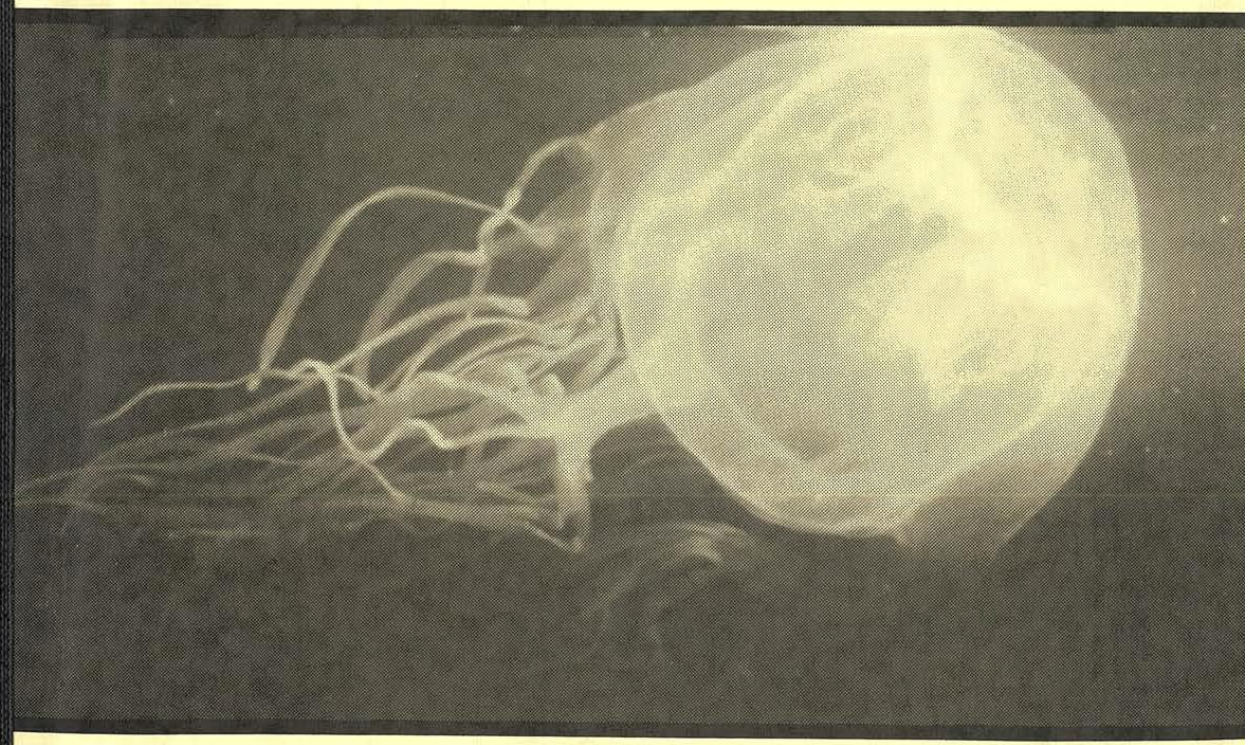
BARNES ON BOX JELLYFISH



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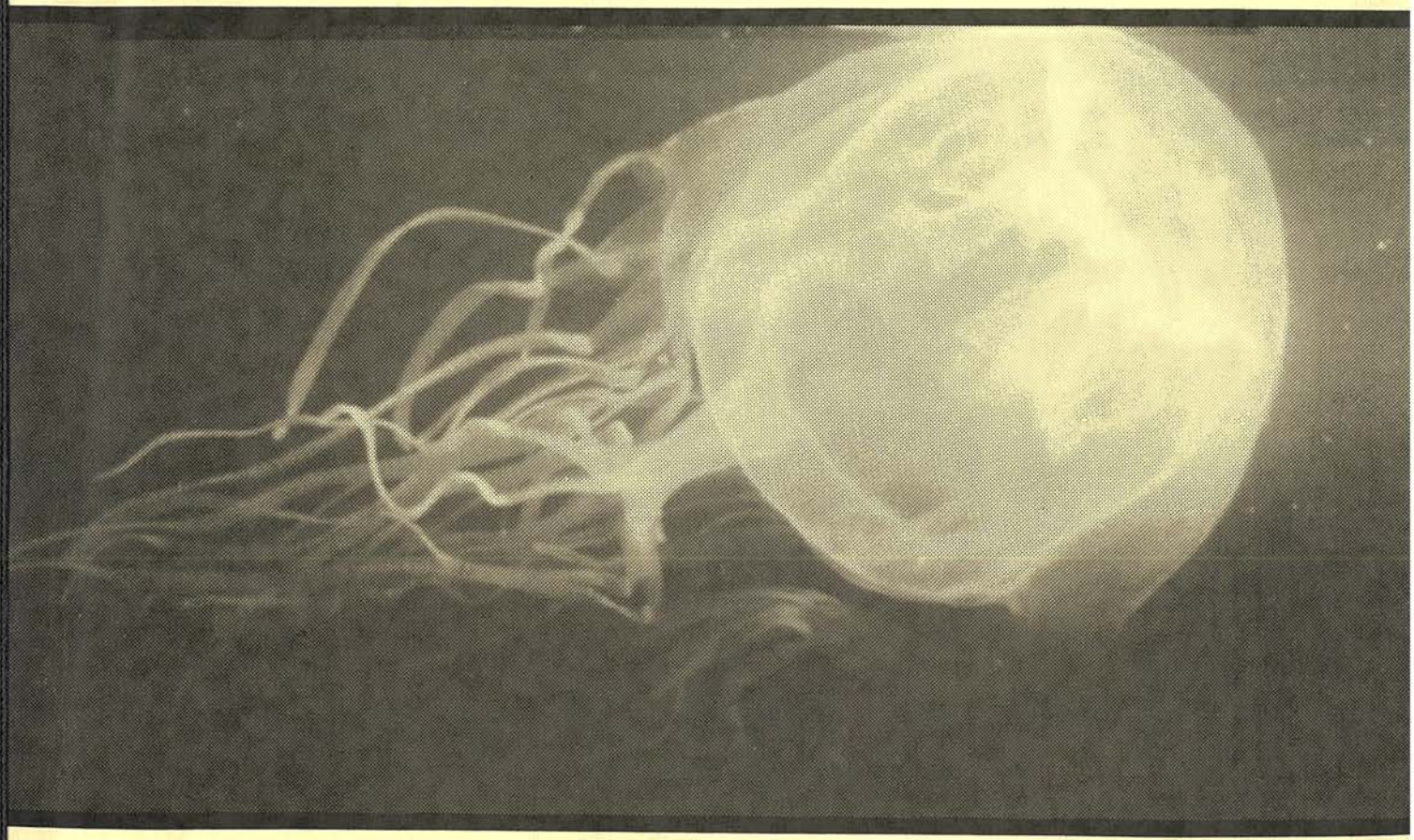

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BARNES ON BOX JELLYFISH

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INTRODUCTION

Jack Barnes was one of the first "home grown" researchers I met when the University College of Townsville (now James Cook University of North Queensland) started in 1961. His name was already known to me because of my interest in venomous marine animals, and when he first came to the University I was immediately attracted to the man's attitude and commitment to understanding how the Chironex fleckeri discharged its venom, how human victims could be saved, what was the nature of the constituents of the venom, and what could be done to find an "antidote".

We did a small amount of chemical work for Jack; enough to identify the principal constituents as being protein in nature, and thus recognizing that we did not have the facilities or the expertise to pursue the studies Jack wanted conducted.

Despite my inability to help to the extent he wanted, Jack kept coming back to report on his work, and he seldom spoke of the other stingers which feature so significantly in this summary of his work, by Barbara Kinsey. I suspect that through the mid 1960's, Jack Barnes made enormous personal sacrifices to continue his studies on the "box jelly fish". He had a wonderful dry wit and one can clearly recall the statement that he only practiced as a doctor for sufficient time to feed his family and to pay for the field work and reagents needed for his research on the "box jelly fish". In fact, he said that he would prefer his wife to work to earn the money necessary for basic needs, so that he could concentrate on his deeply loved research.

He mobilised a chain of contacts at least from Mackay to Cape Tribulation, including practicing members and officials of the Surf Life Saving Association of Australia (Queensland Branch) and many medical practitioner colleagues. In this way he always knew when stingings had occurred, and he developed a reliable supply of "stingers".

Contact was subsequently maintained more frequently during the period over which two of his children Jenny and Nick were in Townsville at University.

Whenever my work took me to Cairns I looked forward to seeing Jack. He so much enjoyed his work and his quiet way of telling of the recent results was always spiced with deep insight - not only to the solution of this problem, but also to the attitudes of others working in the field.

In 1984 the Queensland Government through the Hon. Bob Katter Jnr., Minister for Northern Development, Aboriginal and Islander Affairs asked me to chair the "Box Jelly Fish Committee" to recommend to the Government on methods that could be adopted to minimise the risk of human envenomation by Chironex fleckeri and to advise on methods of treatment that should be used when people are "stung".

At this time my contact with Jack Barnes became more intensive. One day in his room, amid boxes of records, and mindful of the unfortunate loss of all of Dr. Hugo Flecker's records, I asked "what will you do with all your records in the longer term?". Jack looked around and said "Oh, I suppose they'll burn them when I've gone." But of course that was not the true Jack Barnes. That was the quick retort. Not only Jack, but his wife and his children all wanted to see his work properly recorded and archived.

Then began the process of finding a way to access the information. First, would Jack allow it? He had been known to be pretty careful about who could see his records. At first reluctant, Jack later agreed provided he could select the person who would be suitably qualified and who "would be able to put up with a prickly fellow like me". (Jack never had any false impression about the way academic colleagues saw him - he was always straightforward in everything he said and his reputation derived from that great characteristic - which, unfortunately so few share.)

Second there was a need to find the money. Here a champion emerged in the person of Des Urquhart then District Governor of Lions Club District 201 Q4. Des arranged for me to meet with his colleague District Governors at a Lions Convention in Sydney and the support for the collation of Jack Barnes' accumulated works was guaranteed.

Third, with Jack's permission and the Lions Clubs' financial support, who could we find? Barbara Kinsey "fitted the bill" in every way and Dr. Barnes was comfortable in her quiet but efficient presence.

Barbara had just completed the tape transcripts in early August 1985 but a display was planned for the University's Open Day. The display was entitled "Barnes on Box Jellyfish" and was organized by her from Jack Barnes' records. It created great interest!

Sadly Jack Barnes never saw it. Nor has he seen the results of the analysis of his great works, and this publication, even in draft form.

He passed away on August 11 1985.

Knowing the man, I am sure that he would approve of the fact that this precis of his work will provide the researchers of the future with access to his more specific records, many of which are held in the archives of the James Cook University of North Queensland. Mrs. Barnes and her family retain some specific records, which are of great personal value because they all worked alongside Jack in most of his investigations.

Jack Barnes the man, Jack Barnes the medical practitioner, and Jack Barnes the pioneering authority on jelly-fish behaviour and envenomation will never be forgotten by those who met him in any of the above roles. He was a great North Queenslander.

He will live in the hearts and minds of those he left behind, and that is not to die.

Joe Baker.

ACKNOWLEDGEMENT

Without Joe Baker, Des Urquhart and the Lions Club District 201 Q4, I would never have had the opportunity to embark on a truly fascinating assignment. I am very grateful for their support.

I had only one week in Cairns, familiarising myself with Jack Barnes' notes and catalogues, copying tapes and asking questions of him when he could spare the time between his patient's appointments, and as I found something that required explanation. He had so much information, both in his head and in the fading notes that I wondered if I could ever do it justice. His dry humour doesn't translate on paper into the wit I heard in that week and later, when transcribing the tapes. I'm very glad I met him.

I had just finished the transcriptions of his tape recordings when we heard of his death. There was still so much information to be compiled, and there were still some intiguing questions to be answered. I was very fortunate. Jack Barnes has a wonderful family, and some very special friends, who, despite their own grief have been most supportive. I cannot thank them enough, especially Mrs. Loloma Barnes and Mrs. Jenny Roberts who were tireless in their efforts to find more information for me when I approached them with my questions.

Nobody can do justice to Jack Barnes' work. There is still an enormous amount of information to be gleaned from his records and it is a measure of the quality of his research, that it can provide the answers for many current problems. It has been a great voyage of discovery for me.

.....B.E.K.

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PRELIMINARY REMARKS

During the hottest months of the year, bathers in Australian tropical waters have been subjected to stings from marine jellyfish. These range substantially in severity, and a number are fatal.

Historically, although a surface float was never seen at the time, fatal stings were ascribed to Physalia, the Portuguese Man'o'war. This theory remained uncontested until 1943 when Frank McNeill suggested that a cubomedusan was the more likely contender.

Dr Hugo Flecker, in Cairns, was a medical practitioner with widespread natural history interests. He maintained a Registry of Injuries due to Plants and Animals from which he had established that serious injuries from marine stingers were a public health problem in North Queensland and other tropical coastal areas and that the earlier ideas on causation were probably erroneous.

During the Second World War, Ronald Southcott was in the Army Medical Corps in North Queensland. He noted some 70 cases of marine stingings, between December 1943 and January 1944. About 10 of these showed wealing (the others probably were Irukandji stingings). There were no fatalities. He implicated Chiropsalmus as well as other jellyfish in these stingings.

Flecker concentrated his efforts in the search for the stingers responsible whenever the opportunity occurred. Southcott had decided to attack the problems of the systematics of the cubomedusans. Together they were a formidable team. Their careful investigations traced the fatal stings to a hitherto unknown cubomedusan, Chironex fleckeri.

Most of Flecker's notes were lost when he died, but Jack Barnes was given a special legacy, the letters written by Southcott to Flecker at the time of this collaboration. These are a fascinating record of their search.

Jack Barnes had practised Medicine on Thursday Island, in Torres Strait and in Cape York Peninsula areas, prior to setting up in Private Practice in Cairns in 1953. He had seen stinger fatalities, and possibly the stinger itself (5), and had corresponded with Flecker from Thursday Island.

After the death of Flecker in 1958, Jack Barnes was asked to continue Flecker's work on the directory of stinging organisms, the original of which had been lost. He set about this task with great energy and enthusiasm, enlisting the help of the general public, lifesaving clubs, ambulance personnel, fishermen, and service clubs. He asked for water samples from the sites of stings, details of wind, weather, state of the tide, depth of the water - any information which might possibly be relevant. In the process, he collected a substantial amount of information about many marine related problems, e.g. ciguatera poisoning.

One of his major breakthroughs was in capturing the small carybdeid responsible for Irukandji illness. This had been a mystery illness. The sting is mild, there is only a slight redness at the site of the sting and the symptoms take about 10 minutes to develop. The symptoms mimic those of appendicitis and he noted (pers.comm.) that many of the victims had been subjected to unnecessary surgery in times past. With the discovery of the Irukandji carybdeid, Carukia barnesi came his warnings to be cautious of a diagnosis of appendicitis in victims who had been swimming very recently, and, for those who had been mildly stung and suspected an Irukandji sting, not to reenter the water and risk drowning from the sudden onset of intense pain.

Barnes' work encompasses a wide range of interests and organisms. Emphasis will be given in this report to Chironex fleckeri, but where other organisms, especially Chiropsalmus quadrigatus become important as comparative organisms, they are also discussed. Some of the minor collections made may be of interest to a few research workers, but it would be impossible in the time allocated for this report to do more than mention that he did have notes pertaining to marine organisms which have been known to sting, bullrout, hydrozoans etc., but that these form a minor part of his notes.

Some of the discussions of work done will be incomplete. Where possible others who are familiar with Jack Barnes' research have been asked for information. However it seems more true to the spirit of this work that the reader should be aware of the information contained in his papers and should be aware of his interpretation of that information.

Where conclusions are unavailable, they are best pursued in the original material by those working close to those particular aspects of his research. This report is concerned with Barnes' conclusions.

Where possible, Jack Barnes own words have been used with little modification. He is the best person to describe his work. In some instances it has been necessary to summarise, insert minor explanations and change the sequence of sentences in the collation of the work, but every effort has been taken to minimise extraneous input, unless it was felt that further explanations were necessary to the general reader's understanding of certain aspects of this report.

There are some explanations and qualifications relating to this report. I have used the word antivenom, instead of Jack Barnes' term, antivenene. I have also inserted metric measurements alongside the original imperial measurements. Also, recent work implicates Chiropsalmus quadrigatus in other parts of the world with lethal stings (pers.comm. R. Hartwick J.C.U.). I have been asked by him to comment that the references to Chiropsalmus in this report refer to the Australian C.quadrigatus, and should not be extrapolated to Chiropsalmus quadrigatus outside Australian waters.

The major sources used for this report consist of Barnes' catalogues, published papers and articles, and tape recordings of lectures, letters and comments (transcripts of these tape recordings are reproduced as Appendix A).These have been supplemented from working notebooks relating to such subjects as toxin tests and nematocyst identification, a few letters, a scrapbook of newspaper articles and an early Curriculum Vitae. Southcott's letters to Flecker were consulted. There is also a card file, which parallels much of the catalogue information. Most of this material will be archived at James Cook University. Personal material is the property of the Barnes Family.

Where Jack Barnes photographs are used, they are used under normal copyright conditions.

GENERAL INTRODUCTION TO MARINE STINGERS

Barnes' range of interest covered all marine stingers, but concentrated on two major related groups, the Carybdeids and the Chirodropids. These are distinguished from other jellyfish by their squarish body shape, with the tentacles positioned at the corners of the "box" - hence the title "Box Jellyfish".

Carybdeids are generally small, but the largest, Tamoya, can have a body size of 7 inches (18cm) while Carukia is the size of the tip of the thumb. Single tentacles are borne at each of the four corners of the body and are a feature of the carybdeids. The tentacles range in size from up to 6 feet (5.5m) long and 1/2 inch (1.2cm) in breadth in Tamoya and from a few inches to 4 feet (1.2m) long (and hair-like when extended) in Carukia.

The Chirodropids are the group to which Chironex and Chiropsalmus belong. Again the body shape is square, but in this group the tentacles are multiple and arise from fleshy projections (pedalia) at the corners of the body.

As can be seen in the transcript relating to the Queensland Health Education Council pamphlet (6) and the letter to Maurie Mulcahy (2), he was involved in the characterisation and recognition of all marine stings and stingers. This is reflected in the early catalogue entries, where a wide variety of jellyfish and an assortment of stinging hydroids were collected and documented.

GENERAL DESCRIPTION OF CHIRODROPIDS

Since the Chirodropids form the major subject of this report, a general description is given to familiarise the reader with some of the terms used.

Body sizes range from 1 - 10 inches (2.5-25cm) across the bell, and most specimens fall within the 2 - 5 inch (5-12.5cm.) size range. Chironex 3 inches (7.5cm) across the bell can be dangerous to children, and adults are at risk from sizes 4 1/2 inches (12cm.) upward. Chiropsalmus is smaller than Chironex when it reaches full maturity, but both are usually found at less than full adult size.

Chironex fleckeri and Chiropsalmus quadrigatus are constructed on the same general body pattern (16), a hollow bell-shaped body which is rather square. At each of the corners of the "square" lie the pedalia. These are fleshy projections variously referred to as "arms", "legs" and "hands". These pedalia develop more branches as they mature, and the tentacles are attached to these pedalial branches.

Chirodropids are very difficult to see, the body being transparent with a faint blue appearance. Even under such ideal conditions as flat calm they are almost invisible, although the tentacles may be seen as mauve or yellow strings moving in the water (8). The tentacles vary in length from a few inches to many feet*. This is a result not only of the size of the animal but also of the degree of contraction of the tentacle, and this varies with the activity of the specimen e.g.feeding, travelling over a rough bottom, etc. The tentacles vary in width from the equivalent of the diameter of sewing thread to that of thick string, and the outermost tentacles may have a blue or purple colouring with the others variable, yellowish in Chiropsalmus quadrigatus and pale blue,grey or dirty white in Chironex fleckeri

Internally, the stomach lies at the top of the bell and is surrounded by a whitish fringe of digestive filaments. From the centre of the stomach, the swallowing tube or oesophagus hangs down within the cavity of the bell, ending in four petal-like expansions analogous to the mouth and lips (16).

There are junction lines extending vertically from the level of the pedalia to the level of the stomach. These are formed by the fusion of the internal and external layers of the jellyfish at these points and are called the interradial septa. These septa give rise to the reproductive tissues or gonads as the box jelly matures.

Midway between the interradial septa lie the perradii, these are thickenings of the mesogloea** which develop as intrusions into the bell and the shapes which develop are characteristic of the two genera under consideration.

* an inch is roughly 2.5cm, a foot is roughly 30cm.
**(Mesogloea is the jellylike material which lies between the epidermal layer and the gut, and gives solidity and structure to the cubomedusan)

DISTINCTIVE FEATURES USED TO DIFFERENTIATE BETWEEN CHIRODROPIDS

The mesogloeal thickenings in Chiropsalmus have a simple shape and those of Chironex a complex, multidigitate, coxcomb-like shape. Reproductive tissue overgrows these interradii, originating from both sides of the interradial septa.

The reproductive tissue develops first in the upper half of the interradial septum in Chironex, and as the gonad sheet overgrows the complex shapes of the perradial "nuclei" a vast area of gonad tissue is produced. In Chiropsalmus the gonad origin is initially larger and lower, and as it grows, the whole of the interradial septum contributes to its growth. Its form is leaf-like and it spreads toward the perradii, overgrowing the simple mammiform perradial nuclei. In maturity the reproductive area in Chiropsalmus is simpler and smaller than that of Chironex. These gonadal differences are useful in differentiating between the two in preserved specimens because preservation in formalin transforms the barely visible gonad sheets into opaque whitish structures, clearly visible against the semi-transparency of other tissues. In life the differences between the gonads are very difficult to see.

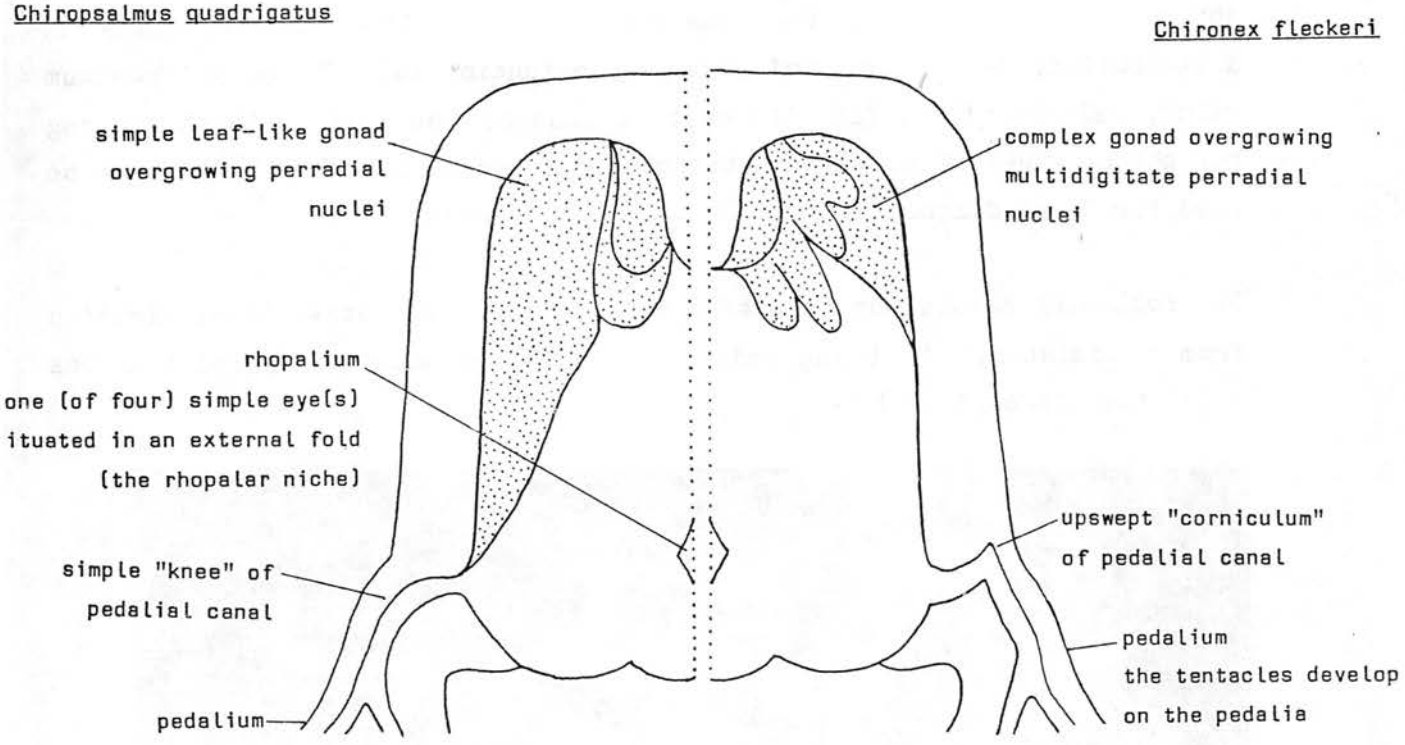
Not only are mature Chirodropids differentiated by differences in their gonads, but also by the shapes of their pedalial canals. These are tubular channels which pass through the transparent fleshy pedalia carrying nutrients to the tentacles. The membrane lining the canal is somewhat opaque, so that its outline is readily visible, especially against a bright background. At the "knee", that point at which the canal changes direction by about a hundred degrees, there is a marked difference in the shapes of the pedalial canals; Chiropsalmus is a simple bend, while Chironex has an upswept corniculum, an extension with the appearance of a rose thorn. This is one of the best means of differentiating between the two genera, especially among young specimens.

Chiropsalmus quadrigatus is a smaller species than Chironex fleckeri.*

* There is current evidence to suggest that this is true for the Australian Chiropsalmus quadrigatus but not necessarily true for Chiropsalmus quadrigatus in other parts of the world - pers. comm. Dr. R. Hartwick J.C.U.

Differentiation between Chironex fleckeri and Chiropsalmus quadrigatus requires familiarity with certain features. If examples of both chirodropids are compared at equal sizes across the bell, Chiropsalmus will have shorter and more slender tentacles, less heavily beset with nematocysts (20). The tentacles of Chironex are, by contrast, robust and strap-like (22). There are never more than nine tentacles per pedalium in Chiropsalmus, while Chironex may have as many as fifteen (1).As mentioned in the general description, there are also slight colour differences in the innermost tentacles.

GENERALISED BODY PLAN



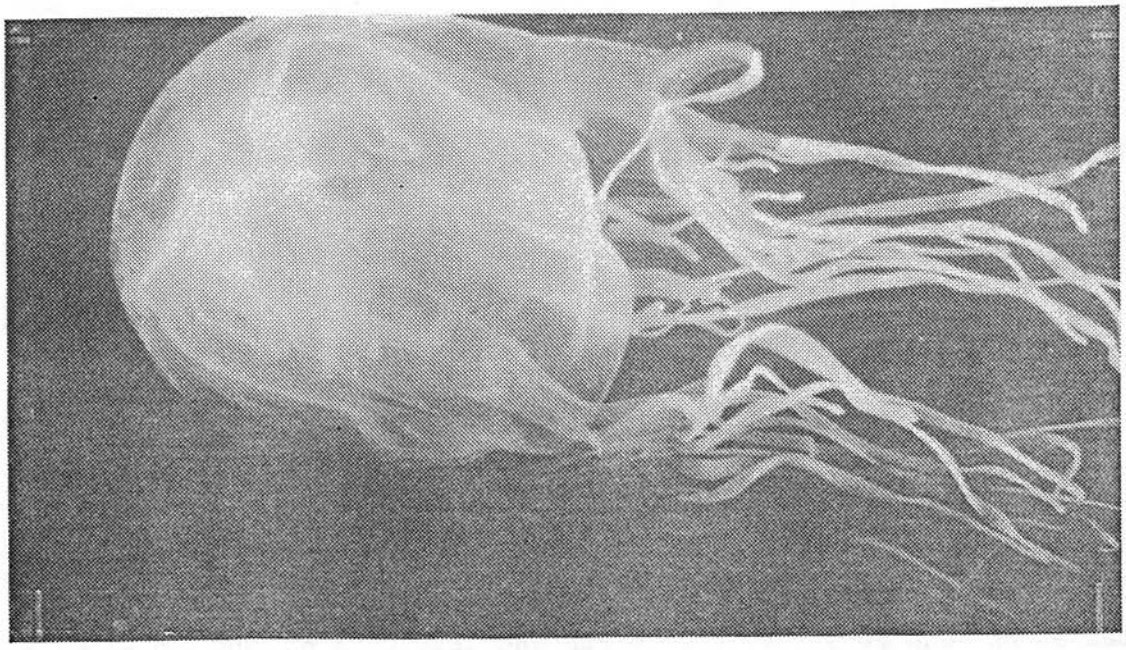
These features are also helpful in the identification of Chironex in the field. While the pedalial canal or gonad characteristics cannot be seen readily under field circumstances, the size of the animal, the number of tentacles on each pedalium, the length and thickness of the tentacles and the concentration of nematocysts thereon are useful diagnostically.

IDENTIFICATION OF CHIRONEX FLECKERI IN THE FIELD

When there is a need for the collection of Chironex e.g. for antivenom preparation or scientific research, then it becomes very important to know how to track them down and catch them in their own element. Chironex fleckeri in the field are almost invisible(7) but with practice and by using polaroid glasses to reduce the reflections from the water surface, they can be traced by their shadows on the sand. Their feeding habit consists of a series of undulating movements and, as they cruise along, they break the surface of the water with a characteristic oval ripple. In reasonably clear water (26) this ripple may be the most obvious sign of their presence.

While Chironex fleckeri and Chiropsalmus quadrigatus are very similar in appearance and occur in the same season, they differ substantially in distribution, behaviour, and stinging potential(16). To be of maximum value, reliable identification must be made on the spot, without waiting for the services of an expert. Obvious differences between the two can be used for "spot diagnosis."

The following points can be useful when making a tentative identification from a distance," it being neither helpful nor wise to approach a box jelly too closely" (16) :-



Chironex fleckeri (photograph by Jack Barnes)

The following comments are summarised from the article on morphological differences between Chironex fleckeri and Chiropsalmus quadrigatus(16).

a)**Size of body.** If more then four inches in size then it is probably C. fleckeri. C. quadrigatus is the smaller species" and rarely exceeds four inches.

b)**Colour of tentacles.** On medium sized jellies if all tentacles are brightly coloured then the jelly probably is Chiropsalmus. The outermost (unpaired) tentacles are bluish or purple on healthy specimens of both species, with the remaining tentacles being quite vivid shades of yellow in juveniles. At a larger size, Chiropsalmus often retains this yellowish colour, but the paired tentacles of Chironex soon fade to a dirty greyish- white.

c)**Width of tentacles.** Wide ribbon-like tentacles are typical of Chironex. Chiropsalmus tentacles are finer.

d)**Number of tentacles.** If each pedalium carries more than eight(?)* tentacles then the specimen is probably Chironex. Chiropsalmus rarely, if ever, in these waters carries more than nine tentacles even at full maturity, whereas Chironex has as many as fifteen tentacles per pedalium at full maturity.

e)**General appearance, solidity, and speed of movement.** Chironex is a more robust jelly than Chiropsalmus, has thicker mesogloea, and a more clearly defined cuboid shape. It swims faster and has a more solid "feel" when handled.

* Compare with nine, in section "Distinctive Features used to Differentiate Between Chirodropids".

ADVICE ON HANDLING LIVE SPECIMENS

In his paper describing the morphological distinctions between Chironex and Chiropsalmus(16), Barnes gives the following advice on handling live specimens.

a) Protective clothing should be worn.

b) The outside of the bodies of both Chironex and Chiropsalmus can be handled with impunity, provided the tentacles are kept clear.

c) When collecting from a net, push the tentacles aside with a stick and grasp the apex of the jelly between thumb and fingers, the top of the bell is firm and easy to hold.

d) Ensure that you are upwind of the jelly when lifting from the water.

e) When collecting in calm water, move ahead of the movement of the jelly and let the body swim into your hands, promptly lifting upwards and away from your body.

f) Do not forget the possible effect of tide and wind on the tentacles.

g) In rough water use a scoop net with a long handle "or better still observe from the beach".

h) Remember that tentacles retain most of their stinging power after removal from the water and even after many months can cause injury in the presence of moisture. Formalin or spirit destroys this capacity.

A point to note(24) is that when swimming the tentacles of a box jellyfish trail behind it like streamers in the airflow of a fan, and cannot be deflected voluntarily in any other direction. As the tentacles are the only part of Chironex capable of stinging, the safest approach to this animal is from the front or the side, forward of the bell.

Describing the way Chironex move (1), steering by means of deviations in the velarium, Barnes makes reference to their " uncanny speed and

manoeuverability" and also states "but fortunately, cubomedusae cannot reverse....* when one is catching them by hand."

Chironex can swim at 3-4 knots (7) and can keep it up all day. They can see well enough to avoid major obstacles, and quite well up close. Their avoidance reactions are well documented in the section relating to the Mission Beach Expedition.

When asked if catching was normally done by hand or by net Barnes commented "the way to collect them is to have them swim to you , it is safer to be in front of or beside Chironex when in the water. They are caught by swimming them into hand-held containers which are dunked into the water just ahead of the moving specimen. Nets are not used for collection because they are destructive."(personal communication).

"The light sensitivity of Chironex is very great and its ability to pinpoint the source quite remarkable..... It was once thought this phototropism could be utilised to trap Chironex on a large scale" (see the section relating to the Mission Beach Expedition). The attempt failed because Chironex is only attracted to light of a moderate intensity, light powerful enough to draw them in from a wide area served to repel them as they drew nearer. Very high intensity lighting e.g. electronic flash, appears to stun the jelly for at least 15 seconds.

The section titled "Collection of Specimens for Milking" should also be consulted, if that is the aim of collection. Milking requires some very careful approaches to the removal of specimens from the water, and very gentle handling to prevent premature discharge of nematocysts.

* (.... denotes an inaudible section of the tape).

PRESERVATION OF SPECIMENS

In the early stages of the investigations (16),well preserved and properly labelled specimens were welcomed. One of the problems encountered was inadequate preservation of both skin scrapings and box jellies. In an effort to prevent this loss, Barnes asked that collectors treat their specimens in the following manner:-

a) Storage in formalin and seawater. This is prepared as one volume of formalin to every ten volumes of seawater (including the volume of the specimen contained therein).To produce an attractive specimen, in a natural attitude, he suggested having the specimen swimming, then trickling formalin down one side of the container. The box jelly then dies in a natural attitude and settles slowly into the stronger layers of formalin at the bottom.

b) Storage in methylated spirits. This is the second best choice, however it inevitably produces shrinkage and distortion in the specimen.

c) The containers used for transport should be glass, plastic or any other material which does not stain or corrode. Plastic bags are satisfactory if well supported in a suitable carton or box, and plastic rubbish bins are excellent for the transport of larger specimens. The container should be of adequate size to allow the specimen to move without restriction in any direction in its liquid storage medium.

d) The specimen must be adequately labelled. This should be done in ordinary pencil (not ball-point pen or ink) on good quality paper and included inside the container with the specimen. Information given should consist of where and when collected, the name of the collector and any other interesting details.

Storage and transport of toxin is described in the section relating to toxin extraction and testing.

THE STINGER SEASON

"The Australian stinger season commences earliest on the (Australian) west coast , soon after the arrival of the first summer rain clouds. This generalisation may have some some application to the whole of the tropical coast. If the wet is either early or late in the season so too is the arrival of the dangerous medusae"(20)

In the years prior to 1966, Barnes investigated the significance of this finding, in an endeavour to trace its relationship to:

a) slight water temperature rise

b) a slackening or reversal of flow in oceanic streams (coastal currents?)

c) a considerable freshwater runoff following more than six months of dry weather.(20)

"Chironex fleckeri appears to prefer waters of lower specific gravity, seeming to hug the coast. As the monsoon influence moves eastward a succession of appearances of this box jelly is noted, at first around the shores of the Northern Territory, then in the Gulf of Carpentaria, and later down the eastern Queensland seaboard (20)".

Experience gained in Australia showed Chironex present in shallow, inshore waters only during the warmer months of the year. Where they went in winter was still unknown. The first influx coincided with the first summer storms (24), and was considered to probably be related to the calmer seas as the trade winds dropped, the warmer water and to the presence of the small shrimp which swarm in coastal waters at this time. As Jack Barnes said (7) "After my 18 years of checking weather against jellyfish presence, it is not often that you find them before the first summer storm - you will nearly always find them after - within a week after it .It has got nothing to do with the storm, it just happens to be a coincidence between water temperature and humidity and storms.... Their earliest appearance is about November, their latest disappearance is June, but normally you'd expect them at the end of November or the beginning of December, numerous around Christmas time in the school holidays and gone again by about April".

By 1971, at the Surf Life Saving Association Seminar on Marine Stingers in Townsville Barnes was obviously aware that there may be another answer to the concept of stingers apparently arriving from northern waters. "At the present time (July) in the Gulf of Carpentaria, small box jellies about the size of a button are extremely numerous. It would be valuable to know whether these are in the river estuaries or on the Queensland coast..... Professor Burdon Jones has indicated that the University (James Cook) would be happy to receive and make reports on this type of thing".

Reference is made (5) to Chironex sometimes being very, very big when the first specimens are seen. This is likened to finding a full grown plant before finding any juveniles. There is also a reference to Chironex in January or February not necessarily being at their largest at that time.

In 1972 "the season was extended in keeping with recent findings", (the season is quoted as mid- to late summer.) and the potentially lethal size was given in the Queensland Health Education Council leaflet on stingers(6), viz. "that 3" size is dangerous to children and from 4 1/2 " upward can kill an adult". The point is made that they are more numerous after local rain, especially near river and creek outlets and that they are usually absent when seas are rough .

TIMES OF MAXIMUM DANGER

A survey undertaken in 1960 (8) showed the distribution of "stingings" as being maximum in December-January. This did not appear to relate to a parallel between beach attendance and the number of stings.

Barnes noted a statistical correlation between stinger fatalities and recent heavy rainfall(20). "This may not be coincidental, for current work on venom collection, involving the stinging of tissue membranes by living tentacle suggests that nematocyst discharge ratios are higher in diluted sea water. It is therefore possible that lowered salinity may be at least partially responsible for the unusually high discharge rates evident in lethal stings...."

"Although maximum sizes are not usually seen until near the end of the stinger season, well grown specimens may be present among the first arrivals, and no rule can be given concerning the range of sizes likely to

be encountered in a given area at any specified time. Thus while most of the swarm may be of a particular size, large and small specimens of C. fleckeri often co-exist in the one area. Even when, as occasionally happens in particularly sheltered localities, the sizes are fairly uniform, collections from a few miles away may yield specimens much larger and/or smaller in size. For practical purposes, therefore, it is best to assume that if C. fleckeri is present even in minimal sizes and numbers, conditions may not be safe for bathing."(20)

"C.quadrigatus populations tend to be of more uniform size, within each swarm, but again there is marked variation in size from one locality to another."(20)

WHEN ARE CHIRONEX FLECKERI FOUND INSHORE?

Inshore prevalence is closely related to local weather. During calm weather, and especially if this calm follows winds with a northerly component, cubomedusae may be present in large numbers within a few feet* of the beach(20). The calmer the water, the closer Chironex approach the shore, being sometimes very numerous in as little as 15" (roughly 40cm.) water(24). "It doesn't much matter whether you've got a flat calm or a northerly or a nor-westerly as long as it doesn't ruffle up the water, they'll move in following their food supply - it moves in and stays there when the weather is calm "(7)..... As he commented in "The Mystery of the Sea Wasp" (5) "This is good sort of water for them, fairly calm, little bit of a swell, waves not breaking until they get very close to the beach, these are the sort of conditions they like.(5)".

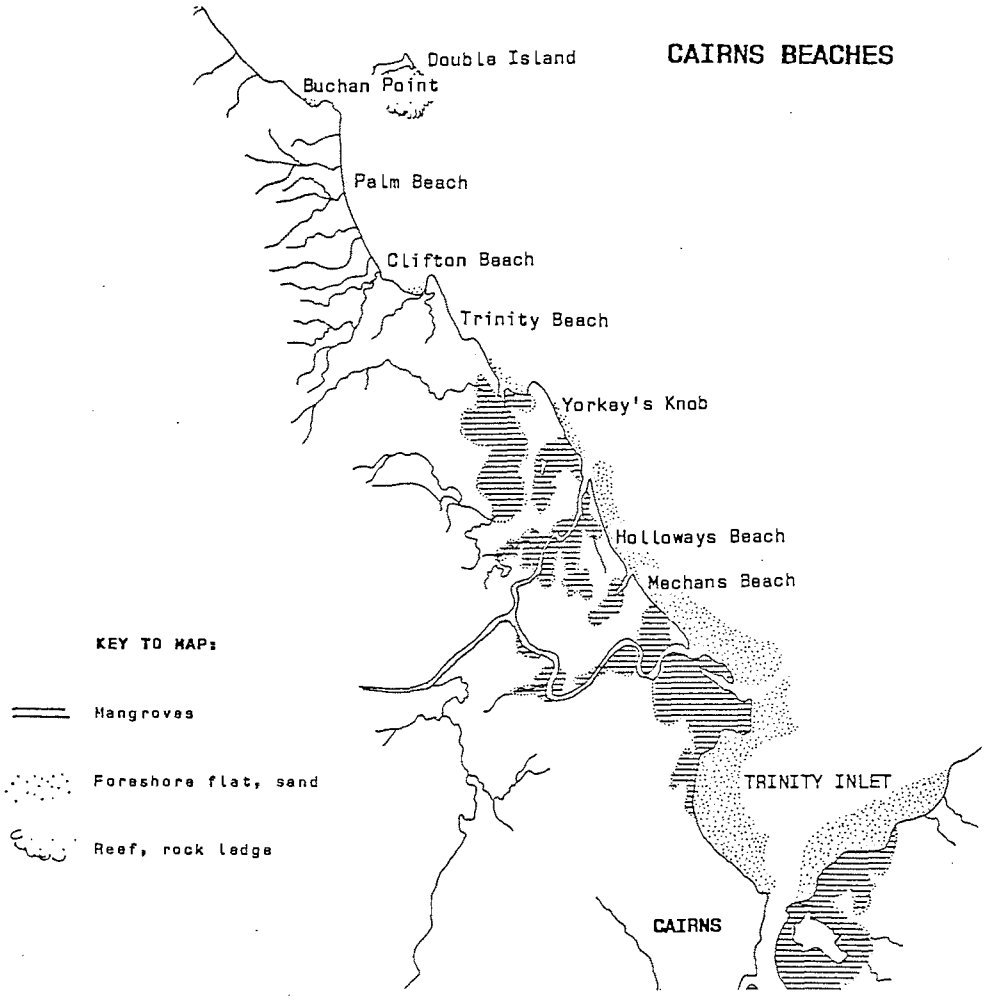
Flat calm conditions occur usually in mid-summer and on such occasions cubomedusae may be very numerous in water only a few inches* deep, very close to the shore(8). Calm weather is the time of greatest danger to small children, who should be kept out of the water until the shallows have been carefully inspected and tested, preferably by dragging a net. In the presence of a slight swell they are more likely to be found seaward of the breaking waves and at a greater depth. Persisting rough conditions usually confer freedom from cubomedusan injuries, at least in shallow water.

* an inch is roughly 2.5cm, a foot is roughly 30cm.

Some beaches are massive harbours for stingers. Barnes felt sure that there are a number of these sites where large Chironex congregate, and that identification of these areas by test netting would be a fruitful way to go, as then specific warning signs could be erected on the beach.

He found, for example, that at Mission Beach 1/10th of the area contained 9/10ths of the box jellyfish. This is the area around the creek which lies about 1 mile (2 km.) south of the site of the old Moonglow Motel. The motel site is currently (early 1986) being developed as a resort. He mentioned two beaches which he protected from development as surf resorts, because they were "massive harbours for Chironex" (26). **(The other site could probably be traced by careful statistical analysis of his catalogue collection , which is outside the scope of this report. I have not been able to ascertain it by other means.....B.E.K)**

He also mentioned the Palm Cove /Clifton Beach area in relation to Irukandji stingings. This area has a current flow in north-east winds which tends to concentrate these oceanic stingers on these beaches (12). Massive numbers of people have been stung and hospital resources strained when these particular conditions prevailed (7).



WHAT CONDITIONS DRIVE CUBOMEDUSANS FROM INSHORE WATERS - WHERE DO THEY GO?

In 1966 Barnes maintained that during rough weather cubomedusae disappear from open beaches to seek deeper or more protected waters. "Cubomedusae .... are particularly sensitive to turbulence, which they obviously detect at a considerable distance....under rough conditions they virtually disappear and it is not known whether they retreat to shelter or simply rest on the bottom at greater depths"(20). By 1973 Barnes was much more aware of the movements of Chironex and his statements showed that "they do not like rough water, as they are somewhat fragile and have long tentacles which get broken up. In rough weather, when they detect turbulence in the water they very quickly and deliberately seek shelter. They either move out and deep, well off shore between reefs, or they go up deeply into the river mouths."(7)

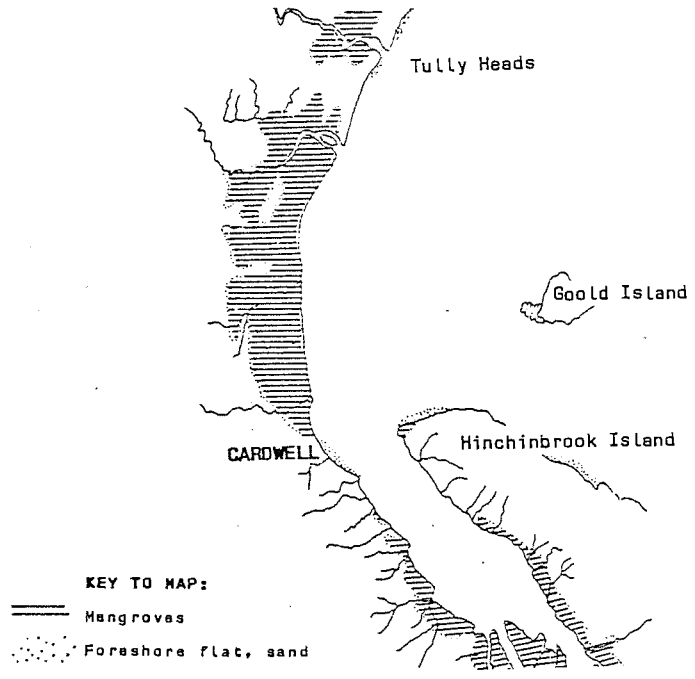
This does not necessarily apply to juveniles because he said big stingers behave differently to small stingers in turbulent situations. The latter "put up with lots of things so there is a lot of safety in numbers."(26)

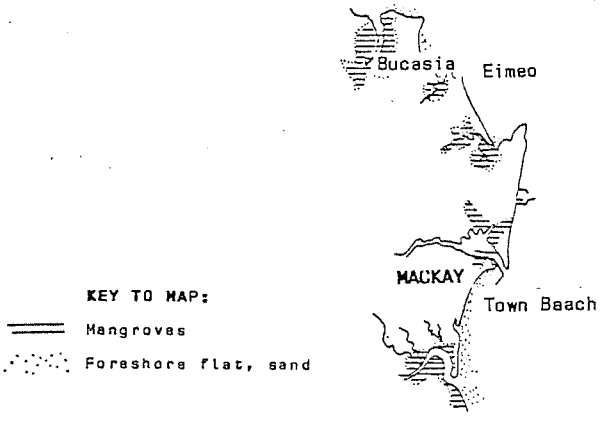
OCCURRENCES NEAR/IN COASTAL RIVERS

Certain correlations between the presence of Chironex and lower salinity situations had been noted e.g. that the most dangerous beaches are those with protective headlands that gently slope to the sea, have a nearby outflow of fresh water and lack stands of coral or marine vegetation(24).

CARDWELL and BUCASIA

(Sites of fatal stingings)





As previously mentioned, "in rough weather most of the shelter is deep in river mouths.... they go up the river mouths" (7)and that "they are found in inshore waters.... More numerous after local rain, especially near river and creek outlets.." (6)

Reference to the Mission Beach Expedition* shows that he concentrated his search area around a creek outlet, with a great deal of success. He described the presence and behaviour of large Chironex in the interface between higher and lower salinity waters. Chironex prefers water of lower salinity, while Chiropsalmus prefers specific gravities closer to normal ocean salinity.(20)

OCCURRENCES NEAR OFFSHORE ISLANDS/CORAL REEFS/IN OCEANIC WATERS

In Roche's "Image" article (24) Barnes made the point that turbulent water, breaking waves and underwater obstructions are carefully avoided by Chironex and this probably explains why off-shore islands are relatively safe.

"There has been unnecessary avoidance of genuine reef islands and the deep waters surrounding these and also of coral cays, much to the detriment of the northern tourist industry.It is now quite clear that areas of clear oceanic reef water are not invaded by Chironex anyway, and neither Chironex or Chiropsalmus likes to operate over obstructions rising from shallow bottom as is the case with coral and perhaps also with extensive weed beds around an island".(6)

"Not found over coral reefs or in deep waters well offshore"(6). This statement should be compared to the discussion on the distribution of Carukia, which is a true oceanic species brought inshore (often in substantial numbers) by certain wind patterns (27)

* The Mission Beach Expedition is treated separately in this report.

NATURAL FOOD OF CHIRONEX FLECKERI

Chirodropids usually appear about the same time as the first summer storms, probably relating to the calmer seas, warmer water and migration of small shrimp which swarm in coastal waters about this time (24). "The influence of seasonal rains has particular bearing on the availability of shrimps and other small crustaceans, also fish fry, on which the larger Chirodropids have been observed to feed. Both species prefer Acetes australis which is rarely seen inshore during the dry season, but becomes abundant following good rains.Large areas of shallow water may be coloured red by schools of these small shrimps, and strong inshore winds can cast untold millions up on the beaches (20). Bathers should view the presence of A. australis as a danger sign, for the Chirodropids frequently move amongst them , distending their stomach cavities with as many as twenty or thirty shrimps at one time. Digestion occupies about 2 hours , after which the residue is regurgitated through the oesophagus and a new "load" taken. In the absence of suitable crustaceans very small fish are acceptable as food, but these present a greater problem in capture".

Chironex's feeding pattern consists of swimming near the surface in the shallows, then periodically suspending all activity, and sinking passively to the bottom. If this manoeuvre is successful the jellyfish sits with its apex down, with the trailing tentacles falling inside the bell. The captured food is located and removed from the tentacles by the manubrium. The medusa then rises almost vertically to the surface making a characteristic ripple (20). This habit of cruising below the surface to rise and break the surface with this characteristic oval ripple (24) may be the most obvious sign of its presence.(24)

A large Chironex may have tentacles 8 to 10 feet (2.4-3m.)long when they are extended for feeding purposes. In contrast, the contracted state of 3-4 feet (90-120cm) long is the more normal length when just travelling (26). They prefer to feed in clear water and will ignore lesser numbers in preference to larger aggregations of prey (personal communication).

In the talk to the Q.A.T.B(7) when Barnes is referring to the inshore presence of Chirodropids in calm weather he notes that "as long as the wind doesn't ruffle up the water they'll move inshore. The reason for this

is that they're following their food supply (Acetes australis). They move in too. They are then able to stay inshore while the weather is calm.

NATURAL PREDATORS OF CHIRONEX FLECKERI

The only mention made of natural predators was made at the Seminar on Marine Stingers held at J.C.U. (26) As fish and a lot of marine creatures eat Box Jellies, the Government's decision to get rid of the old arrow head traps was welcomed because the small tailor, bream, small spanish mackerel and queenfish so trapped are known Box Jellyfish eaters. So are Toadfish and Parrotfish. Crabs and "shells"(?) are known to eat tentacles without any apparent problems, and the comment was made to the effect that the less we interfere with natural population balances, the better.

DISTRIBUTION

The Australian distribution of Chironex extends across the whole north of the continent , and downwards on the east and west coasts to about the 26th parallel (20). The present limits ...seem inconsistent with water circulations in the Coral Sea however these limits are likely to be extended as the species becomes better known and collections from some outposts may be biased in favour of larger specimens, thus automatically eliminating C. quadrigatus at its usual sizes. Mixed populations are not infrequently found between Cooktown and Innisfail where the two populations overlap, but as mentioned previously these tend to occur only under fairly specific conditions. There is some evidence that C. quadrigatus prefers specific gravities nearer to ocean normal than does Chironex. Although much more data is required, it would at this stage (1966) seem that when C. fleckeri and C. quadrigatus occur together as mixed swarms the local specific gravity tends to be intermediate between their optimal requirements.

By 1973 this distribution had been expanded, and it was known that Chirodropids are all through the tropics in the Pacific, in Malaya, south China Sea , Solomons, Philippines, New Guinea, on both the North and South sides (7). They had been found all the way down the coast, with Chiropsalmus found as far south as in Moreton Bay and Brisbane. In general, however the distribution was considered to be inshore waters north of the tropic of Capricorn (6).

BREEDING HABITS

In 1971, in the S.L.S.A. Seminar (26), Barnes drew attention to the presence of small box jellies about the size of a button, which were extremely numerous in the Gulf of Carpentaria at the time of the Seminar (July - August) He pointed to the value of knowing if these were also in the river estuaries and on the Queensland coast and commented on current interest in where the box jelly breeds, and where they spend the different stages of their life.

One of the more elusive fragments of information relates to breeding habits of Chironex. These were alluded to in three pages of very sketchy lecture notes, intended for Barnes personal use, and it is probably best to quote this excerpt in full, rather than lose its impact. "Very large specimens separate from pack, often in pairs, late in season. Separate sexes, shedding products into gastro-vascular cavity, regurgitating through stomach and oesophagus. Uchida, for Carybdea, says the egg forms a planula then rapidly develops through the circular stage there being no true metagenesis. Discuss mating behaviour. If this seems a tall story, note other evidences of awareness and response to environment".....etc.

In mature captured specimens, pairs were occasionally seen to entwine their tentacles and for each to place their tentacles within the bell of the other. At first this was assumed to be coincidental, but the size, maturity and actions of the specimens argued for a form of courtship.Later this behaviour was also noted in the field. (pers. comm. J.R.)

DIFFERENCES IN BEHAVIOUR BETWEEN ADULT AND JUVENILE CHIRONEX

At the 1971 Seminar on Marine stingers (26), Jack Barnes made the point that there is not always a distinction in peoples' minds between adult and juvenile Chironex, and that this is unfortunate, because there are a number of features where they show profound differences. It is also important in regard to protection and prevention to differentiate between large and small Chironex.

Very rarely are mixed populations seen, but small box jellyfish have been found in test drags, yielding as much as two hundredweight (100kg.)of specimens 2" (5 cm.) in width (26). While this is an extremely impressive volume of stingers it is unlikely to cause death. This is because a massive sudden inflow of venom is necessary for death to ensue. There would certainly be extremely painful stings with severe local reaction.However the risk that a lethal amount of venom would be released under these circumstances is slight.

As he commented,(and as is obvious from his venom studies with prawns and mice), it is a massive, instant input of venom that kills. A series of smaller inputs will be detoxified in the body comparatively quickly. The bulk of his research was geared to using that premise and the various methods of protection and treatment e.g. protective clothing, netting, deactivation of nematocysts, all have their basis in the prevention of this sudden massive release of venom to the victim.

Also, he maintained that big stingers lie low in turbulent situations but that little ones will "put up with lots of things, so there is a lot of safety in numbers".

In reference to the use of netting, he pointed to the reactions of large box jellies to nets. He did not specify the likely reaction of small box jellies to the presence of nets, but he did say that the public should be aware that "these (nets) are an attempt to protect their lives not their skins, that they should do for themselves". This appears to indicate that he expected that small stingers may not be deterred to the same extent.

RESPONSE MECHANISMS - BEHAVIOUR

In Barnes' Curriculum Vitae (1968), he commented that underwater observations were made on all major stingers, to establish normal patterns of behaviour under a wide range of natural conditions. This was undertaken in conjunction with studies on water movements. Their responses to various stimuli were tested and their stinging mechanisms examined in detail in aquaria .

The robust body walls of Chironex are composed mainly of jelly-like substance embedded with muscle fibre and the contractile ring of muscle at the rear of the medusa between the tentacles and around the opening of the body cavity is called the velarium. When body walls and the velarium are relaxed, water is drawn into the rather large central cavity of the jellyfish. Then as the muscular walls contract and the velarium narrows, the water is expelled very forcibly as a jet and this forms the means of locomotion(24). Change of direction is achieved by asymmetrical contraction of the velarium, causing the propulsive jet to be deflected. With this swimming and steering mechanism the jellyfish usually travels in a straight line at a speed of about two to three knots, but when alarmed it can increase the force and rapidity of contractions and achieve a greater speed, somewhere in the vicinity of five knots. It can also turn very rapidly. The pedalia do not act as rudders or steerage mechanisms as proposed by some earlier authors. "The tentacles trail behind the jellyfish like streamers in the airflow of a fan and cannot be deflected voluntarily in any other direction", (24). This big box jelly swims by jet propulsion.. by this means it can do a good 3-4 knots and it can keep it up all day.(7)

"During relaxation of ....body, the velarium opens and then partially closes on contraction, deviating to one or other side for steerage. This is an efficient system giving the jelly uncanny speed and manoeuverability but fortunately, cubomedusae cannot reverse"(1). (He was discussing this as a useful attribute when attempting to capture Chironex.)

Large stingers usually swim against the water stream. On meeting an obstruction such as a net, their first reaction will be to go to the bottom and probably lie there tangled up, for a minute or so pretending to be dead. Then they will start pumping away, and work their way round that

net as they would any other obstruction, so they can resume their journey. If there is insufficient lead on the bottom or if there is something lying on the bottom and the net is lifted at that point, they will almost inevitably go through the opening, because they are systematically working against the net. Holes in the net can be another source of difficulty.(26)

When disturbed in calm water they respond promptly by "diving" either actively or passively and may not return to the surface for a considerable period.

Chironex has four sensory organs, recessed into a "cave" in the side wall of the body, the rhopalar niche. They register posture or attitude, change of direction, change of light intensity, probably some types of vibrations, and as one of the light sensitive areas is equipped with a convex lens, it is likely that the animal has a crude sense of vision. This jellyfish can thus always distinguish between up and down . It can immediately register turbulence in the water and avoid large obstacles. It is very rarely cast up on the shore(24). Light sensitivity is very great, it will home in on the light of a match (or its former position) from a distance of 10 ft. "Its got eyes. It can see, not very well but it can see quite well enough to avoid major obstacles and it can see quite well up close and the eyes are turned perpetually inwards normally, contemplating....stomach."(7)

Barnes noted that they are "very sensitive to the sight of something dark. They have four sets of eyes.....you don't know what sort of picture forms in their mind ..."(5)

As large Chironex are sensitive to dark objects in the water, and make attempts to manoeuvre around them, he felt that it would be appropriate to have dark nets. This, of course, has great practical significance. Dark clothes on a slowly moving body are most likely to be avoided by Chironex. He found that if he donned black socks and stood in front of a jellyfish it would never touch him, providing it had adequate space in which to manoeuvre(26).

In the water they are almost invisible and particularly elusive, (8) rarely detected by casual observers. It seems certain that human injuries are the result of accidental contact rather than of aggresssive action.

The severity of a sting is highly dependent upon the reaction of the person being stung.

As Barnes noted, in relation to large box jellies; "Nearly all injuries are generated because the person is moving too fast relative to the jelly. Jellyfish do not attack. If they see something large, particularly something dark, they will go around....all large dark things are interpreted as obstructions and they try to avoid them.... There is also a lot of water turbulence, and they do not like that..... If people would go forth into the water, watching where they were going, they may not see the jelly, but the jelly would probably see them and turn away"(26).

"If you dive in you are not giving it a chance. If you dive under it, it is not attacking you, you are attacking it. It is defending itself.....If you are going slowly, you will get stung by the longest tentacle, the nearest tentacle. If you instantly back off, no great harm is done. If you start leaping up and down or if you reach down to see what that is, that tentacle has become attached to you and the longer you stay there, the longer you mess about, the more the tentacle will contract and pull the jelly back to you"(26).

"In both Chironex and Chiropsalmus, the nematocysts are concentrated upon transverse ridges, which encircle the slightly flattened tubular tentacles imparting a finely banded appearance. During tentacle contraction the rings of nematocysts approximate to form an undulating but continuous surface which inflicts a wide, uniform intense sting. Extended tentacle causes a milder and more slender weal, on which a pattern of transverse bars may be seen, corresponding to the separated rings of nematocysts "(8)

It is therefore in the interest of anyone contacting a tentacle to minimise the amount of tentacle and degree of contraction within it. The tentacles are the only part of Chironex capable of stinging. If the touching tentacle can be prevented from contracting and bringing the body of the box jelly and therefore the remainder of the tentacles into dangerous proximity to the victim, the risk is greatly decreased. He suggested that gentle backward movement would accomplish this end.

Barnes mentioned (pers. comm.) that he and others experienced with Chironex had been exposed to these preliminary stings, and that with the appropriate response from the victims, that the stings had been very mild. He estimated that only about 5% of the nematocysts fire on initial contact. Add to that the fact that the tentacle in an undisturbed animal is probably extended and the nematocyst rings spaced well apart, and the risk of large scale envenomation decreases considerably.

Barnes felt that once this stretch reflex was avoided, the battle was largely won. Of course the best method of protection was to present a surface to the box jellies that they did not recognise as a food source, outwitting the chemoreceptors of the tentacles. This he did by the use of protective clothing, e.g. pantyhose. He also mentions a design for two way stretch material (26).

The stinging capsules are concentrated on raised rings closely spaced along the tentacles, and the core of the tentacle is contractile. The length can be altered by a factor of approximately four, either by contraction or relaxation from the normal swimming position. When the tentacles are fully contracted, the rings carrying the nematocysts are closely pressed together like beads on a string and if the core of the tentacle is fully contracted, it will break. This mechanism is sometimes deliberately invoked by the jellyfish to free itself from an undesirable attachment.

"The tentacles are capable of relaxing or stretching to many times their usual length, or may be vigorously contracted into short, thickened semi-rigid structures. As the axial contractile fibres are uniformly distributed about a central canal, twisting does not occur as the tentacle shortens"(8).

In Observations on Jellyfish Stingings in North Queensland (8), Barnes noted that the number and length of the tentacles increase with the size of the jellyfish. The largest Chironex (slightly larger than a man's head with 15 tentacles on each pedalium), carried a total of more than 300ft (90m.) of tentacle under normal (non-contracted) conditions (a total of 60 tentacles, averaging 5ft (1.5m.) in length). In 1971 (for a similarly sized jelly) he quoted (26) a length of 3-4 ft (1-1.3m.) long when travelling, compared to 8-10ft (2.5-3m.) long when extended for feeding.

At both ends of the season, stingers may be found in mobs of mixed size, with large and small individuals. In the late part of the season very large specimens separate from the pack, often in pairs* (lecture notes). The breeding habits are referred to in the section by that title.

There is also evidence for hunting in pairs. Much of Chironex's prey tends to school in the water. Such schools can be herded by systematically circling predators.

"They used to hunt in pairs, usually one swimming just in front or just below the other. Their positional "stations".....changed slightly over a period of time. They cooperated to herd small fish (.....)preferably prawns. They always seemed to be in pairs at the beginning of the season - we only ever saw large single* jellies late in the season"....." When two jellies were together there was considerable intertwining of tentacles and the front one's tentacles sometimes extended over the bell of the rear one," (pers.comm.J.R.).

Chironex can also be herded themselves - see the Mission Beach Expedition section.

They have been seen to rest, both as captured specimens in bathtubs and in the field. There are a number of prerequisites for this to occur. The water cannot have too high a salinity or the jelly cannot lower itself onto the substrate, nor can they tolerate resting in the shallows in high wind conditions, because they would be battered.

This phenomenon was noted mid- to late afternoon. The jelly would rest with the bell down and the tentacles retracted close to or inside the bell and near to the bottom. This was seen in waters about 3-4 ft (90-120cm.) deep, although the search was rarely carried into deeper waters. This behaviour was also seen as a defense mechanism when the jelly had tackled something too big or too vigorous and was having its tentacles damaged, and had then been seen earlier in the day. By late afternoon, the seas were often quite rough and choppy so it may also have been defensive at that time also - as well as resting. (pers.comm. J.R and L.B.)

Captive specimens kept in bathtubs were also seen to rest. They adopted an intriguing attitude, spreading their tentacles out fan-wise onto the substrate, attaching the jelly to the bottom. (pers.comm. J.R.)

Observations on behaviour are not confined to this section, but scattered through the text of this report. Reference should be made to those sections on the comparison of behaviour in adult and juvenile Chironex, the Mission Beach Expedition, the natural food Of C.fleckeri, and their breeding habits. The sections relating to their presence inshore, near or in coastal rivers, and offshore provide insight into the factors effecting movement patterns (generally related to salinity and weather). The section on tentacle reaction should also be consulted for further information on the stretch reflex.

ABORIGINAL LORE

The first contact that Jack Barnes had with fatal stings was on Thursday Island, where two children died (5). The Thursday Islanders brought him a jellyfish found in the vicinity, which was not preserved but he did approach Flecker for further information about it.

He was obviously impressed with the knowledge the Aboriginals and Islanders had in relation to Box Jellies, and as he said to the Q.A.T.B. Conference (7) in relation to Southcott's careful work on Chironex "... he reckoned he had found a new jellyfish. Now, it was only new to the white people at that stage, but it was new and it needed a description .... and it dawned then on science for the first time what the aborigines had known from way back and if somebody had thought to ask them they would quite readily have told them...."

(In Injuries to Man from Marine Invertebrates - Cleland and Southcott)
Dr. J. H. Barnes .... forwarded information from Mr. W. Mackenzie of Aurukun Mission, on the Archer River. "The dangerous medusae are well known to the aborigines there who say they have had trouble with the jellyfish from the "olden times". However there are no ceremonies, dances or songs connected with the jellyfish. Two deaths in native children have occurred at Aurukun, but no details were submitted. Serious cases of stinging occur however, every year".

Further information from Mr. Mackenzie, through Dr. Barnes....." according to the natives these are the only dangerous type in this area. They seem to have two names for the stinging kind - oolmilla (accent on ool-) and yoomyulla (again accent on the first syllable). There is one family here which has jellyfish generally as one of their tokens, but I have not been able, so far, to get any myths about this particular totem.."

When asked at the Q.A.T.B. Conference for information on aboriginal lore, Barnes commented : "They state quite definitely that children must not enter the water after the first storm of summer. Now that is a fairly good guide. After my eighteen years of checking weather against jellyfish presence it is not often you find jellyfish before the first summer storm.You nearly always will find them after - within a week after it. It has nothing to do with the storm, it just happens to be a coincidence

between water temperature and humidity and storms. But it was their rough guide and a pretty good one, and they'd belt the daylights out of the kids if they saw them go near the water after that first summer storm and that was their main treatment. Of course it was good preventative treatment to whack them on the end with a spear."

"Where they did get these kids stung they had a number of things they used to put on. They seemed to recognise that there were two situations, there was a fairly small sting that needed relief and they used to put various vine saps on....*e.g. Convolvulus ....on a small sting practically any vegetable juice has a remarkably soothing effect, ... I don't know why this is true but it does have a soothing effect. But on a big sting they recognised that you should put nothing.....they didn't have any metho in those days.... and they recognised that putting any of these .... on did enhance the chance of killing the patient. They had a different approach there. I don't know if this was a getting in first idea but this .... used to pick them up by the feet, swing them around their head and dong their head on a tree. This was done down at Aurukun during my time in north Queensland, two kids had their heads donged on trees. Those children survived, but whether they would have survived without being donged on the tree, I don't know."

There is one other reference contained in the Mission Beach Expedition notes. This refers to a sting at Yarrabah. there is no way of knowing from the information given whether the treatment was considered to have any background in aboriginal lore or not. It is mentioned here only because it occurred in an aboriginal area.

* denotes inaudible section of tape.

UNDERSTANDING THE NOTES

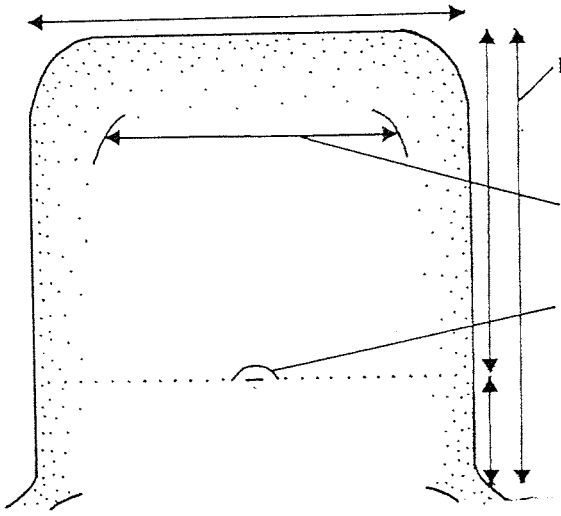
In order to understand the catalogue entries certain abbreviations should be noted.

c.f. = Chironex fleckeri
c.q. = Chiropsalmus quadrigatus

T1, T2 etc = number of tentacles per pedalium, indicative of size and maturity of specimen.

F0 to F4 = degree of maturity in the gonads of Chironex fleckeri
T0 to T5 = degree of development (of tubercles) of Chironex fleckeri
Q0 to Q6 = degree of maturity in the gonads of Chiropsalmus quadrigatus
(This information is contained in the key for description of gonads of C. fleckeri and C. quadrigatus).

CHARACTERISATION OF CUBOMEDUSAE



H = Height of bell, may be as two measurements,
top to rhopalar niche,
rhopalar niche to base of bell

W = Width of internal cavity of the bell

Rhopalium in rhopalar niche

T = Number of tentacles per pedalium

Gonad Development

F/T – refers to the degree of maturity in Chironex fleckeri

Q – refers to the degrea of maturity in Chiropsalmus quadrigatus

A variety of terms are used in Barnes' notes. These may be self-explanatory to the reader. In case they are not, I will interpret some of those most likely to be encountered. Others not mentioned here are described in the text.

DAS = dorsal abdominal segment
SVM = alcohol
branch water = tap water
aq.dest = distilled water
scaph.= scaphognathite (a part of a prawn's body)
h.b. = heart beat
flick = muscular spasm
rhopalium = primitive eye
rhopalar niche = an indented part of the body, in which the rhopalia lie
velarium = a muscular ring around the opening of the body cavity, used in locomotion.
gonads = specialised reproductive tissue
nematocysts = stinging cells
cnidocysts = stinging cells

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TIDE, MOON AND CHIRONEX

In February 1974, Jack Barnes conducted a preliminary examination of his data in an attempt to discover if there was a relationship between lunar periodicity and the presence of Chironex.

There is a comment at the beginning of these notes relating to observations made by Jack Romano in 1967, reporting large numbers of Chironex at Porter's Creek on 14th and 15th January 1967, and a lesser number on 19th January. That year new moon was on the 11th, and full moon on the 26th January. This placed the greater number present just after the new moon spring tides, and the lesser number at the time of the neap tides.

The preliminary examination consists only of four pages relating twenty 1967 sightings to phase of moon. Barnes made no comment in these notes with respect to any findings.

(These had no significant pattern when I plotted them out. Of course the sample is small.....B.E.K.)

TENTACLE NUMBER TO SIZE COMPARISONS

There is a problem relating to another person's research notes, which may not have been overcome in the following tabulations of those notes. It is often understood by the person undertaking the research that certain procedures and measurements will provide certain information. Sometimes those procedures or measurements may be undertaken differently, as a result of gained knowledge, or expediency. Some of the original measurements were not the standard top of bell to rhopalar niche measurements, and I have not included them. Some are labelled as being "to niche", others were not. I have assumed that these others were to be included as they were of similar value to the specifically labelled ones. This may be an incorrect assumption. If this information is of value to the readers I caution them to check the original numbers for themselves. As with the previous tables I have not included specimens which were between sizes, e.g. those with 2 tentacles on some pedalia and 3 tentacles on others.

.....B.E.K.

CHIRONEX FLECKERI:

Tentacle no.	No. of specimens	Mean height*(mm.)	Range (mm.)
2	4	12	11 to 17
3	9	16	9 to 33
4	8	19	15 to 27
5	16	26	19 to 32
6	10	31	22 to 45
7	23	38	20 to 53
8	22	43	23 to 68
9	30	60	30 to 90
10	24	71	45 to 104
11	19	81	40 to 110
12	11	87	60 to 140
13	3	113	65 to 170
14	1	62	---

CHIROPSALMUS QUADRIGATUS:

Tentacle no.	No. of specimens	Mean height*(mm.)	Range (mm.)
2	2	10	8 to 11
3	17	15	10 to 19
4	16	22	17 to 27
5	48	30	18 to 50
6	50	40	32 to 53
7	16	46	30 to 60

It should be stressed that these are included as a guide only, for the reasons referred to earlier.

GONAD CHARACTERISTICS

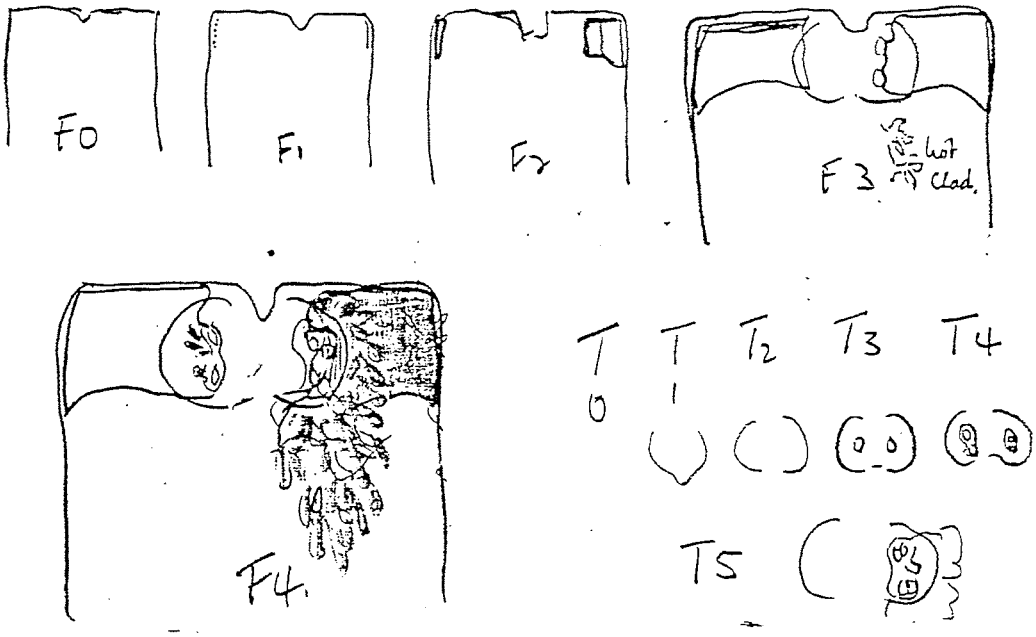
The differences between the gonads of Chironex fleckeri and Chiropsalmus quadrigatus are briefly discussed in the section titled "Distinctive Features Used to Differentiate between Chirodropids". Male and female gonads are identical in form and the sex of the specimen can only be determined by microscopic examination.

Descriptions of the development of the gonads are described and illustrated in Barnes' papers, Chironex fleckeri and Chiropsalmus quadrigatus - Morphological Distinctions (16) and Studies on Three Venomous Cubomedusae (20).

The section relating to "Understanding the Notes" gives the method used in the catalogue to describe the maturity of gonads. Barnes not only drew up a guide to the development of gonad tissues, but also related this to the size and tentacle number of the specimens examined.

Drawings were made of the various stages of development of the gonads and these are reproduced here.

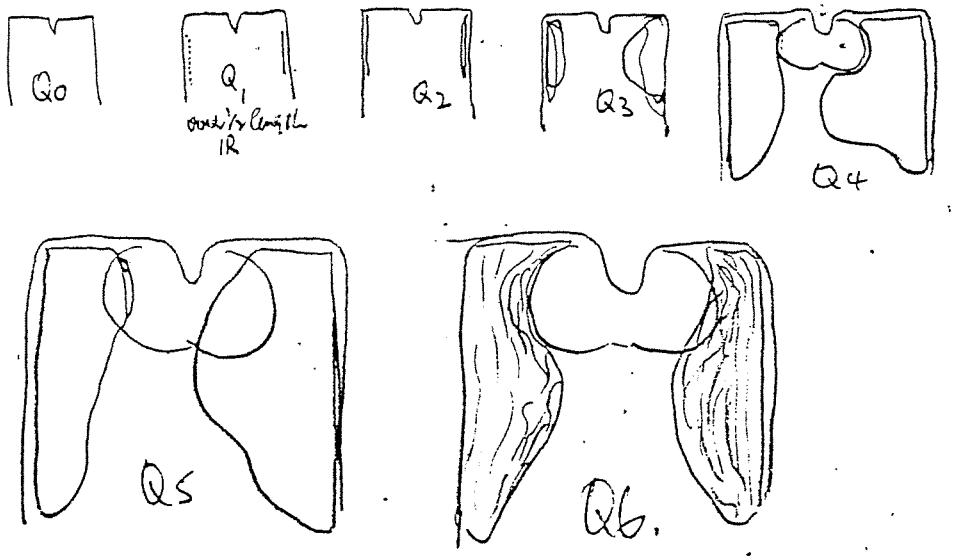
In Chironex both the amount of the gonad sheet and the growth of tubercles are important features.



A series relating gonad development to number of tentacles and comparing this with the height from the bell to the rhopalar niche was documented for Chironex. The numbers counted are relatively few, but are included as a guide.

Gonad Stage	Number of Specimens	Tentacle Number Range	Mean	Height* Range	Mean
F1 T1	2	5	5	23 to 27	25
F1 T2	2	5 to 7	6	27 to 30	28
F1 T3	5	5 to 8	6	30 to 35	33
F2 T3	8	7 to 9	8	37 to 58	48
F2 T4	3	8 to 10	9	48 to 68	61
F3 T3	2	8 to 12	10	48 to 60	54
F3 T4	1	10	10	65	65
F4 T4	2	9 to 10	10	68 to 74	71
F4 T5	7	9 to 13	11	60 to 170	92

There are two sets of drawings for Chiropsalmus, both are reproduced here as there are differences between them. One set of drawings finishes at the Q5 stage, the other finishes at the Q6 stage.



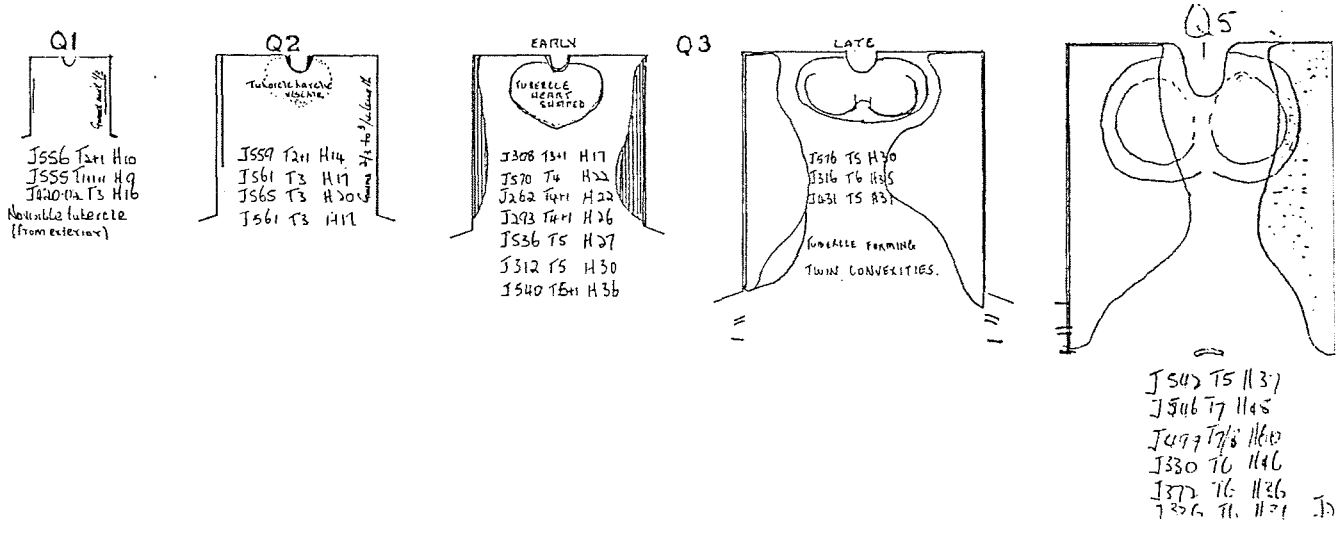
Height* (bell to rhopalar niche measurement, not total bell height)

The reason that the height measurement was taken from the bell to the rhopalar niche was because this is more likely to be an undamaged area of the specimen. The mouth of the bell is fragile and more likely to be damaged in collection, or distorted in preserved specimens, and therefore not a good parameter to choose.

One of these sets of Chiropsalmus drawings relates the number of tentacles and the height* to the gonad development. These are the results of a small sample (see diagram).

Gonad stage	Number of Specimens	Tentacle Number Range	Tentacle Number Mean	Height*(mm) Range	Height*(mm) Mean
Q1	3	3	3	9 to 16	12
Q2	4	3	3	14 to 20	17
Q3 (early)	7	4 to 6	4	17 to 36	26
(late)	3	5 to 6	5	30 to 35	32
Q5	7	5 to 7	6	36 to 60	43

This series consists of a small number of samples and does not include Q6 specimens. I have taken the tentacle number given to the lower option e.g. T7/8 indicates that some pedalia have 7 tentacles and some have 8, while T 4+1 is taken to be a specimen with a 5 tentacled pedalium, one tentacle being brightly coloured.(pers. comm. J.R.) The notes relating to this series mention three specimens at Q6 size, with an average tentacle number of 7 and an average height of 47mm.



Height* (bell to rhopalar niche measurement, not total bell height)

THE VALUE OF STINGER IDENTIFICATION

There had been some degree of controversy in the early work regarding the identification of lethal stingers. Deaths had been ascribed to Physalia, despite the fact that the distinctive floats of Physalia had neither been seen in the water nor had they been found stranded on the beaches. By the time that Jack Barnes became involved, the consensus of opinion favoured cubomedusae as the villain(s). However, the case against them was not cut and dried.

When Flecker died in 1958, Barnes pledged to continue Flecker's work on Marine Stings. He set about collecting a wide variety of marine organisms in an attempt to re-create Flecker's records which had been lost at the time of his death.

At the time that Barnes began this work, the roles of the various stingers and their potential had not been fully elucidated. MacNeill had made the point that Physalia was not a likely contender as the killer and speculated that a Carybdeid might be responsible. Flecker made the breakthrough when he had the beach at Cardwell netted in the aftermath of a fatality there, sending the contents of the net to Ronald Southcott for identification. Southcott's work on Chironex separated it from Chiropsalmus and into its own genus. Then he compared it with another specimen from a known fatality, stored in the School of Public Health and Tropical Medicine which was identical and incorrectly identified. Barnes mentioned in a talk (7) that Southcott's description of Chironex was largely correct but that there was some further modification to be made in the description, which he himself made (presumably (16)).

The identification of stings and stingers was of such importance to the early research that Barnes very rarely talked about Chironex fleckeri, without referring to other related stingers. It was vital to know which stingers were potentially lethal, in order to observe them, and later to work on securing the venom from them in order to produce antivenom. His catalogue of collections shows a wide range of collected organisms ranging from hydroids , to seaweeds, to potentially hazardous fish. His work on the Q.H.E.C. leaflet summarises his information on those stingers he considered the most hazardous.

It was important to him that people understood the differences between the stingers and the stings they conferred, because there is a tendency to consider Chironex in isolation and since much of what shows up clinically may be other stingers, it is important that all categories of sting and stingers be documented.

The major references to identification of stingers are the Q.H.E.C. Pamphlet(6), the paper on the morphological differences between C.fleckeri and C.quadrigatus(16) and Studies on Three Venomous Cubomedusae(20).

One of the major problems associated with stinger research in the early years, and one which has not completely disappeared in the face of greater knowledge, is that of identifying stingers and stings. A number of people claim that they have been stung with Chironex and that its effect was not as great as has been claimed for other victims. This is perfectly possible if massive envenomation has not occurred. However the other explanation for a relatively mild sting is that the victim was stung by Chiropsalmus, not Chironex(pers. comm).

As he points out (2), from the practical viewpoint, the major reason for distinguishing between Chiropsalmus and Chironex is that Chiropsalmus transfers a much smaller quantity of venom to the victim and is therefore not capable of causing death, except possibly after a very massive sting to a very small child. There is no evidence in Australia of a fatal sting caused by Chiropsalmus. The reason that Chiropsalmus is less of a danger lies in the fact that it is so much smaller than Chironex when mature, has fewer nematocysts (he estimated 5% of the number found in Chironex) and fewer and shorter tentacles. The injury is, however, very painful with symptoms persisting for up to three days, and for this reason, he felt that patients with large stings should be referred for medical attention and the doctor may consider giving corticosteroids either by mouth or intravenously to modify the effect.

IDENTIFICATION OF NEMATOCYSTS

When Hugo Flecker died in 1958, his carefully compiled register of marine stings was lost. This was a great loss to tropical marine science and a new start had to be made to collect the information required. This was desperately needed in order to categorise and identify stings and stingers. Barnes undertook to continue the collection of this information in order to regain and expand upon that knowledge which was Flecker's heritage.

His first published information was in the Medical Journal of Australia in 1960 (8). It reflected information gathered by Cairns Ambulance Centre and Cairns Base Hospital from 1956-1958, and in the period 1958-1960 gathered from the information collected on special stinger forms distributed to ambulance personnel and medical practioners.

This research analysed details of stings from marine sources. Records indicated that:

1) Stingings tended to occur in batches
2) each batch of stingings consisted of stings with substantially uniform characteristics

As he noted: "thus clinical patterns emerged. Stingings of doubtful aetiology were correlated with locality , weather conditions, stings due to identified agents and stings investigated by nematocyst study, and with the established presence of identified stingers on certain dates. By such means it was often possible to establish tentative diagnoses in the doubtful cases, backed by a variable amount of circumstantial evidence."(8)

When discussing the identification of stings (8) he commented: "I was experimenting with a technique suggested by ....Southcott....and was able to recover stinging capsules from the skin of two patients. The shape and internal organisation of the principal tentacular nematocysts of a particular species are constant and often differ widely from unrelated species. For example Physalia nematocysts are spherical while those of Chironex fleckeri or Chiropsalmus quadrigatus are cigar shaped. Capsules from the new stings (Cyanea) were superficially similar to those of the

cubomedusae, but smaller, proportionally stouter, and more rounded at the poles, resembling a sausage rather than a cigar. Also the "threads" in unexploded nematocysts were coiled in eight turns of a spiral about the longitudinal central tube. Such an arrangement is not found in the nematocyst spectrum of C.fleckeri or C. quadrigatus. The clinical distinction was therefore substantiated by this simple investigation.

He mentioned in the notes for the Queensland Health Education Council Pamphlet (6) that it would be useful to include some "detail on collection of useful material from the sting area ... either tentacle or slime remaining on the skin of the victim. Tentacles are of course fairly obvious and after treatment with metho, can be safely handled and transferred into methylated spirits, or preferably 5% formalin solution. Even when there is nothing visible on the skin, valuable material can sometimes be obtained by scraping. The technique is to use a sharp knife or razor blade held at right angles to the skin. Tentacle remnants, skin scales, hairs and sand will accumulate on the edge of the blade, from which they are wiped off onto a matchstick. The matchstick should then be placed in a small bottle with or without preservative, i.e. metho or formalin as mentioned above and the material on it will remain in satisfactory condition for some days. Special forms have been prepared by Burdon-Jones and the Queensland Surf Lifesaving Movement to facilitate accurate and complete reporting."

There is also an excerpt from the Royal Australian Navy Medical Newsletter (15) which relates to the collection of material from stings. The technique is very similar to that detailed above, although he does suggest including crumpled cellophane to prevent excessive movement within the jar.

It is obvious from Jack Barnes' comments that he could identify all the major stings, e.g. "Chiropsalmus is, in fact, closely related to Chironex and the capsules deposited on the stung skin are also very similar. They can however be distinguished by expert microscopic examination" (2). His forensic skill was consulted in cases of fatal stingings to prove that the causative organism was Chironex. The distinction between Chironex and Chiropsalmus nematocysts is a particularly difficult one to characterise because they are so similar.

Compiler's comment

I had some difficulties with this section of the work. Barnes' notes contain a series of graphs detailing the sizes and shapes of nematocysts, in particular those of Chironex and Chiropsalmus. I carefully scrutinised these in an attempt to ascertain the differences between them, without reaching a conclusion. I also made enquiries of those who may have known where and what the clues were, again without any solution being reached. However, in his records there is a letter to Shirley Freeman of the Defence Standards Laboratories, which presumably provides the answer. In it he mentioned that the capsules of Chiropsalmus are identical in appearance with those of Chironex, though uniformly smaller,(usually less than 50μ in length).

The reason that this was not immediately apparent, relates to another feature of Chiropsalmus capsules which appears to be reasonably constant. They have a rather narrow size range, which is apparently related to the overall size of the specimen.

The situation relating to Chironex is much more confusing because there is a wide range of nematocyst sizes found, overlapping the Chiropsalmus range in small sizes of Chironex. Not only that, but a sample taken from one area within the tentacle (e.g. top, middle or end) has a very different nematocyst size spectrum from that of another area. In C.quadrigatus the size of the nematocysts varies from largest at the top of the tentacle to smallest at the tip . Maximum differences in size are about 3.6μ

At one point in the graph books reference is made to "mature capsules only". The range there is as wide as anywhere else in the measurements, but as to whether this was an unusual count, or the normal count, must remain somewhat conjectural. Logic would argue that it should be the normal method, as Barnes referred often to the fact that immature capsules fail to penetrate tissue, and therefore they would not be important in regard to identifying a sting.

In discussion, he mentioned that as nematocysts were discharged, they were replaced and that it was a fascinating phenomenon . We did not pursue the subject at the time and I did not have the opportunity to discuss it again. I have found no reference to this in his notes.....B.E.K.

Identification of the sting by examinining the nematocysts found on the skin was important in investigations especially when sudden death had occurred. Take this comment made early in Barnes' research : "Southcott and Kingston have shown nematocysts remaining on the skin of two victims match those of C. fleckeri and C. quadrigatus... other evidence in preparation of publication (Cleland and Southcott) indicates that Cubomedusae may be the major cause of death from marine stings."(8) Also: "It is anticipated that the roles of C.fleckeri and C quadrigatus may be more clearly defined by comparing nematocysts available from tentacle with those recoverable from the skin of victims..."(20)

Photographs and descriptions of these nematocysts can be found in the Observations on Jellyfish Stingings in North Queensland (8), Extraction of Cnidarian Venom from Living Tentacle (22) and in the article in Roche Image (24).

Drawings and written descriptions of the nematocysts were made throughout this phase of the research and are to be found in a series of graph books and notes, labelled appropriately. In Chironex and Chiropsalmus penetrating venom-containing nematocysts are "football" or "cigar" shaped. The photographs and drawings found in the articles mentioned in the paragraph above, provide a summary of this work. "Paired" and "unpaired" tentacles are mentioned in nematocyst measurements. It would appear from a crude drawing in Margaret Hayes' work that all tentacles are paired with the exception of the first. This does not exactly agree with the idea that one can have a tentacle number of 6, 8, or 14 etc.

In practice, it seems that identification was not often based only on the nematocyst spectrum. Such factors as tentacle width, length and number, and the severity of the reaction were important diagnostic features.

IDENTIFICATION OF STINGS

There are descriptions of a number of marine stings in the Mulcahy letter(2), in the Queensland Health Education Council Leaflet(6) and in the talk given to the Queensland Ambulance Transport Brigade.(7). These provide good verbal descriptions of the differences between stings.

These describe stings from all the major marine stingers, and give valuable information on their recognition and treatment. Some of the specific characteristics of marine stings take time to develop, such as the "squirting" redness associated with Carukia (Irukandji) stings, or the blistering which can occur with a Chironex sting if not promptly treated.

A sting from a small Chironex can be confused with one from a large Chiropsalmus as far as length and number of tentacles is concerned. The nematocysts remain on the skin as the threads penetrate, leaving a "frosted" ladderlike pattern mirroring the arrangement of the nematocysts in rings aroung the tentacle. There will be differences in the distance between these bands of nematocysts depending on the source of the sting and whether the tentacles were extended to capture food or contracted for fast swimming (this also affects the width of the tentacle and wide strap-like weals are characteristic of a sting from a contracted Chironex tentacle).

Jack Barnes believed that many of the minor stings attributed to Chironex were indeed Chiropsalmus (pers.comm.). He also made the point that Chironex stings are triggered by a series of circumstances, that many people had been mildly stung by Chironex brushing past them in the water and suffered only minor discomfort, but that when Chironex is disturbed by sudden movement in the water such as running, splashing and general horseplay it becomes disoriented and a much greater potential danger. When the tentacles are stretched on contact and adhesion to its victim there is a greater likelihood of nematocyst discharge. If the victim panics and attempts to pull away, there is a greater risk of becoming entangled in more tentacles and of a massive firing of nematocysts occurring. He felt strongly that the victim's reactions determine the amount of venom received. The Surf Life Saving Association Seminar (26) gives a clear description of the sequence of events which occur in a sting.

TREATMENT OF STINGS

The initial difficulty with sting treatment was knowing which stinger was involved. As can be seen in the transcript for the Queensland Health Education Council (6), a wide variety of marine stingers can be encountered in tropical waters. Cleland, Southcott and Barnes were all involved in disseminating this information. "Injuries to Man from Marine Invertebrates" by Cleland and Southcott is a collection of case histories and information (including much from Barnes) on a substantial scale.

Barnes' input was both technical, as in the M.J.A. paper "Cause and Effect in Irukandji Stingings"(12), and aimed towards the general public. Letters to Maurie Mulcahy (2)and John Power (4) and the QHEC pamphlet (6), related to the recognition of marine stings, and the Mulcahy letter and the QHEC pamphlet give information regarding treatment. Newspaper articles were written with the view to informing locals and visitors how best to treat stings, especially life-threatening Chironex stings.

With time there were changes, treatments originally considered appropriate were changed as new information or technology surfaced, as is the case in all dynamic scientific research. In any discussion of sting treatment, the logical approach is to consider such changes, and the reasons for them, as they are frequently the practical end product of many years of research and clinical experience.

Much of the information following is gleaned from scrapbooks of newspaper cuttings. There is a problem when using such sources, because as they are comments made by an observer, that they may not be strictly as stated originally. Add to that the fact that they are being subjected to further comment in this report, and there is a risk that there may be some inadvertant variation on what was originally said. Every effort has been made to eliminate this potential source of error.

Barnes wrote a number of Press articles, at first anonymously, and later in his own name, in which he described the types of stingers likely to be encountered and asked for specimens of marine stingers of all types. The response appeared to be very gratifying.

By October 1960, a committee to organise a warning system for stingers at beaches in the Cairns area had been formed. Barnes suggested that the approach to be taken was as follows, firstly remove the victim from the water, then remove the tentacles and slime from the affected area with dry warm sand, wet sand, seaweed or a dry cloth. Methylated spirits should be used to inactivate the stinging cells which may be adhering to the skin. He stated that on no account should the affected area be washed with fresh water because this had been found to aggravate the sting.

An article in late January / early February, 1962, no longer had this sequence. The suggested treatment was to pour methylated spirits freely over the skin, using dry sand to scrub off the stinging capsules and slime if metho was unavailable. Fresh water was to be avoided until the nematocysts were inactivated.

By February 1963, after the death of a 10 year old boy at Bucasia Beach, near Mackay, the following suggestions were made: removal of all attached tentacles, mouth to mouth resuscitation if breathing had stopped and cardiac massage if there was no pulse. He also suggested the immediate application of a tourniquet if the stings were on the arms or legs, as this would prevent the flooding of the system with the injected poison. By November of the same year, the methylated spirits treatment was stressed and rubbing with wet sand was rejected. It had, by then, been recognised that this was causing a greater amount of damage.

As an aid to treatment, venom was required in quantities adequate for research into its nature, and to attempt the production of antivenene. Milking methods were established in 1964. (See separate section relating to Venom).

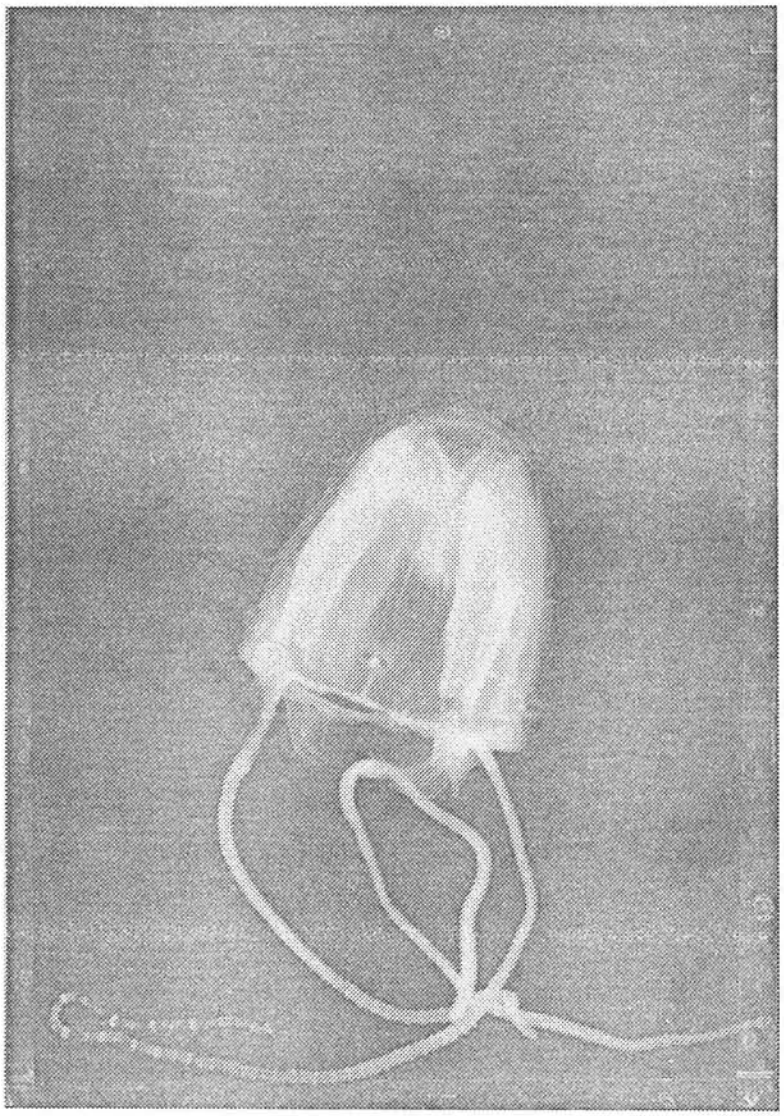
By early 1966, Barnes' first aid recommendations were approaching their final form. The first point made was that the sting should not be disturbed, and that methylated spirits should be poured over it. He noted that methylated spirits does not stop the original sting, but that these are multi-stage stings, and the sooner the metho is applied, the sooner the tentacles shrivel and stop injecting poison into their victim. Rubbing with wet sand was shunned, because a greater amount of venom was introduced into the victim's circulation, and constricture bandages and artificial respiration advocated where appropriate.

A life-threatening sting was received by a young victim early in the new year. Those around, acting from knowledge instead of ignorance, responded quickly and correctly, and the victim survived. It was a measure of the success achieved by providing the correct treatment information. Other successes followed.

(These days vinegar is advocated instead of methylated spirits. I asked Barnes for his opinion of the relative value of each of these. He replied that both were useful, and that each acted in a different manner. When vinegar is applied to a sting, the nematocysts which have not penetrated the skin do not discharge, whereas when metho is applied to a sting the remaining nematocysts do discharge, but they do not penetrate the skin. The effect produced by either methylated spirits or vinegar is essentially the same, since the whole point of flooding the sting is to prevent further envenomation from occurring. He felt that the discharge of nematocysts which can be observed when metho is used, is misunderstood, and thought by some researchers to provide the potential for further envenomation. He was convinced that the nematocysts are so damaged that this cannot occur. He had seen some results from a mixed treatment with alcohol and vinegar which he felt were worse than from either individual treatment and that the mixed treatment was unsatisfactory. He cautioned that the choice should be either vinegar or metho, but not both....B.E.K.)

Barnes believed that in this day and age, severe scarring should not accompany a sting from a box jelly. Prompt administration of antivenom (within the hour), relieves the pain and reduces scarring. With smaller box jelly stings, he also suggested (6) the use of either antivenom or injections of corticosteroids.The use of corticosteroids is suggested (6 and 2) because they have an excellent and quite specific effect on the local injury.

One of the major highlights of Barnes' career was the discovery of Carukia barnesi. The search for the carybdeid responsible for Irukandji illness is documented in the M.J.A. article (12) and is a fascinating tale of his seven year search. Using himself and other volunteers as guinea pigs, he also tested painkillers for their effectiveness. He was thus able to recommend the appropriate treatment, pethidine chloride, later followed by aspirin.



Irukandji carybdeid, Carukia barnesi
(photograph by Jack Barnes)

PREVENTION

Believing that prevention is by far the best option in dealing with stingers, Barnes set up an extensive network of "stinger watchers". This was a group of volunteers, lifesavers, ambulance personnel, fishermen, interested children and adults. If a stinger was sighted or captured in a certain place, or if a sting had occurred, then he was in a position to alert the local media and warn the general public.

The presence of large box jellyfish in the Cairns area is dictated by the wind pattern. This is not because stingers are brought in by certain winds, in fact they are active swimmers and their movement is independent of such factors. They are, however, strongly affected by the absence of prevailing winds and in a flat calm or with a Northerly or North-Westerly which does not ruffle up the water they will move in, following their prey (7). South-Easterlies with rough weather are avoided, because Chironex are fragile and their tentacles can be readily broken in rough water. Having established this pattern Barnes used to produce newspaper reports and radio reports warning of danger periods.

There is a paradox where warnings to the general public are concerned. It is a "damned if you do, damned if you don't" situation. Barnes was thrust into the middle of controversy. Local government authorities and tourist operators felt that warning people of the dangers of stingers would drive them away from the area in large numbers and that warning signs would render them liable to prosecution. Neither is there a totally "fail safe" situation, beaches could be netted, winds assessed and still there could be an individual stinger present. Nor would beachgoers always hear or read the relevant warning.

One of the tactics applied to assess the numbers of stingers in an area was the issue of specially designed nets for the use of life-saving clubs. These were used to make test drags in their own particular areas. From these test drags, it was hoped that each area would then become familiar with those conditions under which jellies are more likely to be present, and whether some sections of the beach are more likely to have jellyfish present (e.g.around the mouth of a creek). Such test drags give an indication of potential danger which can be relayed to the general public. Negative drags do not imply safety but positive drags do imply danger.(2)

Netted enclosures were discussed in relation to big box jellies. He felt that all too often people did not understand that they were designed to prevent loss of life, not to prevent all stings. They should be designed to keep large Chironex out, not fragments of tentacle, small stingers etc. He observed them systematically working against nets, and probing their defenses for weak points. This is graphically described in the Surf Life Saving Association of Australia's Seminar on Marine Stingers (26).

As far as personal protection goes, he graduated from a wetsuit to lightweight clothing such as a pantihose and skivvy (7). The Roche publication (24) shows his children in protective clothing at the beach. The thickness of protective wear does not have to be great and he felt that knit fabrics were less restrictive as far as movement goes, but cautioned that some fabrics were more suitable than others (26). He also noted that dark objects in the water are avoided and this would appear to have obvious implications for stinger suits. One point he made when shown a V-necked stinger suit was that it would do a good job, but that the wearer would be vulnerable to Irukandji stinging, as they swim high in the water. (pers.comm.)

VENOM EXTRACTION

There are two major sources of information relating to Jack Barnes' venom research, the Address to the Royal Society (1) on the "Extraction of Cnidarian Venom from a Living Tentacle" and the paper of the same name which was presented at the First International Symposium on Animal Toxins (22). These summarise many years of research and encompass the search for an appropriate membrane, the preservation and production of toxin for animal tests and for characterisation and use in the production of antivenom. There are also notes relating to the various animal tests and the method of obtaining the venom, these notes will be held in the archives at James Cook University.

The details of the production of the venom which was provided for the Commonwealth Serum Laboratories have commercial potential and remain the property of the Barnes family. They are not the subject of this section. Only that information which has been previously published, or publicly discussed, and the notes pertaining to the development of the technique which were not considered by Jack Barnes to prejudice his interests, form the background to the following discussion.

VENOM vs TOXIN

One of the delights of working with Barnes' notes, has been his approach to each area of research. He defined the problems very precisely, and in no case is this more obvious than in the toxin testing. He also defined (1) the substances with which he was working very carefully indeed. These are his definitions:

> **Toxin** is any ... (substance ?) of organic origin which exerts an adverse biological effect whether the substance be in its original form or in any other the ingenuity of man or the processes of nature can devise.
>
> **Venom** is that matter elaborated by an animal specifically for offense or defence and actively transferred to the prey or victim. Any extrinsic modification of this material immediately degrades it from venom back to toxin.

He pointed to the fact that early attempts to produce coelenterate toxins had consisted of taking a large accumulation of tentacle, breaking it down by the action of its own enzymes at a lowered temperature until partial autolysis occurred, and then by selective filtration, washing and centrifugation, obtaining a mush consisting of nematocysts only. This mush was then attacked chemically, osmotically, or mechanically to break open the capsules. The capsule remnants were then centrifuged and the clear supernatant retained.

This material was very toxic, and was considered by a number of workers as venom. He objected to this term for the material for the following reasons:(1)

1) - As there is more than one variety of nematocyst present, there is also the probability that each type of nematocyst contains its own specific toxins.

2) - Functionally mature injector type nematocysts are the only source of venoms transferred to the tissue of victims. Many capsules are immature and their fluid content differs from that of mature capsules. This has been shown by differential staining reactions. These immmature capsules are not discharged under normal conditions of stinging and the inclusion of their contents produces an atypical end product.

3) - Other nematocysts and their immature forms are present. Their functions are adhesive or entangling. They contribute nothing to the true venom of the species and their presence, together with the presence of mesogloeal tissue (which may also be toxic) may also distort venom ratios or mean that atypical substances are included in such material.

4) - Capsular walls ensure isolation of their contents only while cellular or mucoid investments remain intact. With maceration and separation techniques, genuine venom may be contaminated and active constituents lost because of contact with non-capsule sources.

These then were the reasons for rejecting the more traditional approach to collecting toxin by maceration and separation techniques. What was required, both for chemical investigation, and for the production of

antivenom, was a product as close as humanly possible to the venom injected by the action of the nematocysts.

In order to minimise the undesirable influences mentioned previously, Barnes set out to "utilize the natural stinging mechanism of the jellyfish, nominating the target and recovering the venom injected." The logic of his approach was undeniable, the refinements required took a great deal of thought and patient effort.

(As far as his own end product was concerned, Barnes frequently uses both terms, venom and toxin. He knew that he had extracted the contents of the discharged nematocysts and very little extraneous material (e.g. a small amount of material from the membrane). In general this section of his work has been labelled "Toxin Tests". However, when the extract is called venom by Barnes, I have followed suit....B.E.K.)

MEMBRANES

The method chosen to milk the tentacles of their venom was described in the Address to the Royal Society (1) and in his publication "Extraction of Cnidarian Venom from Living Tentacle" (22). It consists of placing a membrane across the top of a jar, or a perspex platform, lying the moist tentacle on the surface of that membrane and by means of a series of electrical stimuli, inducing the tentacle to discharge its nematocysts. Success was gauged by the number of and clear passage of nematocyst threads passing through the membrane and the amount and strength of the venom collected on the inner surface of the membrane.

A variety of membranes were used in an attempt to find an appropriate target. These ranged from latex, cured rubber, cellulose (Visking 25u thickness), polythene and polyvinyl films, to sheep intestines, swim bladders of fish, hog stomach and to the final choice of human amnion. With non-animal membranes, discharge rates were lower and the only penetration through these was thought to be associated with faults in the continuity of their surfaces. Adhesion and penetration occurred readily on all animal membranes. Amnion proved more satisfactory than the others because of its cleanliness, availability, low leakage rates, absence of faults, and because its clarity provided an excellent medium for examining the penetration of individual nematocysts under the microscope.

As discussed elsewhere, the surface presented to the tentacle makes a great deal of difference to the penetration of the nematocysts. With this milking method, nematocysts can be milked only when they discharge their venom on the inner surface of the membrane. If the nematocyst threads travel through the membrane at an angle then the chances are that the cell contents will not be released on the other side. This means, of course that such venom is not available for milking. Microscopical evidence for the direct passage of nematocyst threads through the membrane was most important to assessing the appropriateness of the membrane.

Certain treatments of the amnion were made in order to ascertain the best and most practical approach to its use. As it is a perishable membrane, thought had to be given to a method of preservation which would give an end product which was an acceptable target for nematocyst release. Adhesion rarely occurred on denatured amnion (e.g. treated with formalin, heat or alcohol), and although electrical stimulation provoked normal adhesion, with some capsular deposition and discharge, penetration of the membrane by the nematocysts was minimal or absent. The most practical treatment was found to be storage in a saturated salt solution and washing prior to use.

Amnion was peeled from human placentae and membranes immediately after delivery, washed, stripped of chorionic remnants, and stored in a saturated sodium chloride solution. Then, when required, it was softened by soaking, and desalted by placing in running water for at least 15 minutes.

Fresh amnion elicited similar tentacle responses to brine-soaked amnion, except that there was a greater tendency for the injector threads to penetrate the membrane obliquely in fresh amnion and only 50% reached the opposite surface. This, of course, meant that less venom was available for collection. Brine soaking therefore produced a more satisfactory membrane from a number of points of view.

The surface presented to the tentacle was also important. If the amnion was mounted with the epithelial surface uppermost, better direct penetration of the nematocysts was achieved. Barnes also temporarily improved penetration by setting up a moisture gradient in the membrane, but this could not be sustained (22).

Venom milking through a membrane is a very slow procedure and the yield is very small. The requirements are exacting, and time consuming. Box jellyfish venom is not stable at ambient temperatures, and there was often a loss of potency, (or a low "prawn unit" bioassay, which argued for a loss in potency), which was a disadvantage of the method. A "quick milk" method was developed which answered these problems.

THE "QUICK MILK" APPROACH

In his Curriculum Vitae (1968), Barnes notes that "very much larger quantities of Chironex venom were required for chemical, physiological and immunological studies". Intensive research was involved, and he comments that costs for equipment, salaries and time were greater than for any other aspect of his investigations. "The breakthrough came in 1967 when it was found that intact living tentacle could be forced to discharge its total venom content ....."

Not only was the potency of the extract much greater per ml, but the volume was also increased, the time taken for milking was decreased and the exposure of the extract to ambient conditions was lessened, thereby diminishing the probability of the labile venom breaking down.

As mentioned earlier, details of the venom milking process have commercial application and are the property of the Barnes family. Stocks are still available.

CHIROPSALMUS MILKING

"A special problem encountered with Chiropsalmus is their tendency to shed tentacle on the slightest provocation", even a sudden drop in temperature. The following approach was suggested; that small containers be kept on dry ice in a small insulated container (suitable for carrying) and that the Chiropsalmus be induced to shed their tentacles immediately after capture, the pieces being dropped into the refrigerated containers. Frozen and defrosted tentacle is "very lively" and should be suitable for extraction.

The tentacles are very small, and shrink up to a stub, even though they may have been 15" long a few moments previously. Therefore there could be confusion that such tentacles come from juvenile Chiropsalmus, or have

fragmented. They are enormously difficult to milk using the same techniques as used for Chironex and very different from Chironex in their handling characteristics (correspondence S.F.). "This milking was incredibly difficult to do...we eventually stopped collecting it as we felt it was not lethal and of purely academic interest (pers.comm. J.R.)

THE MEMBRANE MILKING PROCEDURE

As milking always took place in the field it was necessary to have the working set up portable and convenient. Collections were made in the very early morning (0430 - 0700) on a making or high tide in the pre-dawn calm. Then as the wind rose, specimens would be taken ashore and milked (pers. comm. J.R.)

The collecting vessel was a domestic coffee jar [as seen in the photo of the working set-up (22) or (24)], across the mouth of which was stretched the membrane with the epithelial surface outward. This was secured with rubber bands which also held a small tinfoil electrode in contact with the membrane. A small amount of air was removed from the jar by means of a side tube in order to produce a moderately concave surface on the membrane. Electrical stimulation was provided by a Multitone Progressive Treatment Unit. The method and equipment is fully described elsewhere (22), and a summary only is included here.

Cut tentacle is "extremely irritable" when taken from freshly caught specimens and it was found that premature mass discharge of nematocysts could be controlled by moderate anoxia, produced by a reduction or cessation of aeration just prior to milking. Tentacle was placed across the concavity of the membrane and a small charge placed across it, to encourage it to adhere. The voltage employed was the minimum to cause a visible discharge of nematocysts in Chironex and Chiropsalmus. The concavity of the membrane seemed to serve two purposes, to act as a collection point for the venom which had penetrated the membrane and was able to fall or be washed into the collection jar and to act externally as another site to which water could be added and the toxin collected. The product from the external site was less "clean", but very potent. The membrane/tentacle was maintained in a moistened condition throughout stimulation.(22)

The side tube was used to introduce water into the jar to swill the venom from the lower surface of the membrane. The fluid recovered represented diluted venom and if not immediately required was stored between -15 C and -10 C. Some samples were vacuum dried.

The results were assessed by the microscopic examination of the membranes and by bioassays with prawns and mice as the test organisms. Venom was injected into the first or second abdominal segments of prawns and either intravenously or intraperitoneally into mice. As a result of this particular method a small amount of cellular debris from the amnion was associated with the venom.

TENTACLE REACTION

Hand caught Chironex behave differently to those scooped up in a net. When netted, or if the animal is excited, nematocysts are discharged and the tentacle develops a "frosted" appearance. Premature discharge wastes venom which would otherwise be available through the milking process, and so the efficiency of venom collection depends on the handling of the specimens as well as the subsequent treatment.

In the intact jellyfish, nematocyst discharge is influenced by contact, chemical recognition, tension mediated reflexes, tentacle contraction and the changeable "mood" of the animal (22). Agitation caused by water turbulence, handling or some form of restraint such as obstruction to progress, or traction on the tentacle will provoke such responses as increased rate and power of propulsive action, evasive change of direction and contraction of tentacle to less than half the usual length. With even rougher treatment, the animal may relax completely, tumbling to the bottom amidst a profusion of lax tentacle. Coincident with either of these responses the reactivity of the tentacles is greatly increased and the tentacles will adhere to any contacted surface, even the jellyfish itself.

Tension on the tentacle is a major component of the response, and if tension is maintained or increased (such as occurs when a victim is struggling to move away from a sting) there is a propagation of the discharge along the length of the tentacle. If traction is sufficient to cause pedalial distortion, the discharge can extend to the whole group of nematocysts on that tentacle and occasionally, to the whole tentacle

array. Under the microscope these fired nematocysts are seen to be largely glutinant (adhesive) in function. A further and even more intense firing of injectors accompanies strong muscular contraction within the tentacle. To obtain the highest quality venom, these local and remote controls of mass nematocyst responses must be avoided during collection yet utilised in the milking process (22).

COLLECTION OF SPECIMENS FOR MILKING

The major difficulties which are the result of the responses discussed in the section relating to tentacle reaction can be lessened by the following approaches:-

1) - Small Chironex and Chiropsalmus are easily captured by hand, using a firm grip over the apex of the umbrella but unless withdrawal from the water is smooth and unhurried stretch-mediated discharge is likely.

2) - Large Chironex should not be lifted from the water as the "weight of dependent tentacle automatically initiates reflex discharge."

3) - Surface swimming Chironex and Chiropsalmus can be taken by forcing a horizontally held container into the water immediately in front of the moving body. Inrush of water transports and protects the tentacles.

4) - Specimens with long tentacles should be sharply "bumped" immediately prior to collection. The animal usually responds by contracting its tentacles to a more convenient length.

5) - Chironex swimming at depth can be brought obliquely to the surface by cautious redirection of the body.

All containers for collection should be scrupulously clean. Cubomedusae are prone to shed their tentacles in captivity, but cast off portions retain their activity for some hours if the oxygenation is adequate.

TOXIN TESTING

The test animals used to assay the strength of the venom produced were greasy backed prawns, Peneus merguensis and small native mice. Prawns were the more commonly used test animal of the two, being both readily available and appropriate as a target organism.

The venom produced was injected into the first abdominal segment of the prawns and either at the base of the tail or later, intraperitoneally, into the mice. Their responses were then detailed e.g. in prawns, the reaction of the heart beat, gill pump, and scaphognathite and any body movements; and in mice, respiration rate, paralysis or unusual movement, urination and cyanosis. Near death responses and death time, compared to the amount of venom injected gave an indication of the strength of the venom under investigation.

Each batch varied significantly, depending on a variety of factors, overall efficiency, the length of time between the capture and milking of the jellyfish, premature discharge of venom as a result of handling, the temperature at which the venom was stored (it is quite labile at room temperature or if heated, and is readily broken down by bacterial decomposition). Results were recorded as the weight of the prawn, the dose, the site of injection (D.A.S.= dorsal abdominal segment - usually the first), the amount of venom as a proportion of the weight of the test animal and as "prawn units" which was an assessment of the total weight of prawns (in grams) which would be killed by 1 ml of the venom within 5 minutes. An analogous system applied to mouse testing.

When material was diluted, Barnes found no parallel between prawn toxicities and toxicities to vertebrates. This suggested that the factor lethal to prawns is different from that lethal to mice or rats and that its maximum activity was manifested under different conditions. Barnes noted that when diluted toxins were used, there were substantial variations between his assays and those of others, and felt that this was a genuine inconsistancy, perhaps due to a hitherto unsuspected factor which might be worthy of study, (letter to Turner, Defence Standards Laboratories 1968).

FACTORS AFFECTING THE STRENGTH OF THE VENOM

The venom was marketed on the basis of its strength, as concentrated venom was required for the production of antivenom and for the chemical examinations to which the venom was subjected in attempts to elucidate its nature and its mode of action.

Certain characteristics of the venom became obvious as attempts were made to produce a "cleaner product". One of these characteristics was the capacity for venom to adsorb strongly to almost any surface, with a concomitant loss of of active component at each passage. Barnes comments to Shirley Freeman (Defence Standard Laboratories) in 1973; "Passing the crude toxin through a Millipore disc can give a very clean product but I don't normally do this because there is a substantial loss of active component onto every surface presented - damn stuff adsorbs like fury. Which is why some workers "condition" all equipment with peptone or the like."

He noted that with each dilution made to the toxin during testing, that there was an apparent increase in relative strength. This is described by him in 1968; "The emergence of additional toxicity upon dilution is quite remarkable and I feel this phenomenon is worthy of quite intensive investigation. Probably the most likely explanation is that the biologically active fraction is present in a phase equilibrium, with a substantial portion inactive at high concentration. With progressive dilution there may well be a shift in equilibrium with increasing quantities of material entering the active phase. Alternatively, dilution may selectively affect the deficiency of some antagonistic component ... maybe ... combination of these and other equally possible conditions".

Freeman's research into the pharmacology of the toxin and Barnes' clinical observations and his own experiments were complementary and fruitful. He supplied her with a variety of materials, tentacles from which she derived a toxin (by maceration techniques) very similar in components and toxicity to his toxins.

In 1973 he commented that the quick milk venom had a toxicity around 16,000 mouse units per ml and it was possible to obtain a much more potent extract by slow partial defrosting, which eliminates extraneous substances.

Another of the factors influencing the biological activity of the extracts is the temperature. While the material is most lethal at 40°F, it drops to 50% or less at room temperature. This is not a change due to denaturation, as the hgher toxicity reappears as the material is cooled again. Barnes felt that this was a result of antagonistic enzyme activity which is controlled at lower temperatures.

STORAGE AND TRANSPORT OF TOXIN

Various storage methods were used, vacuum drying and freezing. Of the two, freezing appears to be the method to stand the test of time, although there were occasional episodes where power losses caused problems. Loss through ebullition during vacuum drying was a fairly major problem as the toxin had a distinct tendency to froth when the vacuum was applied.

In later correspondence Barnes refers to supplies of frozen material, which are stable stocks. Because the toxin is so labile and because it is subject to bacterial degradation at ambient temperatures, it was put into containers of dry ice as soon as it had been milked, then stored in the freezer.

For transport, the original bottles of frozen material were placed in wide mouthed Thermos or Coolite flasks (with openings at least 3" in width and capacities of 1/2 litre or greater), with dry ice. This was then packed in a coolite box with further dry ice and with this treatment remained frozen solid from Cairns to Melbourne. Liquid Nitrogen was not suitable as it was too cold and the glassware cracked.

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THE MISSION BEACH EXPEDITION, 14th - 23rd January 1966

This is a summary of the account of a ten day expedition to Mission Beach. The expedition (as described in the catalogue; between J1544 to J1566), is an interesting overview of the area at that time. Some of the descriptions may not hold in all circumstances as such things as the slope of beaches will vary under different weather conditions etc., but the general information will be valid. The following summary is extracted from the catalogue and should more information be required, it is suggested that the full text be consulted. This will be held in the archives at James Cook University.

On the 14th January 1966, Innisfail QATB recovered a floating, presumably dead Chironex at Flying Fish Point. This was a large mature specimen, which indicated the likely presence of others in the vicinity.This specimen was collected en route to Mission Beach.

Netting and trapping were two of the activities in which local fishermen were involved. Barnes had set up a network of fishermen, ambulance and lifesaving groups, and concerned locals, which supplied him with a wealth of information and specimens. When on such expeditions he made a point of contacting interested locals for their observations and also inspected the beaches for evidence of netting and followed up hearsay about the catch from such activities. Some of this anecdotal evidence is included here.

Also included are descriptions of the behaviour of Chironex, their response to his presence and their response on being handled.

This section also contains summarised descriptions of two stings from large Chironex specimens. Barnes noted his reactions to these stings with great objectivity. The stingings occurred as a consequence of the windy conditions which were present at the time, leading to the accidental contact. His notes are a rare record of the time taken for the body to respond to a certain treatment and the degree of discomfort encountered.

The information which follows is arranged in sequence, from the north to the south. These beaches were visited on a variety of dates, and in a variety of wind conditions. This information is contained in the text.

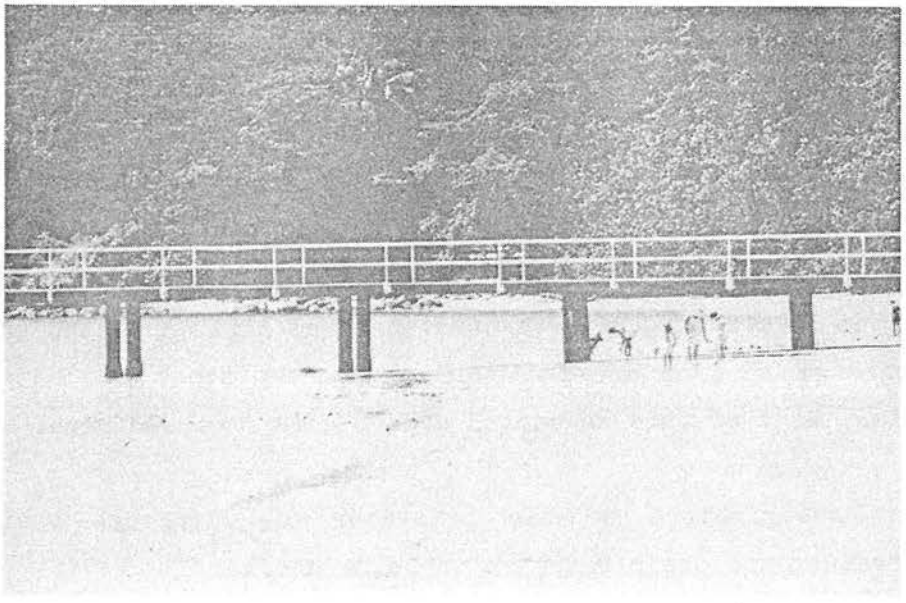
KURRIMINE BEACH

January 16th: Kurrimine Beach is exposed to the south-east and on the day it was inspected the wind was blowing from that quarter at 10 knots, and moderating. The water was rough and dirty, and no Chironex were seen. Kurrimine was a favoured beach for netting by local fishermen, because of its muddy bottom and the proximity of the nearby living reef.

CLUMP POINT JETTY

(Clump Point Jetty lies to the north of Clump Point, the headland to be seen in the second photograph.)

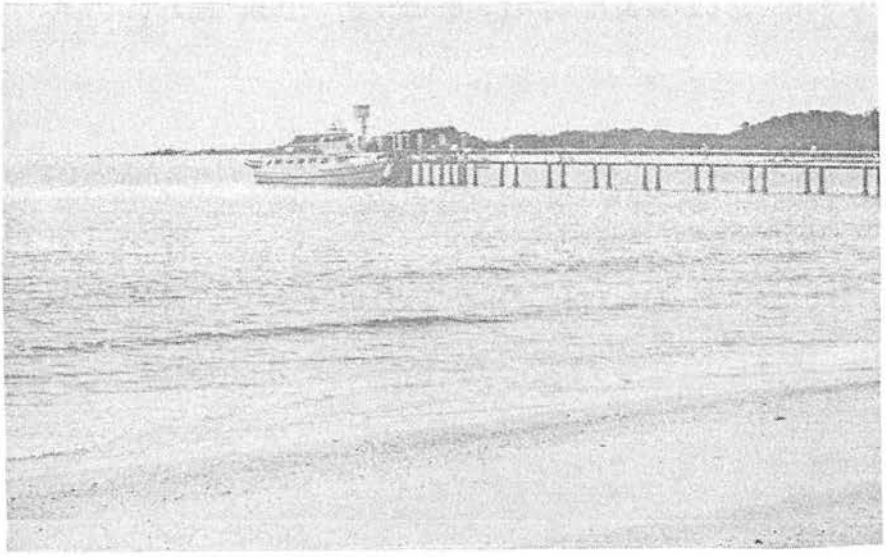
January 18th:Winds light east to north east at 5-10 knots; 6 small Chironex were netted by a camper near Clump Point jetty, their size was in the range 1" to 1 1/2" (2.5 to 3.8cm).



Clump Point Jetty:
October 1985, low tide, winds light.

January 19th: This site was used at night for observations with respect to the response of cubomedusans to light. There was an overhead fluorescent light and in addition Barnes used both a pressure light and an underwater light with a 72W (sic) globe. At one point a cubomedusan 2 1/2"(6.2cm.) in width was seen to enter the sphere of light but did not closely approach the light and was not seen clearly enough to identify. Small carybdeids (not Irukandji) were markedly attracted and were captured in buckets. The smallest of these was used as a test animal, with Barnes as the guinea

pig. It produced a severe sting almost instantly, with waves of pain approximately 2 minutes apart, and comparable in severity to a medium Chironex sting. Methylated spirits was applied 9 minutes after stinging, and produced relief within 2 minutes, the stinging sensation subsided, neuralgic twinges persisted into the first hour, but at the end of the second hour the only remaining symptom was some slight local tenderness.



Clump Point Jetty:
October 1985, low tide, winds light.

January 20th: Further observations were made at the jetty with the additional light sources, but this time there were no approaches by either carybdeids or cubomedusans. A very large Chironex was observed swimming at the dim fringe of light produced by the overhead fluorescent light. It circled very slowly, making at least 3 full circuits and swimming at depths of from 1-3 feet (30-90cm), appearing to avoid strong illumination deliberately .

BOAT BAY (NARRAGON BEACH)

This is the first sheltered inlet north of Clump Point. It lies between Clump Pt. Jetty and Clump Point headland.

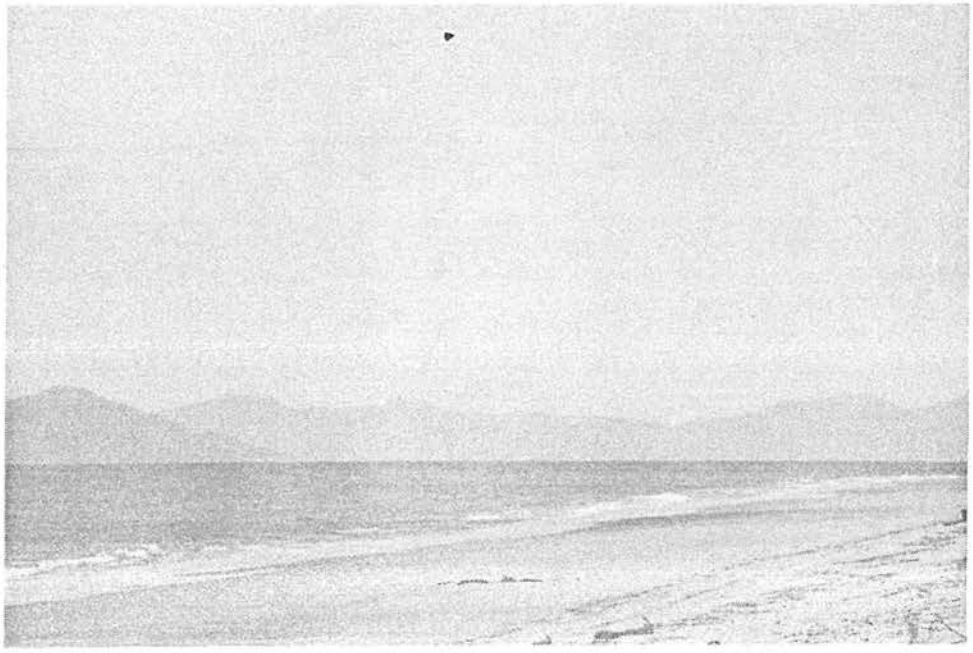
January 18th: The winds were light, from the east to north-east at 5-10knots, the water was clean inshore and green backed prawns were fairly numerous. In a confined area near the mangroves at the end of the small sandy beach, in a depth of two feet of water, 2 medium and one small

Chiropsalmus and one small 1" (2.5 cm.) Chironex were collected by hand. A local naturalist claimed to have seen considerable numbers of Chiropsalmus here on other occasions. Up until this time, authenticated specimens of Chiropsalmus had not been taken south of Etty Bay.

January 19th: A medium sized Chiropsalmus was taken at the same site as the previous day, but no further specimens were found either in the bay or along approximately 1 mile of beach to the south of Clump Point.

MISSION BEACH

January 15th: A 15 knot wind produced rough seas, however because of the gentle slope of the beach, the 30" (75cm) surf was breaking about 30 yards (27m.) from the shore. The water was very dirty and there were no sightings of jellyfish in the area, or reports from other areas.



Mission Beach:
October 1985, low tide, winds light.

January 16th: Following up a report that small box-jellyfish had been netted at the north end of the beach proved unproductive for Barnes. A night search with the underwater lamp was also fruitless.

January 17th: After the south-easter died down, a light north-easter developed. The water remained rough and murky and the likelihood of

visually detecting Chironex was slim. A small 2 1/2"(6.4cm.) Chironex was found on the beach, giving the appearance of having been stranded, which was contrary to the belief held previously that they sensed and avoided the probability of being stranded.

January 18th: As the winds dropped, becoming light and variable from the east to north east at 5 - 10 knots, the water cleared considerably. Wave height had dropped to 6" (15cm).

January 19th: The wind was now from the north-east at 10 knots or less and the waves were ripples at the beach only. No Chironex were sighted here.

January 20th: The wind had dropped even more and did not exceed 5 knots all day. The seas were almost flat calm in the morning , but by 1500 hr. small rollers were present at the shore.
At about 1000 to 1100 hours 5 large Chironex were collected in water 1-3ft (30-90cm.) deep, very close to shore within an area extending up to 200 yards on either side of the mouth of the creek, approximately 1 mile (1.6km.)south of the Moonglow Motel. These specimens were all swimming north at a rate of about 4 knots, strictly parallel to the beach, in very clear water. The colour of the body was milky blue, contrasting well with the sand background, and the tentacles, which were invariably carried in the semi-contracted state about 15-30" in length, (38-76cm.) appeared as a parallel series of bluish grey strands. The innermost tentacles extended to a greater length, so that the appearance was that of a cylinder of tentacle approximately 1 ft (30cm.) in length which tapered to a point for the remaining distance. Three of these were milked for venom. Again, in the early afternoon, three more specimens were captured, one slightly northward of the creek the others slightly southward. All were in water less than 3ft.(90cm.) deep and moving south. It is not known if this change in direction of the movement of the box jellies was related to a change in direction of the tidal flow. The largest of these Chironex and another of the morning's catch were later milked for venom.

January 21st: A flat calm day, with a barely perceptible north-east breeze. The water was very clear and the waves were only ripples on the beach to a maximum height of 4" (10cm). Once again the area within 100 yards (90m.) of the creek proved productive, and "1 huge Chironex .... 2 other very large C. fleckeri" were taken for milking. Vast numbers of

Congolai prawns were entering the creek at that time, the rising tide creating a strong flow into the creek."

January 23rd: A light north-easterly breeze increased to 15 knots, causing a considerable swell by late morning. Again the creek area was searched in the early morning, with the tide rising to near full. Neither jellyfish nor Congolai prawns were seen at the site. However, between the creek mouth and the huts lying to the south of it, 7 large Chironex were collected. They were swimming near the bottom in water 2-3ft. (60-90cm.)deep. The direction of swimming appeared random. Later in the morning, as the tide was running out from the creek, staining the water in an area approx 30 yards seaward and 50 yards to the south, 3 Chironex were captured in the southern margin of the stained water, swimming at the bottom.

Certain behavioural notes were made upon these specimens and I quote:-

> "Whilst manoeuvering these jellyfish into position for capture, I gained the strong impression that they were aware of my presence whenever I stood in a line 15 to 45 degrees away from their line of movement and that the jellies turned away on detecting this presence.... one medium Chironex was tested at length for an evasion response. This response was so marked that it was possible to shepherd the jellyfish a considerable distance towards shore. A position immediately in front of the jellyfish did not appear to be perceived, nor one immediately behind, but intermediate positions resulted in a decisive turning movement of evasion."

> "On two occasions, in an attempt to bring the jellies up from the bottom, the head of the medusa was handled, directing it into an upward direction. On both occasions the jellyfish immediately became quiescent, and fell to the bottom where it rolled about passively ensheathed in its own tentacles for a period up to 2 min(ute)s. This response was quite definite, and was later confirmed with other jellies..... These jellyfish were also swimming at the bottom, and efforts to direct them to the surface were rarely successful. The "playing dead" response was elicited on several occasions...."

On the return trip from the early morning collection, Barnes received a sting from a medium sized Chironex. A summary follows, as rarely is such a subjective phenomenon described by a trained observer. The pain was immediate and severe, but upon the liberal application of methylated spirits (within a minute) considerable relief was obtained and the tentacles were readily removed. The pain lasted about 15 minutes, and no local lesions were evident.

Later in the day, hampered by water depth, wind and wave action, he received an extensive sting while capturing an extremely large specimen. About 3 feet (90cm.) of tentacle became firmly attached to his left leg from mid-thigh to ankle. The pain was alarmingly severe. About 1 minute elapsed before it was possible to apply methylated spirits and in the meantime no effort was made to dislodge the tentacle. Upon application of methylated spirits, the tentacle shrivelled and was easily removed. The methylated spirits was obviously effective in preventing further stinging, but in no way relieved the pain which persisted at an excruciating level for over 15 minutes. Although feeling slightly weak and very tired, he continued collecting and in doing so, rewet the sting which caused a noticeable increase in the level of pain (he compared it to full strength formalin applied to an open wound !). Subjectively, he also felt his heart to be pounding heavily with a slow pulse, but on checking found the rate to be 110 per minute. Severe discomfort from this sting persisted more than 2 hours, worsened each time it was wetted with seawater, slightly relieved by further applications of methylated spirits each occasion. Despite the fact that all unfired tentacles had obviously been well neutralised, waves of increased pain occurred throughout the first 90 minutes.

Local injury consisted only of linear red marks around the ankle which did not form weals or vesicate or ulcerate, and local swelling subsided within 4 hours. He compared his sting to another milder sting which occurred at Yarrabah on the same day. There the victim was rubbed with sand, then hot onion 5 minutes later (which gave considerable relief) and after at least 10 minutes, methylated spirits. Weals formed, deep necrosis in the areas of contact and oedema to just below knee level occurred, even though the injuries were no longer painful. Despite the fact that the original injury was less severe, the subsequent problems were greater. This being ascribed to the sand treatment and delay in application of a suitable fixing agent.

TAM O'SHANTER AREA

Information was given (Walker) about local water movements and likely sites for Chironex. Walker had placed traps in bays north and south of Tam O'Shanter Point, and related the success of these to the prevailing winds. In northerly weather the main water stream enters the bay to the north of Tam O'Shanter Point, bypasses the beach to the south of Tam O'Shanter, and runs to a point 1/2 mile (0.8 km.) south of Hull Heads. The site of the trap set in the first sandy bay north of Tam O'Shanter was generally considered to be more favourable than the bay to the south of the point. However, given light south-easterly weather cubomedusae would then be likely to enter the more southerly trap.

HULL HEADS AND GOOGARRA* BEACH

January 15th: The two beaches were continuous and similar in character, fully open to the south-east and shelving fairly rapidly to cause steep breakers inshore. The winds were from the south-east at 15knots and the water close inshore was extremely dirty and littered with flotsam. The conditions at that time would have made netting very difficult, and there was no information gathered from that source.

Hull Heads:
October 1985, low tide, note exposed, extensive sand flats at the time of this photograph.

* The National Mapping Programme names this beach Googarra, Barnes refers to it in his notes as "Coogarra".

Walker's information about local water movements indicated that in northerly weather the main currents run from Tam O'Shanter Point to a section of the Hull Heads Beach about 1/2 mile (0.8km.) south of the river and under these conditions they have been seen in the mouth of Hull River. At the time of the last influx, Barramundi had been plentiful, with prawns only in moderate numbers. Most people questioned suggested that February was the optimum time for Chironex in the area.

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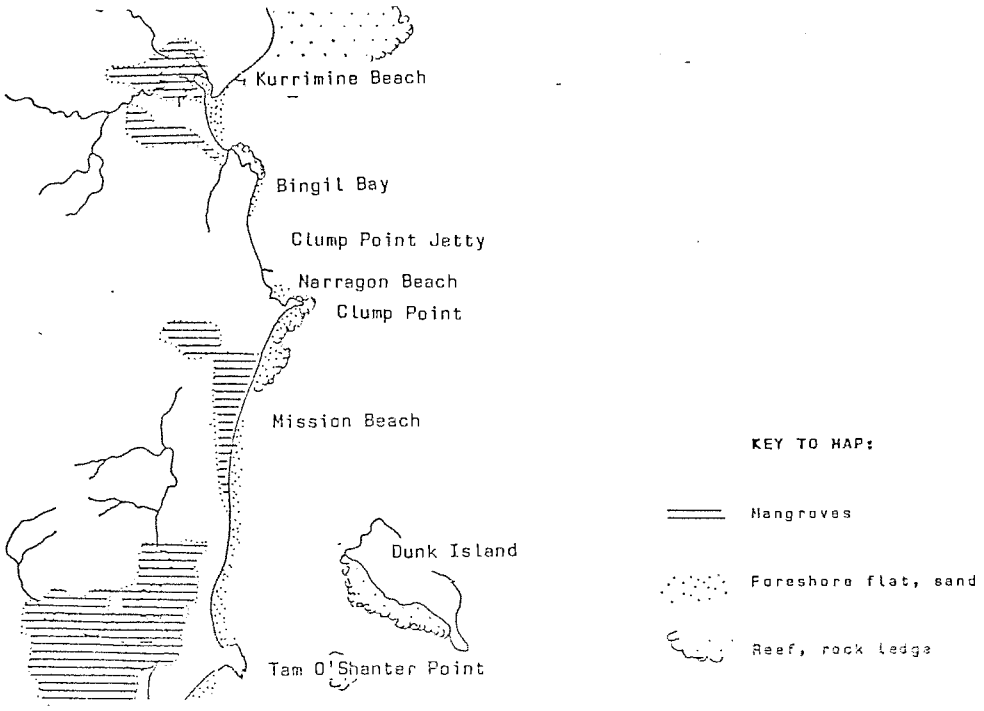
Collections were made on a "making" tide or at high tide. Stingers were never around much at times of low tide. (pers.comm. J.R.).



(The photographs in this section were taken in October 1985. They were taken at low tide, and many show extensive sand flats. The days were clear and bright, with only the slightest wave action. These are, with the exception of the state of the tide, ideal stinger conditions. They do not reflect the beach angles and conditions of January 1966, but are included to give a feeling for the beaches involved.....B.E.K.)

ASSOCIATIONS OF DR. BARNES

The following is included as an indication only of the range of Jack Barnes' interests. It is taken from a very old Curriculum Vitae (1968) and does not mention his M.B.E. and his later interests:_

Quarantine Officer, Government Medical Officer and Medical Officer of Health for Thursday Is.,Torres Strait, and Cape York Peninsula Areas 1947 to 1953. Medical Superintendent Thursday Island Hospital 1947 to 1953: Medical Superintendent Waiben Hospital 1950 to 1953: Private Practice (G.P.) Cairns 1953 onwards.

Senior Research Officer NHMRC;
Research Consultant Qld. Dept.Harbours and Marine
AMA Rep. Cairns Hosp. Board (2 terms)
8 terms as either Clinical Recorder, Liaison Officer, Secretary or President of the AMA Cairns Branch.
Cairns Delegate N.Q.Medical Conference Coordinating Committee (4 terms)
Cairns Delegate AMA Convocation (twice)
Vice President N.Q. Medical Conference
Medical Advisor to N.Q.S.L.S.A., Cairns and Ellis Beach Clubs
President Far North Queensland Underwater Association
Leader, Underwater Research Group
Medical Member, Coordinating Committee on Alcoholism, Cairns Regional Sub-Committee.

AFFILIATIONS:

Member, Australian Medical Association
Member, Australian College of General Practitioners
Member, International Society on Toxinology
Member, Australian Society of Authors
Member, Queensland Royal Society
Member, Australian and New Zealand Association for the Advancement of Science
Member, Etty Bay Surf Lifesaving Club
Member, Ellis Beach Surf Lifesaving club
Honorary Life Member, Cairns Surf Lifesaving Club
Member, Great Barrier Reef Committee
Member,Australian Commando Association
Member, North Queensland Naturalists Club etc.

As Barnes noted in his C.V.(1968)"...as Flecker's records had disappeared with his death, I was extremely fortunate to make contact with ...Southcott....through more than 800 pages of closely typed correspondence with him, I learned the rudiments of medusan zoology, the niceties of specimen preservation, a system of meticulous data recording and retrieval and also gained access to the opinions and publications of widely scattered workers on allied subjects . Southcott was a source of assistance and encouragement and insisted on a factual, honest and rational approach."

"Emphasis was placed on securing community participation, particularly that of fishermen, trap operators, beach residents, ambulance and medical personnel, news services, naturalists, skin divers and, of course, the Lifesavers. Instructing and keeping contact with these unpaid assistants involved a vast amount of time, talk and correspondence, but the community contribution to success was enormous and sometimes indispensable."

"With such a network, few stings or stinger invasions escaped investigation. Each injury was documented, recording details of appearance, effect, treatment, location, past and current weather, tide and details re water depth etc. Personal examination of victims was made whenever practicable and representative lesions photographed as teaching material. Integrated information on >400 injuries was studied."

"Identification locally of collected marine specimens was not always possible and Prof. P.L.Kramp of Copenhagen provided invaluable assistance with the identification of problem material."

FUNDING

External funding came from a variety of sources (16 and C.V. and Newspaper clippings). Much of the research was undertaken as a personal commitment, and at personal cost. Those sources which I have been able to identify are:- the Cairns Junior Chamber of Commerce, Lions Clubs and Jaycees) Department of Harbours and Marine, Queensland, and the National Health and Medical Research Council, Australia. Donations were made by members of the public, often "from victims who felt obligated for the customary free treatment".This list is neither exclusive nor does it reflect the monetary value of the contribution, it does reflect the concern of a community..B.K

APPENDIX A - TAPE TRANSCRIPTS

(1) Address to The Royal Society of Queensland - Townsville, 18/7/1966

(2) Letter to Maurie Mulcahy - concerning slides and comments to be used in a talk in Townsville on marine stingers 20/1/1969

(3) Recording made by Jack Romano on the night of a fatality at North Mission Beach - comments by Barnes. Time 1910h. 24/11/1971

(4) Tape for John Power, ABC TV Features for a feature on Chironex and an episode of "See It My Way".

(5) "The Mystery of the Sea Wasp" - ABC TV Feature 18/12/1972
Production - John Power; Photography - David Telfer;
Background inspiration - John Stackhouse.

(6) Queensland Health Education Council - Leaflet concerned with marine stings - recorded by Jack Barnes 22/1/1972.

(7) Talk by Jack Barnes at the State Conference of the Queensland Ambulance Transport Brigade - 12/12/1973.

APPENDIX B - PUBLICATIONS

(8)"Observations on Jellyfish Stingings in North Queensland" , Medical Journal of Australia (1960), 2, p993

(9)Contributions in "Some Medusae from Northern Australia", P. L. Kramp, Transactions of the Royal Society of South Australia (1961),85, p.197

(10)Siphonophores, Part 1 of a Series ", The North Queensland Naturalist, (1962),30, p131

(11)"A Dangerous Starfish - Acanthaster planci (Linne), with R. Endean, Medical Journal of Australia, (1964) 1 p592

(12)"Cause and effect in Irukandji Stingings", Medical Journal of Australia, (1964) 1 p897.

(13)"Siphonophores, Part 2 of a Series", The North Queensland Naturalist, (1964) 32, p135

(14)"Major Stinging Jellyfish - Australian Tropical Coast", printed in conjunction with the North Queensland Branch of the Surf Life Saving Association of Australia, (1964)

(15)"A Diagnostic Procedure for Marine Stings", Royal Australian Navy Medical Newsletter, (1965)3 p1

(16)"Chironex fleckeri and Chiropsalmus quadrigatus - Morphological Distinctions ", The North Queensland Naturalist, (1965)32, p137.

(17)Contributions in "Injuries to Man from Marine Invertebrates in the Australian Region", J. B. Cleland and R. V. Southcott, National Health and Medical Research Council Special Report Series No.12 , Canberra (1965).

(18)Contributions in "Poisonous and Venomous Marine Animals, 1, B. W. Halstead, United States Government Printing Office, Washington D.C. (1966).

PUBLICATIONS - (Cont)

(19)"The Crown of Thorns Starfish as a Destroyer of Coral", Australian Natural History, December (1966).

(20)"Studies on Three Venomous Cubomedusae", read at Symposium No.16 of the Zoological Society of London, published in "The Cnidaria and their Evolution", Academic Press, (1966).

(21)"Marine Stingers. Recognition and First Aid Treatment", Health Education Publication No.114, in conjunction with the Queensland Health Education Council, (1967)

(22)"Extraction of Cnidarian Venom from Living Tentacle", read at the First International Symposium on Animal Toxins, April 1966, and printed in "Animal Toxins", Pergamon Press, (1967)

(23)"Major Stinging Jellyfish - Tropical Australian Coast " revised version (1967).

(24)"Chironex fleckeri Roche Image 31, p24

(25)"Stingings by Jellyfish" Proceedings 1st International Convention on Life Saving Techniques - Supplement to Bulletin of the Post Graduate Committee in Medicine, University of Sydney 18 No12 (1963) p103.

(26)Proceedings, "Seminar on Marine Stingers" The Surf Life Saving Association of Australia, held at James Cook University of North Queensland, 31st July - 1st August 1971.

APPENDIX A
Tape Transcripts

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This section is comprised of tape recordings made by Jack Barnes for others, and recordings made by others for Jack Barnes.

Those tapes which were made at conferences and public lectures are generally very variable with respect to the clarity of the speech. Audience and external noise was frequently a problem. The tapes have been transcribed with a great amount of care, but certain gaps in the text were unavoidable These gaps are indicated by four dots .... (which is not intended as an indication of the amount of missing material, but that there is a section of text at that point, which could not be deciphered.)

As these are verbatim, or as near to verbatim as possible, there are some sections for which one has to guess which slide is probably being shown, or a situation or action to which Jack Barnes is referring. These are generally straightforward.

Jack Barnes' papers are clear, precise examples of the writer's art. His talks are conversational and less structured. They are not as easy to follow because they contain many comments and asides, but they are rich sources of hitherto unrecorded details, informed guesses and frequently, humour.

Address to The Royal Society of Queensland
Townsville, 18/7/1966

Ladies and gentlemen, as you have heard the subject is "Extraction of Cnidarian Venom from a living tentacle".

I would first like to comment on the circumstances which prompted this work. Each summer, the waters of the tropical Australasian region are invaded by a multitude of jellyfish. Many are harmless but some are of quite exceptionally lethal potential. Where and how these jellyfish spawn is largely unknown and this is especially true for the cubomedusae to which order the most dangerous species belong.

Perhaps we could now look at some cubomedusae troublesome in Australian tropical waters, and mention their typical effects.

Slide: This is the Irukandji carybdeid, actual size about the end of my thumb. In the water this graceful little jelly is invisible except under favourable lighting and moves with surprising mobility. It is an extremely elusive animal and only a few specimens have been captured to date, despite many years of patient effort. In fact, its existence and causative role in irukandji illness was discovered less than five years ago and the jelly has not yet acquired a scientific name.

These beads on the tentacles and the warts upon the body are aggregations of stinging capsules or nematocysts, quite small and in this species, not very numerous but containing a remarkably potent fluid. Even in transient contact some of this fluid is transferred to the tissue of the victim. The immediate and local consequences are slight.

Slide: Just a slight nettling sensation and the production of tiny papular weals in a reddened area perhaps 5 x 8 cm. in extent.

Later the weals subside and the area sweats profusely. The classical and distinctive effects are systemic and come later.

Slide: Usually about twenty minutes after contact. These are the symptoms: severe abdominal pains, thoracic constriction, limb pain, back ache, vomiting and/or cough, neuralgias, head ache, dry mouth, ... parasthesiae.
The illness is severe and without treatment may persist for many hours but is never fatal.

Personally, I find this delay of toxicity most intriguing. Obviously venom does not have such slow action on elective prey, otherwise the carybdeid would never get a meal, being on the run as he is.

Perhaps Irukandji venom in its raw state has little effect on man and the illness suffered by the latter is the result of breakdown products or an accidental triggering effect on one of our own endogenous systems. In either event, further study of the mechanism could be rewarding if we could obtain Irukandji in numbers sufficient to allow extraction of venom.

Slide: This is one of the larger cubomedusae, multi-tentaculate, but otherwise similar in general structure to the carybdeids. The body is not round but rather squarish, hence the popular name "Box jelly". This term is, I think, descriptive and infinitely preferable to that dramatic abomination so loved by the newspapers, "Sea Wasp".

This is the front end of the jellyfish, here the mouth, oesophagus and stomach. Here in a recessed niche is a sensory organ of which there are four, each with position detectors, numerous light sensitive spots and an eye with a well developed biconvex lens.

This skirt is the velarium and the device for controlling the direction and force of the water jet which cubomedusae use for locomotion.

During relaxation of .... body, the velarium opens and then partially closes on contraction, deviating to one or either side for steerage. This is an efficient system giving the jelly uncanny speed and manoeuverability but fortunately, cubomedusae cannot reverse .... when one is collecting them by hand.

The name of this jelly is in some doubt. I call it Chiropsalmus quadrigatus and keep hoping the rest of the zoological world will follow. Actually, Chiropsalmus quadrigatus was first described by Haeckel in 1887 from a beat up immature specimen whose definitive structures were largely absent. The species was redescribed in 1910 by Mayer. On this occasion from a superfluity of material. In saying a superfluity, I am tactfully suggesting that Mayer probably used two specimens instead of one as the basis for his description. .... cardinal sin of course, but one often committed with impunity.

Unfortunately, if my suspicions are correct, he incorporated two species: Chiropsalmus quadrigatus and Chironex fleckeri in the one description thereby confusing the literature for another fifty years.

As narrowly defined by Barnes, the distinctive characteristics of Chiropsalmus quadrigatus are: tentacles multiple and with the exception of the first, arising alternately from both sides of the claw.

SLide: Pedalial canal sharply angulated and bearing no upward projection at this point. Perradial eminence ... form and with no secondary outgrowths. The gonad arising from the full length of the inter-radial septum and forming paired leaf-like lamellae extending towards the perradius here. Notice also the fairly fine tentacles of Chiropsalmus quadrigatus, limited to a maximum of nine on each pedalium at sexual maturity.

Slide: This is the jellyfish described by Southcott under the name Chironex fleckeri a new species as from 1956. I have recently examined specimens of Chironex fleckeri in the United States National Museum at Washington taken from South Pacific waters in 1908 and 1909 and all labelled Chiropsalmus quadrigatus by such eminent authorities such as A.G. Mayer and S.F. Wright

It is therefore not surprising that Southcott's new speciation was viewed with some reserve overseas but I am happy to say that I can lend very strong support to my Australian colleague, despite some errors in his description also. There is not the slightest doubt that Chiropsalmus quadrigatus and Chironex fleckeri are two different species, whatever names the systematist may eventually lock in after so much confusion.

This, by my redescription, is Chironex fleckeri. I hope the name will stick. The diagnostic characteristics are: tentacles again arising alternately from both sides of the claw, pedalial canal peaked into a corniculum at its angulation, per-radial eminences giving rise to secondary digitations. .... gonad origin restricted to the upper half and usually the upper third of the inter-radial septum. Gonad expansion (is) intimately associated with the proliferations of the per-radial eminences.

Slide: This Chironex seen from a different angle, peaking through the velarium, up its skirts, one might say. The tentacles have been amputated.

Here are the .... with the per-radial nucleus now forming little whorls about the original growth axis.

The trabeculae are covered by a sheet of gonad.

Slide: Chironex getting to a larger size with gonads near sexual maturity. That jelly was somewhat larger than my head. They get quite a lot larger in favourable seasons.

SLide: A poor picture, but showing Chironex at an interesting stage. This size is certainly lethal, at least to persons of small body weight. I would like you to notice the tentacles, robust, strap-like and closely beset with rings of nematocysts - millions of them.

So much then for the morphological distinctions; an essential preliminary to selecting the correct medusae for milking. Medically, the differences between Chiropsalmus and Chironex are, in my opinion, just as clearly defined. Chiropsalmus even near maximum size is less dangerous than a part grown Chironex such as we now see.

Slide: This is quite a small injury from Chironex on the seventeenth day, still far from healing, which will leave a permanent cicatricial scar. The jelly is of moderate size.

Slide: This photo was taken on the fifth day after the large .... caused by the sting had been .... The necrosis extends deeply down to the fatty layer and the oedema is only slightly less three years later. Again, this was a relatively small Chironex injury.

Slide: An extensive sting causing death within ten minutes.

Slide: A smaller sting but nevertheless fatal because of its intensity and the lesser tolerance of a small child. This little lad lived for more than twenty minutes and was actually sitting in the Outpatient Department of a well equipped hospital when he collapsed. It so happened that the senior surgeon and specialist anaethetist were passing through the department at that time but resuscitation failed. I participated in this effort and I was acutely conscious of just how little we knew of the nature and the mode of action of this venom.

This then is the background to the present work, the isolation of pure venom to study.

If I have taken a long time in these preliminaries, I hope you have not been bored. I believe that a clear understanding of the problem and an understanding also of the animal with which we are dealing, is a prerequisite to any progress in the subject.

The isolation of toxin from tentacles of coelenterates is not new. This was done by ... and ... in 1902, ... and by Podolsky in 1980; ... and ... by ... in 1922; and by Marr, and others since that time.

The animals used were anemones and Physalia and the extracts were obtained either by grinding or by simple steeping in various organic solvents.

As a result of this work it is clear that the actual jelly substance and various tentacular cells contain toxins in their own right, apart from anything which may be present in the stinging capsules. Some of these toxins have been given names, e.g. congestin, hypnotoxin etc.

I would emphasize, however, that these toxins come from the whole tentacle and that they probably contain very little material actually contributed by nematocysts.

To avoid confusion between tissue toxins and actual venoms Glaser and Sparrow in 1909 evolved a mechanical separation technique. Further developed by Phillips and Dodge all within the last ten years.

Dr Bob Endean is doing much the same thing in Brisbane at the present time.

Basically, this approach consists of taking a large accumulation of tentacle, and stewing it in its own juice at reduced temperature until partial autolysis or maceration occurs; in straining or sieving, repeatedly washing and centrifuging until only the nematocysts remain. The mush so obtained is then attacked chemically, osmotically, or by various form of grinding to break open the capsules.

The capsule remnants are then centrifuged off and the supernatant is retained. The product is extremely toxic and many workers do, in fact, regard it as venom, but to this misuse of the term I very strongly object. As this is to me an important point, I intend to elaborate. Toxin is, to my mind, any ... of organic origin which exerts an adverse biological effect whether the substance be in its original form or in any other the ingenuity of man or the processes of nature can devise.

Venom is quite another matter. Venom is that material elaborated by an animal specifically for offence or defense and actively transferred to the prey or victim. Furthermore, any extrinsic modification of this material immediately degrades it from venom back to toxin.

Now if we accept this rather strict definition, very few of the materials currently being tested by venomologists are actually venom. Certainly the product of tentacle maceration and separation techniques is not, for the following reasons:

Cnidarians have no single venom repository, their potential being dispersed in a multitude of microscopic organelles which will be referred to as nematocysts. Each of these has its own indirect mechanism. Four or more types of injector capsules are commonly present on the one organism, serving different purposes and presumably containing different toxins.

Functionally mature injector type nematocysts are the only source of venoms transferred into the tissue of victims. Such capsules commonly make up a small proportion of the nematocysts detectable in either offensive or defensive tissues. In defensive situations the majority of the capsules are usually large injector types but many may be functionally immature to the extent that their fluid content is unripe and this can be shown by differential staining reactions. Such capsules would not be discharged under normal circumstances of stinging.

In offensive areas, that is, those concerned with food capture, other nematocysts of adhesive or entangling function may predominate, discharging in conjunction with the injectors thus contributing nothing to the true venom of the species. Immature forms of these ancillary nematocysts may also be present. Apart from these complications, mesogloea and other elements of nematocyst bearing tissue have toxic properties unrelated to the venom, as was previously mentioned and the capsular walls ensure isolation of their contents only while cellular or mucoid investments remain intact. In maceration and separation techniques I therefore saw that genuine venom may be vitiated by loss of active constituents, nutrient modifying substances from non-capsule sources, distortion of the venom ratios from the different capsules, inclusion of contents of nematocysts not normally functioning as injectors and inclusion of atypical contents of immature capsules.

The main object of the new technique is to minimise these undesirable influences. Strictly speaking, there is nothing new in my technique either. All that I have done is to utilize the natural stinging mechanism of the jellyfish, nominating the target and recovering the venom injected. .... target or object to be stung, I use a membrane. In theory, the jellyfish is supposed to sting this membrane, penetrating it by virtue of the injector threads and depositing pure venom on the opposite surface, separated from all unwanted tentacular products. In practice however, there were some unexpected difficulties.

I had originally anticipated that .... salt preservation does not destroy the value of amnion but sterilisation or toughening by such additives as formalin or alcohol cannot be employed as the medusae no longer except the denatured tissue as a food object, and either fail to sting or, if forced to do so by electrical stimulation, fail to penetrate.

Slide: This is the working set-up using amnion. The collecting vessel is a domestic coffee jar 12cm. across the mouth, grooved at the top so that the membrane and small tinfoil electrode can be held in place by rubber bands. The side arm consists of a tapered adaptor tubing and rubber clamp - all salvaged from disposable transfusion gear and these communicate with the collecting chamber through a ¼ inch hole bored in a non-critical position. The white box is a muscle stimulator in common use by Physiotherapists.

Amnion is mounted, epithelial side outward and slight concavities produced by aspiration through the side tube. To this concavity tentacles are applied in convenient lengths and if necessary, stimulated by short passes of square wave direct current. Polarity is not important.

Chironex tentacle adheres firmly and under favourable conditions, stings viciously. Adhesor and entangling discharges are confined to the outer surface but all three types of penetrant capsules send their threads through in normal fashion everting fully at the opposite surface and there discharging venom. I can best show you this in a series of pictures.

Slide: This is Chironex tentacle in longitudinal section, central canal with digestive and absorptive galnds, mesogloea and muscle, tentacle rings alternately large and small and bearing six types of nematocysts which I don't think we will be able to see in this picture.

Slide: This shows five of the six types of nematocysts normally present on Chironex tentacle. Large ovoid and cigar shaped capsules are penetrants and there is, in addition, a smaller cigar-shaped form which we do not see here.

Slide: This is sting on amnion under low power, note the spacing due to alternate rings of nematocysts. This is the same thing again under higher optical power. The focus is on capsules at the outer surface by you can see penetrating threads end on, as they pass into the membrane.

Slide: Here are the threads on their way through.

Slide: Now they are at the collecting surface everting fully and hanging free.

Slide: This is the same process but from a different angle. It is a cut section of amnion, rather thick, showing amnion epithelial surface, adhesive, injector capsule, injector thread, free and open end on the collecting side of the membrane.

All these photographs refer to Chironex but I should mention that other jellyfish such as Chiropsalmus and Cyanea have been tested on membrane and behave in a similar fashion.

In the early stages of this work, the only means for assessment of results lay in the microscopy of the stung membrane. For example, on the membrane you have just seen, the penetration made in contact areas was fifteen hundred threads per square millimetre. Because of spacing between rings and between tentacles, the average rate over the whole membrane was much less, about thirty thousand threads per square centimetre.

Thus, about 1.5 million capsules discharged their contents through a particular membrane. .... this approximation a little further and taking into account the average volume of the capsules, the yield should have been about .006 (i.e. six thousandths) of a millilitre of venom. Actually, it is possible to obtain about five times this yield from a simgle membrane but only by the use of disproportionately large amounts of tentacle. The reason for the drop in efficiency is that some areas of the membrane rapidly acquire an occlusive coating of capsules and a further tentacle applied over these areas fails to make intimate contact with the membrane. Thus the output of many capsules is wasted.

The capture and proper handling of Chironex large enough to be suitable for milking is a difficult and dangerous business, and there comes a time when it seems better to change the membrane rather than waste the rather precious living tentacles.

The final phase of the amnion milking procedure is to recover as much as we can of the small volume of venom which we have accumulated on the inner surface of the membrane. This is done by washing the collecting surface with 10 mls. water introduced through the side arm. Recently we have been testing these washings against prawns and mice in a rather crude form of bioassay. It is interesting and reassuring to find that the effect is similar to those observable after natural stinging.

To process one large Chironex on membrane takes one hour, i.e. one hour after everything has been set up and the jellyfish captured. Typically, the dilute washings of a single milking contain toxin sufficient to kill fifty prawns of average weight of 5 grams, in less that five minutes using subcuticular injection. Intravenously, the same milking would kill twice this weight, i.e. 500 grams of mice in even shorter time, about two minutes. The animal experiments have been unsophisticated and directed mainly at assessment of .... evidence individual hypersensitivity, I believe the same is true for man. Secondly, detoxication in living tissue is rapid and some lethal doses can be repeated at thirty minute intervals. .... show the same critical tolerance which I have long postulated for humans. By this I mean that up to a certain dosage level Chironex venom is well tolerated producing little, if any, systemic effect. A slightly larger dosage may have very drastic consequence e.g. a mouse may be equally unaffected by injections of 5, 10, 15 or 20 units of venom whereas 25 units will kill him within five minutes and 30 units may reduce his survival time to a few seconds. I don't want to labour this point unduly, but obviously it has considerable practical significance.

Letter to Maurie Mulcahy
slides and comments for a talk on marine stingers in Townsville 20/1/1969

20th January, 1969 for Mr Maurie Mulcahy concerning slides and comment to be used in a talk in Townsville on marine stingers.

Maurie, you can use whatever approach you like, but in getting these slides out, I had in mind that you might like to deal very briefly with some of the minor stings and stingers first, and then get onto the main subject of Chironex. This is worthwhile because many people don't seem to recognise that there are a number of different stingers and if they are going to think that all the stings they see are due to Chironex it will either cause unnecessary alarm, or on the other hand give the impression that some people receive very minor injuries from this animal and therefore may have some sort of an immunity. This idea is to be discouraged. All slides are marked with a dot which should be at the top right hand corner when the observer is looking at the screen.

Slide 1, numbered 125, is a crude line drawing of Physalia. The points here are that it is a fairly small animal in northern waters, that it has a gas filled float, is usually blue in colour and has only one long stinging tentacle. This animal therefore cannot be involved in an injury consisting of multiple lash like injuries.

Slide 2, number 56, shows a typical injury from Physalia where one long tentacle has been in contact with the boy's back and has been rolled a bit from one side to another in his attempt to remove it.

Physalia is commoner in the summer months but can occur at any time of the year and usually requires strong winds to blow it inshore. The stings are quite painful, but the discomfort is usually of fairly short duration. The injuries don't blister and the treatment consists of simply, methylated spirits, followed by some soothing cream, preferably with a corticosteroid content.

Slide 3, numbered 558, is of the big Snottie jellyfish Cyanea which usually comes into northern waters rather late in summer, about February, March or

April. These jellies carry a lot of tentacle and therefore usually inflict multiple injuries which are notable for the bright red flare along the lines of application of tentacle (show slide 25). Pain is less than that from all other jellyfish in this series and usually lasts for not more than twenty minutes. It is dramatically relieved by application of any sort of plant juice but the best treatment, as for all types of jellyfish stings, is application to metho followed by a suitable cream. The red marks are slow to fade but do not blister or scar.

Actually, the main significance of Cyanea injuries is that they are likely to be confused with Chironex injuries, causing unnecessary alarm. On the beach they can be distinguished from Chironex injuries by the fact that there are no transverse markings across the line of sting, that the victim is far more comfortable than you would expect from the extent of the injury and also usually, Cyanea jellyfish can be seen in the water. Scientifically, it is easy to prove the point by taking a scraping from the skin which will yield capsules distinctive in size and shape and quite different from those of Chironex.

The next slide 653, shows a more troublesome stinger, Chiropsalmus quadrigatus. This is one of the larger box jellyfish and in appearance, very similar indeed to that of Chironex.

The points of distinction are, firstly, Chiropsalmus is smaller, has finer and less numerous tentacles, tends to occur in swarms and is anatomically different in some important particulars. Some of these differences are not apparent in small sizes, but at any size the shape of the canal inside the pedalium, that is the arm which carries the tentacles, is distinctive. If you look at the uppermost pedalia in this picture you will see inside the pedalium and arising from the lower part of the body, a whitish tube which travels a short distance outwards and then turns quite sharply at almost a right angle to go downwards towards the tentacles. This is the pedalial canal and in Chiropsalmus it has the general shape of a human knee. You will see later in Chironex the shape is quite different.

A booklet written by me and published by the North Queensland Naturalist

goes into a lot more detail on distinguishing between Chironex and Chiropsalmus and there are some useful illustrations in this. Copies are still available.

In the area Cooktown to Tully, Chiropsalmus are very common jellyfish but details of its distribution in more southern waters are not yet known.

Because of its similarity to Chironex it is often confused with the latter and it is for this reason that specimens of box jellyfish captured, Townsville or southward, are required for expert identification. The sting from Chiropsalmus is also similar to that from Chironex but of much lesser severity.

Slide 73 shows a very extensive Chiropsalmus sting about as large as one expects to see, photographed on the seventh day when healing is almost complete without any specific treatment. For such a large sting there is little swelling, no ulceration, no permanent scarring and the patient returned to work the day after injury. Notice the transverse bars on the lines of stinging similar to that in Chironex injury.

Chiropsalmus is, in fact, closely related to Chironex and the capsules deposited on the stung skin are also very similar. They can, however, be distinguished by expert microscopic examination.

From the practical viewpoint, the major reason for distinguishing between Chiropsalmus and Chironex is that Chiropsalmus transfers a much smaller quantity of venom to the victim and is therefore not capable of causing death except possibly after a very massive sting to a very small child. We have no evidence of a fatal sting caused by Chiropsalmus. The injury is, however, very painful with symptoms persisting for up to three days and for this reason patients with large stings should be referred for medical attention and the doctor may consider giving carticosteroids either by mouth or intravenously to modify the effect.

In order of severity we now pass on to what used to be called the Irukandji sting caused by a small four tentacled carybdeid medusa fairly recently discovered and now named Carukia barnesi.

Slide 241 shows a fully grown specimen of Carukia about the size of the end joint of your thumb. In life the tentacles are very long and the body of the jellyfish also carries stinging capsules so that it is sufficient for this little jellyfish merely to brush against a bather to inflict its sting. The sting itself is neither obvious nor very painful although it often looks more impressive some ten minutes later as in Slide 381. The main effects of Irukandji stinging are delayed for about twenty minutes after contact, when the victim becomes acutely ill and very definitely requires the services of a doctor. The main symptoms are itemised in Slide 244 and all of these are relievable by a suitable dose of pethidine given intravenously. Irukandji or Carukia sting is never fatal.

Speaking of fatality brings us to the subject of Chironex, the only jellyfish known to exist in Australian waters capable of causing death by virtue of the direct poisonous effect of its venom, as is the case with snakes. It is well to stress this point that death following a Chironex sting is due to poisoning, not to shock or sensitisation or anaphylaxis or simply the inability to tolerate such intense pain. Chironex victims die simply because the injected material produces profound changes in the cells of vital organs.

Slide 475 shows Chironex swimming near the surface in calm water, the view being from the front and slightly to one side. This is a medium size specimen about equal in size to a half gallon can of ice cream and much of its tentacles have been lost. They should be at least four times as long as the body of the jellyfish itself. At this size, Chironex is probably not lethal to an adult but could certainly kill a child.

The next Slide 476 shows the same jelly from a different angle, showing the circular opening through which water is forced as a jet action in swimming and the characteristic and distinctive shape of the canal in the upper pedalium. As in Chiropsalmus, the canal arises from the body of the jellyfish, goes out into the pedalium and then turns downward towards the tentacles. However, at the point where it suddenly changes direction there is an upward prolongation or horn, or rose thorn shaped projection, which is never present in the pedalial canal of Chiropsalmus. In case anyone is having difficulty in seeing this important distinguishing feature, Slide no.

120 of a preserved specimen shows this structure rather more clearly. In larger specimens of Chironex and Chiropsalmus there is also a marked (difference) in the arrangement of the gonad tissues, Slide 609 shows a view up the skirts of Chironex where the gonads are seen as a multitude of finger-like processes inside the cavity of the bell.

In Chiropsalmus (Slide 625) there is a totally different arrangement of eight smooth rounded bulges. This is an important distinguishing point and with a little experience can be spotted through the side wall of the jellyfish.

Injuries from Chironex are always severe unless properly treated. The injury seen in Slide 18 occurred many years ago before the universal adoption of methylated spirits as a first aid treatment. The jellyfish was large and the tentacles remained in contact for a considerable period. Massive blisters formed and when these burst, the skin underneath disappeared leaving raw tissue. Healing was slow, with scarring, and swelling persisted in the foot for some years. Slide 401 was also taken before the days of metho or tourniquets.

.... might have saved a life. Instead the skin was rubbed with sand and the child died so quickly that skin reaction could not occur.

Nowadays, with improved treatment, the outlook for Chironex victims is vastly improved. The next four slides illustrate this very clearly. The first two, 699 and 701, show the forearm of a young lad with a well limited though intense sting. The stings were rubbed with sand and later washed with fresh water, greatly aggravating the envenomation. He died twenty minutes later although he need not have done so had either tourniquets or methylated spirits been used.

Slide 782 shows one of the worst Chironex stings of which we have record. Methylated spirits was applied with little delay and when the lad collapsed on the beach, apparently dead, the effective mouth-to-mouth resuscitation and external cardiac massage restored consciousness quite quickly. Failure to apply tourniquets was probably the cause of two further episodes of profound collapse but from these he was also resuscitated. You see him there in hospital, sleeping peacefully, about four hours after his encounter.

Meantime, oedema fluid had been sucked out of his lungs and hydrocortisone succinate had been given intravenously and also some antihistamines and analgesics and the crisis is now over. The next day, as shown by the next slide, he was well on his way to a complete and uneventful recovery.

To show this was no fluke, here is another picture taken 24 hours after a massive Chironex sting. Application of metho was somewhat delayed but no attempt was made to interfere with the sting before its application. The boy collapsed on the beach with pulse and respiration apparently stopped, and was resuscitated by two girls who had only a rudimentary knowledge of First Aid and no experience of the techniques they employed. As you can see from the abrasion over the ribs, the chest was literally massaged instead of rhythmically compressed, but fortunately, the girl gave him several smart thumps on the chest before she started rubbing.

As has been seen in two other cases, a few thumps on the chest are sometimes all that is required to restart the pumping action of the heart. When the patient showed signs of recovery, tourniquets were applied and he was transported to hospital. There, he was given the standard treatment with intravenous hydrocortisone succinate, also antihistamines and analgesics, and as you can see, he made a remarkable recovery. Two other similar cases were treated last season with equally satisfactory results. It is worth mentioning that we now use corticosteroids in all severe Chironex stings even where life is not threatened because of the very excellent effect on the local injury.

So much then for recognition, diagnosis and treatment. You may possibly feel that so many advances have been made in these fields that prevention is no longer necessary but don't forget that Chironex stings are exceedingly painful, that the fear of stinging reduces the tourist potential of the north, reduces attendances at local beaches, interferes with recruiting for life saving clubs and has many other important ramifications, not the least of which is the tendency of the public to use fresh water swimming holes with the even greater risk of drowning.

Don't forget either that survival after a major sting depends on correct and very efficient handling right from the moment of contact, through the

initial collapse, through transport and hospital, and not all cases are going to do as well as the recent ones I have instanced.

Prevention is still vitally necessary and this means an awareness of when dangerous jellyfish are likely to be present, their detection and removal if possible and adequate information to the bathing public. It is not always possible to be accurate in our predictions and unless jellyfish are actually demonstrated in an area, the public is often very lax in the observance of the warnings.

It is for this reason that specially designed nets have been issued to many of the major life saving clubs to be used in test drags in their own particular areas. From these test nettings it is hoped that each club will gain experience in the conditions under which jellyfish are likely to be present; determine whether some sections of their beach are more dangerous than others; issue appropriate warnings and demonstrate to the public that they are taking an active interest in the prevention of unnecessary injuries. Unfortunately, test netting is not a foolproof procedure, that is to say, if it fails it doesn't necessarily fail safe. It is entirely possible to take multiple drags along a beach at what seems to be the most favourable time and to find no sign of noxious life. Ten minutes later, however, a single, large, potentially lethal Chironex may drift in, completely undetected. There is, at present, no way of guaranteeing against this and all reports based on test netting should bear this factor in mind. However, if the procedure is carried out systematically and energetically and regularly it can make a very useful contribution to public safety and is well worth doing.

From our knowledge of the habits of the jellyfish and of experiments carried out in the Cairns area, the most effective way of testing a beach appears to be as follows: Firstly, dragging should commence at that end of the beach from which the water movement is coming. Secondly, the net should be carried out to waist depth and then drawn out parallel to the beach in a downstream direction. The downstream end of the net is taken ashore first, then the upstream end. At all times, care should be taken to see that the lead line does not leave the bottom, nor should the corks be allowed to submerge through too vigorous pulling. The lead line should be kept slightly in advance of the float line.

A series of drags should be made one after the other, and initially, until the most favourable areas are found, either the whole beach or sections at fairly close intervals should be tested. The test area should certainly extend well to either side of the lifesaver's controlled area.

If the sea is completely calm with only small waves lapping right at the beach, it is not necessary to drag in a depth greater than 3 ft. 6 ins. or 4 ft. as the jellyfish will, under these conditions, be close inshore. On the other hand if waves are breaking in 6 - 12 inches of water, the depth of the drag should be increased accordingly.

Under rough conditions, with large waves breaking in more than 3 feet of water, dragging would extremely difficult and not likely to be productive. The reason for this is that Chironex rarely swims in highly turbulent or broken water. This is not to say that water inside the line of breaking waves is necessarily safe because if the waves have come up quickly, jellyfish may not yet have had time to move outward. Strong winds and high seas do, however, produce safe bathing in shallow water provided the rough conditions have persisted for more than 24 hours.

All jellyfish caught during test netting should be carefully examined. Circular forms are, generally speaking, pretty harmless. Anything where they are slightly squarish or cuboid shape is likely to be dangerous.

Large squarish jellyfish will be either Chironex or Chiropsalmus, or possibly and rarely one of the big ocean-going carybdeids which have only one tentacle on each pedalium.

Small squarish jellyfish with four pedalia and one tentacle on each are also Carybdeids and are of considerable interest. They may be Carukia, previously called Irukandji, another extremely similar jellyfish which has not yet been adequately studied and is currently referred to as pseduo-irukandji because it doesn't cause such severe illness, or one of the other four or more species of carybdeids which are known to occur in Queensland coastal waters.

All carybdeids, i.e. the squarish box jellyfish with four pedalia and one

tentacle on each, are of scientific value and should be preserved in formalin solution - one part of formalin to ten parts of sea water.

Samples are also required, in formalin, of the multi-tentacled box jellyfish - probably either Chironex or Chiropsalmus, although at least one other species is thought to exist on the Queensland coast.

The size of larger specimens should be recorded and the easiest way to measure is to find how far the fingers must be opened to get a grip over the apex or top end of the jellyfish, or to put it another way, the minimum width of the squarish top. For identification purposes, the best specimens are those in the middle size range which can be grasped with the fingers held open 1 - 2½ inches. If larger specimens are sampled it is not necessary to forward the whole jellyfish. One quarter of the body cut from the apex to the skirt and including one pedalium is sufficient.

The data required with each batch of specimens consists simply of; place of capture, date of capture, time of day, and state of tide. This information is best written in black lead pencil on a strong piece of paper placed in with the specimen. For transport, preserved specimens can be removed from the liquid together with the paper carrying the data and placed in a plastic bag. A number of plastic bags can then be placed together in a more robust container to prevent crushing and leakage during transport.

Any assistance which lifesaving clubs are prepared to give in this investigation would be deeply appreciated and could add materially to our existing knowledge in helping to solve the overall problem.

Recording by Jack Romano, North Mission Beach — 24/11/1971 comments by Barnes

This is a transcript of a recording made by Jack Romano on the night of the fatality at North Mission Beach caused by Chironex fleckeri.

Time 7:10 Sunday 24th November 1971

(Jack Romano about to interview, or get statements from, four eyewitnesses who witnessed the stinging and death of a young lady at Mission Beach, this afternoon at approximately 4pm or minutes after.)

Now, John, in your own words .... Oh, Kim * I'm sorry. In your own words, could you tell us exactly what happened this afternoon?

We were standing underneath the tree at the front of the motel watching .... knock down coconuts when we heard, or noticed prior to this, the husband or the fiance of this woman going along the beach after having had a dip for about 10 minutes and he'd obviously called his wife in, because the next time we looked across, both were in the water.

We were not paying any attention to the couple until we heard screams which we thought "well, they are playing" and then realised when we glanced up that this man was dragging the woman, or appeared to be dragging the woman, who was in the water up to her neck, by the hair.

.... You say the woman was in the water up to her neck, Kim, do you mean she was neck deep or she had bent down and was immersed in water up to her neck?

Sorry, Jack. She appeared to have dropped to her knees and he was trying to lift her up and she stood up and he, by this time, was at the water's edge and he ran ahead of her and she was running after him, crying out and collapsed .... 3/4 way to the beach. And he went to the tower, grabbed a towel and covered her head with it and then .... her across and it was at that point that I realised that this was serious and ran to .... calling out: "Jack! antivenene ! metho !" and it was from then on .... and I ran

* Name used could either have been Kim or Ken

back and a few other persons were assisting in the resuscitation of the woman who, when I first appeared on the scene at her body, - she was a rather deep blue.

Metho was applied .... was made to remove the seawasp tentacles from the body. At this time, maybe seconds, minutes later, you turned up on the scene, Jack, with the antivenene and more metho, but ran out of this and ran back for more while other people were coming in with methylated spirits. Meantime the two persons concerned were .... the resuscitation by applied cardiac massage and the other one was doing mouth to mouth resuscitation. The antivenene, the lady herself was covered in sand. Somebody had apparently thrown sand onto her body and methylated spirits was used to remove sand from the buttocks .... which the injection was given intramuscularly.

.... mouth resuscitation continued with cardiac massage, but (just a), almost immediately after the injection she appeared to change colour .... more favourable tone. Its hard to say whether it was pink, ... still definitely blue, and then she was not long afterwards, again, ... even with the cardiac massage and the mouth to mouth resuscitation, she turned blue again.

At this stage I left the scene for more methylated spirits from a four gallon drum. Others had come in and were assisting in removal of the tentacles all the time, but using methylated spirits prior to this.

With the removal of tentacle, I wish to add here, the tentacle was removed in a manner which would be most desirable to the patient, after copious flooding with methylated spirits. Methylated spirits was used to the extent of over 3 gallons. Sand on the body that John .... Kim* mentioned could have been the fact that the body was thrashing round on the sand. Of some importance might be the way that the girl ran from the water. Again: Kim?*

Jack, I should have explained this, that when I saw the couple stand upright near the waters edge, maybe ankle deep or calf deep, the gentleman was running with her and then left her to run ahead to get a towel.

She was running rather erratically up the beach and collapsed, half way up.

But when they reached this ankle deep water - were they in deeper water before they got to their feet?

Jack they were - appeared to be in water in thigh depth. He was standing up and seemed to be trying to lift her out of the water or dragging her along and eventually got her to her feet somewhere near the edge of the water and then ran with her part way up the beach, left her to run ahead, and we realised he went to get a towel - and in that period of him .... sprinting ahead she ran erratically, seemed to be throwing her arms about and collapsed on the sand. Prior to this collapse, I was genuinely under the impression that they were skylarking.

The long hair that Kim mentioned could have been tentacles because the girl in question had rather short hair.

Second observer, we'll call him John, which is his right name. I'd like to ask you John, to give a full description of what you saw this afternoon.

.... for starters, I wasn't actually at the front of the .... on the beach, I was .... part .... looking for coconuts .... heard the screams .... girl had been stung. I raced down to the water .... down the beach and here she was lying on the sand .... tentacles all over her .... two qualified nursing sisters attending to her .... about a dozen other people. And these people that were there they were all very helpful insomuch as they were applying methylated spirits and applying ....* blankets to cover her body and keep her warm. And I just watched in case I was needed and I was there for approx. 25 minutes and in this whole time these two nurses never stopped ....

Do you think, John - What steps were taken to try and save the girl's life?

.... applied a .... oxygen mask .... which they did apply was the cardiac massage which was started .... and kept going up to about 25 minutes

* Sounded like "hot blankets"

later.

Did you see these nursing sisters give any injections at all?

No, I didn't see them give anything, no.

In other words, you arrived on the scene a bit later than the nursing staff and Jack Romano?

.... I arrived approximately five minutes later

John arrived on the scene after I did and he didn't witness quite as much of the activity as Kim and the two nursing sisters. I now put one of the nursing sisters on.

Now I'll put Mary on with her version.

I was standing on the beach .... couple .... the water, and we were watching and the girl started to scream and the fellow was chasing her. We didn't take much notice .... then as they ran out of the water with the fellow still chasing her, the girl started to fall, so ....

In the water?

No, as she'd stepped out of the water. She ran a few feet from the water and she started to fall and she collapsed face down and her husband ran round frantically trying to scrape the stinger off.

.... where was he trying to scrape the stinger off?

With his hand, he was pulling at it and .... and a fellow ran up to the shop to get the metho .... see if we could get a pulse and started to try and resuscitate her. By that time the metho was there. The stinger was all over her abdomen, back and both arms. She was bleeding .... and her lips were blue and her eyes - pupils were dilated. .... threw her over and gave her 10 mls in the buttocks.

With that statement I'd like another correction please .... serum bottle and the needle.

We drew up everything that was in the bottle, ... 10 ml syringe, and we just .... the air off and gave her the rest.

Would you say there was 10 or 5 ml in the bottle - or syringe?

There would have been 5 ml in the syringe when we gave it.

To what part of the girl did you administer the injection?

Right buttock, upper outer quadrant. We turned her on her back and commenced resuscitation and after a while we got a bit of pulse and the pupils contracted. They were still pouring metho over her. People were throwing sand all over the .... we were trying to tell them to stop but, you know, we just couldn't get through to them .... commenced resuscitating and after a short period the pupils dilated again and nobody could get a pulse and she started bringing up white frothy substance from ....

.... What types of resuscitation were you using?

.... mouth to mouth, cardiac resuscitation. After I'd say about a minute - 2 minutes of resuscitation she started bringing up white frothy substance through the mouth and the ...., we turned her on her side and tried to clear the airway. We put her back and then just kept on trying to resuscitate her.

At one stage you tried a plastic tube down her throat -

Somebody produced a plastic tube .... better airway, but the tubing was soft and just coiled in the mouth. It was useless. Resuscitation was 1:4 ....

Do you say the girl showed any signs of recovery after the injection was given, immediately after?

Yes .... after giving her injection, as I said, about 1 minute - 2 minutes, the pupils contracted and we did get a pulse. She didn't regain consciousness but .... lips .... instead of blue and then went back to the blue. (garbled tape)

Personal reaction now is that if the patient had been strung up by the ankles and other means of resuscitation applied she could have stood more of a chance. This again is conjecture.

Another qualified sister, we'll call her Sue. She will tell us exactly what she saw.

Do you think that there's anything that could have been used which may have been able to save this girl's life?

.... if we'd had the sucker there, it would have helped. They did have oxygen but there wasn't a mask or anything; an airway probably would have helped a lot too. But other than that -

I'd like to add here that the two girls did a fantastic job as far as I'm concerned. They never eased up at any stage. The only time they eased up on mouth to mouth was to roll the body over and try to clear the airway. This also includes the closed cardiac massage. These two girls worked on the body continuously. After speaking with Sue and Mary I find that the sand on the body was not caused through the thrashing of the patient but the indiscretion of an elderly couple who kept throwing sand on the body while the two girls were trying to work on the body and they persisted in doing this until they were cautioned by the two, that they were doing more damage than enough.

Jack Barnes Commentary follows -

Jack Barnes:
This is the end of the transcript. What follows is an attempt at reconstruction of the train of events based on the account obtained from the dead girl's companion, from Romano and from the two nurses that I subsequently reached at Mission Beach and also from an inspection of the

marks upon the beach.

It would seem that the pair had been on the beach together, sunbaking after previous swimming. They re-entered the water shortly before 4 o'clock to wash off sand before leaving for Townsville. They were larking together in the water no more than waist deep. The man was then mildly stung on the right leg and drew smartly away, in the process, swirling the water. At this same moment, the girl was apparently either bent over or on her knees in the water so that when the jellyfish contacted her, it was near the surface and between her left arm and her chest. She screamed so loudly that this caught the attention of the people at the head of the beach, in front of the Moonglow (Motel).

The girl's companion says that when she was stung she threw up her arms and he saw tentacles adhering and tried to tear them off with his hands. He did this while assisting her into shallower water and then she got to her feet and ran with him to the water's edge and a few steps beyond.

She was staggering at this stage and he ran ahead to get a towel. Meantime, she followed, running with an unsteady gait. However, she reached a point more than halfway to the top of the beach, a measured distance of 50 paces - approximately 50 yards from the water's edge, then collapsed face downward.

Her companion ran back to this point, bringing a towel with which he again tried to remove tentacle. He said he realised he was doing no good and he saw that her face was blank and had jaw hanging and he rushed up to try to get help.

Meantime when the group in front of Moonglow saw the victim fall, they realised for the first time that the situation was serious. One man, Kim*, ran to get Romano and the two nursing sisters, Mary and Sue, ran to the girl.

Subsequent measurements show this distance that the nursing sisters ran as approximately 100 yards. When they reached the girl they saw that she had a lot of tentacles on both arms and body, that she was apparently

* See footnote

unconscious, and then they turned her over. They could not obtain a pulse and saw that her pupils were dilated. They then commenced resuscitation with Sue giving mouth to mouth respiration and Mary performing external cardiac massage. There was no immediate response. During this initial effort they were impeded by throwing of sand by an elderly couple, apparently with good intention.

Then the antivenene arrived, brought by Romano, together with methylated spirits. They put metho on the stings, turned her on her side, gave the antivenene into the upper outer quadrant of the buttock and promptly resumed their efforts at resuscitation using 4:1 beat. Meantime, others continued to apply methylated spirits and to remove tentacle.

One of the nurses, a senior one, and also one other observer believe that there was a significant improvement in the victim's condition about 1 to 2 minutes after the antivenene was given and the resuscitation resumed. This improvement was not maintained and (it) is not clear whether it was due to better resuscitation or to the giving of the antivenene. It consisted of an improvement in colour and the return of heartbeat. Again it is not clear whether this was spontaneous heartbeat or whether it was produced by the external cardiac massage. In any event this improvement was not maintained, the victim's colour became more bluish, the pupils dilated again and the pulse was lost.

Shortly afterwards resuscitation was rendered difficult by copious fine froth from the victim's nose and mouth. This was repeatedly removed but more rapidly formed and no sucker was available to remove this. In that respect, it has been suggested that it might have been helpful at this stage to suspend the victim by the feet, but this was not done.

Both forms of resuscitation were continued for an estimated time of 25 to 30 minutes by which time the ambulance had arrived and the girls assisted in placing the body on a stretcher and they are not aware of whether any further resuscitation was attempted after this time. It seems unlikely.

In regard to the amount of antivenene given - 5 ml seems to be the correct amount. My enquiries indicate that both girls had previously performed

resuscitation of the type given to the victim on the beach and that they were reasonably proficient in this.

Subject to actual experiment I estimate the time factors as follows:-

From the moment of stinging, which was presumably the moment of screaming, through the time taken for the situation to be recognised, for initial attempts to remove tentacle and for travel to the edge of the water - a minimum of 30 seconds and a maximum of 60 seconds.

For the girl then to run with faltering gait up the beach 50 yards or alternatively for the healthy young companion to race up the beach, get a towel and come back down - approximately 30 seconds.

Thus from stinging to collapse, an estimated time of between 1 and 1½ minutes.

Then from recognition of collapse by the nursing sisters, for them to run across a distance of 100 yards, I reckon this would have taken between 30 and 60 seconds.

Then to assess the situation before commencing resuscitation, probably another 30 seconds. It seems unlikely that there is an interval of more than 2 minutes, in any case, from the time the girl collapsed until resuscitation was commenced.

Time of arrival of the antivenene was probably about 2 minutes after resuscitation commenced. Sometime after this was given, there was an improvement in the girl's condition and I estimate this as having occurred at between 5 and 7 minutes after the original stinging.

It seems safe to say, therefore, that no further sign of life was detected beyond 10 minutes, although resuscitation was continued for at least another 20 minutes.

This completes the commentary.

Tape for John Power, ABC TV Features

(This was a tape recorded for the use of John Power, ABC TV features; the first part of it was erroneously over-recorded and the original therefore obliterated. What it amounts to is that I am offering him photographs and further description to assist him in the preparation of his feature on Chironex and an episode of "See It My Way".)

John, on the historical side I was unable to find anything useful or usable on Ron Southcott. If you want to go any further with this, I suggest you contact him at his home address. He is:

Dr. Ronald V. Southcott,
2 Taylors Road,
MITCHAM, S.A. 5062

and tell him that this suggestion comes from me.

On Dr. Hugo Flecker, deceased, I found a picture of the old chap taken about the time he was actively engaged in jellyfish work. The photo was taken by Lionel Law Studios, Cairns, and shows him holding the bill of a sawfish. The garb is typical, spectacles on forehead also typical, also the broad tie, and the sleeve band at half mast looks very like the old bloke in his prime. I think that you might well want to use this. The only other picture of Flecker I found was a studio portrait and I don't think very suitable. I was unable to locate the negative of the Flecker photo so had the photo copied and subsequently enlarged. It's not bad but a bit fuzzy.

On myself in former years there is a copy of a studio photograph with open neck shirt and felt hat and chin strap all intact. The origin of this was a sepia print in pretty poor condition and I think they did quite well through negative to the final enlargement to retain as much detail as we have there. I would say it is a good likeness of me at the age of 19. I reckon it was taken in February or March of 1942 prior to going south for Commando training at Wilson's Promontory. There seem to be, in less formal vein, only four photographs which might be usable from that era. These are all from pretty battered 35 mm negatives and it could be that the prints

would need a bit of work upon them to make them usable for your purposes. They all would have been taken in 1942 between about June and August when we were doing a stint in the Northern Territory prior to embarkation for Timor.

The first one showing me clean-shaven and squatting on a rock in the middle of the Roper River, was taken at Roper Bar Police Station, age then 20, in a squatting position and general appearance quite typical. Then there is another one I think also taken at Roper Bar showing me having a bit of tucker with two of my mates.

Then there are the two photographs of Barnes doing his washing in a 25 lb flour tin and not looking very happy which is understandable because I don't think we had any food for three weeks at that time and you might notice the ankles rather ballooned up with the beri-beri. This starvation episode was on one of the Edward Pellew Group of Islands in the Gulf of Carpentaria at a place called Vanderlin, as I remember.

Five of us were put out there as a forward observation post with radio, to report on potential movements of Japanese submarines into the area and also aircraft approaching from the Gulf side. Our radio went on the blink after a few weeks and I think they forgot we were out there. It is not a place I remember with any great affection.

We eventually got off Vanderlin on a small ship and went across to McArthur River landing at Borroloola where we got some reasonable food and I remember we unearthed a mighty supply of grog. Incidentally I find I was in the Australian Army for one year and 143 days of which one year and 10 days was spent on active service. Loma tells me that you are also looking for a picture of Nick at about the time when he was one of the experimental victims of Irukandji stinging.

This was in 1961 when he was nine years old but unfortunately 1961/62 seems to have been a particularly barren period of Barnes photography and the only things I can find are two colour transparencies - one taken in 1960, June showing a small and slightly indistinct boy half-way up a palm tree; and the other in December 1963, showing Nick with me on the beach in front of

the catamaran where we are putting sand into bottles. These were drift bottles to be released offshore to determine water movement. Actually there was very little growth in Nick over that period and if you think either of these is suitable, I guess that would be legitimate.

The next on the list were some microscopic versions of tentacle and capsules and I have there one picture with purple code spot and no number, labelled "Chironex tentacle longitudinal". This shows the arrangement of the circular bands on the tentacle alternately large and small. It is in the tufts or expansions on the top of these rings that the stinging capsules lie. This is a projection positive but you might think it preferable to use the negative version of this for your purposes.

Then there is slide 802 which is a phase-contrast photograph of the cigar shaped and football shaped capsules which are mainly responsible for injection of poison and also showing three other types of capsules. Between these you will notice that all the larger capsules are fired and what is visible there is the strong spike covered butt of the tube which emerges first in the stinging process.

Similar to this is a 2¼ square negative labelled 802.1 which I think might well be better for your purposes. It is less cluttered, you can see some of the thread beyond the butt and I think the spikes on the butt show a little better.

Slide 803 is a section through soft animal tissue, to wit, amniotic membrane, which has been subjected to stinging with Chironex tentacle and then sectioned and shows the tight aggregation of capsules on one surface, the outer surface, with the threads penetrating through the membrane and the finer ends of them coming away free on the other side.

There is a similar picture 803.1 on 2¼ square negative and again you might think this is better for your purposes.

Slide 205 is a related picture showing under very high magnification the commencing process of stinging. This is a Chironex capsule on human skin, skin taken from a fatality, and in this you see the butt having achieved

an entry and fixation but the tubes still lying mainly within the cavity of the capsule. I wonder are you still considering an animated series on the discharge of capsules, if so I would be happy to be consulted on this because I have probably a better experience of watching capsules actually discharging than anybody else I would know of. It is a fairly complicated process in some ways and if we do go to the trouble of producing an animated version I would like to feel that it was as accurate as possible.

Now we have the problem of the Petrie pictures, Ian Petrie, the lad you photographed down at Bramston Beach. The series starts with 780 which is a picture of the sting on the legs with the boy sleeping after his final resuscitation in the Babinda Hospital. I am sending you the original of this, not because I really want to, but because I have no other. You will notice that it has a strong bluish cast and I would appreciate the attempts of your laboratory to produce duplicates in which this is largely eliminated. I think you know that I regard this as an extremely valuable and quite irreplaceable slide and I would appreciate extreme care.

Then there is 805, a duplicate with a greenish cast actually an improvement on the original and again, maybe they could do something about this in the laboratory. It shows Ian on the day after the injury sitting up and taking some notice, not very much because he would still be under sedatives.

I have located two other photographs of Ian soon after the stinging which I think occurred on New Year's Day, 1968. There is one here on the 7th January showing him sitting up on some rocks at a beach and another on 31st March, 1968 showing the back of his legs. Both of these are apparently from the same film and the colour is very poor and I presume this is why I have not previously attempted to duplicate these, and as there are no duplicates and I do not have authority to release the original photographs, old Petrie being pretty cranky about me having them at all, I don't see that I can do anything about these two at the moment. However, I do intend to try copying them tonight and if I have any luck and you still think there is a need for them in about 10 days time, we might go further into it then.

John, there is one other photograph of Ian Petrie. I think it was taken with an instamatic camera on colour reversal film and there is a print with it. I am enclosing both. This is very flat and colourless but I believe that with different handling it would be possible to get something much more useful out of this, perhaps introducing a little bit of pink or magenta and ginger up the contrast a little bit. This is up to you and whether you think the lab can do this.

Also I know there are some black and whites I took last year showing the persistence of the stings on the front and back of the legs of young Ian but I seem to remember that you said you had obtained adequate pictures of these when you were down at Bramston Beach with the living boy and no doubt this is more impressive. However, if you didn't and if you think you need these, I will look them up. They are still in negative form and have never been printed.

The only other specific subject mentioned by you was the young woman Dorothy Hess who died as a result of a sting at North Mission Beach on 21st November, 1971. After checking with my group of transparencies, I think the only one legitimate to show is a lateral view because the view of the back shows a great degree of staining which is not directly related to the jellyfish and might cause a lot of confusion. The lateral view, is however, quite clear in showing lines of stinging and her face is tactfully turned away. This slide has not been indexed and therefore only carries the number "12" and the date, November, 1971.

All that now remains to offer you is a small assortment of other stings. We didn't discuss your need for these in any detail and I do feel quite strongly it can be a mistake to show a series of injuries all looking somewhat like one another. I don't think it is necessary to educate our audience in the fact that these stings can be lethal, but it may be a good thing to show them how similar the stings are, how recognisable they are, and how extensive they may or may not need to be, depending on whether one is an adult or a child.

I have therefore given you a graded series in which the first is 760 - a fairly extensive but mild sting. The mildness mainly resulting from the

fact that it was immediately treated with metho, i.e. within 30 seconds of the actual sting. The girl ran out into the arms of the lifesavers who happened to have a gallon of metho on the beach.

Then there is 309 which is a moderately extensive and quite severe sting where the application of metho was delayed for about two minutes resulting in blistering and some ulceration later with some permanent scarring which would not have resulted for instance in the case of the girl in 760. You could regard 309 as a borderline, potentially lethal sting for a boy of that size (I think he was about 11) and had it not been for the metho or had he been rubbed with a towel, he might just have croaked.

Then there is the leg and arm of a boy shown in 797. This bloke had a pretty large injury from quite a big jellyfish and collapsed shortly after leaving the water. He was resuscitated by two girls who saw the incident from the beach road and rushed down, so you could again say this was one that was saved by correct treatment. He was also given our more modern treatment with corticosteroids which resulted in no blistering and no scarring.

Slide 699 on the other hand shows quite a small sting, in fact the total of tentacle anywhere on this child's body was something like 8 ft and as the boy weighed approximately 4 stone, one might reasonably have expected survival in this instance properly treated. You notice how much more vivid the skin markings are because this child did in fact live for 20 minutes allowing the skin reaction to develop. At this stage about 20 minutes after death* he was having some distress with his breathing. He still had not had any tourniquets or methylated spirits, mainly because I think his father was a German fairly recently arrived and who knew nothing of the subject. Anyway while he was teetering on the brink between death and survival at 20 minutes, somebody decided he was too messy to see a doctor all covered in sand like that and they washed him with fresh water. He promptly collapsed and could not be resuscitated. The reason, of course, being that he already had a lot of pulmonary oedema (waterlogging of the lung) and this made it impossible to get near entry with artificial respiration.

* 20 minutes after stinging

The final one in this series is 401 which shows a very extensive sting on both legs of a young girl who died very rapidly indeed without benefit of treatment. The stings don't look very dramatic which is simply because of the extreme rapidity of her death. One might speculate that had tourniquets been applied very promptly she might have stood a chance but I think the event was just simply too sudden and traumatic for anybody to think of this.

I am wrong. There is just one other slide. I have put this out because you might feel that this is a horribly grisly collection of fatalities and near-fatalities which of course, is the exception rather than the rule. I would say that for every fatality there could be something like 500 stings of a degree shown in the 2¼ square colour transparency. This was a very attractive young girl (and even the bit of leg you can see is attractive), who arrived on the overnight plane, and bent on swimming in northern tropical waters, and without knowing anything of the stinger menace, she hired a taxi before breakfast the following morning from the motel, and was stung almost immediately after entering the water. She was extremely irate because there were no signs and no information given to warn her. Even if you don't want to use the picture it's a nice little piece of leg, don't you think? Reference number of this slide is P351R7.

Having got all of that over, I must apologise for the time it's taken but at the same time explain that your boy David worked the ....* case out of me and it took a couple of days to get over that and by that time we had an assortment of low pressure systems and cyclones like we haven't had for many a year and the rain has been coming down by the bucketful ever since. You blokes certainly just got your pictures completed in time. There will be no more pictures this year, I'd reckon it's going to take a month or so for the water to clear even if it stopped raining right now. The humidity in Cairns over the last three days has varied between 92% and 100% mostly the upper end of that range and I have been very reluctant to handle the photographs under these circumstances. In fact, I had to cart the whole caboodle down to the surgery in a plastic bag and after running the air-conditioning in my closed off room for a few hours, got the humidity down to 85%. If the transparencies all sprout fungus after this, I am going to blame you John.

* the "soul"? case

I must say too, while there is some tape left that I thought David did a magnificent job while he was up here. He rose manfully early each morning and very tactfully avoided open conflict with me during that first wicked hour of my awakening and worked damned hard under pretty trying conditions. I reckon he is a good boy with a pleasant personality to boot. We understand that some of the later footage was pretty good and I am looking forward intensely to seeing this material of which I think there must be now a considerable surplus of really first class stuff. I don't really think that we can have too much of this sort of unique material. It is extremely unlikely that I am going to have the opportunity to spend this amount of time again under favourable weather conditions with a TV crew present and it may well be that we have here something entirely unique, unlikely to be duplicated in the next 10-15 years. Some of the later stuff might not have been really what you were needing John, but I would like to explain that I asked David to take quite a lot of material of the jellies behaving normally on their own as I feel that there is a very wide scope for education and this is magnificent background material, the use of different sections of which could avoid the possible monotony of repeat showings of a standard film with a standard spiel.

I have in mind that in future years at the commencement of the stinger season, there should be three, four or possibly even five showings of a film dealing with Chironex emphasizing how danger can be avoided and how injuries should be treated. So please, please, please, don't throw anything away - you can reserve that privilege for me; I reckon I might have earned it.

Regards John, and again looking forward to the outcome.

"The Mystery of the Sea Wasp" — ABC TV Feature 18/12/1972

Photography: David Telfer
Production: John Power
Background Inspiration: John Stackhouse

Commentator:
Jack Barnes, a doctor in general practice in Cairns, North Queensland. He's going fishing this morning for a creature that can kill and is all but invisible in these tropical waters.

It has many names. The aborigines have known it since the dreamtime. To North Queenslanders it's the stinger, the box jellyfish and more commonly the sea wasp. To Jack Barnes, it is Chironex fleckeri, the most venomous creature in or out of the sea, deadlier than the king cobra snake or the taipan. It is a creature that has obsessed Jack Barnes and one he has made his life's study.

Those tentacles that flow so gracefully behind the bell, the head, contain enough venom to kill three adults. Death can come from a massive sting in three minutes when the tentacles are wrapped fully across the body.....

Dr Barnes chases the jellyfish to milk its venom for his research. He is careful to touch only the bell which is harmless blubber. The worry is that he may not see one of the tentacles.....

Commentator:
This is the first time you have been stung is it?

Barnes:
Oh no! This happens all the time when you are handling them, but unfortunately I got that jellyfish angry by handling it, touching it when I was getting it in and when they're like that they're very cranky and .... maximum sting possible from every bit of tentacle.... He stung the bucket and he stung himself. He has stung everything in cooee!

Commentator:
Is it a paralysing sort of pain?

Barnes:
No, no it's a burning, electrifying pain, multiple stinging and slight tingling behind it, mostly a sharp burning feeling, I think. Something like a green ant, bull-ant bite... Oh, really you can't compare it exactly, it's just something very special... it beggars description really.

Commentator:
The largest structure on earth, the Great Barrier Reef, stretching from New Guinea more than a thousand miles down the Queensland coast. It is only a few miles from here that James Cook's barque "Endeavour" struck a reef of coral.-----(music)

The reefs are thick with jealous guardians, often their beauty is deceptive. The butterfly cod's gorgeous garments hide spikes venomous enough to cripple a swimmer. The stonefish is a master of camouflage and lies in wait until trodden on - the agony is excruciating.

The box jellyfish is disguised in its near transparency. It swims, not on the reef, but along the fairly shallow waters off the reaches. It is here that Dr. Barnes spends long hours watching his quarry.....

Could he kill?

Barnes:
He could kill a smallish person. It certainly could kill a child. A small adult he could kill, that's if all the tentacles were applied. That jelly's probably got 13 to a corner - they get 15 when they get really big .... only about so big. Very sensitive to the sight of something dark. They have four sets of eyes, and these eyes .... you don't know what sort of a picture forms in their mind, but they're.....

.... in January and early February but this does not mean they are the largest at this time. Sometimes they are very very large when you see the first specimens so that it is not like watching a seed grow into a plant. We sometimes find the full grown "plant" before we find any little ones.

This is good sort of water for them, it's fairly calm, a little bit of a swell, waves aren't breaking until they get very close to the beach and this is the sort of conditions they like.

Commentator:
For .... years the box jellyfish has claimed sixty lives, the last here at Mission Beach. The victim, a young woman, did not regain consciousness. The tentacles about her body measured more than 60ft.

In January 1968, Ian Petrie is twelve and on holiday -

Petrie:
I .... about out here, the water is up to my waist depth, you know. I was .... speedboat. I just can't remember anything else.

Commentator:
Loss of memory is ususal in those who survive. Ian awoke next morning in hospital, his legs scarred badly by the whip like markings of the sea wasp.

Petrie:
....

Commentator:
Jack Barnes' first experience with the fatal capacity of the box jellyfish came when he was a doctor at Thursday Island at the tip of North Queensland. Two children were fatally stung and the Thursday Islanders brought to Dr. Barnes a jellyfish they said they'd caught in the water. Dr.Barnes did not keep the specimen, something he was to regret in the years to come, but he did seek more information about the jellyfish from Dr. Hugo Flecker, a Cairns Radiologist.

Dr. Flecker was a man with a scientific curiosity that extended well beyond his own profession and it was this curiosity, combined with the accident of war, that was to help solve the mystery of the sea wasp. It was World War II that interrupted Jack Barnes' medical studies and sent him off as a commando to Timor. The men of Z Force Commando fought a guerilla war that tied down 12,000 Japanese for nearly a year. Jack Barnes was to lose 5 stone and to indulge a natural love of danger.

In Australia, the army sent troops north to Queensland to train for the pacific campaign. They had little to do but to swim in their spare time. Ronald V. Southcott was a young army doctor and he was busy treating the swimmers for marine stings. During that hot summer of 1943-44 at Trinity Bay, Dr. Southcott treated the soldiers, recorded their symptoms and sketched some of the victims and the jellyfish they found. Strangely there were no fatalities among the soldiers.

Early in the new year of 1944, a seaman attached to his unit, brought Dr. Southcott a jellyfish in a bully beef tin. He noted that the jelly-fish was transparent - glassy - he called it, and difficult to see in the water. He had no way of preserving it so he sketched it, then drew some of the tentacles across his upper arm and forearm and felt a burning and prickly sensation. After some minutes, he said, minute wounds as long as sago grains appeared on his arm. A few weeks later Dr. Southcott's unit was moved out and on to New Guinea.

The life cycle of the Chironex continued undisturbed by war. The jellyfish had long been a subject for aboriginal artists but science was yet to make any distinction between it and the other harmless members of the species with which it was so easily confused or to link it with the summer deaths and injuries in North Queensland. It was just another jellyfish.

Then on January 20th., 1955 a small boy went paddling in shallow water at Cardwell in North Queensland. His mother saw him run screaming from the water and she found some slimy substance covering his legs. Daryl John Muller was five. He died in his mother's arms, his death attributed to an unknown marine organism. Dr. Hugo Flecker asked the police to net the sea off the beach and the specimens were sent to Dr. Southcott who was by then, Honorary Zoologist at the Museum of South Australia in Adelaide.

There were seven specimens, four adults and three juveniles which he labelled A67A. They did not tally with the recorded descriptions of jellyfish. For two weeks Dr. Southcott continued his microscopic examination, then finally, he was positive. He declared A67A a new species. He named it Chironex fleckeri, combining the Greek word "Chiro" for hand with a latin "nex" for killer, and "fleckeri" for his colleague,

the doctor in Cairns.

A67A was the same killer that he had so meticulously sketched at Trinity Bay in 1944. It was almost certainly the same species that had killed the two children while Jack Barnes was at Thursday Island. At last the jelly-fish was identified but little was known of its life cycle or venom.

Jack Barnes moved to Cairns and continued the studies of Southcott and Flecker.

Barnes:
I think I accepted this job in about September and (at) Christmas of that year I went over to Green Is. and .... early morning dip and saw a lot of jellyfish .... about a foot deep, a windrow as they call it .... or 4 feet long, by twenty miles wide, just streaming in ....

Commentator:
Barnes began to explore his new field, closely examining the tentacles that hang from the four corners of the bell. Each tentacle measuring as long as 20ft. in a fully grown Chironex. Inside the bell is the main body cavity for digestion of food, usually small prawns. The bell shape and the snake like tentacles give the jellyfish family the name "cubomedusae".

The tentacles of the Chironex contain its deadly weapons. Thousands of stinging capsules called nematocysts. Inside each lies a coiled thread in a pool of poison. Direct contact with the tentacles increases pressure inside the nematocyst forcing up the first part of the thread which is more flexible than the rest.

The second part follows stronger and tubelike, armed inside with small spikes. The tube rotates and turns itself inside out, the spikes digging into the skin and forcing up the third part of the thread. It is thinner and hollow and lined with a triple spiral of hooklets and again this tube inverts itself digging and cutting into the tissue. The thread is now fully out and the venom flows and all of this is in 2-3 seconds.

Dr. Barnes got the first specimens of venom by inducing the Chironex to

sting human skin. Later he developed more sophisticated ways of obtaining greater quantities.

At the Commonwealth Serum Laboratories in Melbourne rabbits were given carefully controlled amounts of venom until they were highly immune.

The serum separated from the blood and .... from the rabbits became the standard antivenene, or antibody. The modified globulin proteins of blood neutralize the venom and reduce the scarring of skin tissues after stinging.

Another bigger challenge followed development of the anitvenene. (This was) producing a vaccine, a modified form of venom to prompt the vaccinated body to make its own antibodies.

In this stage thousands of mice, and hundreds of guinea pigs, rabbits and monkeys have been used. It is a delicate painstaking operation. The vaccine must be effective and safe to administer ....

In Queensland, the tourist .... is big business. Each year more than two million go north to the sun. The busy season coincides with the jellyfish season. (This is) one reason that some North Queenslanders have been reluctant to make public the dangers of the Sea Wasp. Even then the vaccine does not seem to be the complete answer.

Jack Barnes believes that the residents will accept the vaccine, but he doubts if tourists will think it worthwhile for a few weeks holiday. He hopes the answer is in protective clothing. In this trial, a skivvy and a schoolgirl's pantihose. It has to be light enough to swim in and strong enough to deflect the Chironex's stinging capsules. If it is not, Jack Barnes could be one more fatality for Chironex fleckeri.

Barnes:
Well we're just going to (wind?) these tentacles right across the pantyhose, doesn't stick, doesn't sting, jelly getting a little upset .... again. Try it on the skivvy, different kind of stick to the skivvy .... annoy him properly again.

(laughter) ....

The object is to keep them from making intimate contact and then there's not much sting at all. There's none whatever unless you push it in. And when you do actually (trick?) one then you do drive some of the material into contact and it gives you a very minor sting. It's only equivalent to sandfly bites. I think this has very adequately demonstrated that you can run the tentacles repeatedly over thin fabric like that without their recognising, apparently, that there is some "stingable" material there.

By the way, I get a lot of criticism, I get a lot of (baiting?) but I think its fairly good humoured laughter on the whole. It used to be .... vicious type of nature, though. They felt strongly that it wasn't right for me to publicise a thing which might hurt the tourists, but now that we have a number of deaths and now that it has been demonstrated .... something we can do about it, I think the public are laughing in a very different way. They're laughing with me instead of at me now.

Queensland Health Education Council — Marine Stings leaflet 22/1/1972 recorded by Jack Barnes

(This tape recorded on 22nd. January, 1972 by Jack Barnes is for the use of the Queensland Health Education Council in the preparation of a leaflet concerned with marine stings. It is to be taken in association with a previous recording which was concerned mainly with the illustrative material in this pamphlet.)

Firstly, in general terms, I think the existing layout of pamphlet 143 was quite good with the exception that there should be an illustration of a box jellyfish on the front cover. In regard to the main plate I have, I think, suggested the inclusion of some other stingers and perhaps the deletion of the ctenophores and hydromedusae to make space for these, but I am assuming that the central, opened out section will still contain paragraphs dealing separately with each animal.

I now suggest that these paragraphs commence with distribution and season for each grouping; then body, giving distinctive features and size range; then tentacles, again with features and size range and finally, sting characteristics.

BOX JELLY, CUBO, SEA WASP

(TWO SPECIES -Chiropsalmus quadrigatus and Chironex fleckeri)

Distribution: Inshore waters north of the Tropic of Capricorn. Not found over coral reefs or in deep waters well off shore.

Season: Mid to late summer, when inshore waters are relatively calm. More numerous after local rain, especially near river and creek outlets. Usually absent when seas are rough.

Body: 1-10 inches, mostly 2-5 inches. 3 inch size dangerous to children; 4½ inches upward can kill adult. Body transparent, faintly blue in water,

difficult to see.

Tentacles: Length from few inches to many feet. Width from sewing cotton to thick string. Outermost tentacles often blue or purple, others variable (C.quadrigatus usually yellowish, C. fleckeri usually pale blue, grey, or dirty white).

Now in the above you will note that I have made a number of alterations, some of very considerable practical importance. For instance, the area of infestation is extremely important because there have been major panics in southern waters where a lethal sting from Chironex fleckeri just doesn't seem to be conceivable and, conversely, there has been unnecessary avoidance of genuine reef islands and the deep waters surrounding these and also of coral cays, much to the detriment of the northern tourist industry. It is now quite clear that areas of clear oceanic reef water are not invaded by Chironex anyway and neither Chironex nor Chiropsalmus likes to operate over obstructions rising from a shallow bottom as is the case with coral and perhaps also with extensive weed beds around an island.

I have extended the season in keeping with recent findings, indicated potential lethal size which is again of very considerable practical importance, amended the descriptions mainly in terms of colour and have inserted the point, under distinct characteristics, that box jelly stings are always immediately painful. This does tend to make more clearly the distinction between box jelly and Irukandji, or for that matter Snottie stings.

Coming now to the Carybdeids, both large and small, there is a bit of a problem here. You will recall from the other tape that there are difficulties in nomenclature with about seven different species coming under the general name of carybdeid.

It might be best to start with a general heading "CARYBDEIDS" and state: "Carybdeids are like box jellyfish but have only one tentacle to each corner. All are nasty stingers."

CARYBDEIDS

Distribution: Oceanic forms (e.g. Tamoya and Carukia barnesi) are occasional and short term summer visitors mainly in "Northerly" weather. Other species (e.g. Moreton Bay carybdeid) can be present in sheltered waters throughout summer.

Body: Tamoya large and flabby, up to 7 inches; Carukia up to 1 inch; others up to 2 inches.

Tentacles: Tamoya up to 6 feet in length and ½ inch in breadth, usually greenish. Carukia a few inches to 4 feet, hair like when extended.

Perhaps we should have said earlier in the general section on carybdeids that all are transparent, faintly coloured and difficult to see.

Sting Characteristics: Tamoya broad and whip like with closely spaced ladder pattern, may be multiple. Intensely painful. Large stings may be dangerous. Carukia initially mildly painful. After a new minutes skin shows a circular area of redness and goose-pimples. After about twenty minutes, severe back ache, chest and abdominal pains, vomiting, shooting pains in the limbs and elsewhere, occasionally great difficulty in breathing. Medical attention essential in severe cases.

Other Carybdeids effects variable. No fatalities reported, but medical attention desirable in severe cases.

The next animal to be described probably is Pelagia if you have decided to include this in the illustration. The common name for Pelagia is "little mauve stinger".

PELAGIA OR "LITTLE MAUVE STINGER"

Distribution: Mainly subtropical both in coastal and oceanic waters.

Season: Mid to late summer.

Body: Round, mushroom shaped, pinkish purple, up to 2 inches in diameter.

Tentacles: About 1/8 inch thick. 4-8 inches in length, rarely adhere. Colour brownish yellow.

Sting characteristics: painful, often irregularly shaped, resemble hives or bee stings with red margin. Some victims develop severe cough and laboured breathing for which medical attention should be obtained. Not fatal.

Blue bottle, Portugese man-o'-war (Physalia - the name Physalia utriculus is in question these days. Most authorities say there is only one species - Physalia physalis but we needn't go into this).

PHYSALIA

Distribution: World wide, oceanic, sometimes blown inshore in large numbers.

Season: All months of the year but commoner in summer months.

Body: A gas filled float, usually bluish with shades of green, pink and/or purple. Rarely over 4 inches.

Tentacles: Always dark blue, many a few inches in length with major tentacle (occasionally multiple) very much longer - up to 8 feet.

Sting characteristics: A long thin line of separate rounded or oval weals, white in centre with red margins. Very painful. Not fatal.

HAIR JELLY, SNOTTIE, GIANT BLUBBER (Cyanea species):

CYANEA SPECIES

Distribution: World wide, oceanic, carried inshore by prevailing currents.

Season: In Queensland, mainly during late summer.

Body: Round, flat on top, with scalloped margins, coloured milky white, mustard brown or white with dark spots; one species purplish.

Tentacles: Very numerous, 5-20 feet, transparent, almost colourless.

Sting characteristics: Multiple lines, often with zig zags, initially showing as white dots but later as bright red streaks. Pain moderate. Not fatal.

* * * * * *

In general it is fair to comment that the sections devoted to treatment, i.e. two-thirds of one opened out sheet, contained in pamphlet 143, include a lot of redundant material. My suggestion is that the space be totally reorganised as follows:

The central third should be devoted to "Treatment of Minor Stings" as a large type heading.

TREATMENT OF MINOR STINGS

1. Apply methylated spirits or substitute as listed elsewhere on this sheet.

2. Apply anaesthetic cream or lotion.

3. Identify type of sting (Irukandji stings, although apparently minor, may be followed by severe illness).

4. Keep samples of tentacle or slime for examination (see below).

5. Notify lifesavers or other organisation concerned with investigation or control of marine stings.

Cyanea stings usually do not require medical attention. Pain relief by pertinent drugs is sometimes required for Physalia stings, and minor injuries from most of the carybdeids

Pelagia stings may be followed by difficulty in breathing, requiring medical attention.

Irukandji (Carukia) stings almost invariably produce a delayed severe (though not fatal) illness and injections of pain relieving drugs are usually desirable.

Box jellyfish stings only a few inches in length and not very numerous do not call for emergency treatment but if the skin appears to be blistering, medical treatment with antivenene or corticosteroids will reduce pain and result in more rapid healing. Extensive and severe box jellyfish injuries can be rapidly fatal and should be given emergency treatment.

IMPORTANT

After stings though to be caused by Irukandji or Pelagia, victims should not re-enter water until all risk of secondary effects is past. Delayed effects may impair breathing, muscle power and co-ordination, with risk of drowning.

* * * * * * * *

Now that seems to be all that is necessary on treatment of minor stings and it would be a good thing, I think, to take over the boxed section

saying "Information needed". There is still much to learn about marine stingers etc. but please note that relevant information is no longer to be sent to me but to:

Professor C. Burdon-Jones,
James Cook University of North Queensland,
Townsville. 4810

Also on this page, I think, could be some detail on collection of useful material from the sting area (i.e. either tentacle or slime remaining on the skin of the victim. Tentacles are of course fairly obvious and after treatment with metho, can be safely handled and transferred into either methylated spirits, or preferably 5% formalin solution. Even when there is nothing visible on the skin valuable material can sometimes be obtained by scraping.

The technique is to use a sharp knife or razor blade held at right angles at the skin. Tentacle remnants, skin scales, hairs and sand will acculate on the edge of the blade from which it is wiped off onto a matchstick. The matchstick should then be placed in a small bottle with or without preservative, i.e. metho or formalin as mentioned above and the material on it will remain in satisfactory condition for some days.

Special forms have been prepared by Burdon-Jones and the Queensland Surf Lifesaving Movement to facilitate accurate and complete reporting.

I leave it to you to sift out how much of this material relating to information and communication you can usefully insert on that treatment page.

What now remains is the one-third sheet headed "Emergency Treatment For Severe Box Jelly Stings", and I think that "Severe Box Jelly Stings" should be in fairly large type.

EMERGENCY TREATMENT FOR SEVERE BOX JELLY STINGS

1. Send for antivenene and trained assistance.

2. Pour methylated spirits on victim's back if tentacles visible there.

3. Lie victim on back and pour metho on other stings.

4. Apply tourniquets high on all affected limbs.

5. Flood all stings again with metho, liberally.

6. Use mouth to mouth method to inflate lungs approximately ten times per minute.

7. If heart stops thump chest once and do cardiac compression - press lower part of breast bone strongly every two seconds.

. Tourniquets should be kept in place for up to 1 ½ hours, I repeat 1 ½ hours this matter having been discussed with Dr. Drury Clark, until antivenene has been given, medical instruction received and/or patient fully conscious and breathing normally.

. Do not abandon resuscitation too soon.

. Do not wash victim. Do not move until condition has been satisfactory for ten minutes.

. Preserve tentacles for scientific examination, or obtain skin scraping if no tentacles available.

IF METHO NOT AVAILABLE: Use any non-irritant fluid having a high alcohol (spirit) content (whisky, gin, brandy, O.P. Rum, rubbing alcohol, some perfumes, after shave lotions etc). Do not use water, kerosene or petrol. Weak formalin solutions (5% to 10%) are effective but special care is necessary to protect eyes, nose, and mouth. Formalin should be washed off with sea water after two minutes.

IF NO SUITABLE LOTION IS HANDY; throw salt, sugar, dry sand, or any dry powder (flour, talc, road dust) on sting until tentacles are thoroughly coated. Then wait a few minutes for moisture to soak away from tentacles, do not rub, but then scrape away the tentacles with a wiping action.

DO NOT SPREAD STING BY RUBBING with hands, wet sand, cloth, sea-weed, paper, etc. No water, fresh or salt should be allowed to touch the skin until alcohol (metho, etc.) or formalin has been applied. Patient should not bath for two hours.

and that just about wraps it up as far as I am concerned.

I am aware that I have made a number of changes which may seem in some ways rather minor but none of these have been made without due thought.

I have omitted the emphatic reference to wet sand not being used because I don't think this is any worse than rubbing with other materials. I WANT TO CONDEMN ALL OF THESE AS GREATLY AGGRAVATING THE INJURY.

Perhaps there should be a further reference to antivenene under "Emergency Treatment For Severe Box Jellyfish Stings" in the following terms:

Severe injuries from Box jellyfish, even though small and not threatening life, are extremely painful and may be very slow to heal. Many of these should be treated either with antivenene or injections of corticosteriods to minimize the local injury. Such treatment can be helpful even though delayed by 12-24 hours.

I see that I am near the end of the reel but there is one other point, an important point that I have overlooked and that is, protective clothing. Prevention is always better than treatment. If at all possible, there should be an insert on this stating that very thin clothing is protective against jellyfish but care should be taken to prevent loose openings through which tentacles may enter. School girl pantihose is excellent on the lower body and various close fitting garments with long sleeves can be used on the upper part of the body.

Now I am pretty tired and I have got a cold and I realize that some of this may not be very comprehensible so I shan't object if you wish to ring me and I would of course, very much like to see the proposed draft of the new pamphlet if this is possible. Signing off --------

Talk by Jack Barnes at the State Conference of the Queensland Ambulance Transport Brigade — 12/12/1973

(There are two tape recordings of this talk. This transcript contains the material from both tapes. The shorter tape was originally modified to exclude some of the more indistinct material of the longer tape. I have endeavoured to include as much of the information as could be gleaned from both these records.)

B.E.K.

The material in this tape takes origin from a recording by Mr Alan Pitt, Superintendent of the Boonah Q.A.T.B. The original material was recorded in Cairns at a State Conference of the Queensland Ambulance Transport Brigade at which Dr Barnes was the guest speaker on the subject of marine stingers. Dr Barnes is introduced by Dr Aubrey Pye.

(This tape was recorded on 12th December, 1973 and consists of a transcript from a recording made at the Q.A.T.B. Conference in Cairns by Mr Alan Pitt, the Superintendent of the Q.A.T.B. Centre in Boonah. The subject was marine stingers, the speaker Dr Jack Barnes, and the introduction by Dr Aubrey Pye.)

"....Dr Flecker of Cairns who discovered this dangerous jellyfish.

Dr Barnes graduated from the Queensland Medical School. His medical life has been spent in Thursday Island and Cairns. And now, I have the greatest pleasure in introducing to you Dr Barnes."

- You may have a little trouble with visibility.... Can everyone see anything except blue? I think that if you can see that you will be able to see the others. Now the subject is marine stingers in rather limited aspects because we can't cover a subject with some four thousand jellyfish and some forty stingers amongst them, through the zoology, the embryology and the many other "ologies" that we get mixed in with a subject like this.

What we aim to do then today is to talk about the real practicalities of the situation as they affect the subject and particularly as they affect ambulance bearers; and for this reason I am going to narrow the thing right down to a fairly simple question of whether we are dealing with big box jellies, little box jellies or other jellies because this is the practicality of the situation.

Now the big box jellies are the Chironex fleckeri and its close relative, nephew, I suppose you might say, Chiropsalmus - they are very similar jellies and they produce similar stings but the Chiropsalmus being a lot smaller being a lot less toxic because of its smaller size, is not such a big problem, but from an ambulance point of view or the public point of view when they do sting they can not distinguish between the two. And as they very rarely see the jellyfish you have to group those two bigger box jellies together.

Then we come to the smaller box jellies. Oh! you say, what do we mean bigger? What I say, big as your head or big as a two gallon bucket or in extreme cases as big as a five gallon rubbish tin, that big.

Now smaller box jellies, what do we mean smaller, about the size of the end joint of your little finger up to the size of about an orange and those are your smaller box jellies and in this context they are the jellies with only four tentacles and we'll see some presently. And then there are the others.

Now the others are mostly not life threatening, mostly not creating a great medical problem but some extremely painful, all, I think, alarming and all necessitating some action by the lifesavers, the ambulance and quite frequently the medical profession also.

Now these others; I suppose, the one that's been known longest and blamed for most stings is the old floating blue bottle, Man-o-War, or more correctly, Physalia. Physalia I mention mainly to dismiss at this stage. But it has to be mentioned because in the early days, at the time when Flecker moved in to try to find out why stings seemed to be so much worse in the tropics than they did elsewhere, the thing that absolutely dominated the situation was this jellyfish, Physalia. It was the most

toxic jellyfish known at that time, the most painful, and everything was blamed on the Physalia. And if you died of a sting, it was still a Physalia sting and despite the fact that the Physalia had not been known to cause death elsewhere, they said "Ah well, these North Queenslanders, either they're a bit puny, they've got crook hearts, or they've got an allergy or they've got something, but it's the Physalia knocking off these blokes. They shouldn't have been in the water - it's all their fault!".

Now Flecker mainly, I think, deserves undying credit for being a skeptic. He was one of the greatest skeptics I ever knew. He didn't trust anybody to pay him and he didn't trust his machines to function and he didn't trust anything he'd read that came from another source. He said that this Physalia thing was bunkum. He said that the Physalia didn't kill people, therefore if people were dying, it had to be some sort of other animal. He noticed the fact that people with very bad hearts and crook kidneys and so on aren't usually swimming vigorously on a northern beach. He said if they were well enough to be on that beach and swimming, they were well enough to stand a Physalia sting. The fact that they didn't, it had to be something else. Now it wasn't until near the end of Flecker's days that a fatality at Cardwell clinched the matter. He had postulated this, he had argued vigorously, and following the Cardwell fatality, in about 1955, I think, he exhorted the Police to get out and to net the area. This they did the morning following. And they collected a very big mixed bag of jellyfish and they put them all in a big bin with formalin and they sent them off to Dr. Ron Southcott in South Australia.

Ron Southcott sorted them out. There were no Physalia amongst them. The dominant animal was a stinger about as big as his head and it answered to the general description of a previously known jellyfish not noticed around Australian waters but known in the Philippines and elsewhere, as Chiropsalmus.

Now Chiropsalmus was not thought to be a lethal jellyfish either, so this caused another little bit of an impasse and Southcott is a cynic too, he doesn't believe much, and I tactfully suggest we might all follow these good leads and not believe much, because we are told an awful lot of rubbish in a very authoritative way sometimes. And some

of the things I might say today I suppose somebody might not believe and might prove I am wrong on too. But anyway Flecker found that it wasn't Physalia. Southcott found it wasn't Chiropsalmus and when he looked into this thing microscopically, he found there were differences between this jellyfish found at Cardwell and the proper description of Chiropsalmus. So he reckoned he had found a new jellyfish. Now it was only new to the white people at that stage but it was new and it needed a description. Southcott did it and in memory of Flecker; he called it Chironex fleckeri. And it dawned then on science for the first time what the aborigines had known from way back and if somebody had thought to ask them they's have quite readily told them, So -

We thought we had the thing made at this stage, we'd found a new jellyfish. We'd found that it could kill. We investigated its habits. I did most of this because Flecker resigned from his medical work to do this promptly dropped dead.

It's rather common I think, you know, this giving up your life's work to pursue your great life hobby and dropping dead about then. It seems to be the lack of pecuniary stimulus or something. I'm going to keep right on working for many and many a long day, much as I hate it because....

Now the other thing that Flecker did was to raise the question whether there was just one mystery jellyfish or whether there might be two because we noticed that people who died, died pretty smartly. If they recovered, they recovered quickly and completely.

But every now and then, there would be an epidemic. You might call it an epidemic because I remember seeing three truckloads coming in from the beaches. And they were full of carcases, you might say, but these carcases were alive and they were writhing and they arrived at the Base Hospital. I was much intrigued, they came past my house with them - I was looking out the window and I saw all these bodies in the back of the truck heading for the hospital.

Ambulances couldn't cope, the numbers were too great - forty - fifty at a time. I went down to the hospital to see what this sort of thing was. You know, I was rather hopeful it was food poisoning or something

and I might learn something.

These people all had been stung and they were lying on the floor in the cabs, some of them were on couches, some of them were out on the roadway because again there were too many and they were vomiting and they were writhing and they were cursing, sweating and none of them died. Now this was what Flecker had seen; and he said, well these stings were something different and he postulated that this also was caused by a marine organism and he had reason to think it was a jellyfish.

Now Flecker was an extraordinarily persistent man. Nobody believed this. This was nonsense to the general public. They said this was silly. I mean, there were forty to fifty people stung in the one spot and we'd peer around in the water and we'd see nothing. It's ridiculous to suggest that this was a jellyfish.

But Flecker wouldn't accept that sort of thing. And so when a couple of people got stung in the city baths (it was salt water in those days) he said: "Right, all out! All out! Turn off the pumps!" And he got the Naturalists Club there, with buckets and pieces of cheesecloth and he took the water out of the city baths, bucket by bucket, and poured it through a piece of cheesecloth and this was, you know it took two days....

He found the most amazing things in those city baths because nobody ever cleaned them out like that before. ....Flecker was, that he didn't find the jellyfish. He was not a man to give up easily this Flecker. He said, "I don't give a damn whether we found it or not, it's got to be a jellyfish", and in due course I'm happy to tell you that it was found to be a jellyfish. And why they didn't find it in the city baths was that it had been through the pump and the pump had chopped it up and it was in unrecognizable shreds, but still perfectly capable of stinging so I think Flecker's dedication to his own well founded views is something we might all bear in mind for the future. We've got a lot of problems in this world and people have got facile explanations for them.

If they don't fit properly, just because they can't see what the alternative is, let's not stop looking for it. I'm not giving a political speech at the moment but you might well think it.

Now this is Chironex fleckeri the way we are lucky to see it sometimes. Most times we don't see it at all. And that's the body of the animal up there, and those are the tentacles coming down there. Now that's on a nice clear day, bright sunlight, clear water and a boat to look from. That little bit of white stuff down the bottom there, that's the side of the boat, so we were quite close to that stinger and it's not very visible.

So we know a little better what we are talking about that's standing right over the top of one; in clear water, bright day and it's still not very visible. The jellyfish is in the upper part, that's the body of the jelly there, those are the tentacles there .... and we often do find that we can see that shadow a damned sight better than we can see the jellyfish so I want to make this point right now, these are hard to see unless you know what you are looking for and unless you have special equipment such as polaroid glasses, as we'll see later ....

And it's ridiculous for dad to sit up under a tree on the beach with his stubby in his left hand and his cigarette in his right, and say "the kids are down there swimming, but it's all right, I'm watching them".

Now, if we get this creature in a tank and we do that to it, we put it in an aquarium tank and we put side lighting on it and a black sheet behind it, then we tend to see something. What we see is a large thing much bigger than my head with a number of tentacles and a general squarish sort of shape ....

Chiropsalmus .... and a much lesser lethal capacity ... And there is another one of what I would classify as big box jellies because it's not quite as big as your head, but as long as your head.

This is the stinger which is starting to grow prominent in the South, a thing called Tamoya. Now Dr. Endean is ....

A lot of people have been stung down there and they said "it's Physalia", and then they said "No, it's a little mauve stinger" and then they said "no it's something else", and then they said "they're neurotic anyway". But the fishermen were a bit persistent and they said well, there's a funny looking thing and they talk about the box jellies up north and this think looks like an elongated box, more like a coffin maybe with four tails on and we think that's it. And in the fullness of time, Dr Endean found that this was an important creature and he said that this is Tamoya.

Now the Tamoya that you see on the screen here is the way we see them up here, about 8" long - the tentacles have been broken off because they're horrible things to handle with their 5 feet of tentacle on them. So, the first thing you do if you've got a Tamoya is to chop off the tentacles, and that's what has been done here. Again, its a hollow thing which is not round, it's sort of square and it's got four corners and the difference between it and the others has yet to be established. When it's down south they're only about as big as a teacup, this one up here, as I say, would be 8" long, now whether an 8 inch Tamoya will kill you or not we haven't found out because the only stings that have been encountered up here have been in lifting them from the water where you get only that tentacle across the fingers and that of course wouldn't be lethal for any jellyfish.

Now we're talking about the small box jellies. Now, you won't see that very well and it's not surprising, nobody ever does. That's why it took so long to find. But you will see four strings of, you might say, cobwebs with dewdrops on it, and those are the four tentacles and in that picture they're about 2 feet long, the body of the jelly-fish is there, and it's about as big as the end of my thumb. Now that's the same animal, hauled out, stuck in formalin and photographed in strong light. The tentacles get all puffed up and the jelly goes all milky and so would you if you sat in formalin for a few hours....

This is the jellyfish we see all the way along the east coast, in fact all the way around the world, right down into the Antarctic where they come 20ft across, up into the Mediterranean where they are only

about 6-8 inches, and around here they run from about 8 inches to 2 feet. The tentacles hang down, unless they've been caught on a reef or in rough weather, about 20 - 30 feet and this animal has had a bad reputation in the past but despite the very earnest endeavours of Ron Southcott and a few others including myself we haven't been able to kill anyone with this jellyfish.

And there's a Physalia in an aquarium tank just in case you've forgotten what Physalia looks like. It's the thing you see at the high tide mark on the beach and the little boys go along stamping on them and the gas bubbles go pop.

Now it comes back to remind us about this big box jelly .... swims by jet propulsion. You can see that .... in the middle of the back of the body there where the jet of water squirts out as it goes, and by this means it can do a good 3-4 knots and it can keep it up all day. It's got eyes. It can see, not very well but it can see well enough to avoid major obstacles and it can see quite well up close, and the eyes are turned perpetually inwards normally, contemplating .... stomach....

The eyes are not very obvious there, there and there, one on each side. And they've got big tentacles and they're long and they're stripey like that with rings running around them and those are features I want to notice because we're going to talk about the chemical aspects of these stings. How do you know if there's a big box jelly sting?

If there's a lot of tentacles, and the odds are the victim will have more than one on him, usually six, eight or ten. The tentacles have got stripes on them and you see these markings on the skin also in some places if you look for them, and as we know its a big potent, potentially lethal animal and anybody who's got multiple sting marks with transverse bars in them and extremely near to death.... If he's dead as a doughnut, it's a certainty,because no other animal that we know of will kill him as quickly.

This is a typical sting from the early days and it shows the interesting grading of the sort of injuries we can get. That picture was taken three weeks after contact with the jellyfish. See the markings across the chest where it looks like he might have been gravel rashed? He might have done a duck dive on sand or something. Those are due to the tentacles rolling across - did not attack - and few capsules fired on this brief contact. In the left elbow there we see a permanent scar which is where the tentacle did stick on, in, firmly and take so long to heal that it gave us one of these cicatricial scars, of the type the aborigines used to produce by rubbing mud in them.

There's a more recent sting, you can see the main effect goes from more or less a surface burn, to a blistering effect to a tissue killing effect, leaving an ulcer.

There you .... an ulcer, multiple tentacles; you notice in all these pictures multiple tentacles, severe skin damage and in this case, again from the old days before effective treatment, the .... of the skin, just rots out over a period of weeks, falls away .... . Now all these stings we have seen are non-lethal, not because they're not tough enough or big enough stings, but because they're not extensive enough. Although you get venom into circulation, you don't get enough into the circulation to worry the victim, what's most worrying is the skin effect. If you saw something like that today you'd be very upset indeed. We don't have any modern day pictures because with present day treatment there isn't anything worth taking a picture of.

Now this is the sort of sting which is marginally lethal. I want you to get this very clear, for every sting which is lethal there are one thousand approximately which aren't; and so anybody who's been stung by a jellyfish or even a box jellyfish is not necessarily in great trouble. This young man was, because that's getting close to a lethal sting. The reason it wasn't lethal, as far as we know was, he had one gallon of metho poured over him within one minute of contacting the jelly and leaving the water. The metho was sitting in a bottle, on the beach and it was poured over him liberally and although he has quite a bit of damage there he was hopping about.

As a matter of fact, he was stung again the next week, so some people take a lot of beating.

That's also from the old days and of course, that's lethal. Now it wouldn't have to be lethal, it was lethal in the circumstances, because it was a big sting and a big jelly and it was a little girl and somebody rubbed it with a towel and made sure that she got an adequate dose and then somebody else dropped some water on it and they kept plucking away at the tentacles which were adhering to the skin at that time until she just died before their eyes. Nobody thought to put a tourniquet on, but those stings are almost exclusively on the legs, nobody knew about metho, nobody knew about leaving the damn thing alone, and that was an unnecessary death.

We thought that was an unnecessary death, this little boy survived an hour and a half despite the fact that he fairly big sting on a very tender young skin. His father was a German, didn't understand English, didn't know anything about box jellyfish, wasn't prepared to be told not to swim in that bay at that time. But worse than that, he took his little boy in with him and he dragged him around on the end of a rope and he dragged him smack through a jellyfish. Now the little boy put on a fair sort of turn about this, so his father, you know said, "Well, we Germans are tough", I guess, and he refused to do anything. And he refused to have any medication put on it, and it was only after about an hour that he was persuaded by another German that this could be bad and he should take him to the hospital. It was very unfortunate that he would have done that, because if he'd just stayed at home and maintained his German independence that boy probably would have lived.

When he got to the hospital, the nurse said "He's too dirty to see the doctor" and they washed him, and he died right there and then. Another unnecessary death, it could have been stopped at any one point. It could have been stopped before he went in the water; it could have been stopped when he came out, with methylated spirits; stopped after that with tourniquets; or stopped if the nurse had just been less obsessed with cleanliness.

That's the other side of that arm - its not a very big sting ....

That's a lethal sting - and that's one that had to happen because it's on the body massively, on a girl who has thin skin - not hairy, nor is it very suntanned in the area stung, minimum clothing on, you couldn't put tourniquets (on). (She) did have a lot of methylated spirits put on, she did have antivenene given, she did have artificial resuscitation to which she temporarily responded. But as soon as the circulation started up again she picked up more venom from underneath her skin and she died. There's only one way that she could have been saved in my opinion ... was if her boyfriend hadn't tried to remove the tentacles in the first place. She might just have been alright. It was a marginal situation, I think, when he picked up the towel and gave it a rub, it made it a non-marginal one.

Thats the back of this same girl. Now I show this for a particular reason. There's a tendency and its particularly in the Surf Livesaving clubs, that when the victim comes out you must make him lie on his back, but its not a bad idea to have a look at the back first because sometimes that's where most of the sting is. And if you lie them on their back and then pummel their chest, all you are doing is massaging it into them. So, before you lie a victim on the back, pour some metho down it first, or on the sand, or on a towel, and then lie them down.

(The Speaker has shown a slide of a sting at Kurramine Beach with the comment that this is an obviously lethal sting and has stated that the boy was stung close to shore, that the father was a long term devotee of the jellyfish information program, instantly recognised what had happened and immediately applied the methylated spirits which he had on hand but despite this, the boy stopped breathing and lost his pulse. The father applied artificial respiration and a pulse returned and the boy vacillated on the beach three times between apparent clinical death and apparent partial recovery.)

Now this, of course, is an obviously lethal sting. This is the bloke if you want to ask about heaven, get him to tell you it after. He went there three times and came back again. He was severely stung.

His father was a devotee of the whole jellyfish investigation for many years and knew exactly what had happened, and knew exactly what to do. He had the metho there and he poured it on him but the little boy stopped breaching and lost his pulse. His dad put on a tourniquet, got down and gave him some mouth to mouth, thumped his chest and the boy came round again.

Then somebody said"you've got to take that tourniquet off." So he took it off and the little boy passed out again. This happened (I think) 2 or 3 times on the beach. Whether he actually died each time and was resuscitated, this isn't very clear but he certainly turned black and had no pulse.

The ambulance came along, and at this stage he was in one of his better stages. They had to put the tourniquet on I think and he was transported to hospital. One the way his circulation kept up pretty well and he received another dose of venom from underneath the skin into his circulation and he had to be resuscitated in the ambulance.

When he got to hospital, again he died and as he had two doctors present there we can say he was dead. But they had recently heard my dictum that nobody is dead until they smell and so they got stuck into him. And they gave him cardiac massage and they held him up by the feet because they couldn't give him mouth to mouth breathing, his lungs were so choked with fluid. And so they held him up by the ankles and they blew into his mouth and let the fluid run back. And, eventually Dr. Maguire lay on his back, on the floor .... tube; and in that extraordinary position for intubating the larynx, he did that. And having done that they put a little tube down the endo-tracheal tube and they sucked out the juice and from that moment on the bloke never looked back. And that's him the next day.

..... That's another boy with a lethal sting. Now what we regard as lethal is approximately 2 feet of tentacles per stone (body) weight of the person. Its a gross weight ratio. That's a bit rough because its dependent on the size of the jellyfish .... . This boy .... was on his own at the beach and he was stung and he was seen to run out of the water from a car travelling along the Cook Highway. Two girls in the car saw him run out and do an extraordinary sort of

flop on the sand and they said "that's funny, that's an odd thing to do with no audience" and so they drove down the beach to see just why had he done that and they found that he was pretty heavily covered in jellyfish tentacles and he appeared to be dead.

Now they had heard something about resuscitation and they knew that you have to give the chest a thump and then you have to do some cardiac massage. So they gave the chest a thump and this started his heart again. And this is very, very commonly so with these people, they're not hard to get their heart running again. Usually a thump on the chest will kick the heart off again. And they gave him a few puffs down the mouth which may or may not have been necessary and they massaged him; and they didn't do anything but that, and they had sandy hands and they massaged him and they rubbed all the skin off his chest (and that took something like four months to heal because they wore that boy just about down to the bone there,) but they save his life undoubtedly and it was the thump that did it. And they carted him into town and we gave him cortisone and antivenene and stuff and .... he's alright and that's him the next day sitting up in hospital.

And this was another one of similar magnitude to the, - of much greater magnitude really than some of the ones that died in Mackay. This one was pretty lucky because she was the girlfriend of one of the lifesavers. He was sitting on the beach and they had this bottle of metho there and she said "I think I'll go in for a dip", and she went in and was immediately stung and they .... out immediately and the boyfriend poured metho over her and put her in a car and brought her into town and she had antivenene and so on; she was .... the following night. I think she married the lifesaver.

Now those were all Chironex stings and they all had .... in common. They're multiple stings, they do a lot of skin damage. They may or may not kill but they're recognisable sort of stings. Its not hard to pick a Chironex sting, particularly as the tentacles are always on it too, they are like little dirty bits of thread.

And that's a smaller Chiropsalmus and that's about the best it can do.

That's a maximum sting from Chiropsalmus, and if you were to see that new I don't know how you'd decide whether that was a small Chironex or a big Chiropsalmus. But the point doesn't matter, it's a big box jelly. It should be taken reasonably seriously; it should be watched and these days it should be taken to medical attention, (for) assessment and determination of which jellyfish it is and determination as to whether it should have antivenene or not.

Now, this antivenene thing I mentioned a few times. We don't just give antivenene to people who are nearly dead or likely to die. We give it to anybody who is going to take a long time to heal, anybody who is going to go through extreme distress in the process of healing, and they do! These days we give it to anybody who has a severe sting, even if its only a little one. And its quite incredible stuff. If it's given within one hour you can see the patient's look of relief dawning on their faces as the stuff goes through the .... vein and this is no exaggeration. It takes about 2 minutes to squirt the stuff in and a lot of them, by the time the injection is completed, (they) say "..., that's better ....". Its a modern miracle.

I want you to think of this one, because its a box jelly which can be possibly lethal, and it will leave not perhaps more than 2 or 3 marks, but they'll be the same type. There'll be skin damage, there'll be bars across them and they actually could be recognisable because those tentacles are a good half inch wide and I'm seeking information, so, if you find one of these and you can find somebody to put it on without .... I'd be very glad (.. laughter ..) know what happens!

Now, there are only a couple of other stings you can confuse with box jelly stings and this is one of them. And this comes from the big snottie jellyfish that I said is all around the world, and 20 ft. across in the Antarctic. And it produces very dramatic looking zig-zag red marks and they're causing a lot of unnecessary alarm because this is a pretty minor sort of stinger. It's not very painful and the sensation lasts only about 20 minutes. The sting doesn't blister, it doesn't die, there's no scar and the whole thing is over as far as the patient is concerned in half an hour. And as far as you can see,

its gone in 2 - 3 days. And the giveaway is that nobody would have a box jelly sting of that size and be quietly smiling there for the camera - just would not!

And that, of course is a Physalia sting and they don't really look anything like the other ones. There's some wealing, its a line - usually only one line, and there's no blistering. There's no tissue destruction but there is a lot of pain. And those people do need treatment, but they don't need tourniquets and emergency measures.

Now that brings us to the point where we've finished with the big box jellies and I don't want to confuse the issue by going on to the small ones immediately. I'd invite some questions on, specifically, big box jellies and what to do about them.

(This question from the audience concerned the time of the year when big box jellies might reasonably be expected to be present.)

Yes, big box jellies, they're summer. Their earliest appearance is about November, their latest disappearance is June, but normally you'd expect them at the end of November or the beginning of December, numerous around Christmas time in the school holidays and gone again by about April. The distribution, by the way, is a lot wider than has been realised. They're all through the tropics in the Pacific, in Malaya, South China Sea, Solomons, Philippines, New Guinea both North & South side, but of course, on the north side of New Guinea they get them in our winter because it's the other way from the tropic. They're not confined to Cairns as some of the people in Townsville would like to tell you. They're all the way down the coast; fairly numerous in Rockhampton and thinning out to Maryborough and the Chiropsalmus was recently down in Moreton Bay and Brisbane. If Chiropsalmus can get as far south as that, no doubt Chironex can too occasionally, so this is not strictly a Northern problem.

(The next question related to the use of methylated spirits as this was not standard equipment on beaches in the south.)

Now this metho is .... . Up here we usually do carry it. Everybody who goes near the water carries metho, I think, these days. This is an accepted thing. I had better explain what the metho is all about. It's not a treatment, it's a preventative. What it does is to deny water to the stinging mechanism of the tentacle. The tentacle breaks off on the skin and at the time it breaks off maybe on 5-10% of the capsules have fired and penetrated and deposited the venom underneath the skin. The remainder are sitting there and they will fire if you mess about with the tentacle, rub it, stretch it, and so you can get 5-10 times the extra venom in by disturbing the tentacle which hasn't been somewhat neutralised.

Now what the metho does is to suck water out of the tentacle. The firing mechanism and the penetrating mechanism and the flow of venom depends on water. This can not happen without the presence of water, and the metho removes the water, dries out the tentacle a bit and you can then say with reasonable certainty there will be no further stinging. Whatever has gone in, is in, and the metho doesn't make any difference to that. But usually what is already in is not lethal, it's what is to come in during the emergised attempts to get rid of tentacle. So that is the primary reason for metho. It's to dehydrate. If you haven't got metho, well think what will dehydrate, beer won't and petrol won't because it doesn't take up water and kerosene won't. So you have to think in terms of dehydrating. It's not just that it's a spirit or a special sort of fluid. But road dust will, salt will, sugar will, because all these things suck up water and they can compete with the tentacle for water. So you're looking for something to dry it with. And anything that occurs to you which will suck up water out of those tentacles, this is well worth putting on if you haven't got the metho. But metho is just so much the better. You can use talc. You can use absolutely anything so long as it is not watery and so long as it will suck up water.

(Following through, a member then asked about the method of application. He had come to the conclusion that it would be unwise to rub the metho on.)

Yeah, Yeah, you don't rub it on, you don't tip in on, you flood it on. You get a can and you pour it up and down and up and down and then what's left in the can you pour that on five minutes later again and if you get another can meantime, you pour that on. It is a big operation the metho. It's not a couple of ounces, you want a gallon.

The other thing I might mention as emergency treatment where you haven't got metho is that if you can't dehydrate the tentacle, you can at least coat it with something; and again, when you move it then it will be coated and it won't sting, this is again where I like road dust. There is always road dust. You got there by road and it's nearly always dusty near a beach.

Only as a last resort would I turn to sand because sand does not suck up water. Sand does not coat very well and it seems to be something that people like to do is to grab a handful of sand and rub it, and it usually achieves only one thing, and that's to spread the sting out. If you must use sand, get hot dry sand and sprinkle it on and try to use that as a coating and that is the only value that sand has.

(Query: After you have applied liberal metho or things like that, do you take steps to take the stinger off or would you leave that alone?)

When you've put the metho on the tentacle it starts to shrivel up and shrink away and it usually drops off. If it doesn't drop off, you can please yourself you pull it off, or leave it there.

(Query: Is it safe to handle it?)

Yes, it's safe to handle. You can do what you like with that tentacle. I suppose one very good thing to do with it is to put it in a bottle and send it in with the patient so that we get a little bit more data.

(Query: Doctor, in that case where Errol Maguire had to intubate that kid, you said this fluid was present in the lungs. Does this occur in all cases of a sting?)

No this a question of time. It is one of the .... the action of the venom is not fully known. Again there is a lot of argument between what I say and between what .... says, and what Bob Endean says .... and I'm only giving you my version of it.

What I think this venom does:

(a) it creates pain with one fraction which is not a lethal one;

(b) it damages the skin through a second fraction of the venom again not a lethal one;

(c) it has this peculiar other material which we cannot identify chemically. It is some sort of protein, but it does not fit into any family of protein we know, which enters the circulation and in the process of being distributed in the blood it has an effect on every possible cell in the body. What I think this effect is and I am getting a little bit of support now, it inactivates the membrane of the cell. In other words, it sort of takes the clothing off the cell. It prevents the cell membrane from building up the electrical charge which prevents what ought to be in, from getting out, and from what ought to be out from getting in. As soon as you get a good dose of venom around a cell, things that are in a high concentration inside the cell move out, and things that are in a high concentration outside move in, and you get a total disruption of the normal chemical balance and electrical balance of the cell and so it hits lungs and it hits brain and it hits muscle and it hits kidney and it hits any cell, and which cell it hits depends on time.

Now if you get a very massive dose the cardiac cells are going to be the critical ones and they're going to go out and the person is going to die before anything else might happen. If the dose is a bit lower, you don't stop the heart. Then it is the lung that is next vulnerable. The cells cease to have their individual function, the blood pressure is still circulating through the lung and the

fluid from the blood moves into the air space(s) in the lung(s) and fills them up with serum and they get acute pulmonary oedema. And if it is not the lung that cops it and if you manage to get them through that, but the stuff is still circulating, then it will be the kidneys and the kidneys can pack up, they can fail to make urine and they can die from renal failure. But it is a question of time and dose. Big dose has an immediate effect on the heart, slightly less dose, a lethal effect more slowly via the lungs, slightly less does again, lethal effects over a period of days on the kidneys, if it is not stopped.

Query: Doctor after pouring methylated spirits on, how long would you have to wait before you can take off the tentacles?

I never take the tentacles off at all. I leave it till tomorrow when someone else does it for me. I can't see any point in taking the tentacles off but I would think if you want to take it off for psychological value or to put in a bottle, not less than ten minutes, and not less than two applications of metho.

(The next query was a beauty, this ambulance bearer said "If the victim can die so quickly, how does a tourniquet help? What happens to the injected venom? And, if a tourniquet is a good thing, when should it be removed?)

Reply: Well, the trouble with this stuff is, it's not injected in one little spot like a snake venom where you could cut it out. You could put a tourniquet on and you could chop off the lower half of the leg, say you know it's not a very big price to pay and you could sew it up and take the tourniquet off and Bob's your Uncle! But this is deposited in millions of tiny little droplets under the skin and so it almost amounts to a potential intravenous injection as the blood is flowing through the skin as it is going to pick up the staff with remarkable speed and if it picks up enough - that patient goes unconscious or goes dead and you're talking ..... .

The blood flow has stopped but if you then resuscitate and you start the circulation, the stuff is still sitting there under the skin and it will be picked up, and another load will be picked up by that circulation. This is why you get the sort of fluctuating situation where they hover between life and death, sometimes four or five times, before they finally die. We see this a lot in test animals where we have the dose very marginally lethal. They can nearly die, then the circulation drops and they stop absorbing venom and they come good again. Now what happens apparently is that the venom that goes into the blood is destroyed in twenty minutes flat because we can keep on pumping doses into test animals almost killing them, giving them twenty minutes to get over it, then giving them the same dose again and you can do this as long as you like. So they must be totally removing what's in their blood. But if you put it under the skin it is not destroyed at all and it can sit there for hours. It is only destroyed after it gets into the blood, so that in the tissues, in the skin, it is a going thing for quite a long time and this is why you've got to leave your tourniquets on for a long time and I would not hesitate to leave a tourniquet on for two hours if the situation was critical. I might say that lots of orthopaedic surgeons don't hesitate to either if they're just feeling a bit tired on a Monday morning .... leave it a bit longer I've seen them deliberately left on for two hours without any grave consequence especially in young people.

(The next speaker was clearly a believer in sand as an emergency treatment. He suggested that it could be a good thing to use a combination of sand plus metho at the earliest opportune moment.

Query: Well, I wouldn't argue it might be a good thing to do but we are dealing with people; and if you let people use sand I tell you what they'd do they'd get a handful and they'll rub it. They would be dead before they get the metho. In theory I agree with that, but in practice I don't think you can trust people to use sand. They would use it the wrong way.

If I could say something else about this metho by the way. It's

not a treatment, as I said it's to prevent more stuff getting in. It doesn't treat anything that's already in there. It's not a pleasant thing for the patient, it does not relieve the pain and this has been commented on in many quarters as a reason for not using metho, they say. It doesn't do a thing. Well, it doesn't, from the patient's point of view it does not relieve the sting and might make it a little worse. So after you have adequately drenched it with metho a couple of times, it certainly is legitimate and I think proper and desirable if you could put a soothing cream on and the stuff we're using at the present time is Xylocaine Ointment. Put a bit of that on and smear it out and if it's not a very big sting we might rub it in a bit and they get immediate benefit and relief, and we'd follow that with a corticosteroid cream and rub that say half an hour later. Metho is not treatment, metho is prevention but I believe that most of these stings are preventable, you're not going to have to do anything heroic if you just prevent them getting the full dose. If they only get the small dose they have when they reach the beach, if they don't get any more into them, they'll live.

(Next question and answer to indistinct to transcribe.)

(The next question was in relation to aboriginal lore. What precautions did they take in regard to marine stingers?)

They state quite definitely that children must not enter the water after the first storm of summer. Now that is a fairly good guide. After my eighteen years of checking weather against jellyfish presence, it is not often that you find jellyfish before the first summer storm. You nearly always will find them after - within a week after it. It has got nothing to do with the storm, it just happens to be a coincidence between water temperature and humidity and storms. But it was their rough guide and a pretty good one. and they would belt the daylights out of the kids if they saw them go near the water after that first summer storm and that was their main treatment of course it was good preventative treatment to whack them on the end with a spear.

Where they did get these kids stung they had a number of things they

used to put on. They seemed to recognise that there were two situations, there was a fairly small sting that needed relief and they used to put various vine saps on, these beach vines with the purple flowers (Convolvulus-y looking flower) These were mostly used by the aborigines they .... mangrove saps, there were a number of vegetable juices ..... And on a small sting practically any vegetable juice has a remarkably soothing effect, and I don't know why this is true but it does have a soothing effect.

But on a big sting, they recognised you should put nothing (except they didn't have any metho in those days). And they recognised that putting any of these .... on did enhance the chance of killing the patient. They had a different approach there, I don't know whether this was a sort of a try to get in first idea but this .... used to pick them up by the feet, swing them around their head and dong their head on a tree. This was done down at Aurukun during my time in North Queensland, two kids had their heads donged on trees. Those children survived. But whether they would have survived without being donged on the tree, I don't know!

(Then another fellow said that perhaps this Chironex thing is overrated or perhaps some people have better immunity to it, because he had seen pictures of men running the tentacles through their hands without any apparent harm.)

Well the palm of your hand, the average man's hand is not permeable to these jellyfish threads. They're very, very fine threads, they are two millionths of a metre thick and that's very fine and just can't get through the cornier parts of the skin. If it gets through in here fine, it will get through there but not here. It won't get through here on me because it just doesn't get a good contact.

Likewise most of the hairy middle parts of my leg I can stand jellyfish tentacles across those because they don't get a good contact and they don't sting very hard. They perhaps don't even recognise hair as being edible but when it's skin they most certainly do.

Now there are a lot of questions about variability of effect but if you get it around the ankles where your socks have worn the hairs off or across the top of the foot where you never did have any hairs and mostly it's fairly tender, these are the areas of very savage stinging because the tentacles get good contact, get good chemical stimulation and this is what it needs to fire. It will fire the vast majority of its stinging capsules on those special areas. Likewise, up around your chest, a bad place to get stung. On the back, it's not so bad, the sting is severe on the back but it can't penetrate sometimes into the underlying tissue.

The skin on a man's back is remarkably thick, its nearly ¼ inch thick in places and the penetration of the threads is only about ¼ inch and so sometimes you can have a good sting on the back without any of the venom getting into the circulation, it's all in the skin.

This of course is the background to the use of the pantihose protective wear. The capsule is a minute thing 23 microns wide, on the average 80 microns long and it spits out a little preliminary prong when it is discharging which is about 40-50 microns long and it is this length and this is the blunt bit on the end of a sharp pin. That is how thick it is. It is not a pin head, it's just a tiny thing and the success of the whole injecting operation depends upon that first bit out getting "spudded in" you might say, anchored into the tissue, into the skin. If you put in a layer of the sheerest pantihose it will stop 9/10ths of those reaching the skin at all. The little beak that comes out first is so short and if it doesn't reach the skin and it doesn't get attachment, whatever happens after, that doesn't matter very much because it's non-directional and it's going to go waving off in various directions and the 2,000 microns that come out after it are very unlikely to penetrate the skin in any substantial numbers and this is how pantihose works.

It also works because it is not edible. You just try! And the jellyfish knows that. Their tentacles only sense anything they take to be edible or they take to be a threat to them. Naturally they don't go round stinging the sand and the seaweed and the rocks and everything they touch including one another. They only do that if you start pulling their tentacles and getting them mad, well,

they will sting anything that touches. But normally, they are just cruising around looking for tucker and if they cruise across a piece of pantihose, well that's not tucker. They keep right on going, they don't stick to it, they don't sting.

It is a remarkable thing, too. Well, it's a wonderful thing for me anyway after years and years and years of getting stung over and over and over every season, to now just walk calmly right through them with my pantihose on - lovely feeling'

(Do you put anything in prevailing winds bringing them in greater numbers, or ?)

I do. Its the absence of prevailing winds that interest us. The .... our prevailing winds are winter, ... roughs up the sea and they don't like rough water, they're pretty fragile and they've got long tentacles and they get bust up. The detect turbulence in the water very smartly and they move out and deep and they go up the river mouths.They deliberately go into shelter in rough weather and most of the shelter is either deep in river mouths or well offshore deep between reefs, this sort of thing. So its the South - Easter and the rough weather which keeps them away and as soon as you don't have that, it doesn't matter much whether you've got a flat calm or a Northerly or a North-Westerly. As long as it doesn't ruffle up the water they'll move in. The reason they move in is that they're following their food supply - it moves in too. They follow that in and are able to stay there because the weather is calm.

Now Northerlies bring in this other little stinger which I think we might pass on to now but they don't bring in Chironex. Chironex comes in of its own accord. Its a strong swimmer and it goes out when its ready, too, as soon as it sees it's rough it goes out I don't think the wind matters very much with Chironex, it's a question of no wind that matters. But it does matter with this other little bloke and I want to tell you about this, because this is even much more important in recent years. I think we've got the Chironex thing largely beaten and we're perhaps hearing more about this other one.

Now, that this one, this thumb sized thing with the long tentacles that Flecker emptied the pool looking for and I chased for 7 horrible years before I eventually caught the first one - and that's it! A little bit battered actually because it had been squashed on four peoples' skin before that to find and make sure that it was the right thing. Those four people will all vouch to this day that's the right stinger.

Now that thing causes a very, very minor sting, very minor, at the time of contact. It just feels like a prickle, some people don't even know they've been stung. And very few kids would cry if they got stung by this thing, immediately. They would comment on it that's all. And they would .... alright and the sting would decrease and they might be back in the water or getting back in for 10 minutes before they'd actually start to get sick. Then they'd start to get sick in the manner that's mentioned up there. Now those are your .... and they're nice big words too.

No words can describe exactly what this Irukandji or Carukia or small carybdeids or small box jellies (all varieties of names for the same thing) - what this can do to you is beyond description, you want to die, there's no argument. You are one pain from head to foot, and it varies and it shifts from your belly to your back and back up to your head and shifts down to you legs, and you're vomiting and your coughing and your eyes .... If you'd seen it you'd believe it, if you haven't you wont, so I wont go on about it. But these people are horribly sick and why they don't die I don't understand, but they don't, even when they get 4 or 5 stings they don't. Well, nobody has yet.

We nearly had 3 deaths last year under very special circumstances, where lifesavers had put out a net to protect the swimmers. A great swarm of these things came in to the extent that every cupful of water would have one in it and they banked up on the outside of the net. A few got through. The lifesavers realised that this net was not going to hold things as small as that and they'd better get it in before the public got the impression that nets were not effective. And so they got out on the outside of the net and they hauled the thing in, and in the process they probably got 50-60-70 stings and we had 17

blokes close to death, 3 of them very close to death at that time. But that was a special circumstance I trust will never be repeated. I'm sure no lifesaver will ever pull in a net from the outside again in the presence of jellyfish. If you're going to pull it in you must stay inside.

.... now the interesting thing is that .... and most of what you see there is the mark from the bloke's watchband, not from the sting, but the sting actually was under his watch band.... and that is a small Carukia irukandji sting .....

Beware of making a goat of yourself with these people. It's done regularly, it's been done since early times. People say they get in the water and something stung them, and they're alright for a while. But when they're up on the beach or maybe half an hour later in the water, they started to get crook and they got a belly-ache or a backache and they vomited and they got a headache and they got a few other things - you name it, they got it. But mostly they complain of backache and bellyache and sometimes difficult breathing. Now if you say to them " that's just a pie you ate", you know you've made a bad boo-boo. And if you say " you're hysterical, man quit .... up and down" you're likely to get bopped. They're not paralysed, these fellows. But they're very.... and when they get to hospital and the sister says" calm yourself, you big strong ...."and refuses to give him some pethidine then she's going to be sorry too. And it's very easy to make a fool of yourself because there's nothing to see. You'd better believe them. If they've been in the water and they say they're in very severe distress even if they can't even remember having a sting, we assume that they ran into one of these little tiny things and that's the .... sting they've got.

I don't think many Australians are hysterical; every one of these people seems to be. They cannot keep still, they cannot concentrate, they cannot describe the sting, they just (say) " Oh, Gosh sakes, Doc., give us something would you?" They don't want to talk about stings, they just want to get on with it. And they'll get some and then 10 minutes later they say " Oh, come on, come off it! Give me something more! " - and they are in trouble and the only thing that you can do is get them to a

doctor smartly. Realise what they've got, take them to a doctor and let him give them a .... dose of pethidine intravenously. And then they will take a deep breath and say, " Ah! Thanks! " and they'll stay good for half an hour and then they might need a bit more , and the pains will come back and they might need some more pethidine.

This is a real sting, hitting more people than we recognise. It's been common on the East Coast at least as far south as Brisbane. When you go back in the records you find that this has been happening since white man first came to Australia. It's common right across the tropics, common in the Gulf of Carpentaria and down the other side, down around Broome.

A number of newspaper reports on Broome are quite fascinating - " Forty Swimmers Stung By Sea Snakes " and so on. These are Irukandji stings. They didn't see any snakes but in those days the only thing they could think of, I suppose, would make you figure that it would be a snake. So they assumed that there were a lot of invisible snakes around there.

And you get a lot of these epidemic stories in the newspapers and obviously there are waves of these little stingers. Now, they happen in ships at sea, where you have people come in and say that they broke their back sliding in the swimming pool on these ships, they must have broken it because when they got out their backs got so sore and they couldn't walk and they couldn't stand. And if you asked them " Did you break your belly too ?" they'd say " Yes. That's true. It is sore!" and it turns out that these things are being pumped into the pool through the filter. They're small enough to go through, and the people are getting stung, on board ship, in the swimming pool.

And I'm sure we can get a lot more of this yet. Don't go .... this, seeing in a year about ... often get operated on for appendicitis. Any diagnosis will do but seeing sometimes.... stingers.

.... each side of the arm, not much to see, it's a little red patch - a few little goose pimples again. Now this is what happens if you get it on your chest and see it about half an hour later. You don't see any goose pimples and you don't see any patch, you see an extraordinary reddening in

the sting area. And you can wipe that away with a towel and it comes out again and it squirts again. A little bit later on it will reverse that, the rest of the skin will be 'squirting' and the patch that was originally stung is quite dry. Now, there is something in this poison that upsets the .... mechanism. .... they don't have temperatures. Anything that you can measure on them is explainable in terms of .... in the hot climate being pretty upset. And we don't know what the venom does have, but its most certainly .... and it does clamp up the belly muscles. You could drive a truck across the belly of some of these people and not dint it and that's one of the ways you find out. Of course, if you .... operated on for appendicitis too ....

Now this is the last one I'm showing you. I'm showing you because of just one reason. That's something we caught six years ago. It looks exactly like that other little carybdeid. There are some very minor differences but we didn't recognise them. We bottled it and preserved it and numbered it and so one and we, I think, discovered (?) it again, but three times since that animal was caught we've had an invasion of what appeared to be the Irukandji or Carukia barnesi, but the people have either been not nearly as sick as you would expect when stung or they've been a lot sicker and unrelieved by pethidine. And it now appears that we have at least four of these .... stings of different potential, ..., and we're back to about the stage where Flecker started. We know something and we know almost nothing. We've solved 2 or 3 problems and it appears (we have) at least another four to go.

On that note I leave you. We get terribly smart about a lot of things in this sea business and just when you think you're getting to be pretty knowledgeable you realise how terribly ignorant .... You've just learned enough to know how silly you've been to think you knew it.

- Acclamation -

Thank you Doctor, for giving me the opportunity of expressing on behalf of this gathering here, our appreciation to Dr Barnes. I feel sure that most of you fellows here have done a little bit of lecturing in your time. I think you have been told in the past to first say what you have to say in the first ten minutes or so because then they will go to sleep on you. I think Doctor has been speaking to us now for close on an hour

and if there's nothing else discussed at this conference I feel sure that the trip all the way from the Gold Coast up to here is well worth it from our point of view. Other people who are here must feel exactly the same, we could go home tomorrow and we've had a mighty Conference, just through our friend Dr Barnes, on my right here.

.... Doctor, I feel that you have shown us tremendous information this morning. You've given us a really good talk, you've demonstrated it so well, as a matter of fact you leave me dumbfounded I don't know what to say. But you know how the people here feel. I feel now as far as those questions Dr Pye mentioned about them coming down the Gold Coast, I suppose its one of the reasons the Gold Coast is so popular, is because those big boxies so far haven't arrived down there. We have a few little things down there do give us a bit of trouble now and then. But it isn't a problem....

I would like, on behalf of the gathering here, Doctor, to express our sincere thanks and appreciation to you for the time, the preparation and the delivery that you have put, into this talk this morning and I've asked everybody to join with me in letting us show, with a vote of acclamation, our appreciation to Dr Barnes.