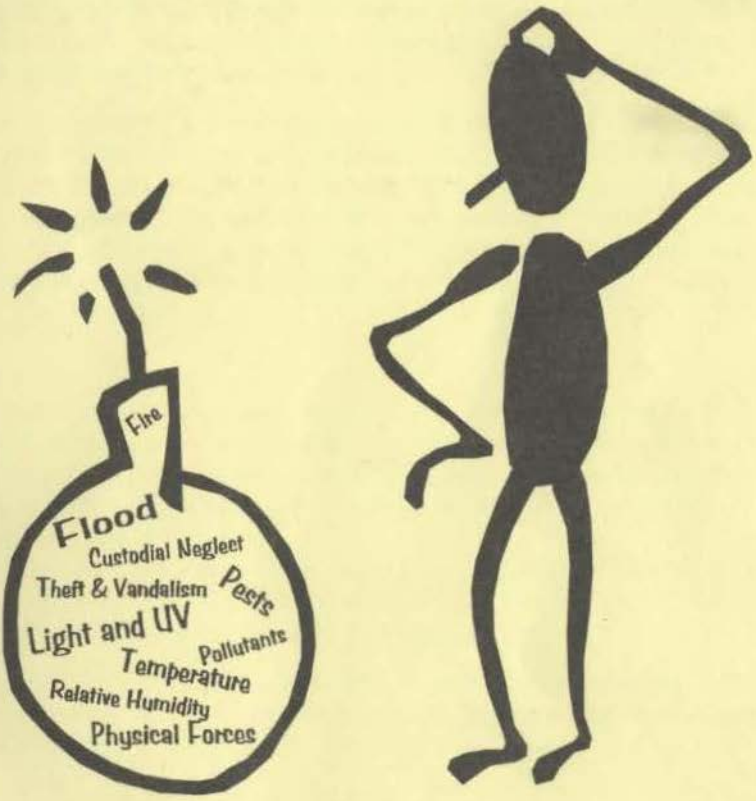
Natural Sciences Conservation Group Newsletter

Issue 5 April 1997



The Ten Agents of Deterioration

An issue by issue guide to the risks facing museum collections

Narcotising Sea Anemones Conservation Forum Grants

Newsletter

Natural Sciences Conservation Group

Editorial

By the time you read this, *Anthrenus* and *Attagenus* will be making their way through your windows/glass cases/display fronts laden with their little time bombs of destruction. Maybe not, perhaps your museum managed to splash out on some gaskets or window sealing compound or new hi-tech cases. Whatever your situation watch out there's a beetle about!

This year started off with a small flood due to a burst pipe in our oldest building on site: this will be written up with, hopefully, many other useful examples of flood, prevention and cure, in the next issue. Budgets are always twitchy subjects at this time of year and I'm sure were all having much less to spend this year let alone get funding for SPNHC in Wisconsin this year? At least we have Cardiff complete with ceilidh and much imbibing of velinvoel beer. Happy Easter!

Simon Moore

Errata

Those readers who asked me about Martin Elliott's name appearing in issue 3 may be interested to know that the letter decrying the undervaluing of natural science conservation was written by James Dickinson. How Martin's name got onto the paper that James sent me is a mystery but apologies are proffered to those who were confused by this error.

Secondly a ghost line (from p.15 but absent from the proof) appeared at the top of p. 7 of Jenny Moore's review of the Slide Mountants Meeting (pp 6-7, issue 4). Deleting this line up to "Peter" should then make sense.

Finally an apology to those who received a scrambled newsletter issue 4. Extra copies of this issue will be available at the AGM, otherwise apply to Simon Moore on 01962 846337.

Any articles for inclusion in the newsletter should be sent to the Editor at:
Hampshire County Council Museums Service, Chilcomb House,
Chilcomb Lane, Bar End, Winchester SO23 8RD

View From the Chair

Your committee met on 6th March and for a change travelled to Liverpool Museum. The main part of the meeting was concerned with our forthcoming meeting and AGM, being held jointly, this year with the Biology Curators Group. I would like to urge members to attend and for the benefit of our members further afield, we will be attempting to record the proceeding on tape. Members should have received booking information, but a registration form is also enclosed within this newsletter.

The whole committee would like to thank the National Museum and Galleries of Wales for generously hosting the two day event and the evening reception. Julian Carter's hard work has resulted in an exciting programme of speakers and we are particularly pleased that May Cassar of the Museums and Galleries Commission Conservation Unit has agreed to present her latest research on cost benefit analysis within conservation in our keynote speech.

Paul Brown reported back from the recent Conservation Forum meeting and it transpires that one benefit of membership is access to grants to attend member's conferences and meetings. So, if you need assistance for our conference, see the details later on in the newsletter and apply to the Conservation Forum for a grant. If you are interested in attending any of the other Conservation Forum members meetings, grants seem to be applicable to these as well.

Your committee continues to express concern over Natural Science posts at risk, particularly in conservation at Bristol and Glasgow. Rumours reach us of problems in other institutions and we will respond if you provide us with details. We are co-ordinating responses with BCG and GCG through joint representatives on our committees.

We hope that this issue on Fire will provide a good start to our series covering the agents of deterioration ad may I remind you that Flood is the next topic.

See you in Cardiff

Kate Andrew

Natural Sciences Conservation Group AGM 17th April, 1997

NOTICE TO ALL MEMBERS

Elections to the Committee

The 1997 AGM will be held at The National Museum and Gallery of Wales in Cardiff on the 17th April.

Nominations are sought for the following posts on the NSCG Committee.

Secretary - Term 3 years.
Bob Entwistle has served over 3 years, and unfortunately must retire.

3 Ordinary Member posts - Term 2 years.
Caroline Butler and Angus Gunn are retiring from the Committee after completing their terms. (One extra post due to combining membership secretary and treasurers post).

Assistant Editor -
Nick Gordon has come to the end of his 2 year term but wishes to continue. He has been nominated to continue.

Nominations for these posts should be sent to:- Bob Entwistle

Ipswich Museum High Street IPSWICH LPI 3QH

They MUST be received by the 20th March.

If no nominations are received for a particular post, we will take nominations from the floor at the AGM.

The Conservation Forum

UK Organisation in Partnership with The Conservation Unit of the Museums & Galleries Commission

Grant bid and proposal to the Conservation Advisory Committee of the Conservation Unit from the Conservation Forum for administration of UK conference grants.

The forum is very grateful for the opportunity to manage the grants funds which the Conservation Unit of the Museums and Galleries Commission propose to make available to the Forum to administer. These individuals will be members of one or more of the conservation professional bodies comprising the Conservation Forum.

The Conservation Forum proposes that for this first financial year of the transfer of the administration of these funds from the Conservation Unit to the Conservation Forum, that the grant is divided among the membership currently making up the forum, as follows: Each body is to be allocated a sum equal to five percent (one twentieth) of the overall amount, with the remaining fifty percent available to all the bodies according to pressure of need. This would afford the flexibility to meet greater need in particular areas where there might for example be a conference, symposium, or workshop of special importance. In this way we would hope to provide the maximum possible support without the risk of having moneys unspent in areas where the need has not been great during the year.

The forum will undertake to submit a retrospective account at the year end, and it is proposed that the beneficiaries of grants produce a report to be disseminated appropriately. For the bridging period of 1997/8 it is proposed that each Forum body will have 5% of the overall amount to disperse to members of the Forum organisations to attend conferences which it has organised. Where a body is not hosting any conferences, this money will be used to sponsor its own members to attend conferences run by other Forum organisations.

The remaining 50% of the overall amount will be allocated as seems most appropriate to all Forum members as soon as the CAC approval for this post is granted.

The Forum membership has seen and approved the Guidance notes for the administration of UK Conference Grants drawn up by Val King, Training Development Officer for the Conservation Unit.

A calendar of UK conferences already arranged for the financial year of 1997/98 is attached. It is likely that there will be additions to this programme before the beginning of the financial year.

The Conservation Forum Requests a total sum of £5000 to disperse as grants to individuals via the professional bodies for the financial year of 1997/8 plus £500 administration fee.

Tom Caley/Carol Procter 19/11/1996 and approved by all Forum representatives.

Conservation Forum - Insurance Seminar 29th September 1997

One day conference to be held in London, organised by The Conservation Forum with the support of the Museums and Galleries Commission. It will be of interest to conservators and freelancers in other fields. Speakers will include representatives from the main client bodies: National Trust, English Heritage etc. There will also be presentations from experts in the insurance field on loss adjustment, litigation and professional indemnity and from conservators with practical experience in this area. For further details contact: Valerie W. Munday, Conservation Forum Co-ordinator, 16, Queen Anne's Gate London SW1H 9AA Tel: 0171-233 4200 Fax: 0171-233 3686

BCG Trip to the Paris Natural History Museum (November)

Well done Kathie Way for a well-organised trip to the Paris Natural History Museum! Le Eurostar whisked our group of curators, conservators, collection managers and hangers-on neatly under the Channel without kippering us (that occurred the week after our return!), although we did not enjoy being herded altogether onto the train through a very crowded waiting area! The Metro in the Gard du nord treated us to a 'suspect package' incident so that many of our group showed true British grit and initiative by walking the 700 metres to the Hotel Orange in the Rue de Trevise (just off Lafayette).

I noticed that there was an evening of short ballets by 20th century choreographers at the Paris Opera just down the road from the hotel. Despite having to pay 'extra' from the ticket touts (which raised the cost to London prices) it proved to be a most enjoyable evening set in the splendid baroque/rococo decor of the building. A stentorian-voiced programme seller whose cry echoed round the building during the interval combined to create an atmosphere worthy of the famous 'phantom'.

Next day was an early start (for some) to the Natural History Museum to view the newly opened Grande Galerie: an imposing early 19th century building whose vertices have been put to good use to display arboreal and flying species of animals. The basement area follows the current trend for museum lighting - quite atmospheric for the oceanic exhibits that it houses but hard on the visitor who has to squint at the (back-lit and unobtrusive) labels and avoid treading on children. A large plastic, walk round model of sand grains could amuse visitors, making them aware of the ways that meiofauna might intercommunicate with imagined squeaks and scrapes. Film loops showed life at bathyscape levels, shores and tides. Dried marine algae were mounted between sheets of perspex and fluid preserved specimens were suspended in their jars on saucers that clipped onto perspex mounts. The public were obviously tempted to touch the real specimens, as shown by the occasionally ruffled fur or feather, but were politely asked not to do so by the *gardiens*.

Upstairs the African gallery was better lit but the standard of taxidermy was only average; areas of shrinkage seen on birds were less noticeable on the mammal specimens which were arranged as if to process through the gallery to some imaginary ark. The see-thru lifts treated visitors to birds in flight and arboreal primates. The café served excellent drinking chocolate.

While a group of us was waiting to see the *Zoothèque*, or underground store, we were asked to visit the meteor gallery, showing fascinating clips of video/film footage of heavenly bodies coming to earth and the subsequent damage they caused.

The *Zoothèque* itself is a recently built (1994) labyrinth of dry and spirit storerooms utilising manual compactor systems. The maze of doors, corridors and staircases even disoriented our guides, adding a surreal touch - one wondered whether specimens might be beamed from one store to another! The spirit store, as its name implied, held largely spirit-preserved material, only a little was preserved in formalin. Many specimens were suspended in jars using glass balloon floats. Despite its great size many units were overcrowded and there was much conservation work needed to bring the specimens back to a stable and presentable state. The store holds about 1 million fish, 10K mammals, 4.5k birds, several million invertebrates and about 1,000 types. RH was a problem, the store

being on the same level as the Seine (about ½ mile away); nonetheless the store was maintained at 55% RH and 15°C, guarded by a halon extinguisher system.

Keenies (or those who were officially funded for the trip) then visited the micro-zoo but your correspondent's stomach sought sustenance from a nearby couscous restaurant - the only good value meal of the whole trip. Prices in Paris have risen substantially and with the rate of exchange of 8F to the £, a hot chocolate in the Café Kleber cost £3. I noticed that at surrounding tables several students were sharing one (small) bottle of mineral water! Even a light meal in a brasserie included a 0.4 litre of ordinary beer at 45 francs (£5.50) and a plate of chips at 28 (£3.50)! The Eurostar is a quick ride to the heart of Paris but fails to tell you to find the scruffiest bars which still offer a *café-calva* at a reasonable price. At least such beverages can still warm the heart even if shared with some specimens of *Blatella germanica*!

The return journey came all too soon; the Eurostar was again quick but having to wait 40 minutes in a short queue for sandwiches (all that they had despite the tasty menu) reminded me of previous encounters on British Railways back in the 1960's.

Simon Moore

Are we relying too heavily on computers - a reply.

Enquiry: fish spears from the Yukon
Answer: 22
Time taken: 1 minute 30 seconds to answer enquiry, 10 minute to retrieve objects and 8 minutes to print out full records

Enquiry: documents relating to John Player
Answer: 12
Time taken: 4 1/2 hours to search indexes and record cards and to retrieve objects.

One of these enquiries was answered using a computer the other using manual indexes and card systems. No prizes for guessing which one is which.

Museum collections are made up of anything from 100 to 100's of thousands of unique objects. The larger and more varied the collections the greater the amount of paperwork, record cards, manual indexes needed to make sense of it. Handling

huge quantities of data and putting it into a meaningful form is something computers do very well. Type the data in once and hey presto, record cards come out the other end, indexes of any fields, answer's to queries straight from the screen. Add new records and all the indexes are automatically updated so you do not have to spend an age updating all your manual systems. Museums and their collections were institutions waiting for computers to come along!

Computers are not however the be-all and end-all. Of course objects need labels using proven materials and perhaps at present they are not yet able to replace the trusty old Rotring and Rapidograph pens. What they can do however is crunch huge amounts of data in a fraction of the time taken it would take to do it manually. The computer database is much more versatile in extracting information than any manual system. This is of course assuming that the information has been input properly. The quality of your data output is only as good as the data you input. One of the biggest problems with computer database inputting is to know in advance what sort of data will be required in the future. Often not enough thought goes into what sort of data you want to get out of the database to be able to then decide how you are going to put your data in.

Another problem is the complexity of the database. Not everyone is a computer buff who can happily spend hours talking about 'stacked RAM memory' and other such deeply uninteresting things. Much of the ambivalence and indeed outright hostility towards computer databases stems from their perceived complexity and difficulty in extracting useful information. Most people want to sit down, press a button and watch the required data whirl out of the printer. They do not want to have to go through 10 - 20 commands to print things out often in a clunky typeface with little control over page formatting unless you can write your own outputs (yes MODES I mean you). Until data can be accessed by the average non-computer buff then the real benefits of computerisation will not be realised.

Onto the main bone of contention, and the bane of any major computer users' life, viruses. Yes they are a major problem but like the threat of *Anthrenus* the responsible curator/systems manager takes precautions and preventative measures to avoid infection/infestation. No curator ever said 'sorry I cannot accept that material into the collections because there is a risk they may at some stage become infected with *Anthrenus*/*Attagenus* etc.', rather they freeze/fumigate the material before placing it in the store, monitor the store and inspect the material at regular intervals. If any problem becomes apparent then action is taken. So it is with computers. No software should be loaded into computers without first being virus checked, though admittedly virus checkers are only as good as the latest version in use and viruses can still slip through the net. The majority of viruses are transferred between computers by executeable commands such as .exe files so transfer of data files has not been a problem, though some of the new breed of

viruses are being spread in document files. If the only software running is the database then you run no risk of infection. In an ideal world you would run the database on a separate computer or network; if there is free access to the system then anyone can load anything such as free software from computer magazines, often a major source of viruses particularly in the past. The vast majority of museums will be running small scale databases often on one PC so there should be no worries about viruses. All computers should of course have their data backed up at regular intervals, this goes without saying. If you find you have a time delay virus could you not reload your data from a backup first setting the computers date and time to a time before the virus reared its ugly head and extract the data in an uncorrupted form? I have never heard of anyone doing this but it may work!(I have also to date never come across anyone with a virus problem).

The biggest problem with using computers is protecting the integrity of the data. Damaged files and old or faulty equipment present much greater threats than a virus but protecting your data integrity doesn't make as good a news story as a good virus threat story.

As for chucking specimens once they are on computer and a DNA fingerprint taken, does this really need comment?

Computing is becoming easier and faster, and though computerisation of collections data is a daunting prospect once tackled the benefits are enormous. Yes there are still problems to be ironed out, particularly with long term stability of computer papers and inks, but they will be solved. Till then I will still write basic data labels with my trusty Rotring, type the data into my trusty computer, print out its A5 record card, generate indexes and answer all enquiries via the computer. Once the backlog is tackled that is!

Nick Gordon, Saffron Walden Museum

The Ten Agents of Deterioration

Next issue:

Flood

Articles, information, experiences, anecdotes, preventative measures?
Please send any contributions, no matter how small, to the Editor

Narcotising Sea Anemones

S.J, Moore
Hampshire County Council Museums Service, Chilcomb House,
Chilcomb Lane, Bar End, Winchester SO23 8RD

Standard techniques have been reviewed and modified to improve methods for narcotising actiniarians. Experiments have been carried out on the more common species of intertidal and shallow water British sea anemones. A notable increase in the usual success rate has been achieved.

INTRODUCTION

Many techniques have been devised to overcome certain problems encountered when narcotising actiniarians. From these a few have been selected as being at least partly successful. Further modifications to these narcotising methods have been introduced in order to block more effectively the nervous pathways responsible for secondary contraction reactions. Until now, perfectly expanded specimens have been achieved largely by chance. This paper records experimental results and arising problems as a contribution to a better understanding of the process and a more consistent rate of success.

NATURE OF PROBLEMS

1. Keeping an anemone in a medium so that it will not close during the induction period - until it no longer responds to food or tactile stimuli (primary narcotisation stage or PNS). Successful PNS can be achieved by studying the circadian rhythms of the anemones related to water movement for intertidal species and by introducing artificial conditions which stimulate the anemone to remain open; these are cool environment, water movement and presence of food.
   A. Cool environment - container kept in constant-temperature room at 4-10°C.
   B. Water current - to stimulate tidal motion; maintained by magnetic stirrer set between 350 and 500 rpm in 2-5 litres of seawater. This also effected an even mixture of the narcotic.
   C. Feeding with small amounts of food not only encouraged the anemone to stay open but was also necessary in assessing stages of narcotisation as response to food fell off.
2. Having successfully reached PNS, the secondary nervous pathways had to be blocked since the anemone was still responsive to chemical stimuli. Further chemical induction could lead to a gradual closure either by rapid detection of a less tolerable environment or, at a more advanced stage, by the anemone becoming 'accommodated' to the narcotic. According to Shelton *et al.* (1982,

The Ten Agents of Deterioration

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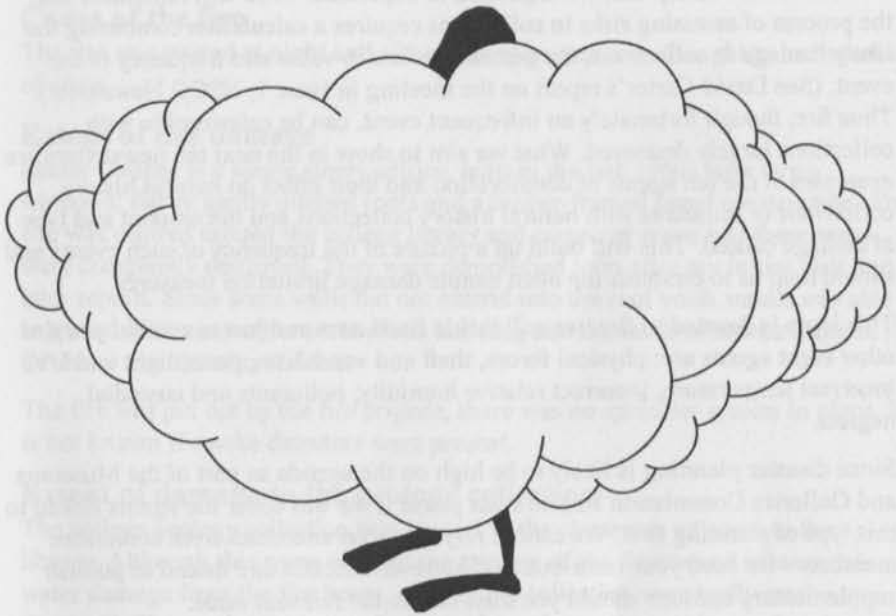


1. Fire

pp. 203-242) this reaction is brought about by the anemone's SS2 endodermal nervous system (see below) which partly controls mouth opening and requires Mg^{2+} cations to block the Ca^{2+} channels and prevent associated nerve endings from firing. In this blocked state the anemone will die and many start to autolyse and decompose which leads to problem 3.

3. Determination of the end point (EP) of narcotisation where a narcotised anemone no longer reacts to any stimulus but is still perfectly intact and has not started to decompose. Visible decomposition normally occurs after about 20 minutes after EP has been attained so that exact estimation or recognition of EP condition is essential. Since it is almost impossible to recognise such a narrow time parameter, coupled with the risk of causing closure by premature fixation or losing the specimen as it autolyses, the problem can only be easily overcome by placing the container of narcotised specimens into a deep freeze approximately 30 minutes before EP is estimated to be achieved. This also has the effect of enhancing narcotisation but can only be effectively carried out with pre-cooled specimens. Room temperature experiments will need to be moved to a cooler environment at least one hour before EP. Introduction of a fixative may also cause tentacle shrivelling due to osmotic syneresis especially noted in (*Anemonia viridis*). Introduction of fixative at low dilution levels has been found to be too slow to halt autolysis.

Narcotising techniques ideally need to be capable of accommodating these problems without becoming too cluttered with physical inducements to keep the specimens from closing. Workers in the field can then carry out effective narcotisation without the burden of complex equipment.

The species narcotised in these experiments are listed below in order of decreasing ease of induction to EP:

Calliactis parasitica, Adamsia carciniopados, Anemonia viridis, Edwardsia tuberculata, Corynactis viridis, Caryophyllia smithi, Cereus pedunculatus, Actinia equina, Urctina felina, Actinia fragacea, Metridium senile (see below) and *Bunodactis verrucosa*.

Specimens of *Sargatia* spp. were not found in sufficiently large numbers for experimentation and there were only enough specimens of *Metridium senile* for one experiment.

RELEVANT NERVOUS SYSTEM PHYSIOLOGY

Muscular actions in Actiniaria are controlled by the following four nervous systems that act independently or interact with each other.

1. Through-conducting nerve net (TCNN) controls fast or slow contractions, caused by stimuli throughout the entire animal.

Points to think about

- MGC standards for collection care require an automatic fire detection and alarm system to BS 5839.
- Although all UK public buildings are required to have a fire alarm, it may only be a manual system and not automatic, i.e. if there is a fire the alarm has to be set off manually and serves only to make people inside the building aware of the need to evacuate; it may not call the fire brigade. If a fire breaks out at night in a building with this kind of alarm, the fire brigade will only be summoned if someone else notices the fire and dials 999.
- Some intruder alarm systems with infra-red motion detectors may pick up the movement of smoke. Break glass detectors would presumably be activated if an arsonist broke a window.
- If you have smoke and heat detectors in your building, check that the calling system is automatic.
- If a building move is on the cards, a new wired-in automatic fire detection system (an expensive short-term investment) is radio operated and portable. Re-useable systems can be supplied by some companies.
- What sort of fire station serves your area? In remote areas, some fire stations are operated by volunteer fire crews on call and will therefore take longer to respond since the fire crew (like lifeboat crew) are called by pagers from another place of work.
- A system incorporating sprinklers is the best safeguard against fire damage. The volume of water discharged by sprinkler heads over the immediate area of the fire is far less damaging than the several hundred of gallons per minute pumped by fire hoses.
- Halon systems are also very effective but under Montreal Protocol on CFCs can no longer be installed as new.

Further information from:
MGC Standards for Biological and Geological Collections (Numbers 2 and 3) include a very thorough standard for the protection against fire with a list of sources of advice and help.

Kate Andrew

Next Issue: Flood

2. Slow system 1 (SS1), ectodermal, controls radial muscles of oral disc, longitudinal muscles of column and tentacles, detachment of pedal disc.
3. Slow system 2 (SS2), endodermal, controls opening and closing of mouth and pharyngeal protrusion.
4. Delayed initiation system (DIS). Evidence of this nervous pathway has been reported by Jackson and McFarlane (1976) in *Calliactis parasitica*. The DIS produces delayed bursts of SS1 pulses.

Excess Mg^{2+} cations (in magnesium chloride) will block the calcium pathways of the TCNN, SS1 and SS2 until recordable activity ceases (PNS). Ciliary action, however, has been observed to continue on the column of *C. parasitica* and narcotisation must therefore be continued until the EP is reached. Organic narcotics have been found to suppress the actions of the SS1 resulting in PNS but few, such as menthol, have been found that can continue narcotisation up to EP; inorganic (Mg^{2+} containing) narcotics have been used in a secondary role to reach EP.

RESPONSE MONITORING

Response to tactile stimuli was made by observing reaction to a 1mm cube of mackerel muscle. The responses were graded (in Figures) as:

1- normal feeding response;
2- nematocysts firing , therefore food adheres to tentacle, but anemone cannot transfer food to mouth and eventually drops it;
3- nematocysts barely firing, food adheres to tentacle for not longer than 2 mins;
4- nematocysts no longer firing, food not adhering to tentacle at all, anemone has no response to tactile stimuli and has reached PNS.

RESULTS

All results were obtained at room temperature unless otherwise stated . Constant improvement was noted throughout. Control specimens were kept in fresh seawater and were put alongside the specimens undergoing narcotisation to monitor the latter's state of opening (i.e. to check for any circadian rhythm induced closing).

Magnesium chloride technique (Figure 1)

Successful narcotisation results were obtained regularly with *Actinia equina* (with magnetic stirrer at 10°C), *Cereus pedunculatus, Bunodactis verrucosa* and with *Corynactis viridis* at 10°C.

Batches of specimens were pre-cooled to 10°C over two hours in two litres of seawater agitated by a magnetic stirrer at 350 rpm.

Smaller batches were used as controls in current-induced seawater, the other specimens were treated with 500ml of a saturated solution (7.5%) of magnesium chloride which was dripped into the container so that a concentration of 1.875% was eventually reached over seven hours.

Actinia equina at 10°C (Figure 1.1). Narcotised specimens were transferred directly to the freezer overnight. Next day, surplus ice was washed away and the remaining block was transferred to a container of Steedman's fixative, semi-concentrated to allow for ice-melt dilution. Final result: out of 24 specimens 18 were fully expanded, six half to three-quarters expanded (88% success). This result proved consistent throughout further experiments.

Cereus pedunculatus at 10°C (Figure 1.2). The specimens were frozen overnight. Surplus ice was washed away the next day and specimens were fixed as before. Final result: out of 15 specimens 11 were fully expanded, two half expanded (80% success).

Bunodactis verrucosa at 10°C (Figure 1.3). Narcotised specimens were frozen overnight and thawed next day in fixative. Final result: all 10 specimens were fully expanded (100% success).

Corynactis viridis at 10°C (Figure 1.4). Specimens were frozen overnight. Surplus ice washed away next day and specimens fixed as before. Final result: all 20 specimens were fully expanded (100% success).

MS-222 Sandoz (tricaine methanesulfonate) (Figure 2)

Successful results were obtained regularly with *Anemonia viridis*, *Corynactis viridis, Bunodactis verrucosa, Calliactis parasitica, Adamsia carciniopados* and *Caryophyllia smithi*. Partly successful results were also obtained from *Actinia equina, Actinia fragacea*. A weak solution of Sandoz was dripped into the narcotising container until a concentration of 0.02% or 0.05% was reached.

Anemonia viridis at 10°C (Figure 2.1). Although this anemone is unable to retract fully the numbers (open) refer to specimens that showed no signs of being affected by the narcotic such as tentacle shortening, syneresis. The EP for *Anemonia* is critical. The specimens had to be frozen fairly rapidly since the first signs of autolysis were already apparent after seven hours narcotising. Final result: out of 12 specimens five were fully expanded (42% success). Fixation of *Anemonia* was found to be difficult since tentacular syneresis occurred This coupled with fast autolysis at EP made this anemone quite difficult to process satisfactorily using this narcotic.

Corynactis viridis (Figure 2.2). Final result: out of 25 specimens 22 were fully expanded and were fixed by dripping Steedman's fixative into the container (82% success).

Bunodactis verrucosa at 4°C (Figure 2.3). Eight specimens were part-fixed during freezing due to signs of rapid autolysis. Final result: out of ten specimens eight were fully expanded (80% success).

Calliactis parasitica at 10°C (Figure 2.4). Narcotised specimens were frozen and thawed in fixative next day. Hermit crabs were removed from shells prior to fixation. Final result: all 15 specimens were fully expanded (100% success).

Adamsia carciniopados (Cloak anemone) together with its hermit crab undergoing fixation in Steedmans following successful narcotisation using chloral hydrate

Adamsia carciniopados at 10°C (Figure 2.5). Narcotised specimens were frozen overnight and thawed in fixative next day. Final result: out of eight specimens seven were fully expanded (88% success).

Caryophyllia smithi (Figure 2.6). Narcotised specimens were frozen after seven hours induction and thawed in fixative the next day. Final result: out of nine specimens eight were fully expanded (90% success).

Actinia equina at 4°C (Figure 2.7). Narcotised specimens were frozen overnight and thawed in fixative the next day. Final result: out of 15 specimens only four were fully expanded (25% success).

Actinia fragacea at 4°C (Figure 2.8). Narcotised specimens were frozen overnight and thawed in fixative the next day. Final result: out of 15 specimens nine were fully expanded (60% success).

Chloral hydrate technique (Figure 3)

Successful results obtained from *Urticina felina, Bunodactis verrucosa, Adamsia carciniopados, Edwardsia tuberculata.*

Narcotisation was carried out at either 10°C or 4°C at a concentration reaching 0.15% or 0.2%.

Urticina felina at 10°C (Figure 3.1). Specimens were gradually cooled to 10°C over three hours in three litres of seawater, gently agitated by a magnetic stirrer at 200 rpm. Narcotised specimens were frozen after eight hours induction. Final result: out of 15 specimens nine were three-quarters to fully expanded. (60% success).

Bunodactis verrucosa at 4°C (Figure 3.2). Narcotised specimens were frozen overnight and thawed the next day in fixative. Induction was rapid. Final result: all ten specimens were fully expanded. (100% success). (The chloral hydrate technique was found to be roughly 50% successful at 10°C and at a final concentration of 0.5%.)

Adamsia carciniopados (Figure 3.3). Hermit crabs were normally removed from their shells. 100 ml of fixative were dripped into the container away from the specimens which were removed to full strength fixative after one hour. Final result: all 15 specimens were fully expanded (100% success).

Metridium senile at 10°C (Figure 3.4). Unfortunately not many specimens were available for experimentation. Narcotised specimens were frozen after eight hours and thawed in fixative next day. Final result: out of six specimens four were three-quarters to fully expanded (60% success).

Edwardsia tuberculata at 10°C (Figure 3.5). Narcotised specimens were frozen overnight and thawed in fixative the next day. Final result: all ten specimens were fully expanded (100% success).

Menthol technique (Figure 4)

Successful results obtained from *Calliactis parasitica, Urticina felina, Corynactis viridis, Adamsia carciniopados, Anemonia viridis, Edwardsia tuberculata.* Partly successful results from *Actinia equina, A. fragacea.*

Menthol crystals were ground to a coarse powder and scattered on the surface of the seawater in the narcotising container. Menthol was found to be equally effective at various temperatures although lower temperatures slowed down the rate of induction.

Calliactis parasitica (Figure 4.1). Provided that the anemones were fully expanded prior to induction, this technique was invariably 90-100% successful.

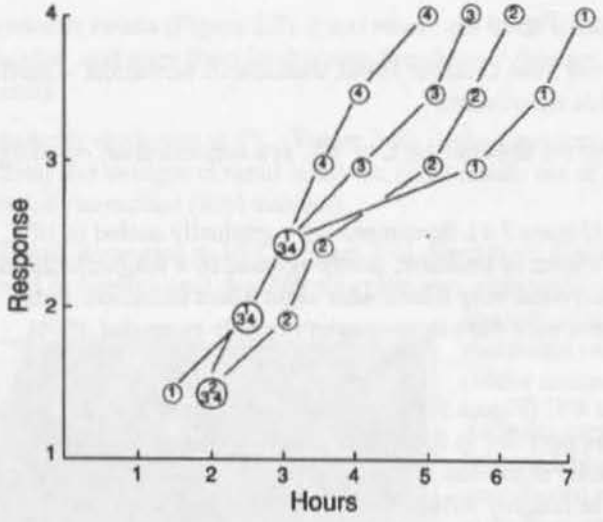


Figure 1, Magnesium chloride technique (all at 10°C). 1= *Actinia equina.* 2= *Cereus pedunculatus.* 3=*Bunodactis verrucosa.* 4=*Corynactis viridis*

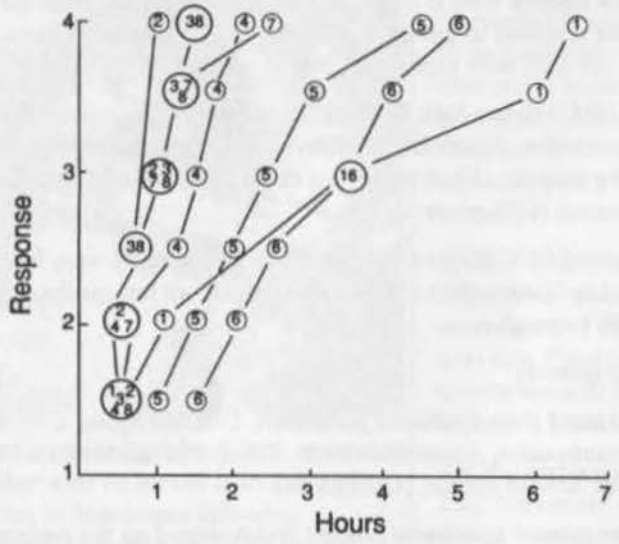


Figure 2. MS-222 Sandoz technique. 1=*Anemone viridis* at 10°C. 2.= *Corynactis viridis.* 3=*Bunodactis verrucosa* at 4°C. 4=*Cereus pedunculatus* at 10°C. 5=*Adamsia carciniopados* at 10°C. 6=. 6=Caryophyllia smithi. 7=.Actinia equina at 4°C. 8=*Actinia fragacea* at 4°C

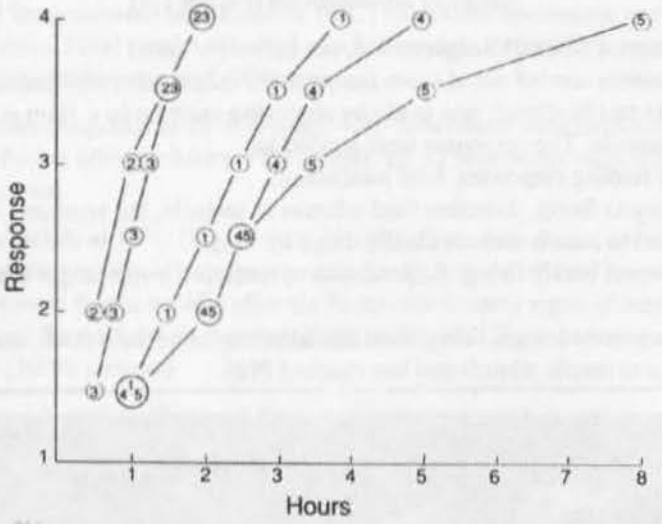


Figure 3. Chloral hydrate technique 1=*Urticina felina.* 2= *Bunodactis verrucosa* at 4°C. 3=*Adamsia carciniopados.* 4=*Metridium senile* at 10°C. 5=*Edwardsia tuberculata* at 10°C.

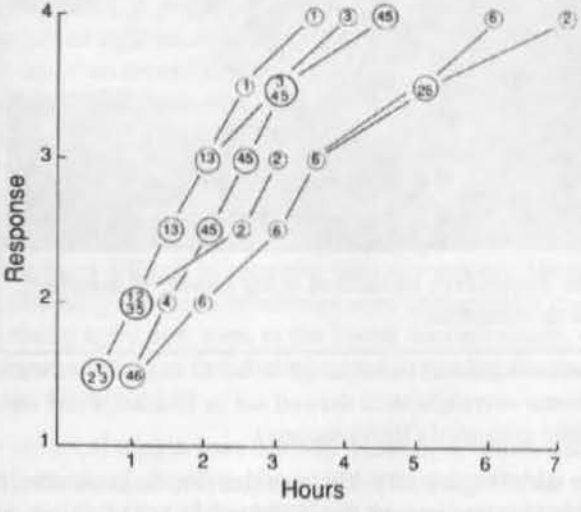
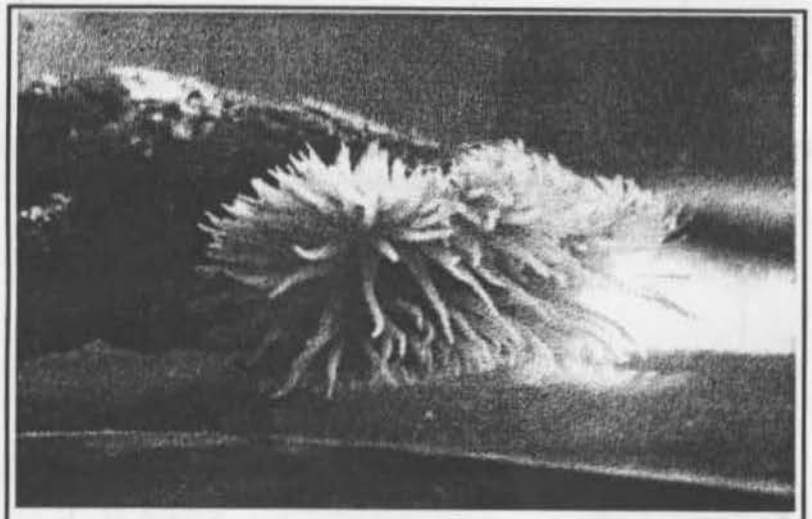


Figure 4. Menthol technique. 1=*Calliactis parasitica.* 2=*Urticina felina* at 4°C. 3=*Corynactis viridis* at 10°C. 4=*Adamsia carciniopados at 10°C.* 5=*Anemone viridis* at 10°C. 6=*Edwardsia tuberculata.*

Stages of narcotisation (Figues 1-4)

Time in hours, ('x' axis) Response 1-4, see below ('y' axis)
All experiments carried out at room temperature unless otherwise indicated. Response to tactile stimuli was made by observing reaction to a 1mm cube of mackerel muscle. The responses were graded as:
1 - normal feeding responses, food swallowed;
2 - nematocysts firing, therefore food adheres to tentacle, but anemone cannot transfer food to mouth and eventually drops it;
3 - nematocysts barely firing, food adheres to tentacle for not longer than 2 minutes;
4 - nematocysts no longer firing, food not adhering to tentacle at all, anemone has no response to tactile stimuli and has reached PNS.



Calliactis parasitica successfully narcotised using powdered menthol, undergoing fixation in Steedman.

Hermit crabs (for this anemone) could be removed or left to narcotise as well. Narcotised specimens frozen overnight then thawed out in fixative. Final result: all 16 specimens were fully expanded (100% success).

Urticina felina at 4°C in dark (Figure 4.2). This was found to be more effective in the dark at 4°C, thawed in fixative the next day. Final result: out of 12 specimens two were fully expanded, six were three-quarters expanded and four, half expanded (79% success).

Corynactis viridis at 10°C. (Figure 4.3). A higher success rate (of full expansion) was noted for specimens narcotised at 10°C; narcotised specimens were frozen after six hours. Final result: out of 13 specimens eight were fully expanded, five were three-quarters expanded (90% success).

Adamsia carciniopados at 10°C (Figure 4.4). Specimens were narcotised at 10°C and were frozen after six hours. Final result: all 12 specimens were fully expanded (100% success).

Anemonia viridis at 10°C (Figure 4.5). Narcotisation was carried out at 10°C, the lower temperature helped to prevent rapid autolysis once EP had been reached, specimens were frozen rapidly after six hours due to early signs of autolysis and were thawed the next day in fixative. Final result: all 12 specimens were fully expanded (100% success).

Edwardsia tuberculata (Figure 4.6). Induction was carried out at room temperature. Narcotised specimens were frozen overnight and thawed the next day in fixative. Final result: out of 12 specimens nine were fully expanded (75% success).

Freezing technique

This was found to be rather unpredictable and should be used only if no narcotising chemicals are available. Fair results were obtained, however, from *Actinia equina, A. fragacea* (about 50% success rate) and especially from *Urticina felina* (about 80% success rate). Specimens were pre-cooled at 4°C for several hours and then moved to the freezer overnight. After washing away surplus ice, they were immersed in semi-concentrated fixative (to allow for dilution by the remaining ice).

Conclusions

Actiniarians have been found to be highly chemo-sensitive to adverse conditions making them difficult to narcotise with any success. Many current techniques for anaesthetising marine invertebrates were unsuccessful due to the toxicity of the narcotising agent and, even in the lowest concentrations, were detected by the anemone resulting in the gradual retraction and/or the secretion of a mucus barrier (see Table 1.).

Four chemical agents were initially found to be usable with actiniarians and these have been tested. Rapidity of narcotisation was variable: compare, for example, the narcotising time of *Bunodactis* in magnesium chloride to MS-222. The menthol technique proved to be one of the simplest and most effective techniques and is recommended for use in the field. Despite its average 25% success rate, the MS-222 Sandoz technique could also be used in the field. Unsuccessfully

expanded anemones could easily be revived within two hours by replacing them into aerated seawater.

If full expansion is required, the user must be prepared to set up the necessary simple apparatus and follow the technique through with patience. If this is done a good consistent result can be assured.

Table 1. ***Narcotising agents found to be unsuccessful in certain species***

	Chloral hydrate	Freezing	Chlorbutol Urethane	Formalin	MS-222	Menthol	$MgCl_2$
A. equina	x		x	x		x	x
A. fragacea	x		x	x		x	
U. felina			x	x	x		
B. verrucosa		x	x	x			
C. pedunculatus	x	x	x	x	x	x	
A. viridis	x	x	x	x			x
C. parasitica	x	x	x	x			x
A. carciniopados		x	x	x			x
C. viridis	x		x	x			

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