk" unless the condition is diagnosed promptly and a colostomy operation is performed. Surgeons treat the disease by removing the constricted part of the colon (the large bowel) and linking the unaffected part to the anus.

The Monash team, led by Dr Grahame Taylor, a senior lecturer in the physiology department, is attempting to identify the nervous system or systems involved and the neuro-transmitters, the chemicals which transmit the neural message, as an aid to diagnosis and, in the long-term, perhaps, to the development of drugs which may obviate the need for an operation.

Taylor's team includes Robert Baum, a research assistant, and past-honours' student Ian Meredith. Alan Koh, a research assistant, also worked on the NHRMRC-funded project until last year when he returned to Kuala Lumpur.

In their attempt to unravel the complex neural mechanisms involved in bowel motility, Taylor and his colleagues are using a special strain of mice, called Piebald Lethal mice, which, because of a genetic defect, are born with a similar condition. The picture above shows a normal mouse (left), Piebald mouse (right).

In the constricted region of the lower bowel of the mouse, there is an excess of these nerves, he says, but they are not responsible for the constriction. Addition of noradrenaline causes the gastro-intestinal tract to relax.

There are also cholinoergic nerves in the region. This class of nerves releases another type of neuro-transmitter, acetylcholine.

Over-activity of this class of nerves should cause constriction of the gastro-intestinal tract, he says, but it is obviously not responsible for the constriction found in Hirschsprung's disease. Addition of atropine, a drug which blocks the action of cholinoergic nerves, has no effect at all on the bowel blockage.

The missing nerves also cause the gastro-intestinal tract to relax, Taylor points out.

"But one might believe that if the affected segment has no nerves or is lacking in a certain type of nerve, the area above it may well be able to force the intestinal contents through," he says. "That however doesn't seem to be the case."

"Clearly, we do not understand the way in which the bowel propels its contents along its entire length."

The nature of the neuro-transmitter released by the missing nerves — the non-adrenergic inhibitory nerves — may be an important clue in understanding this gastro-intestinal puzzle.

Recent work by pharmacologists suggests that peptides (amino acid-containing compounds) may act as neuro-transmitters in the gastro-intestinal tract.

Some of these are expensive to purchase, but Taylor's team hopes soon to test some of them.

"Until we know what the transmitter is we are really working in the dark," he says.

"In the long term, he says, it should be possible to identify the transmitters involved in normal gastro-intestinal motility patterns.

Once this is done, it may be possible to develop drugs which mimic their effects and so provide alternative ways of treating conditions such as Hirschsprung's disease.

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