Another exciting day’s riding with Marjorie was the day I came off! We never did complete this ride in the end. When I had camped with the Nats at Upper Cedar Creek, we had ridden almost to Mt Glorious on the old road which went up to Mt Glorious from Upper Cedar Creek. Marjorie and I were going to ride on the PEI road almost up to Mt Glorious where I thought we would find the end of this old road and then ride down it to Cedar Creek. That was what we set out to do.

We got up past the end of the PEI road and went off on a track to our right thinking this must be the old road. We went about a quarter of a mile or so from the main road to a place where timber had been cut. There was a knoll that had been levelled to make a platform about five feet above the road that had been used for loading timber.

I was riding Achilles and decided to ride up to the top of the knoll and have a look to make sure we were in the right place. So up Achilles and I went and apparently he saw a “fearful fiend” or something and took an enormous shy! Of course what he did was shy over this five-foot drop! There have been two or three times when I have been riding horses that I have thought, “This is it!” and I thought it that time! Achilles did a three point landing on his knees and his nose and I came off the front and did a three point landing on my forehead, shoulder and hip. Even though I hit my forehead it was not grazed as fortunately I was wearing one of those canvas hats I used to wear and it came down over my face. I was knocked breathless. To give Achilles due credit, he got up without striking or standing on me.

Marjorie asked, “Are you alright?” I said, “Well I’m not sure, I think I might have broken my arm or something but I’ll just lie for a while and see how I feel.” She said, “All right, I’ll catch the horse!” Marjorie had a good idea of the needs of the situation, as it was most important really to catch the horse to get me home. So she caught the horse and we sat there and I sort of recovered after a while.

I had not broken anything but I was pretty sore. I rested while we had our lunch but we did not continue our ride down to Upper Cedar Creek, we headed for home. We rode very gently and Marjorie rode all the way home with me and opened the gates, which was very kind of her. Then of course I had to drive back to Wickham Terrace. Charlie Marks came and had a look at me and said I was a bit lucky. My hipbone was very sore but nothing broken.

I spent two or three days lying up and recovering and while I was doing that I read John Steele’s book about the Aboriginal people and his contact with them. His book includes the account of Captain Logan’s death. Captain Logan was on his own when he was killed and the Aborigines buried him, which was very unusual. I asked Johnny Tonge to read the account and find out any other details of what happened. I think the same sort of accident as I had could be what happened to Captain Logan. That maybe his horse got a terrible fright and went down over a bank and the horse and Logan may have both broken their necks. I set out to write up an account of Captain Logan’s death with this possibility but I have only done bits and pieces and never finished it.

For many years around Christmas and New Year we used to ride over to the Draper’s paddock and picnic down at the river. We used to barbecue our meat on the end of a fork stick over the fire. Usually Winnie Draper came down and had lunch with us so we always went prepared for that. Sometimes the children, Eileen and the boys, would come down too. We used to ride through Cash’s paddock and then various other properties or sometimes we rode along the Mailman’s Track. My favourite way to go was through Cash’s because there were lovely gallops going around the side of the swamp and then ending by going up Cash’s hill. People
were very good about allowing us to go through their paddocks. No doubt that was partly due to the fact that they knew grandfather well and he was highly respected in the district. Also my mother was usually with us and so people thought there was a responsible adult who would make sure we did not leave gates open and that sort of thing. We were taught that anyway but some people may not have trusted young people to do the right thing.

In May 1974 David Tonge and I went for a timed trail ride which was up and down a mountain. This was to be ridden within the period of two and two-and-a-half hours. David rode Achilles and I rode Barbary and we finished in two hours and ten minutes. The only entrants who did not qualify for a certificate were the ones who finished too soon. I received a prize of a bag of pony pellets for being the oldest competitor.

In July that same year I went on a thirty-mile endurance ride which had to be completed between four and four-and-a-half hours. This time did not include a mandatory thirty-minute break and veterinary check at twenty miles. The ride was in the Samsonvale area and Suzanne Jones and I trucked our horses to the starting place. I rode Achilles who was much the toughest of my horses and the only one I would take on something like that without prior training. It was a wild westerly windy day and rather hair-raising on the steep tracks through banana farms and along forested ridges. It was better being that sort of day for my woolly coated horse than a still day but not so pleasant for me. I managed to get around, in spite of getting myself lost a couple of times which added a mile or two to the trip, in about ten minutes over time. Once again I received the prize for being the senior competitor. This time it was a bottle of Italian brandy and just the thing I needed when I arrived home!

I also joined a Trail Horse Riders’ Club in 1974 and had some good rides with them. I remember a two-day ride when we trucked the horses about fifty miles southwest of Brisbane and about twenty riders followed gravelled bush roads along the foot of the Great Dividing Range to a camp site in a forested reserve beside Teviot Brook. Five organisers took our gear, arranged the campsite and fed us. A party of fifteen from the Toowoomba Club rode down from Killarney on the Darling Downs, joined us on Saturday evening and rode back with us, following the route we had used. It was great fun and such an interesting cross section of people from an Arab Stud owner to the girl from a bakery. There was another woman scientist riding, whom I knew from Royal Society meetings, and we were very surprised to find each other there! Getting the horses there and back was the worst part of the outing. There were various hold-ups with the truck and Achilles did not get home until after ten o’clock on the Sunday night.

In 1975 I also had some interesting rides. One of these was over to Fernvale, in January, with a party of twenty from the Samford district. Basil O’Brien was our leader and as he had worked for the Forestry Department he took us by the forestry tracks over the ranges to the Brisbane River Valley where we camped at the Fernvale Showgrounds. Suzanne Jones and Marjorie Scheldt were also on that ride. There were young people riding from the Golden Valley Pony Club and some of their parents brought gear and food around to the camp by car. We rode home by a different route and had an alarming finish to the ride in the Highvale area when we were caught in a driving hailstorm.

I spent Easter that year with the Trail Horse Riders at Gatton. We camped there and rode out each day and had some very interesting one-day rides. The Trail Horse rides were rather fun, quite non-competitive and with an assortment of people and horses. Sometimes there was someone who was over-horsed and this provided a bit of excitement. One such time I remember was when a girl was riding a three-year-old colt which had never been ridden with a
mosquitoes and Memories

mob of horses of mixed sexes prior to the ride. I finished up riding a seventeen-hand ex-
racehorse whose owner took over the colt but would not trust the girl to ride her horse so I lent
her mine.

Another interesting ride I remember was on the Queen's Birthday long weekend in 1987. It was
a three-day ride organised by four trail riding clubs. I chose to ride Achilles as he had been
mountaineering from two years old when trained on Marjorie Scheldt’s property and he loved
it. Prior to the ride I fed him extra oats for two weeks. On the Saturday we trucked the horses
to Upper Brookfield where the ride started. There were thirty riders. Our sleeping gear, a
change of clothes and horse feed were to be transported by truck.

The ride was supposed to start at eight o'clock and a few of us set out at eight-thirty but the
main group did not leave until nine o'clock. We rode through the Brisbane Forest Park, an
aggregation of state forests and water reserves west of the Samford Valley, mostly eucalypt
forest. The trails followed the tops of ridges, then plunged steeply down across creeks and up
again. It was showery and about mid afternoon it started to rain steadily. Eventually we
ascended a very long ridge, the last two kilometres being through rainforest, and at about
five-thirty came to a padlocked gate with a vertical bank on one side and thick vine forest on
the other. As it was winter it was rather dark by then. One girl had been shown a track through
this forest some months before but could not find it in the dark. Rather smug about my
forethought, I produced a torch from my saddlepouch, which enabled her to find the track. We
found the way through to Mt Glorious, paddocked the horses and were driven to Camp
Constable. This consisted of a group of cabins and camping sites, an open sided hall and a big
dining room. Meals and hot showers were provided and I obtained a bunk in one of the cabins,
but had to wait until midnight for my sleeping bag and dry clothes to arrive from Brookfield.

The last group of riders did not arrive until seven-thirty and well after dark. We had ridden
about sixty kilometres. I had no ill effects as I had a very comfortable horse and saddle and a
dry torso. Likewise, Achilles was unaffected. The others were quite impressed with the old
woman on the ancient horse, but I really rocked them when I explained that I was not riding
one of my young mares because I was breeding replacements!

We were to have had a day’s ride on the Sunday but it was showery. About half of us rode back
along the track for a couple of hours to have a good look at the rainforest and some others went
home. On Monday the depleted party rode along the verge of the Mt Nebo-Mt Glorious road
and after passing through Mt Nebo the plan was to travel on forest tracks to Upper Brookfield.
I left the party at Mt Nebo, descended the mountain by riding down the “Goat Track” road and
came home. Achilles was full of pep once he smelt his own valley. I then drove back up to Mt
Glorious to collect my gear.

During the 1990s I was still riding once a week with my friend Suzanne Jones around the
forestry tracks in the Samford area. My cousin (next generation) Margaret Ward and her
daughter Rebecca used to come out to Camp Mountain every fortnight and we would go for a
ride. At other times, Lois and Claire, the two Cummins daughters, used to come over and we
would take my horses out.

I think I have lived through the best time for horse riding in the district because now there are
not many places left to ride and there is so much traffic on the roads. There are horse and
walking trails but the only undeveloped places to go now are up on the mountain. All the
forestry roads are locked off now to prevent damage by the trail bike riders and cross country
vehicles and things like that. I am sure I had the best of it.
Trail Horse Riders camp at Teviot Brook, Border Ranges – October 1974

Riding party at Wights Mountain with Patricia on far right – 1971
L to R. Marjorie Scheldt riding Gypsy, Patricia riding Achilles, Forestry Reserve – 1970s

Marjorie Scheldt riding Gypsy, looking over Lake Manchester – 1970s
THE BARRACKS and the MEWS

The Barracks were originally built as quarters for the workers at the granite quarry on “Cushleva”. The materials used came from the demolition of the Columbia Roller Skating Rink previously on the site of the Brisbane City Hall. The contractor for the construction of the City Hall, A. Midson and Son, established the quarry to supply the granite blocks for the base of the building. It operated from approximately 1921 to 1923 and as it was not a commercial quarry, but only used for this specific purpose, it ceased operation at the completion of the construction of the City Hall base.12

The contractor, Mr Midson, had consulted my father in his capacity as a geologist. My father had recommended the site for the quarry and had taken an interest in the work. At the conclusion of the contract Midsons gave him the barracks building and we used to stay in it on our visits to Samford.

When the Japanese came into the Second World War and Darwin was bombed there was a lot of public concern about the risk to other Australian cities. It was considered that as 101 Wickham Terrace was near Central Railway Station, it was in an area that was likely to be bombed if the war came close to Brisbane. Father wanted to have a place out of Brisbane for the safety of the family and so decided to build a suitable residence at Samford.

There were strict controls on building during the war and he could only get permission to build a house if he did not use any new timber or iron. Midsons had given him the barracks building from the quarry so he already had that. It was on a part of the “Cushleva” property and at this stage the family had not divided up the “Cushleva” land. I think father had his eye on this bit anyway, so he got permission from the family to build the house on what was known as the “old farm”.

When my father picked the site for the building, my mother and I thought he was mad. It was just thick timber, mostly swamp mahogany and ironbark trees with no outlook but anyway he said THAT was the site. He wanted a site that could not be seen from the road, where he could pump water from the creek, where this long building could be put on a level so neither end was on high stilts and it had to be facing north. He proceeded to clear the site and it turned out that he was quite right of course.

Mr Jim Scobie was a builder and he and his father before him had worked for the Marks family doing building jobs and repairs. He was an old friend as well as a workman and at that time (in 1942) must have been about sixty years of age. He, his wife and youngest son, who was aged about eleven, came out and lived in one end of the barracks up at the quarry and pulled the other end down. They then gradually brought the bits over to the present site in Mr Scobie’s utility.

My mother specified that she wanted the building to be up off the ground, as she was afraid of snakes coming in. My father wanted it built so that in his old age he would be able to just walk up a slope to get inside.

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12 Patricia wrote a detailed account “Camp Mountain Granite and Brisbane City Hall”, in Samford Reminiscences, Vol. 1, 1984, p. 47.
Mosquitoes and Memories

The original barracks consisted of a long central room, which was the dining and living room, with four rooms at each end. Firstly Mr Scobie re-erected what I call my “mother’s end” which is on the east of the living room. When he built my “father’s end” on the west of the living room some things were improved, including the positioning of windows and making stable doors. So there was a women’s end and a men’s end. This was partly to give father peace from all the chattering children who were invited out and also for privacy I suppose.

Mr Scobie also built a fibro-cement kitchen with a concrete floor on the southern side of the living room. From the earliest times we had a wood stove in the kitchen with an ordinary stovepipe chimney. Verandahs were built along the southern side to the east and west of the kitchen. The one at my mother’s end is timber and about two feet off the ground with steps up to it. My father’s end has a concrete verandah at floor level. To obtain the fill to build up from the original ground level he dug a hole, which is still near the gate into the Barracks yard, and used the soil to make a ramp for the verandah so that he could walk up a gentle slope to his room.

The hole which father had dug collected water and made a nice lily pond in the years when we had good wet seasons. One time Betty Connah was out at the Barracks and had to hurry back to town. She had been working hard and needed a bath so she went into the lily pond to bathe. Thereafter it was known as “Betty’s Bath”. With the recent poor seasons it has been dry. When we had plenty of water in the creek my father used to pump water up and keep it full but after we had a series of droughts he just let it go. It used to have some lovely water lilies in it.

The house remained for several years as a long row of rooms, with verandahs on the south either side of the fibro kitchen. There was a place planned for a bathroom and toilet but they were not installed until later. At first we had an iron enclosure for the bathroom on the western end of father’s concrete verandah. It had a bucket shower, which was filled with water and pulled up with a rope over a pulley. We had an outhouse for a toilet.

When the Barracks were first rebuilt, the bedrooms had doors on the northern side and windows on the south. Father then had the sections of wall underneath the windows cut out and made into stable doors. He had shutters built of old roofing iron from the buildings at the quarry, which could be closed over the windows. The idea was to make the place more secure because on one occasion the original building at the quarry had all the windows broken by some louts. They must have come over from Upper Kedron direction and smashed the windows for the joy of smashing them. I heard the noise from the “Cushleva” house and caught Bunyip and rode up but they had gone by then.

After the war father was able to add an extension to the house and he asked his nephew Robin Dods, an architect, for advice regarding the width he could extend the living room. Mr Scobie again did the building and expanded the living room to double the width and put verandahs on the northern sides of the bedrooms each side of the living room. My mother wanted twelve-foot verandahs but she got ten-foot verandahs, which were as wide as could be built with the span of the roof. When the extension was completed my father had it fitted with his patent leaf shedding gutter.

Also following the war we had the pump connected from the creek and installed a septic toilet and bathroom. The outhouse stayed there unused for a long time and was only removed a couple of years ago when Trevor Mitchell was clearing the place in case of fires. By that time it

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13 The son of Ted’s step-brother, Joseph Espie Dods

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was surrounded by lantana. Trevor saw this large clump of lantana and, as he did not know the outhouse was in the middle of this, put a chain around it and pulled it out with his tractor. Of course the outhouse came out along with the lantana!

When the living room was widened my father set himself the task of smoothing down the walls with a little hand held grinder and then did them over with beeswax and turpentine and that is how they are still. The walls were fairly dark in colour so he painted the ceiling white. The first ceiling was built from pine partitions that were left over from the quarry barracks but the white ants got into them so we took them down and put up some harder boards. The tongue and groove boarded section of the ceiling was built when the room was widened.

In those days the land was quite clear around the house and you could look across to the mountains. There were a lot of stumps still there from the original clearing. When we had very wet weather and the ground was very soft I used to go to work with a crowbar and root out the stumps in the house enclosure. It was very hard work but satisfying and then we would burn them on our winter fire. Now everything has grown up again and whether this is a good thing or not I do not know but it makes the house very private.

I remember one entomological congress that came out here and people asked me how old the building was and I told them it was in its third incarnation! That fascinated them. I explained that the timber was originally in a skating rink, which was pulled down to clear the site for the building of the Brisbane City Hall, then erected as the barracks at the quarry and later re-erected on the present site.

Another amusing recollection I have followed the visit of Lord Penney, the Rector of Imperial College, London, in 1968. He was a famous mathematician and physicist who came to Australia and was visiting around the country. When he was in Brisbane he said that he would like to meet daddy as he was the oldest “Old Boy” from the Royal School of Mines which was one of the three entities that merged in 1907 to form the Imperial College of Science, Technology and Medicine. It was arranged for daddy to pick him up and bring him to Camp Mountain for afternoon tea at the Barracks. We had a nice afternoon tea and Lord Penney presented daddy with an “old boys” tie. Daddy had great fun afterwards saying, “The Lord has been in the car” or, “The Lord gave me this tie!”

Finial Day

In 1955 my father built the fireplace and chimney. He got the plans, which had the correct setup for the flue, out of some book of handy hints that he bought from the Sunday Mail. He had to buy the bricks to build it and he found out that if he bought the measured quantity of bricks it would cost a certain amount and if he bought a load of bricks he got a lot more bricks but it did not cost as much! So of course he bought a load of bricks!

One of his great friends was Professor Bryan, Professor of Geology at the University of Queensland. Sometimes he came out to the Barracks with daddy for the day or he came out for weekends and helped him. They found a big tin wash basin and a big cooking spoon but not as big as my mosquito collecting spoon. They used these to mix a bowl of mortar and that was just the right amount to go around one row of bricks. They would then have a rest for a while and then do another row.

One day they had this basin sitting on the edge at the top of the bricks while they worked. It overbalanced and fell down inside the chimney. It would not fit through the flue at the bottom
Mosquitoes and Memories

and could not be lifted out at the top. It was a very difficult situation. They found a long forked stick and tried to push the basin up the chimney, but it would topple off the stick and fall back down again. Eventually “Prof” Bryan had an idea. He got the electric drill and drilled a hole in the basin while it was at the bottom of the chimney. He then dropped a string down the chimney from the top and tied it through the hole in the basin from the bottom. He was then able to pull the basin back up the chimney with this string.

When the chimney was finished they placed a sheet of fibro cement across the top. Then they had these decorative blocks to place on top of this. “Prof” Bryan said they were “finials” so we called this “Finial Day”. My father, mother, “Prof” Bryan and I all climbed up onto the roof and each stuck one of the finials on.

At the time father was building the chimney he saw an advertisement for a sale at what was then Emmanuel College on Wickham Terrace. This building incorporated the original single-storey stone house built in the 1870s by Charles Lilley, which with extensions and the addition of another cottage became a large boarding house named Richard House in the early 1900s. The Presbyterian Church purchased it around 1911 and established Emmanuel College as a university residential college. After the Second World War the College was moved to St Lucia and the beginnings of St Andrew’s War Memorial Hospital were established.

Father went up to look and he really intended to buy a stainless steel sink. However, he saw a marble mantelpiece and he bought that. He probably bought the sink too. My mother wanted to make him a present of the mantelpiece but he said it was too much like a gravestone! It was taken in bits to Samford where it was erected over the fireplace after the chimney and everything else was finished.

When grandfather bought the place and Keighly was living in the hut trying to combine farming with being a doctor, they tried clearing the huge gum trees off the main flat using a “forest devil”. There are not many of these around now but I understand there is one in the Timber Museum at Gympie.

The forest devil was made up of a winding device and a long iron chain with very long links. The winding device was securely anchored, probably to the base of a tree, and the chain attached high up in the tree to be pulled out. A horse was then used to wind it up to tighten the chain until it pulled the tree over. One day when it was being used the chain broke, flew back, and killed the horse winding it. They did not use it again as they thought it was too dangerous.

One day during the 1950s, my father noticed that the pull from the electricity and telephone wires was twisting the end-frame of the house askew. He decided he needed a counterweight to correct this. He knew where the links of chain from the forest devil were abandoned in the paddock and, with the help of John Scott, collected them and hung some up on the end of the house as a counterweight to the pull of the wires. They are still there and the house has not fallen down yet!

We always ran some cattle on the property as well as the horses. As we did not have any yards or a dip, we used to take the cattle through the paddocks to the Scott’s ayrshire stud “Auchen Eden” next door, to be dipped or for any other handling. We had a cattle dog called Boaz who had been trained from infancy never to chase our cattle. One day when we took the cattle over to John Scott’s dip, they were all milling around in the yard and the dog got very excited. The poor dog knew he must not bite the heels of the cattle so he ran in and nipped my heels! Later on there was a regulation brought in regarding tick control and anyone with stud cattle could...
not allow other cattle on their property so we had to get the yards built. John Scott and Trevor Mitchell designed the yards between them and Trevor built them.

The Mews

Originally the top wooden part of the existing building was the office for the granite quarry on “Cushleva” and was situated near the big machinery sheds at the quarry. The building was on stumps about one foot high and it remained there for a long time after the quarry was disused.

When I was young my mother, and I suppose myself as a tag along, kept our saddlery in Uncle Carl’s dairy shed at “Cushleva”. The rats began to be troublesome and we probably had more saddlery than was comfortable to put in the dairy shed so, entirely at grandfather’s initiative, the office building was moved down and repositioned near the bails at “Cushleva” house. It was raised up on stumps about three feet high and grandfather called it The Mews in a joking reference to the Royal Mews. We used it there at “Cushleva” until long after the barracks were moved to the present site.

At this time Uncle Alec owned the land around “Cushleva”, which included the Mews but he told mummy she could have the Mews so she got the building moved over to the Barracks. The Mews were probably moved to the present site in about 1948. As far as I can remember Ernie Weber did the moving by pulling the building to bits and rebuilding it at the Barracks. Mummy had it put on high concrete stumps, enclosed, and the floor under it concreted. One of the doors at the rear could be lifted out and there was space to garage a small car. At that time Tom Woodward, one of the University Entomology Department staff, went away on about three months leave and left me the use of his car, so I was able to garage it in there when we went out at weekends.

When the Mews building was over near the “Cushleva” bails, we had built saddle-rails inside which were attached to the wall with a hinge and secured by a long nail into a vertical stump. We also had various bins for feed. When it was moved over to the Barracks, and was on higher stumps, we used the lower room for a feed shed as well as a general storage area. Upstairs was used mainly as harness storage as we had a lot of old horse harness.

We also stored some spare stretcher beds and things like that there. As a matter of fact, on the first trip the Nats had out to the Barracks after the Mews building was moved we had people sleeping there. Eventually it got filled up with other things and there was no room for anyone to sleep. Currently it is used as a feed shed downstairs and the top is storage but needs cleaning out.

A few years ago I opened up a big zinc-lined trunk that was housed in the bottom level of the Mews. It was like a wooden box or crate and I thought it contained some old pictures that had been brought out from 101. What I found was an old calico bag containing the most beautiful evening dress that had belonged to my grandmother Drury. It had been made, probably in the 1880s, by Mrs Walker who was a well-known Brisbane dressmaker. I gave it to the Queensland Museum in 1998 but as far as I know the museum has never shown it publicly.14

Later on, a young man, Mike Marendy, was doing research on Mrs Walker and after consultation with the Queensland Museum, contacted me for information regarding this dress. Subsequently he gave a talk on Mrs Walker, accompanied by a fashion parade of clothes she

14 The dress was displayed in 2003 at the “Wearable Art Exhibition” Queensland Performing Arts Centre. Information on this exhibition is printed at the end of this section.
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had made and he extended an invitation to me. Kath Cummins and I attended this function which was held at the Queensland Museum. It was an interesting afternoon and very informative about early fashions and materials.

I think the dress was given to my mother when my grandmother’s things were being distributed amongst her daughters after her death. It was always kept in a tied up calico bag in a downstairs cellar at “Rougham”, which was perhaps part of the secret of its preservation. It was brought into 101 in about 1920 when my mother moved there, and was stowed away in an underground passage that was built of concrete and with brick walls so it was kept in a fairly constant, coolish temperature all the time. It was in beautiful condition except for a bit of georgette that was falling to bits but the silk was in perfect condition. It was stored in the Mews from 1982 until the 1990s when I found it.

Wearable Art Exhibition

The Wearable Art Exhibition was open to the public from the twenty-seventh of May to the eleventh of October 2003. It was presented by the Queensland Performing Arts Centre Museum in association with The Australian Forum for Textile Arts (TAFTA). One of the featured artists was Mrs Janet Walker (1850-1940). The information stated:

“Mrs Walker, as she was always known, was Queensland’s leading costumier of her era, with a career spanning half a century. Before the 20th century growth of mass-produced clothing, Mrs Walker dressed Brisbane’s rich and famous with specially commissioned one-off garments. A fair and respected employer, she was able to achieve a standard of workmanship that won admiration beyond her home state.

Among her clients was the wearer of the gown in this exhibition, Mrs Barbara Jane Drury, the wife of Edward Robert Drury, Manager of the Queensland National Bank. The dress was a gift of Dr Elizabeth Marks in 1998 and was conserved with the generous sponsorship of the donor’s estate, 2003 by Dr Michael Marendy, whose research on Brisbane’s early dressmakers has brought to light the remarkable career of Mrs Janet Walker.”
The granite quarry at Camp Mountain
Mosquitoes and Memories

The Barracks at the quarry site – January 1942

The Barracks at the quarry site – January 1942
Start of reconstruction of the Barracks at the Old Farm – Easter 1942

Reconstruction of the Barracks at the Old Farm – Easter 1942
Nesta at the Barracks and Patricia (left) and Betty Connah cutting front door step with a crosscut saw

Building the front door step. From left. E. O. Marks, Betty Connah and Patricia
The Barracks – 1942

Ted making use of the front door step and Nesta turning first sod of vegetable garden – 1943
View from front verandah – 1955

Dr E. O. Marks and Professor Bryan, “Finial Day” – 1955
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Back view of the Barracks – circa 1960s

Front view of the Barracks from the western end – August 1980
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Front view of the Barracks from the eastern end – August 1980

The old slab hut and yards – August 1980
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Front view of the Mews – August 1980

Back view of the Mews – August 1980
### Notes

**Summary of Dates and Events**

Included in this section is a timeline in the form of a summary of dates and items of interest to show the relationship of events mentioned in the text.

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
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<tbody>
<tr>
<td>1832</td>
<td>Patricia’s maternal grandfather, Edward Robert Drury born, Brussels</td>
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<tr>
<td>1846</td>
<td>Patricia’s maternal grandmother, Barbara Jane Grahame born, Sydney</td>
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<tr>
<td>1851</td>
<td>Patricia’s paternal grandmother, Elizabeth Gray Stodart born, Edinburgh</td>
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<tr>
<td>1852</td>
<td>Patricia’s paternal grandfather, Charles Ferdinand Marks born, Sussex, England</td>
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<tr>
<td>1856</td>
<td>Patricia’s maternal grandfather, E. R. Drury moved from Brussels to Melbourne</td>
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<tr>
<td>1860</td>
<td>Elizabeth Stodart’s family moved from Edinburgh to Melbourne</td>
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<tr>
<td>1866</td>
<td>Patricia’s maternal grandmother, Barbara Jane Grahame married Edward Robert Drury</td>
</tr>
<tr>
<td>1867</td>
<td>Patricia’s maternal great-grandfather, James Dickson Stodart died, Melbourne. His family later moved to Brisbane</td>
</tr>
<tr>
<td>1868</td>
<td>Robert (Robin) Smith Dods born, New Zealand. Family moved to Edinburgh. Two brothers James Stodart and Joseph Espie were born prior to 1876</td>
</tr>
<tr>
<td>1869</td>
<td>Barbara Jane Grahame married Edward Robert Drury</td>
</tr>
<tr>
<td>1870</td>
<td>E. R. Drury and family moved to Sandhurst (Bendigo)</td>
</tr>
<tr>
<td>1872</td>
<td>E. R. Drury became the first General Manager of the Queensland National Bank and the family moved to Brisbane</td>
</tr>
<tr>
<td>1876</td>
<td>Robert Smith Dods died in United Kingdom</td>
</tr>
<tr>
<td>1879</td>
<td>Elizabeth Gray Dods moved to Brisbane and Charles Ferdinand Marks moved to Brisbane. They married and moved to St George</td>
</tr>
<tr>
<td>1880</td>
<td>C. F. Marks and family moved back to Brisbane. Alexander Hammett Marks born</td>
</tr>
<tr>
<td>1881</td>
<td>Ernestine (Nesta) Drury born, Brisbane</td>
</tr>
<tr>
<td>1882</td>
<td>C. F. Marks built 101 Wickham Terrace. Edward Oswald Marks born</td>
</tr>
<tr>
<td>1885</td>
<td>Charles Hubert Marks born, Brisbane</td>
</tr>
<tr>
<td>1887</td>
<td>C. F. Marks purchased “Cushleva”, Samford</td>
</tr>
<tr>
<td>1888</td>
<td>C. F. Marks elected Member of Queensland Legislative Council</td>
</tr>
<tr>
<td>1891</td>
<td>Edris Marie Blanche Marks born, Brisbane</td>
</tr>
<tr>
<td>1890s</td>
<td>C. F. Marks involved in “Rubyanna” Sugar Company</td>
</tr>
<tr>
<td>1895</td>
<td>E. O. Marks attended Southport College</td>
</tr>
<tr>
<td>1900</td>
<td>Nesta and Evelyn Drury returned from Brussels. E. O. Marks moved to Ireland and attended Trinity College Dublin. Resided with Aunts, Annette and Blanch Marks</td>
</tr>
<tr>
<td>1905</td>
<td>E. O. Marks graduated in engineering from Trinity College</td>
</tr>
<tr>
<td>1906</td>
<td>Grandmother Drury moved to “Rougham”. E. O. Marks attended Royal School of Mines and returned to Australia. Employed by Mt Morgan Mining Company. Annette and Blanche Marks moved to Australia between 1906 and 1908</td>
</tr>
<tr>
<td>1907</td>
<td>Grandmother Drury died</td>
</tr>
<tr>
<td>1908</td>
<td>Grandmother Marks died. E. O. Marks employed in Geological Survey of southeast Queensland</td>
</tr>
<tr>
<td>1913</td>
<td>E. O. Marks returned to Trinity College to study for a medical degree</td>
</tr>
<tr>
<td>1914</td>
<td>Nesta Drury travelled to England and she and E. O. Marks married. First World War commenced</td>
</tr>
</tbody>
</table>
E. O. Marks graduated MB, BCh, BAO and enlisted in the British Army

Elizabeth Nesta (Patricia) Marks born 28th April in Ireland

E. O. Marks graduated MD

E. O. Marks and family returned to Brisbane from Ireland and C. F. Marks moved to Samford.

E. O. Marks started eye practice at 101 Wickham Terrace

C. F. Marks ceased as MLC when Queensland Legislative Council abolished

Patricia commenced school at St Johns Cathedral Day School

Patricia attended Glennie Memorial School at Toowoomba until end of 1934

Patricia studied science at University of Queensland until end of 1937. Arthur Drury died. “Rougham” sold following his death

“Rougham” demolished

Patricia’s Honours year University of Queensland

Patricia’s Masters year University of Queensland – worked with Dr Derrick on Q fever. Appointed curator of Pathology Museum at University of Queensland Medical School in August. Second World War commenced and Patricia involved in Horse Transport, Land Army and Mine watching

Patricia’s first paper published

C. F. Marks died. Patricia continued voluntary war work

Barracks moved to present site

Mosquito Control Committee formed. Patricia employed as Graduate Research Assistant in April

Patricia worked at School of Public Health and Tropical Medicine (SPTHM), Sydney for a few weeks with David Lee

Patricia worked at SPHTM again with David Lee and Willard King

Patricia’s first trip alone to investigate malaria outbreak at Lucinda Point

Trip to Gladstone to investigate midge problem. QIMR established

Trip to Rockhampton to investigate outbreak of dengue. Mews moved to present site

Patricia and Kathleen Walker departed for London in February. Patricia worked at the British Museum (Natural History) as well as touring. Enrolled and commenced study for PhD

Patricia awarded PhD and returned to Brisbane at end of year

MVE research at Mildura. Collecting at Townsville, Richmond, Cairns, “Van Rook Station”, Murray and Darnley Islands in Torres Strait, Bamaga

Field survey – Torres Strait Islands, Cape York and Townsville

Great Barrier Reef Committee investigation at Low Isles

Field Survey – Lockhart River

Fieldwork for Bishop Museum – PNG and Dutch New Guinea. Discovered Aedes explorator at the Olgas while on vacation

Malaria Conference at Port Moresby. Collected on Daru Island

Arbovirus research at Mitchell River

Arbovirus research at Mitchell River. Field trip to Lockhart River. Transferred collection of PNG mosquitoes to University of Queensland

Patricia instigated the move to preserve the Samford Bora Grounds

Patricia’s mother died. Samford Bora Grounds gazetted as a reserve.

Fieldwork for Bishop Museum in PNG – Lae and Wau

Patricia’s father died

MCC dissolved and Patricia appointed to QIMR staff as Principal Research Officer but still worked at U of Q. Insect Export Legislation controversy began and continued for about 10 years
Mosquitoes and Memories

Appendices

The following appendices have been included as a representation of some of Patricia’s early work. Each has been reproduced exactly from Patricia’s files.

They have been selected as explanatory examples to cover a variety of aspects – taxonomy, field reporting, history of mosquito collecting, and included are some extracts from various talks and papers. The intention of these appendices is to impart a general impression of Patricia’s attitude and approach to her career.

Appendix A

On Being a Taxonomist

Patricia considered that this talk, given at the University of Queensland Entomology Department in 1964, was indicative of her approach to taxonomy and was therefore a good example to show the nature of her work.

Appendix B

Report of an Anopheline Survey of Lucinda Point, Queensland

This report was chosen as an example of an early field report as Patricia remembered this trip as being the first she undertook alone following her appointment as Graduate Research Assistant for the MCC in 1943.

It exemplifies how mosquito-borne disease is spread within normal living situations and gives good examples of how a survey such as this was approached.

Appendix C

Research on Australian Mosquitoes

Presidential Address to the Entomological Society Of Queensland – 1954

This address was Patricia’s first choice as an inclusion as it gives an understanding of the history of mosquito research, the people involved and the time scale.

It also covers many of the research trips and scientists mentioned in the text.
Appendix D

Extracts from Articles and Talks on Mosquitoes by E. N. Marks

Some of these extracts illustrate Patricia’s devotion to her career and how she often used situations in her private life to further her research.

Appendix E

Publications

I thought it essential to include a list of Patricia’s publications. This list has been compiled from records provided by Patricia.

K. C. C.

Patricia as many of us remember her, taken at the Barracks during the 1960s
APPENDIX A

ON BEING A TAXONOMIST – JULY 1964

ON BEING A TAXONOMIST
by
E. N. Marks

(A Talk to members of the Department of Entomology, University of Queensland 21.7.64.)

I. Introduction.

The Oxford Dictionary defines a taxonomist (it seems to prefer taxonomer) as a scientific classifier. This is sufficient for us to start with, since more of what he or she is and does should appear in the course of this talk. I need hardly say that I am talking only of being a zoological taxonomist and that my examples will be drawn almost entirely from work on one family of insects, the Culicidae.

I do not propose to discuss the principles of animal taxonomy – there are several good books on this subject. I have purposely avoided them in preparing this talk, so that what I give you, though some of it may have been drawn from earlier reading, is projected through my own experience.

Principles are not of much use unless one puts them into practice and a good many of the practices I will mention are, in fact, also principles. Some practices are not exclusive to taxonomists but are, or should be, those of any serious research worker and I hope, therefore, that even if you never become a taxonomist, you may find something useful in this discussion.

II. A Taxonomist and His Animals.

I shall be using the term "group of animals" a lot, because this is a general term – a "group" may e.g. be a species, a genus, or a family.

I want to emphasise, and I will probably repeat this in various ways in my talk, that true taxonomy is not merely descriptive and morphological but involves many aspects of biology. It is living animals that we are attempting to classify, and the groups that they occur in are natural groups. We are trying to find characters which we can use to identify the individuals of one group and separate them from related or similar groups. We use gross morphological characters because these are convenient to observe, and preferably we use those that can be seen on both living and dead specimens. But there may be many other ways in which our groups of animals differ – such as in their ecology, their behaviour, the sounds they produce, the chemical reaction of their pigments, and so on. Nor are we interested only in the ways in which they differ but also in the ways in which they resemble one another, which are equally important for an understanding of classification.

The more the taxonomist sees of his animals alive in their natural habitat, the better he will understand them, and so he needs also to be something of a field naturalist. Of course he cannot know them all in the field, for some will come in collections from remote places. This is a disadvantage that foreign taxonomists encounter when dealing with Australian animals.
Many produce very fine work in spite of it, but the more people we can get working in Australia on the taxonomy of Australian animals, the better will we understand our fauna.

The taxonomist is not only interested in the present differences between his groups of animals, but he has a great curiosity about how these differences developed, and the more he can learn about this the better will he understand the relationships between his groups. So he reads up on all he can on past land formations, past climates, past and present plant and animal distributions, and tries to obtain from his studies of his own group of animals, evidence which can be useful to workers in other fields. In other words, the taxonomist is also a student of zoogeography, of phylogeny, and of evolutionary theory. If he is not, I class him not as a taxonomist but merely as a describer. However, he may be a taxonomist for a considerable time before he can himself contribute to these subjects.

III. Qualifications for a Taxonomist.

Curiosity, observancy, patience, tenacity, careful attention to detail, scrupulous scientific honesty, a critical attitude that takes nothing for granted – these are all requirements for a good researcher in any field.

If you enjoy the mental exercise of running a specimen out on a key, and are not content to leave it at that, but check on the other characters of the group (be it family, genus, or species) to which you have run it; if you get pleasure in identifying all your specimens as far as you can go without specialised knowledge; if you have a great curiosity about the differences between the animals that you see in the field; if you have an absorbing interest in one particular group of animals – one or more of these attributes might suggest you are a potential taxonomist, but lack of them does not rule you out. An interest in taxonomy may develop early or late in one’s career.

An “eye for a species” is a valuable attribute but does not necessarily mean its possessor will make a taxonomist. Many collectors have a wonderful “eye for a species” but lack the patience for the careful laboratory work that taxonomy involves.

IV. How does One become a Taxonomist?

(1) Choice.
By deliberate choice. One may apply for an advertised post for work on the taxonomy of a stated group of animals (such jobs are rare in Australia, but do occur occasionally in CSIRO or the larger museums); or one may apply for a job as assistant to a practising taxonomist; or one may apply for a less specific job in a Museum, such as entomologist, knowing that it will certainly involve taxonomy; or (and this applies probably only to university staff) one’s occupation may allow a free choice of research.

(2) Guidance.
By the influence of a senior researcher who perceives a talent in his junior and encourages and guides him into a field where it can be best used. Mr. Bob Domrow of Queensland Institute of Medical Research started as a cadet at the Institute and is now Australia’s leading acarologist. He was influenced to take up the taxonomy of mites by the past and present directors of the Institute, Dr. Mackerras and Dr. Derrick.

(3) Favour.
By favouring one aspect of a job which offers a wider choice. This happened in my own case where the job was for someone to work on taxonomy and biology of mosquitoes. I have placed
the emphasis on taxonomy, whereas another appointee might have done the minimum of taxonomy and major research in biology.

Three factors probably influenced me and I have wondered while writing this which had the greatest influence – my own natural inclination; the type of zoology course that we did then, with its emphasis on morphology and classification; and Mr. Perkins’ personal interest in taxonomy. I do know that, when I showed a bent for taxonomy, Mr. Perkins most ably fostered and guided it and many of the practices I shall be discussing were learnt from him.

(4) Chance.
This is probably the commonest way in a country such as ours. By setting out to study some other aspect of a group of animals, such as behaviour, or ecology, or comparative morphology, and discovering that one first has to find names for one’s material, some of which is undescribed (Dr. Woodward became a taxonomist this way). Or by starting to work on the biology of a supposed single species (as Mr. Perkins did with the fruit fly then known as *Dacus tryoni*) and finding that in fact one is dealing with a complex of species, whose identity must be resolved before one’s biological work can have any significance.

Some people go no further than describing the species they want to work on and these people are usually mere describers, very seldom true taxonomists. Others find that their interest in classification is aroused, and continue to follow it to become taxonomists, though their other interests are not necessarily abandoned.

Dr. and Mrs. Mackerras are the best examples I know of researchers who have, at various times, been full-time experimental biologists or full-time taxonomists, as their jobs demanded or allowed; but I am not sure in their case which came first.

(5) Recreation.
The preceding are four ways of becoming a full-time or part-time professional taxonomist. There is still a place for the amateur taxonomist, particularly one with scientific training. I include here the professional scientist whose job excludes any opportunity for taxonomic work.

The problem these days is to find the spare time to pursue taxonomy as a hobby, and accessibility of libraries and collections is also important – but it can be done. Mr. J. W. T. Armstrong, a grazier at Nyngan in Western N.S.W., is an able beetle taxonomist; Dr. Eric Reye, a medical practitioner, has collaborated in numerous taxonomic papers on Australian Ceratopogonidae; Dr. Alan May, whose job for many years included fruit-fly taxonomy, now continues to work on them in his spare time from his job as Assistant to the Director of Plant Industry; Father MacAreavy, a Jesuit priest and school teacher, has recently been Australia’s leading ant taxonomist.

V. Some Practices of a Taxonomist.

(1) Selecting a group for study.
We will suppose that for the first time you are taking up the taxonomy of a group of insects, and that you have a reasonable prospect of working on them for four or five years.

You may produce some very competent and useful descriptions much sooner than that, but I would still regard the first couple of years at least as an apprenticeship. Like any profession, it takes time to learn the finer points about practising it; time to realise the scope of one’s subject and to read into and absorb the many aspects of it; time to comprehend one’s obligations to
Mosquitoes and Memories

oneself, to one's colleagues, and to Science. You will go on learning more about taxonomy for as long as you continue to be a taxonomist.

In selecting a group of insects, do not be discouraged if the one that interests you most appears to have been well worked. No group of Australian insects is so well known that it does not need further study. You might not get many new species to your name if you select a well-worked one, but you could still make a major contribution to classification of the group by studying the taxonomy of the immature stages. Even in the well-studied mosquitoes, very little has been done on the eggs and the pupae, and almost nothing on the first three larval instars of Australian species, although the first instar particularly is known elsewhere to be useful in indicating relationships.

Having selected your group of insects where do you start? Some of these steps are of course concurrent.

(2) Making contact with other workers.
You find out whether anyone else is working on the Australian species of your group. This you can find from the literature, from published lists of taxonomists, and from enquiry among other entomologists.

You then establish contact with these other workers and find out what their special interests are. You may have picked a family and want to select a genus for revision and you can ask these more experienced workers to suggest a suitable one. Or, if you have already tentatively chosen your genus, you find out whether this will overlap these other worker's current research, and if it does you find another one.

Let us get several points clear here.

This respect for other workers in one's field is firstly a fundamental principle, but it is also a most rewarding practice.

We are not in the commercial world where you try to entice away the other fellow's customers, or produce more cheaply the same article that he is producing, but in the scientific world, where you are working first of all for the advancement of knowledge and only secondarily for your own advancement – this is something to remember throughout your career.

No one has exclusive rights to the taxonomic study of a particular group of animals but there is so much taxonomic work to be done that, as far as possible, we should avoid duplication of effort.

At all stages of your career, your work will be facilitated and advanced by friendly exchange of ideas and specimens with other workers in the same group, and, in the beginning particularly, you will profit by their helpful advice. Best of all, if you are fortunate, is an opportunity early in your study to work for some weeks with a leading taxonomist in your group, who will help you gain a solid grounding for your research. I profited greatly from the chance, soon after I started on mosquitoes, to work in Sydney with Mr. D. J. Lee and Colonel W. V. King, both of whom had a wide knowledge of the mosquitoes of Australia and New Guinea. Mr. Domrow similarly profited by working in Adelaide with Mr. H. S. Womersley, the chief Australian authority on mites at that time.
The young taxonomist has a duty to the advancement of knowledge in his dealings with the leaders in his field. Remember that the people whose advice you are seeking are busy researchers and that their time is valuable to science; probably there are others besides yourself consulting them. So do your best to work out your problems or identify your specimens first, make your requests clear and concise, don't send them unsorted material, and once they have sent you named specimens, identify your own material by comparison with these and only submit the same species again when you are in doubt.

The experienced taxonomist also has a duty to the advancement of knowledge, not only in giving advice and encouragement to the young taxonomist but also in yielding up gracefully some part of his interests when the occasion arises – as when another wants to describe a species, or study a group that he has collected, studied in preliminary fashion, and put aside to return to at some time in the future. Dr. Dobrotworsky (who has been working on Victorian mosquitoes at University of Melbourne) and I have handed over new species and new life histories to each other so that they could be included in papers on the species group to which they belonged – a happy and profitable collaboration to each of us personally, and we hope a profitable one for mosquito taxonomy since these species were described and discussed in the papers most appropriate to them.

(3) Searching the literature.
You record what literature is available on your chosen group. The basic, and at some stage essential, step is to work through the Zoological Record, but if there is a recent monograph or catalogue you may start with this and leave the Zoological Record till later. You will have to go back to the original descriptions, but recent keys and revisions will be more useful at first.

(4) Recording the species described.
You record what species have been described from the area in which you are working. Before long, but perhaps not immediately, you will need to know what species occur in adjacent areas, e.g. it will be necessary to compare Australian species with those from New Guinea, New Zealand and other parts of the South Pacific.

(5) Identifying specimens.
You take what specimens are available to you and try to identify them from the literature. Here a warning. Remember the taxonomist takes nothing for granted. So, even if the specimen has been identified by a recognised expert, satisfy yourself on every point that you agree with his identification. If a specimen does not quite agree with the description of a species, remember that sometimes the description can be at fault, either inadequate, or incorrect, or based on a misidentified specimen. Where there is any element of doubt whatsoever you will have to thrash this problem out before your study is completed.

(6) Thinking on paper.
Now I come to advice which Mr. Perkins gave me when I started work on mosquitoes, and for which I am constantly grateful to him. This is to think on paper right from the start. Not just on scraps of paper, but in notebooks which you can index and keep for reference. I have used bound foolscap-size books, leaving a few pages at the front for an index in each volume, and currently am on Vol. VI of "Notes on Genera, Species and Specimens" and Vol. II of "Undescribed Species". The latter series contains preliminary notes and sketches of "Spp. Nos. 1-124" – mostly of larvae which I could not identify until link-bred adults were reared; some proved to be described species, some have since been described by others or by myself, and some are still undescribed.

Appendix A

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CRICOS No. 00213J
Mosquitoes and Memories

Smaller bound books have been used on extended field trips in North Queensland and New Guinea, and looseleaf books, with an alphabetical index, for notes on type specimens examined in overseas museums.

The notes may be anything from an observation on behaviour of living specimens, or a query on discrepancies between two published descriptions of the one species, or sketches of terminalia, to attempts to tabulate the characters of the species in a subgenus and arrange them in species groups, or notes on specimens loaned from other collections. It is helpful to date the note so that, in later reference to it, one knows at what stage of one’s research it was made.

It is essential that the indexes be kept up to date, and helpful to have cross-references if the same species is treated in more than one volume. I am still finding it necessary and useful to refer back at times to notes made up to twenty years ago.

(7) Field work.
You take every opportunity to collect your particular group in the field, to get to know the species in their natural habitats. You keep plentiful notes of where and when you collect your specimens, and observe anything that may help towards an understanding of their ecology. For instance you may at first think you have one species which occurs both in rainforest and in eucalypt forest. Several years later you may find evidence to suggest there are two species, one in each of these habitats. If you have kept adequate notes on earlier collections, you may at once be able to confirm the existence of two species by checking the combined ecological and morphological evidence that these early collections provide.

Dr. Dobrotworsky, working in Victoria on *Aedes rubrithorax*, noted constant small morphological differences between specimens reared from cool shaded pools, and from warm sunlit pools, which led him to the discovery that he was dealing with two species whose larvae had quite different temperature tolerances.

(8) Studying distribution.
You study the distribution of the species you are working on. In doing so you must remember that the known distribution is the distribution of collectors, not of the species. If the known distribution is discontinuous you endeavour to find out whether the species occurs in intervening areas either by collecting yourself, or by prevailing on others to collect for you. Gradually in this way you will build up an understanding of the zoogeography of your group. But remember that any theory that is based on the absence of a species from an area (the only evidence of its absence being that it has not been collected) is on very unsafe grounds.

(9) Encouraging collectors.
Once it is known that you are working on a particular group, you will find people whose work may be in other fields, who will be willing to send you specimens. Always acknowledge receipt of their specimens promptly and send them identifications as soon as you can. At times this may inconvenience you, but remember they have given time and effort on your behalf. You will reap the reward too, because they will continue to send you material. This can provide a great interest to someone in an out of the way place who has a bent for natural history and finds somebody interested in what he can collect.

Starting off in this way, I inherited several keen collectors who had become disheartened at the tardy or absent acknowledgment and identification of their material by other mosquito taxonomists. I am ashamed to say that in the last few years I may have discouraged one or two by treating them in a dilatory fashion myself.
(10) Planning for publication.
Your study of your chosen group is leading you towards publication of your first taxonomic paper. Don’t try to tackle a large job all at once. A Government Institution had a young taxonomist working on cockroaches for about four years. She drew a large number of figures and partly completed her descriptions, then gave up the job. I saw her manuscripts which were sent to Mrs. Mackerras to see whether anything could be made from them. Some of the figures had nothing on them to identify them, there were very few cross references to descriptions or full enough notes to tell which specimens had been described – all her work was wasted. If, once she had got some understanding of cockroaches, she had concentrated on one genus, or a species-group, she might have made a worthwhile contribution; or, if her figures could have been identified with particular specimens, they might have been used by a subsequent worker.

So, if your chosen genus is a large one, once you have a good general knowledge of it, concentrate on a species-group. And at all stages identify your drawings and descriptions with the specimens you have used for them. Your work will not then be wasted, even if you have to put it by unfinished for a while, or leave it for someone else to finish.

Avoid treating a single species in a paper on its own, unless it is the only one in its genus, or there is a recent revision of its closest relatives, or it provides the first record of some higher category for Australia, or workers in other fields, such as agriculture, urgently need a published name for it.

Try not to put your taxonomic paper aside half done, or at least try to get those descriptions that you have started completed, otherwise you will find you have to repeat them to a large extent. Sometimes one can return to a partly completed paper and see one’s problems with greater insight, but more often one has to duplicate a great deal of the effort already spent.

On the other hand, it can be very helpful to put a completed manuscript aside for a few weeks, and then reread it with a renewed critical faculty.

(11) Terminologies.
By now you should have a list of all the characters that other authors have used in describing species related to those you are studying, including those used by authors dealing with the fauna of other countries and possibly some you have found yourself, and you will have decided on what to include in your own description. Use the correct morphological terms in your descriptions, not the jargon of specialists in the Order. If necessary you can equate the terms in your text. If there are several nomenclatures for detailed descriptions (as there are for the hairs of the mosquito pupa) state which one you are using, and if for some reason you deviate from that usage, state where and why. If there is likely to be any difficulty at all for others in identifying the parts you name, indicate them by name or letter on your illustrations; do not expect your readers to refer to some other publication to find out what you mean.

(12) Listing specimens and choosing a holotype and paratypes.
Always state the number of specimens on which your description is based, and the localities of them. For instance, if it is based on only two specimens from one locality, another worker can judge that it is unlikely to give much idea of the normal variation within the species. If it is based on specimens from numerous localities, and a second similar species is later found to occur at one of these, if your paper is well set out another worker may be able to tell from it whether you had the second species among the specimens you described. In your distribution records, do not list your localities higgledy piggledy, but in a logical sequence e.g. under each state and from north to south, or east to west.
I will assume that you are familiar with the concepts of holotype and paratypes. The holotype is only a specimen, it is not the species which is a living entity. But in order to identify the species, workers have to refer specimens to the holotype. Those who have not access to the collection where it is deposited will be very dependent on your description of it.

The holotype should be an adult insect. Some species have been described from larvae but this is to be avoided. Selection of the holotype depends on several factors which must be weighed for each species.

The holotype should be as near perfect a specimen as possible, but this does not mean that you should not dissect its terminalia. If the terminalia are an important taxonomic character, sooner or later someone is almost certain to dissect them, so the describer is fully justified in doing so; where they are the main distinguishing feature of the species it is usually necessary that he do so.

One sex only may show very distinctive characters. If both sexes are quite distinct from related species, it may be desirable to choose the same sex as the holotypes of previously described species in the genus, in order to facilitate comparison.

If the species is a variable one, try to select a holotype near the middle of the range of variation. If the species is widely distributed, try to select a holotype from near the centre of its distribution. Try to select a holotype from a fairly large series from one locality, as numerous topotypical paratypes will then be available. If possible select a specimen which has correlated early stages. In the case of mosquitoes this is usually one reared in isolation, with its pupal and fourth instar larval skins preserved and subsequently mounted on a slide. In some cases it could be a female whose progeny were reared.

Paratypes are selected and indicated by the describer of the species, and compared with the holotype by him at the time he describes it and them, and this is the reason for their usefulness. The allotype is a paratype of the opposite sex and usually deposited with the holotype, but its status is that of any paratype. If only one sex was available when the species was described, an allotype cannot subsequently be designated from a later collection (this is done sometimes – I have done it myself before I understood the Rules – but such a specimen has no status in nomenclature). Paratypes of early stages (e.g. mosquito larvae) are sometimes called morphotypes.

It is desirable if the species is a variable one, and certainly safest, to describe your holotype and then note how your paratypes vary from it. In a less variable species, you may prefer to describe the holotype and topotypical paratypes of the same sex together, noting some characters (e.g. measurements) of the holotype.

Preferably paratypes should be topotypical, i.e. from the same locality as the holotype. If they are from several different localities, those from each locality should be discussed separately. All this makes it much simpler for any subsequent worker who might find a second species among your paratypes, to sort out what material you had.

Try to have as many paratypes as you can, at least up to twenty, which can be distributed to various museums. But do not make a paratype of any specimen that you have not examined critically.
If the question arises as to whether you should describe a new species from a single specimen, several points must be considered bearing in mind that your object is to advance knowledge of our fauna.

Is it a good specimen? Even though it may be obviously distinct, it is inadvisable to base a new species on a badly damaged specimen, such as one with head or abdomen missing. It would be difficult to identify specimens from other localities with an incomplete holotype – they might be another undescribed species, and much confusion could result before the problem was resolved.

Has it adequate and reliable collection data? Early collectors often put little data on specimens, and exchanged with collectors in other states or overseas. Some university students are known to put incorrect localities on their specimens – even labelling specimens from New Guinea or south-east Asia with Queensland localities. Unless the specimen has at least a reliable and reasonably precise locality, a new species should not be based on it alone. Faulty zoogeographical deductions and confusion in synonymy can result from describing a species from such a specimen.

Is it from a locality where further collecting is likely to be done in the foreseeable future? If so it is better to put it aside for a year or two in the hope of obtaining further specimens and being able to give a fuller description of the species.

In all these cases, if it would be appropriate to include this undescribed species in a current paper, this can easily be done without formally describing the species by giving descriptive notes on the specimen as “Species A” or “Species No. 1”.

If however the specimen is a good one with reliable collection data, and is from a remote locality unlikely to be revisited by collectors, or from a locality which has been repeatedly collected without further specimens of the species being taken, then it is justifiable to make it the holotype of a new species. In this way it will gain a place in faunal records, attention will be drawn to its existence, and further search for it stimulated. This presupposes that you are quite satisfied that it is a distinct species – not for example, a colour variant of a described species, or the opposite sex of a species known from one sex only. If you have any doubt whatsoever it is much better to refer to it as “Species A”.

(13) Checking the holotypes of described species.
Before the final preparation of your paper you may find it necessary to check your specimens against the holotypes of species described by earlier authors. You may have a chance to do this yourself, if the holotype is in an accessible museum or one which will lend it. If you have to depend on others to check, you need to be most precise in the characters you want checked and it is most desirable to send a specimen you have examined yourself for comparison.

Try not to depend for your identification on a comparison with a paratype, or with a specimen identified by an earlier authority (no matter how world-renowned) unless you know he has actually seen the holotype. In mosquito taxonomy many errors have resulted from workers relying on such specimens.

(14) Deposition of type material.
Make sure that the type of an Australian species is deposited in an Australian museum. Rarely this might not be possible if the specimen is on loan to you from an overseas museum. This is a
point on which to be very firm if you are lending material to an overseas worker for description.

It is the practice of this Department not to retain holotypes (except Culicidae) but to deposit any selected from the Departmental collection in the Queensland Museum.

Distribute your paratypes to several museums. Some are usually deposited with the holotype, others retained in this Department. If there is a museum elsewhere in Australia that has a particularly good collection of your group, send paratypes there, where other workers can see them at the same time as that collection. Send paratypes also to the Australian National Insect Collection in Canberra which is, or will become, Australia’s major reference collection in many groups. If possible send paratypes to the British Museum which is the greatest reference collection in the world. (Any taxonomist working on the world fauna will sooner or later have to visit the British Museum.) Try to deposit paratypes, or at least specimens identified at the time you described the species, in a museum in the State from which the holotype was collected.

(15) Acknowledging help.
When you write your paper, be meticulous about acknowledging the help you have received – record the collectors, who have after all done a great deal towards your paper in providing the material on which it is based, and thank those who have loaned material or given advice. There is no need to be effusive about this.

(16) Testing keys.
If you have constructed keys, get as many people as you can to try them out before you publish them – both experts in your group and other entomologists, especially people of the type who may wish to use them e.g. agricultural or forest entomologists.

A statement that may be quite clear and obvious to yourself may be quite unclear, even to another experienced worker in the same group. I know this from personal experience with a key to Uranotaenia which I prepared and asked Mrs. Mackerras to try out. It failed from obscurity of the first couplet; the characters used were good, but not the way in which I had described them.

(17) Illustrations.
When you are planning to start drawing, take a critical look at illustrations in other taxonomic papers, and decide what you want to emulate and what avoid. Look at papers on all orders for ways of setting out and lettering or numbering plates and giving explanations of them – these can be lucid or confusing. Look at illustrations by outstanding entomological illustrators such as Terzi and Arthur Smith of the British Museum. Look at papers in your chosen order or family for drawings of the characters that you want to illustrate. If you find an illustrator whose style is particularly effective, you may find it profitable to model your style on his, without necessarily following it slavishly. You may not care for earlier illustrations and prefer to set a new style yourself. If you do this, always remember that the purpose of your illustration is to help other workers identify your species. These others, in trying to identify a specimen, have to compare it with the illustrations of different authors and, unless these illustrations have something in common, it will be a difficult task.

So for instance, if you consider that a tergal view of terminalia illustrates them better than a lateral view which other authors have used, it may be as well for you to illustrate both tergal and lateral views.
Besides identifying your drawing with the specimen, which I mentioned earlier, it is a good idea to pencil in a scale of magnification on your drawings as you do them and also to note either on the drawing or in your notebook or manuscript description, the microscope used, the power of eyepiece and objective, and, if you have used a grid, the size of the square (½mm or 1mm) and the size of squares on the paper. This will save you a lot of checking back if you wish later to draw another species to the same magnification.

In the published figures, magnification should be indicated. A scale beside the drawing is the safest. One may work out carefully that one’s drawing is x 120 and that the published figure will be reduced by a half so that it will be x 60, and state this in the “Explanation of figure” only to find that the printed figure has been reduced by more, or less, than a half and one's stated magnification is incorrect. This happened to me once and unfortunately I failed to observe the discrepancy in the proof, so since then I have used a scale.

Do not expect your first drawings to be suitable for publication – get someone experienced in taxonomic illustration to examine critically each one as you complete it until you have developed a satisfactory technique. There are two requirements that the drawings must meet – they must illustrate what you want to show clearly, so that another worker can compare the drawing with his own specimens without difficulty or doubts on what you have drawn; they must also be suitable for reproduction as printed plates.

Plates are expensive and are charged for by area, so fit as much into the one plate as you can without making it confusing. As far as possible, parts of the illustrations should reach the corners and margins of the plate so that there is a general definition of its boundaries – this will improve its appearance.

It is a convention that in shaded taxonomic drawings the light comes from the top left hand corner.

It is usual to do one's drawings at least twice the dimensions of the printed plate (e.g. for a plate 7 x 5 inches the drawing will be 14 x 10 inches). Reduction makes slight unevenness of lines disappear but lines that are too fine also disappear. Use a reducing glass to help you judge whether your lines are too fine, or your stippling too close, or lettering too small.

You may do your drawings separately and later assemble them in a plate, or plan out where to draw them on a sheet of drawing paper of the final plate dimensions. In either case, before you start, check the requirements of the journal to which you intend submitting your paper. If these are not stated, be guided by the size of plates already published in it.

(18) Importance of thorough checking.
Make it a firm rule right from the start that none of your work is slap-dash. You may have a chance to practice this first on your thesis before you publish. Take pride in the care and thoroughness of your preparation. If you feel you are anything to this Department or University try to produce something that is a credit to the Department. This thoroughness applies right through from examining your specimen and comparing other specimens with it, to your manuscript description, to checking the typescript against the manuscript, to checking the galley proofs against the typescript, to checking the page proofs against the galley. It applies also to checking your figures (and this includes numbering of the figures) with your descriptions and captions, and if someone else has done the illustrations for you, it applies to checking their drawings against the specimens. It applies to checking synonymies and spellings, including the correct spelling of locality names. It applies, too, to checking the
requirements of the journal to which you are submitting your paper, and making sure that the
form of the paper and the presentation of the references are as asked for. You may need to
make your references conform to the World List of Scientific Periodicals – remember this is
your job not that of an editor.

All this does not mean that there will be no mistakes, but there should be none that you are
ashamed of. If possible get another taxonomist to read your paper before it is typed in the final
form. It is useful if you can type the first draft yourself. Many leading American taxonomists
do this.

This rule of thoroughness is advantageous to several people.

(i) It is advantageous to yourself. Anyone reading your published paper, even those workers
on other subjects dipping into the summary and discussion, will spot such gross carelessness as
the misspelling of the name of a well known scientist, or discrepancies between figures and
captions. These are the author's responsibility, and the quality of the author's scientific work
and the reliability of his descriptions will be assumed to be as erratic and second-rate as his
proof reading.

(ii) It is advantageous to secretarial staff, and through them to your Department, because the
minimum of their time is taken up in correcting errors in your typescript.

(iii) It is advantageous to the editor of the journal that accepts the paper for publication. Most
editors are honorary officers of a society, and readers appointed by the society to report on
papers are also honorary. These are busy people with their own work and research projects. It
is quite unfair, and certainly not in the interests of science, to expect them to give up their
time to correct an ill-prepared manuscript.

(iv) It is advantageous to other workers. E.g. when papers are submitted for publication to the
University Press, the length of time required for the editorial staff to correct an ill-prepared
manuscript with incorrectly quoted references, may seriously delay publication of succeeding
papers by other more meticulous authors.

(19) Saving on printing costs.
Remember at all times that printing is very costly. Say what you have to say as concisely and
clearly as possible. Cost of a page saved by cutting out excess verbiage in your paper will be
available then for publication of other scientific material.

(20) Supporting publication.
A great deal of publishing of scientific papers is done by scientific societies whose members
voluntarily give their time to run their affairs and to produce the journals. Often most of a
society's income goes towards publication.

Once you are earning a living from being a scientist of any sort, there is a moral obligation on
you to spend some of that income in supporting some of these scientific societies. And don't
just look at this with the attitude “What do I get out of it”. Through them you are supporting
the advancement of science and dissemination of knowledge for which they are all striving in
their particular fields and for which you, if you are a true scientist, are striving too.

This is not just something that is for older scientists to do – the societies need and deserve the
support and interest of young scientists from the time they graduate. Your obligations here are
first to your local societies and then to others further afield which publish papers in the field in which you are working.

I expect you all belong to the Entomological Society of Queensland – it is so closely associated with this department that you could scarcely fail to know about it. The Royal Society of Queensland is another local society which merits your support – it publishes papers in all fields of science (the volume in the press has several papers on insect taxonomy), and it provides for meetings and discussions on varied aspects of science, particularly those that bring together different specialties.

Going further afield, you might consider membership of the Linnean Society of New South Wales which publishes mainly biological and geological papers, or the Royal Entomological Society of London.

(21) Experimental taxonomy.
You may think of taxonomy as a purely descriptive science but there is also plenty of scope for experiment and it can produce valuable contributions to our knowledge of classification. However, before you can evaluate the results of your experiments, you will have to acquire a good basic knowledge of the taxonomy of the group with which you propose to experiment.

One experimental approach is hybridisation. Dr. Woodhill of Sydney University had an Aedes mosquito from Northern Territory which differed slightly but constantly from a common New Guinea species Aedes scutellaris. He established colonies of both forms, successfully crossed them and showed that the cross one way produced fertile progeny but not the other way. He concluded that the Northern Territory form was a subspecies of A. scutellaris. (A few specimens resembling his hybrids have been taken in the Coen district of Cape York Peninsula – we shall need to rear progeny of a Peninsula female, and possibly try crossing them too, in order to establish their identity.)

I found that two forms in Fiji were being confused under the name Aedes pseudoscutellaris – the true A. pseudoscutellaris which is confined to Fiji and what I described as another species A. polynesiensis, which occurs also on many other Pacific Island groups. Subsequent workers successfully hybridised Fijian A. pseudoscutellaris with A. polynesiensis obtained from other areas and concluded polynesiensis was a subspecies of pseudoscutellaris. The fact remains that the two continue as separate entities in the one place where they occur together, Fiji, though what prevents them crossing there has not been fully investigated – it may be their ecology or behaviour or some other factor. Thus successful laboratory hybridisation may provide valuable information, but needs to be evaluated in relation to factors operating in the field, before its significance can be understood.

Another experimental approach, one which I tried with A. pseudoscutellaris, is to rear the larvae of one species in different conditions (in my case at different temperatures or salinities) and see how this affects the various characters used to distinguish the adults from their nearest relatives. With A. pseudoscutellaris I found quite a lot of variation in extent of white and dark scaling, but generally not as great as between species.

In the two-year-old colony, white scales under the proboscis occurred most frequently in adults from larvae reared at "above normal" temperatures. They occurred even more frequently in adults of another strain freshly obtained from Fiji, which were from larvae reared at "normal" temperatures. This points to the well-known hazard of drawing general conclusions on a species from the characters or behaviour of a long established laboratory colony which has not
only been subjected to selection pressure for characteristics suited to the colony conditions, but also may have a genetically limited ancestry.

These are only two of the many ways in which one might experiment in taxonomy. Most experienced taxonomists have noted numerous species or species groups where experimental study would be valuable. Generally they themselves lack either the time, or the opportunity, or the inclination to undertake this study but would gladly advise you and suggest projects if you feel this is the aspect of taxonomy on which you want to concentrate.

(22) Pitfalls.
You are bound to meet pitfalls at all stages of your career, but if you develop the habit of scepticism as well as caution, and take care in starting right from base (e.g. Family or Genus) with identifications, and maintain the habit of careful checking, you may avoid a lot of them. If you have able help where you are working and/or good contacts with other workers, as I have had, you will be rescued from others before you have fallen right in and your error is in print.

(23) Pleasures.
Finally, there are many pleasures in being a taxonomist. The pleasure of feeling you have put your best into a piece of work, even though the results may be unspectacular. The pleasure of studying your chosen animal alive in the field. The pleasure of finding and describing new species. The pleasure of solving the problems of old species whose identity has been in doubt for years – this can seldom be done without the pleasure of collaboration with fellow workers in museums in other parts of the world. The pleasure of unexpectedly opening up new problems which stimulate work in other fields, as when one discovers that two species are involved in what has been regarded as a single species of economic or medical importance. The pleasure, which is one we hope for but may never achieve, of making a contribution to zoogeography. And the pleasure of friendships with collectors and taxonomists in faraway places – crowned, one hopes, by the pleasure of eventually meeting them and having the opportunity to discuss one’s subject together.
APPENDIX B

EXAMPLE OF AN EARLY FIELD TRIP REPORT – MAY 1946

REPORT OF AN ANOPHELINE SURVEY OF LUCINDA POINT, QUEENSLAND, WITH
NOTES ON THE BREEDING PLACES OF ANOPHELINE MOSQUITOES IN THE
INGHAM DISTRICT.

by
ELIZABETH N. MARKS, M. Sc.,
Graduate Research Assistant, Mosquito Control Committee.

With 2 maps and 12 photographs.
[Not included in this example]

I. An Anopheline Survey of the Lucinda Point Area, with a Discussion of the Relationship of
the Findings to the Recent Local Malaria Outbreak.

II. Report on Anopheline Breeding in the Ingham district.

III. General Comments.

IV. Acknowledgments.

V. References.

Maps of Lucinda Point and Halifax.
Photographs of Lucinda Point, Halifax and Ingham.

I. – An Anopheline Survey of the Lucinda Point Area, with a Discussion of the Relationship
of the Findings to the Recent Local Malaria Outbreak.

(i.) Introduction.
Ten cases of benign tertian malaria were reported from Lucinda Point, Queensland, during the
first week of May, 1946, this number representing about 10 per cent of the population of the
township. All had apparently acquired the infection locally. In order that adequate control
measures should be instigated, an Anopheline survey of the area was requested, the results of
which form the subject of this report. The survey extended over a period from 15th to 23rd
May, 1946, and additional information was obtained from collections made by Mr. D. Pryor, of
the State Health Department, between 26th May and 3rd June.

(ii.) General Description of the Area.
The township of Lucinda Point extends over an area about half mile in diameter, made up of
low sandy ridges, separated and surrounded by lowlying swampy areas, except on the east
and north-east, where it is bounded by the sea. Roads run along the ridges, and the houses are
built along either side of the roads, mainly on those running north and south. Thus no house
would be more than 12 chains distant from a waterhole or swamp, either brackish or
freshwater. All bodies of ground water found within half mile radius of the township were
examined and several occurring at greater distances.

The township is divided roughly into northern and southern halves by the eastward extension
of the Lucinda Point-Dungeness road (which runs east and west). Taking first the portion to

Appendix B

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north of this road, on east and north is the sea, on west is the C.S.R. tramline, running to the jetty at the northern end of Lucinda Point. To west of the tramline is a tidal mangrove swamp, an arm of which extends on the east side of the tramline, and is known locally as the "C.S.R. swamp". This portion has been cleared of mangroves. To east of the C.S.R. swamp a sandy ridge runs north and south, along which a road runs, continuing round the northern end of the town and returning along the eastern side, to become continuous with the Dungeness road. This more or less circular road is known as the Parade. Houses are built along the outer edge of the circle and also on the inner side at the northern end. The middle and southern end of the area encircled have been set aside as a recreation reserve. Most of this area is low-lying and forms a swamp with several outlying pools. During cyclones the sea sweeps from the north-east into this swamp and the water when examined was slightly brackish. There is an outlet, at a fairly high level, into the C.S.R. swamp. The northern half of the settlement is mainly cleared, there being some timber on the eastern side of the recreation reserve, and another patch on the south-eastern side of the C.S.R. swamp. To the west of the tramline, however, there is dense bush and mangroves.

The southern half of the town is much more heavily timbered. On the eastern side a road known as School road runs south from the Parade and about ¼ mile along this, to the rear of residences on the western side, is an extensive freshwater swamp which, being to the rear of J. Patterson’s property, is referred to in this report as Patterson’s swamp. An area of dense bush separates the rear of residences on the western side of School road from the rear of residences on the eastern side of the Halifax-Lucinda Point road and tramline, to which School road is parallel. To the east of the tramline, on the south side of the Dungeness road is a small swampy area with a fairly high level drain into the C.S.R. swamp on the northern side of the road.

The Lucinda Point hotel (Royal Hotel) is situated on the south-west corner of the junction of the Dungeness road with the Halifax road and tramline. As already noted, there is a tidal mangrove swamp here on the northern side of the Dungeness road, and about 8 chains west of the tramline a small portion of this swamp appears to have been cut off by the construction of the road, leaving several mangrove-fringed pools. Also at this spot are a number of borrow-pits on either side of the road. About ¼ mile west of the tramline, on the southern side of the Dungeness road is a freshwater tea-tree swamp, while about a mile along the road are further pools cut off from the tidal swamp.

About ¼ mile south of the hotel, on the western side of the Halifax road is a freshwater swamp, while 100 yards south of this on the eastern side is a small tea-tree swamp, and a short distance south of this again is the northern end of a long drain or gutter between the tramline and the road, which runs into tidal mangrove swamps to the south. On the western side of the road at this point there are also tidal mangrove swamps which sweep round in a northerly direction about 12 chains from the road. There is very little cleared ground in the southern half of the township, and all residences are within a short distance of dense bush.

It is obvious, from the low-lying nature of much of the area, that during the wet season the waterholes examined would be much more extensive, and in all probability others also would occur.

(iii.) Account of Anopheline Breeding Places and other Bodies of Water Examined. (Anophelines found in Nos. 1, 4, 5, and 6.)
1. C.S.R. Swamp and Adjoining Pools (photographs I., II., and III.). – The main area of this swamp consists of a shallow tidal body of water, several acres in extent, running north and south, and draining at its northern end under the tramline into a mangrove swamp. This swamp, however, is cleared of mangroves, and consists of an unshaded mud flat with tussocks of
saltwater couch grass. It is stocked with fish, which have access to all parts, and no mosquito larvae were found.

About 10 to 15 yards from the main portion of the swamp, on the eastern side of its southern end, amongst fairly long grass, but otherwise unshaded, are several depressions, 20 to 60 square feet in area, with mud bottoms and grassy edges. These, when examined on 16th May, 1946, contained brackish, slightly discoloured water, but were practically dry by 20th May, 1946. They apparently would be filled by heavy rain, or possibly by extra high tides, or by a combination of both. Culicines were breeding prolifically in these pools, and larvae of *Anopheles punctulatus moluccensis* (this species should more correctly be referred to as *A. farauti*) were collected, but were very scarce. Collections from similar pools elsewhere (see No. 7) suggest that such are not greatly favoured by this species.

At the southern end of the C.S.R. swamp, where it borders the road, is a high bank (now overgrown) apparently where a road at one time has been thrown up. This runs at an angle of 45 degrees from the Dungeness road north-eastern towards the Parade and completely cuts off from the swamp a long, shallow, unshaded waterhole on its southern side, about 40 yards long and 3 yards wide, while on its northern side there is also a long water-holding depression, more or less cut off from the tidal portion of the swamp, and probably formed, in part at least, as a borrow-pit for this old road. Both these pools had been extensively oiled when examined on 16th May, 1946; numerous dead Culicine larvae were observed, but no Anopheles. However they do not appear to differ materially in type from the isolated pool described above in which *A. p. moluccensis* was found.

On the south side of the Dungeness road at this point is a shallow, swampy, grassy area, which would cover about 40 square yards when filled, but when examined on 22nd May, 1946, was almost dried out. The pool had a mud bottom, with thick grass growing in it, and the water extended for 2 or 3 yards under the dense matted grass round about it. Some pollution from cattle was probable. No Anopheles were collected but Culicines were numerous, including both fresh and salt-water species. There is a drain several feet above the present level of this swampy area running under the Dungeness road – not directly into the C.S.R. swamp, but into the long pool cut off on the south side of the old road.

A small waterhole about 2 feet square adjoining this grassy swamp was also examined, and Culicines found breeding but no Anopheles.

An impression was gained that mosquito control measures suggested locally included blocking the tide from the tidal C.S.R. swamp. It must be strongly urged that this would fail to destroy any breeding places of Anopheles, whereas it is exceeding likely that it might create a large and favourable breeding place (cf. No. 4).

2. *Recreation Reserve Swamp and Adjoining Pools* – (Photograph IV.) – This swamp, when examined on 17th May, 1946, consisted of an open area of slightly brackish water about \(\frac{1}{2}\) acre in extent, having a large patch of sedges in the middle with open water round them. Thick and matted “swamp couch” grass surrounds it and the water extends for varying distances under the grass, usually a few yards only except at the southern end where it extends for many yards. The whole area is fully exposed to sunlight. By 22nd May, 1946, the area of open water had been reduced to about \(\frac{1}{4}\) acre. This swamp had been heavily oiled. No Anopheles were found in repeated collections from it but Culicines were collected from a small pool a few feet from its northern edge on 15th May, 1946, amongst the grass along its western edge on 17th May, 1946, and from a small grassy depression about 2 feet in diameter on 22nd May, 1946, this
Mosquitoes and Memories

being about 15 yards south-east of the culvert draining the area, and at the time some distance from the main body of water. On one occasion a fish was observed amongst the matted grass near the edge.

This swamp lies in a shallow basin surrounded by low sandhills round which runs the Parade. It is possible that it receives some drainage from dwellings to north of it, and some pollution from cattle. Its only outlet is a pipe running under a culvert on its west side, so that when the water is about 3 feet below the level of the road it would drain across into the C.S.R. swamp. At present it is far below this level.

To north-east of the swamp the encircling sandhill is at a somewhat lower level, and there is an outlying pool, about 16 square yards in area near the Parade and well separated from the main swamp. This pool had been oiled and also contained numerous fish, and no mosquito larvae were found in it.

During cyclones the sea drives across this piece of ground into the recreation reserve swamp after which residents state that the swamp gives off a very unpleasant smell, possibly due to rotting vegetation. It is regarded as a public nuisance and, therefore, it is likely to be urged locally that it should be filled in.

There are patches of timber and undergrowth (but not dense) separating the recreation reserve swamp from the Parade on the east and between it and the C.S.R. swamp (on the west side of the Parade) on the south-west.

3. Patterson’s Swamp. – This is an extensive freshwater swamp in a hollow separated by a broad sandhill from the seashore, its northern end being at the rear of J. Patterson’s residence at the southern end of School road, which runs along this sandhill. It runs north and south being about ¼ mile long and 50 yards wide. The east edge has mainly a sandy bank with overhanging cotton and scrub box trees. Along the west edge are tea-trees, wattles, etc. In the middle and in places along the banks are large areas of dense, tall sedges; there are patches of open water and patches of waterlilies. Towards its south end the swamp is almost divided in two by a shallow sandbank on which partly submerged grass is growing, while its edges also are grassy in places, sometimes with green algae. The edges of this swamp had been heavily oiled. However when first examined on 15th May, 1946, a small northerly extension among tea-trees, which had been filled by rain, and a couple of outlying grassy pools yielded Culicine larvae but no Anophelines. These had dried up by 21st May, 1946. A few Culicines also were collected from the south-west end of the swamp, but again no Anophelines were observed. In the middle this swamp is waist deep, and it was not possible to search for larvae there. As adults of A. p. moluccensis have been taken in the bush along its banks, they might perhaps be breeding in the shelter of vegetation in the middle (cf. No. 5), and it is regretted that this could not be investigated.

There is dense bush with thick undergrowth along the western and southern sides of this swamp, and the more open timber along the eastern and northern.

4. Brackish Pools along Dungeness Road - (Photograph V.). – Running west from the Halifax road, the Lucinda Point-Dungeness road is at present under construction, being built partly through mangrove swamps. Rocks and sand are used in construction, and sand is obtained from borrow-pits alongside the road where it traverses sandy ridges. At the Lucinda Point end of the road there is an extensive tidal mangrove swamp to north and a small portion of this has apparently been cut off by the construction of the road, as on its south side, about 8 to 10 chains...
to rear of the hotel, there was found, on 16th May, 1946, a shallow brackish waterhole about 30 feet by 10 feet bordered by mangroves, but otherwise exposed to sunlight, with mud bottom and sandy edge. Its greatest depth was about 12 inches and there were numerous old tins lying in it, but no recent rubbish. On this date a few very immature larvae of *A. amictus hilli* and *A. p. moluccensis* were collected, in addition to Culicines. By 20th May, 1946, the surface area had been reduced by two-thirds, the depth was only ½ to 1 inch and larvae were numerous, including the same species of Anophelines, now almost ready to pupate. On 22nd May, 1946, the pool was almost dry, but it is probable that sufficient moisture and damp mud remained for many mosquitoes to complete their pupal period.

This pool contained no fish. Adjoining pools, some of which may, however, have been more in the nature of borrow-pits than cut-off portions of the swamp, were stocked with fish and no larvae could be found; the same applied to a couple of nearby pools on the north side of the road.

The Dungeness road was followed as far as was trafficable (about 1 mile), and at this point on its west side there occurred similar mangrove-fringed brackish pools cut off from the tidal swamp by the construction of the road. Though Culicine larvae were numerous in these, no Anophelines were found. Adjoining pools, which were discoloured and malodorous, contained no larvae. Where portion of the tidal swamp on the north-east side of the road had been drained, isolated wheel-ruts contained fish and no larvae were present.

The type of pool described above has no vegetation to afford shelter for mosquito larvae, and when fish are present breeding is controlled. Being cut off from the swamp, however, they will dry out during dry weather and the stock of fish will be destroyed. When the pools are filled again, either by heavy rains or possibly by seepage from very high tides, they will provide potential breeding grounds for Anopheline larvae.

5. **Freshwater Swamp to south of Dungeness Road.** – A few yards to the south of Dungeness road, and about ¼ mile west from the tramline is a freshwater swamp about ¼ acre in extent. This swamp has been fringed with tea-trees which have recently been felled and the edges are now, like the centre, exposed to full sunlight. Along the edges there is a certain amount of rotting vegetation, and the impression gained is that the equilibrium of plant and animal life in this portion of the swamp has been upset by the removal of the trees and it has not yet re-established itself as a sunlit area. In the middle of the swamp are sedges; the edges are grassy in places, and there are patches of water lilies and of green algae.

When examined on 20th May, 1946, a prolonged search along the edges yielded only Culicine larvae and one immature Anopheline which it was not possible to identify. However this swamp was subsequently visited by Mr. D. Pryor on 26th and 28th May, 1946, and he found numbers of *A. p. moluccensis* larvae in the shelter of the vegetation in the middle of the swamp, the edges at that time having been oiled.

6. **Freshwater Swamps on Halifax Road.**

West of Halifax road, about ½ mile south of its junction with the Dungeness road, is a freshwater swamp about ½ acre in extent. This swamp has a dense, tall growth of sedges throughout, with a few water lilies. The banks are mainly steep and sandy with overhanging trees, mostly wattles, at the top of the banks, so that there are many fallen leaves along the edges of the water. Portion on its north side however has a grassy, shallow edge. Culicine larvae were very numerous in this swamp, but no Anophelines could be found when it was examined on 22nd May, 1946. However, on 3rd June, 1946, Mr. D. Pryor observed a number of
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Anopheline larvae in it, the species of which was not ascertained. There are probably no fish present, since larvae were numerous in open water several feet out from the edge.

In this area there are a variety of swamps. On the west side of the road a short distance separates the freshwater sedge swamp described above from an extensive tidal mangrove swamp to south and west. On the east side of the road, about 100 yards south of the sedge swamp, is a shallow shaded tea-tree swamp which appeared recently dried up when examined on 22nd May, 1946, while a short distance south of this again is an arm of a tidal swamp in the drain between the tramline and the road.

7. Brackish Pools on Halifax Road. – East of Halifax road, at a point about 2 to 3 miles south of Dungeness road, there commences a long waterhole or drain about 3 to 4 feet wide which runs between the tramline and the road and empties into tidal swamps to the south.

At its northern end the water is clear, very slightly brackish and 6 to 12 inches deep; the edges are grassy, with some green algae, and partially shaded by overhanging trees. It is probable that this extremity of the drain is filled by a combination of heavy rain with very high tides. Larvae were scarce and no Anophelines were found.

About 2 miles from Lucinda Point, on the west side of Halifax road, an examination was made of a number of slightly brackish pools, with mud bottoms and grassy edges, 12 to 30 square feet in area, 6 to 12 inches deep, and unshaded. These were a few yards from the edge of a tidal mangrove swamp, and probably are filled by king tides, or very heavy rain. They are similar in type to those beside the C.S.R. swamp at Lucinda Point (see Photograph No. 1). In those pools which were not stocked with fish Culicine larvae were numerous but no Anophelines were observed. There is no habitation in the neighbourhood of these pools.

(iv.) Adult Collections.

When the residences of the various malaria patients were visited, a cursory examination for resting mosquitoes was made inside some, and round about most of them, in such places as outlying sheds, under tank stands, and round butts of trees; but no Anopheline adults were observed, even where conditions of shade and moisture appeared most favourable. Many of the houses in this area are constructed wholly or in part of corrugated iron, which probably would become hot during the day and render the walls unsuitable as resting places. However, the darkness inside these dwellings would make any resting adults very difficult to observe.

The Royal Hotel, Lucinda Point, situated at the junction of Halifax and Dungeness roads, is a concrete building with the inside walls calcimined a cream colour, and the coolness of the interior renders it a favourable resting place for adult mosquitoes, while these are easy to observe on the light coloured walls. A collection was made here about midday on 16th May, 1946, and a total of nine Anophelines were collected, three being dead specimens found in cobwebs, and six living, resting on the walls of various rooms. These comprise four *A. punctulatus moluccensis*, four *A. amictus hilli*, one *A. meraukensis*. Two specimens were dissected, the findings being -

Specimen of *A. p. moluccensis* – No oocysts observed; wings stage I. or II. (very good condition); ovaries stage V. (eggs completely developed).

Specimen of *A. amictus hilli* – No oocysts or sporozoites observed; wings stage II.; ovaries stage IV. or V.; midgut contained remains of almost completely digested bloodmeal.
Several of the other specimens appeared to have had bloodmeals.

Three additional specimens, collected by a member of the hotel staff and submitted on 23rd May, 1946, comprised two *A. amictus hilli* and one *A. meraukensis*. No resting Anophelines were observed in an examination of various sheds, tank stands, etc., behind the hotel.

It is not unusual for *A. amictus hilli* and *A. meraukensis* to be collected from dwellings during the daytime. Lee and Woodhill (1944) state that "Most of the evidence so far available indicates that the adults (of *A. p. moluccensis*) leave the houses or tents after feeding and take shelter elsewhere, but several instances have been recorded of large numbers of fed females sheltering in huts and tents throughout the day." The presence of adults of *A. p. moluccensis* resting in the hotel appears therefore to indicate a large population of this species in the vicinity.

On the evening of 20th May, 1946, between 5.15 and 6 p.m. (i.e. at dusk) a collection of adults was undertaken at the north-western end of Patterson’s swamp (site A on map), between 5.15 and 5.40 p.m. amongst tea-trees at the edge of the swamp, where only Culicines were collected, and between 5.40 and 5.55 p.m. in thick bush about 10 yards west of this site, where one female of *A. punctulatus moluccensis* was taken, its appearance indicating that it was a young specimen. On the evening of 21st May, 1946, a collection was made in a patch of bush along the south-east edge of C.S.R. swamp (B on map); very few Culicines were taken, although this was alongside pools in which they had been breeding freely, and no Anophelines. As there had been a cool change in the weather on 19th May, 1946, accompanied by a light west wind, these collections were probably not a true indication of the adult mosquito population normally encountered.

Further adult collections were made by Mr. D. Pryor as follows:-

On 26th May, 1946, at a spot in heavy timber opposite the hotel, on the western side of the tramline (C on map) between 6.35 and 8.55 p.m., eight specimens of *A. p. moluccensis* were taken and one of *A. amictus hilli*, the latter at 8.25 p.m. Mr. Pryor noted that after 8.55 p.m. the evening became cold and all biting, including Culicines, practically ceased. Of these, five specimens of *moluccensis* and the single *hilli* were dissected. All had wings stage I.; ovaries stage II. or III.; no oocysts or sporozoites were observed and none of the specimens appeared to have had a bloodmeal. The undissected specimens likewise appeared in fresh condition. It is not unlikely that these adults had bred out from the mangrove fringed pool at the rear of the hotel, where both species were found breeding, or possibly, some were from the freshwater swamp ¼ mile along the road.

On 29th May, 1946, at a spot amongst timber on the eastern side of Patterson’s swamp (D on the map), between 6.10 and 6.25 p.m., six Anophelines were taken, all being *A. p. moluccensis*, and adults were observed to be very numerous. Three specimens were dissected; all had wings stage I., ovaries stage II., no sporozoites or oocysts were observed and none had had a bloodmeal. The three remaining specimens likewise appeared recently emerged.

This spot was revisited by Mr. Pryor on the following evening at the same time but no Anophelines were observed and Culicines were scarce, although atmospheric conditions appeared similar. A possible difference was that on the 29th the morning was overcast and threatened rain, though the afternoon was fine, whereas the 30th was fine and clear all day.

These findings indicate the uncertainty of making assumptions on the basis of a small series of adult captures, as the collection of the 29th would suggest that Anophelines were breeding in large numbers in Patterson’s swamp, whilst that of the 30th conveys the opposite impression.
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On no occasion were male adult Anophelines collected.

(v.) Occurrence of Malaria Cases at Lucinda Point.
While the ten locally acquired cases of malaria were reported during the first week of May, there was obviously some time lag between the time the patients first became ill and the time they were recorded as positive cases of malaria.

Mr. J. Patterson, the first case, was admitted to hospital on 4th April, 1946, but had been sick for two or three weeks previously. His residence (I on map) is at the southern end of School road, and he is a fisherman with a lease 3 miles south of this. He states that he rarely moves about in the main portion of the town, and attributes his infection to a visit to the hotel (the first for 12 months) made on 12th March, 1946, maintaining also that all the men who had contracted malaria locally were in the habit of visiting the hotel.

Evidence in support of this suggestion is given below, but an alternative explanation is available. Two brothers L. and W. Keast, living at the northern end of the town (IV on map), are returned soldiers subject to recurrent attacks of malaria. One of these men, when fishing on the beach in front of Patterson's residence, was taken suddenly ill with an attack, and was taken into Patterson's house where he rested until he had recovered sufficiently to return home. The house is of corrugated iron, and very open, and does not appear to provide much suitable shelter for Anophelines. However, Mr. Patterson had noticed "grey speckled" mosquitoes about, and as reported above, adults of A. p. moluccensis are at times numerous in the vicinity.

Miss J. Patterson, daughter of the above patient, and employed at the post office, also acquired the infection at a later date presumably in her own home, though when she became ill she was taken into Mrs. Walker's residence (V on map) next to the post office.

At the northern end of School road were two other cases, F. Herron and V. Hobbs (the latter a school girl), their residences adjoining one another. A covered well in front of the Hobbs's house was examined but neither resting adults nor larvae were found.

From the northern half of the town only one locally acquired case of malaria was reported, this being Mrs. I. V. Johnson, who resides with her daughter, Mrs. Walker (V on map). Mrs. Johnson, however, owns a house on the Halifax road at the southern end of the town (X on map), where she had been in the habit of spending the day, returning to Mrs. Walker's for the night. This house is of iron with a low roof, and in dense shade from overhanging trees; there is a fernery beside it, and about 20 yards to the rear is the dense bush along the western side of Patterson's swamp. Mrs. Johnson was ill before Miss Patterson was taken into Mrs. Walker's house with an attack of malaria. It was subsequently (20th May, 1946) suggested that Mr. Walker was suffering an attack of malaria (locally acquired). This was not proved, but supposing it to be the case, while the possibility of his having acquired it in his own home cannot be excluded, he had, subsequent to Mrs. Johnson's illness, been visiting her house in Halifax road in the evening to feed her fowls, and would therefore have been similarly exposed to any infected mosquitoes in that vicinity.

Another locally acquired malaria case, G. Davis, was resident in Mrs. Johnson's house in Halifax road when he became ill. He has since left the town and it was not possible to ascertain relative dates of his and Mrs. Johnson's attacks.

In the southern half of the town, along the Halifax road, four other newly acquired cases of malaria occurred. One was Mrs. Markkaven (IX on map), resident a short distance north of
Mrs. Johnson’s on the western side of the road. Also resident in this house is J. Stenros, a returned soldier subject to recurrent attacks of malaria. About half-way between this house and the hotel is the home of Mr. J. C. Madsen (VII on map), another locally acquired case. (He stated that he had not been out much or away from the district.) Opposite this, but about 40 yards from the road, surrounded by bush is the residence of Mrs. Camenzuli (VIII on map), also infected locally.

At the hotel (VI on map), on the corner of Halifax and Dungeness roads, are resident C. Burnett, a locally infected malaria case; H. Simpson, a returned soldier subject to recurrent attacks of malaria; and Mr. Ross, the contractor for the Dungeness road, who had had malaria in the Pacific islands before the war, came to Australia in 1937 and has been at Lucinda Point since about January, and who suffers from recurrent attacks of malaria every month or six weeks, which he treats himself. (It may also be noted that the returned soldiers subject to attacks were said to have come back to the district at the beginning of the year.)

In view of the number of Anophelines found resting in the hotel, the presence there of persons subject to attacks of malaria, and the fact that local residents would visit there in the late afternoon and evening when Anophelines might be expected to be biting, it is not unlikely that some, if not most, of the locally acquired malaria infections were contracted there, or in the vicinity, from mosquitoes which had fed there and were resting in the neighbouring undergrowth. Indeed a case could be made out attributing the epidemic to the construction of the Dungeness road, which brought to the district a man suffering from malaria and probably treating it by unorthodox methods, and at the same time cut off portion of the nearby tidal swamp, thus creating a prolific breeding ground for the potential vectors.

However, there is insufficient evidence to prove this case and though it may perhaps be partly true it is not likely to give the full picture of the combination of circumstances involved. Other malarial subjects are known to be taking inadequate treatment, and other Anopheline breeding places have been found.

It is worthy of note, in connection with the occurrence of malaria cases, that in the Lucinda Point area the sources of bloodmeals available to mosquitoes are restricted. Evidence of this is afforded by the apparently unfed state of all the Anophelines taken in the bush. The stock in the township amount to no more than three or four cows; there are a few dogs, and a number of the residents keep their own fowls and ducks; apart from ibis, few native birds were noticed.

Lee and Woodhill (1944) quote the results of various precipitin tests on A. punctulatus moluccensis which indicate that this species shows no special preference for man, attacking a variety of animals and birds, and they conclude that the females attack whatever animal is nearest at hand. In the Lucinda Point area there are so few animals about that these mosquitoes may be expected to travel some distance from their breeding places before finding a source of blood, and the first source encountered will in a large percentage of cases be man; this would not be the state of affairs if there were farmyards or pastures near at hand.

A classical method of naturalistic malaria control which has achieved some success in other parts of the world is by deflecting the biting of the Anopheline concerned from man to animals. While it cannot be stated that this would be practicable or successful at Lucinda Point, it is suggested that the malaria outbreak there might not have involved such a large proportion of the population had a larger number of stock been available to supply bloodmeals for the Anophelines.
Conclusions.

Anopheles punctulatus moluccensis has been found breeding in three places at Lucinda Point, in both fresh and brackish water, and adults of the species have been collected from a dwelling where a locally acquired case of malaria had occurred and also at various sites in the bush about the town. This subspecies is the only proven malaria vector on the Australian mainland and was responsible for the epidemic at Cairns in 1942. It is reasonable to assume that it is responsible for the outbreak of malaria at Lucinda Point, though definite proof from dissections has not been obtained. It is possible also that it has been breeding in additional sites to those found, evidence of this having been destroyed either by the drying up or the oiling of the pools, and where a thorough examination of the edges of a waterhole has failed to reveal any larvae, though the indication is that they are not breeding there, the possibility of their sheltering among vegetation in the middle should not be overlooked.

Two other species of Anophelines were found at Lucinda Point. Adults of Anopheles amictus hilli were taken in a dwelling and in a bush, and a breeding place was located. A naturally infected female of this species was taken once during the Cairns epidemic, and it might possibly fill a subsidiary role also at Lucinda Point. Anopheles meruakensis was found resting in a dwelling, but its breeding place was not located. This species is susceptible to experimental infection with malaria but no natural infection has been recorded.

Breeding places, both from oiling and drying up, are now becoming restricted and it is unlikely that large numbers of Anophelines will again be breeding until next summer. Adults which had had bloodmeals and sufficient time for their eggs to mature were found resting in the hotel, but all adults taken in the bush were apparently freshly emerged and unfed. While it is possible that some of these might continue the infection of the population, most of the inhabitants, both infected and uninfected are now undergoing suppressive treatment (on a voluntary basis) while the cooler weather is also rendering the adult mosquitoes less active. For these reasons it appears that the malaria outbreak is now on the wane if not over.

The cases of malaria which occurred were confined mainly to the southern half of the town and the Anopheline breeding places found adjoin this area. However, the northern portion would be more exposed to sea breezes, and also offers comparatively little shelter in the form of trees and bush, so that if Anophelines did breed in that region they would probably seek shelter in the extensive areas of dense bush and mangroves in the southern portion.

As the Lucinda Point area is one in which extensive swamps and waterholes occur, larvicidal treatment of the entire area is obviously out of the question. At the present time (end of May) pools are rapidly drying up, but when heavy rains again occur it is apparent that there will be extensive areas of ground water available for breeding places and it is impossible to forecast now which of these will be favoured by A. punctulatus moluccensis, a species which is notably catholic in its choice of breeding places. Indeed it is not unlikely that when the selected breeding places have been rendered unsuitable, it will adopt others of different type.

It will therefore be essential that larval control measures be undertaken by someone who is able to distinguish an Anopheline larva from a Culicine (since Culicines will be found in many more places than Anophelines), and who can be depended upon to make a regular check of all potential mosquito breeding places in the area, whether Anophelines have hitherto been found in them or not. At the same time all members of the local population who suffer from recurrent attacks of malaria should be assiduous in their suppressive treatment in order to reinforce any measures which may be taken against the vector.

At the request of Dr. G. C. Morrissey, Government Medical Officer at Ingham, after the Anopheline Survey at Lucinda Point had been completed, collections were made in the vicinity of other settlements in the district in order to ascertain what species of Anophelines were occurring and in what type of breeding places. The information so obtained could then be availed of as a basis for control measures, should further outbreaks of malaria occur in the district.

......[Report continues in a similar manner with detailed descriptions of possible breeding places in the Ingham District]......

Conclusions.
All information available at present points to the conclusion that on the mainland of Australia where *A. punctulatus moluccensis* is present other species of Anophelines may be disregarded as of importance as malaria vectors. This species has been found to be widespread in the Ingham district, where in addition *A. annulipes*, *A. amictus amictus*, *A. amictus hilli*, *A. meraukensis*, and *A. bancrofti* occur.

Records show that *moluccensis* may be found in a wide variety of breeding places, and observations of it in the Ingham district, including Lucinda Point, only serve to confirm them. It would therefore be unsound to make any definite statement as to where it would or would not be likely to be found, particularly if such a statement were taken to apply at a different season, when many more breeding places were available. Bearing this in mind, however, it does appear that more or less isolated, unshaded, grassy puddles and hoofprints round the edge of fresh-water holes are a particularly favourable breeding place, as indicated by the number of larvae occurring in a given area of water; whereas repeated search has failed to reveal any larvae of this species in the water which extends some distance under a dense mat of grass (being consequently shaded) at the edges of brackish swamps.

It appears that control measures directed against the larvae of *A. punctulatus moluccensis* would only be practicable in the vicinity of towns or closely settled areas, or about isolated farms inhabited by persons subject to recurrent attacks of malaria.

III. General Comments.
While it is appreciated that some, if not all, the following miscellaneous observations are outside the scope of this report, they are nevertheless submitted, for what they are worth, as impressions gained by a disinterested observer.

1. Persons engaged in mosquito control measures need only a very elementary knowledge of identification of mosquitoes, the essential being that they should be able to distinguish an Anopheline from a Culicine in both the larval and adult states. If further details are required they can be obtained by submitting specimens to a competent authority. Such a set-up, however, can only yield reliable results if the control worker is an efficient collector, and in order to be such he must be informed on the essential details of the habits and biology of the important disease vectors and pest species and know not only where but how to look for them.

2. An outbreak of mosquito-borne disease, awakening the public as it does to the importance of these insects, no doubt offers the opportunity of more readily enforcing health regulations on mosquito control, such as screening of tanks, etc. The importance of this as a health measure is not in question, but in the case of a malaria outbreak one must beware of its obscuring the fact
that tanks are not the breeding places of Anophelines, and lulling the population into a false sense of security that having screened their tanks they will be safe from malaria infection.

3. Long range engineering projects are important measures of mosquito control. If, however, "long range" means that pools are to be gradually filled with rubbish over a long period of months, in the meantime becoming highly polluted morasses, the breeding places of disease vectors, such schemes are of questionable value, particularly in the middle of a town.

4. Palm Creek, Ingham, bears a striking resemblance to the classical photographs, to be seen in various works on mosquito control of breeding grounds in various parts of the world, before control measures were taken. In such cases the photograph of the "treated" breeding ground shows it transformed into a concrete or earth drain with straight sides and cleared banks. What measures should be taken with Palm Creek are not known, but it is worth pointing out that it acts as a drainage channel, and any scheme preventing rapid drainage of water from the surrounding areas would mean the creation of pools and puddles suitable as breeding places for *A. punctulatus moluccensis*.

IV. Acknowledgments.
Generous assistance has been received from many quarters, and in particular from the following:

Dr. G. C. Morrissey suggested lines of investigation, and Matron M. Duffy, of Ingham General Hospital, made available laboratory accommodation which greatly facilitated the work. In the field, the assistance of Mr. P. Lowes, State Health Department, at the inception of the Lucinda Point investigations was invaluable, while the energy and enthusiasm of Mr. J. Fisher, Acting Health Inspector, Hinchinbrook Shire, coupled with his extensive knowledge of the district, were responsible for such a wide area being covered. Additional collections were made available by Mr. D. Pryor, State Health Department. Mr. and Mrs. A. A. Howell generously provided hospitality at Lucinda Point, and Miss L. Giorcelli loaned artists' materials used in the preparation of the maps.

Their material contributions to the studies on which this report is based is very gratefully acknowledged.

V. References.
(Only those are cited to which immediate reference has been made in the preparation of this report.)


APPENDIX C

TYPICAL ADDRESS TO LEARNED SOCIETY – MARCH 1954

ENTOMOLOGICAL SOCIETY OF QUEENSLAND – 14.3.54

PRESIDENTIAL ADDRESS

RESEARCH ON AUSTRALIAN MOSQUITOES

by

E. N. Marks.

My choice of subject tonight was influenced by several factors apart from the very obvious one that it was a general aspect of my rather narrow speciality. Many of our members had to take an interest in mosquitoes during the last war and I thought they might like to hear what has been done since. Then again research on Australian mosquitoes seemed to have reached a stage where it would be profitable for us to pause, like explorers reaching a hilltop, and look about – see whence we had come, perhaps indications of what had been missed along the way, and the vast unexplored expanse ahead, thus providing a welcome opportunity to pay a tribute to earlier workers whose blazed trail has enabled us to come so far.

To me, there is a strong feeling of continuity running through this story but it has been difficult to know how to present it. I have divided it for convenience into a number of chronological periods. First, a few words of explanation. Where I speak of the number of species described by an author, or during a particular period, I refer only to the number of species or subspecies recognised as valid today and exclude any since reduced to synonymy or known to be synonyms. I have excluded any consideration of New Guinea mosquitoes but have included Torres Strait islands in Australia. I do not pretend to have given all workers their due measure of credit but perhaps have paid more attention to some of the lesser known ones than to those who are justly famous.

From the earliest times, navigators reaching the Australian coast must have been familiar with our mosquitoes. Banks mentions them as "tolerably plentiful" in some places, during the Endeavour’s voyage along the Queensland coast in 1770. For one hundred years after this they remained no more than annoying insects, rather small and delicate for inclusion in collections sent back to Europe. The first identification, though undoubtedly an incorrect one, seems to have been by d’Entrecasteaux who in 1792 at Esperance Bay, Western Australia, recorded that "The mosquitoes fatigued me much. The species (was).... the Culex pipiens of Fabricius."

The navigators and inland explorers continued to complain of them. Stokes, during the survey of the coast by H.M.S. Beagle between 1837 and 1843 frequently found sleep "rendered impossible by the swarms of mosquitoes" but later he did find something in their favour. One of the party became lost in a mangrove swamp and eventually fell down exhausted. Stokes says the mosquitoes "were probably the means of saving my friend’s life, as goaded on by their unceasing attacks, to exertions otherwise out of the question, he eventually reached assistance".

To turn to more scientific observations the basic work on the fauna of a country must be taxonomic, but the taxonomist is himself dependent on the collector. I have been unable to trace most of the early collectors.
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1762-1850. During this period 5 mosquitoes that now occur in Australia were described from elsewhere. Of these, 3 - *Aedes aegypti* Linnaeus, *Culex fatigans* Wiedemann and *Culex molestus* Foskal, were undoubtedly introduced by the white man, the last possibly in fairly recent years.

Five mosquitoes also were described from Australia. The earliest as befits our most spectacular biter, was *Aedes (Mucidus) alternans* described from New Holland by Westwood in 1835. I do not know by whom it was collected, though the specimen still exists in the Hope Museum at Oxford. The next was *Aedes australis* described by Erichson in 1842 and 3 more were described by Macquart in 1847.

I want to say a bit more about *Aedes australis* because it provides a good illustration of the cooperation characteristic of mosquito research, first in the early days between collectors in Australia and taxonomists in Europe, secondly in recent years, between taxonomists in Australia who have knowledge of species in the field, and their British Museum colleagues who have access to type specimens, and thirdly between workers in European Museums. The type specimens of *Aedes australis* were two males and one female sent to Erichson in Berlin by Schayer, Superintendent at Woolnorth, Van Diemen's Land. Subsequent workers were unable to identify any of their specimens with Erichson's description, a couple of suggestions as to what it might be were not accepted and the species has remained in effect unrecognised up to the present. Another species *Aedes crucians* was described by Walker from Tasmania in 1856 and this differs only in size and some male characters from a common species of the N.S.W. and Victorian coast, *Aedes concolor* Taylor which breeds in salt water rock pools. The larva of *crucians* was unknown. During my visit to Port Davey on the west coast of Tasmania last year, I collected some very large larvae, apparently *concolor*, from which were bred large adults resembling *crucians* except that the males had the distinguishing *concolor* characters. One male, however, was pinned straight after emergence and the shrinkage of palps and other parts made them resemble the description of *crucians*. Smaller more typical *concolor* were also collected in the district, and both large and small females were common biting. It occurred to me that it was perhaps the species most likely to have been taken by an early collector, so I looked up the description of *australis* and as far as it went the characters fitted. Then I sent off a batch of specimens to P. F. Mattingly at the British Museum, for comparison with the type of *crucians* and asked him if Erichson's types were still in existence. He wrote to Dr Fritz Peus of the Berlin University Zoological Museum who sent him on loan the original series of *australis* and as a result it was possible to establish the identity of this old species and show that both *crucians* and *concolor* should be regarded as synonyms of it (this synonymy will be published shortly).

I was interested to know more about Schayer who sent many insect specimens to Erichson, and am indebted to Miss E. G. Connah of the Tasmanian State Library for what follows. In August, 1830, the Van Diemen's Land Company, an early pastoral company, was granted 150,000 acres in the Woolnorth area at the extreme N. W. point of Tasmania and, to quote directly from the Company's report of March, 1831 "In addition to the people who have gone out in the service of the company, the directors have engaged and sent Mr Adolphus Schayer a gentleman from Silesia, who has had the selection and arrangement of large flocks of sheep, and is thoroughly acquainted with their treatment, and the means by which the fleeces in Germany have been brought to their present fineness and perfection; he went in the "Renown", and sailed on Christmas Day, and the directors expect great advantages to result from his services." The company had purchased a large number of German sheep which they sent out to their properties together with cattle and horses. Schayer was at first stationed, apparently as a general expert adviser, at the Company's headquarters at Circular Head. Later it was decided to keep only sheep on the coastal properties, of which Woolnorth was the chief, and it was
probably then that he was posted there, as superintendent or overseer. Incidentally the Company still owns Woolnorth, and it is still in the charge of an overseer.

During the next period, 1851-1880, taxonomy was still in the hands of general entomologists overseas; 2 species of mosquitoes were described from Australia by Walker and Thomson, and Walker also described 3 of our species from elsewhere. This, however, is a highly significant period, since during it mosquitoes first became incriminated as vectors of disease and so assumed an importance considerably greater than their pest status. In 1878, Manson in China traced the early development of Filaria bancrofti in Culex fatigans, and though it was not then actually proved the vector, from this discovery stems the vast amount of research on mosquitoes that has gone on since that date. (I have used the name Filaria bancrofti here rather than the correct name, Wuchereria bancrofti). The period has a particular importance for Australia too, as it marks the beginning of research here by an outstanding family of experimental biologists. Dr Joseph Bancroft in Brisbane in 1876, had discovered the adult worm of Filaria bancrofti and with luck he might have forestalled Manson's discovery, as he stated in 1877 that he strongly suspected mosquitoes and he actually experimented with them, but used Aedes vigilax which is insusceptible to infection. (Incidentally Dr Iyengar has recently shown that in New Caledonia it can act as vector of another form of filaria, causing non-periodic filariasis). As an illustration of continuity in mosquito research, only a couple of weeks ago I was out helping Joseph Bancroft’s granddaughter (Dr M. J. Mackerras) collect mosquitoes to be tested as vectors of a microfilaria of a native cat.

The next period, 1881-1900 really marks the beginning of extensive study of Australian mosquitoes in Australia. On the taxonomic side, one Australian species was described from elsewhere and thirteen added from Australian specimens, the latter all by F. A. A. Skuse. Skuse, who had been a student at the British Museum, came to Australia in 1886 at the age of 22, and was employed by Sir William Macleay for about 3 years to work on Australian Diptera. Macleay himself had drawn up descriptions of a few mosquitoes but had never published them. Skuse used his manuscript names for these species. He produced a series of papers, "Diptera of Australia" in Proc. Linn. Soc. N. S. W. of 1888-1890. In his introduction to the series, he says, “Not a single specimen of Diptera of this country has ever been described here,” and slates the inadequate descriptions of earlier authors “many of them (are) worthless and far from advancing science are calculated to create nothing but disorder”. His own descriptions are models of careful and accurate observation and mark the beginning of the modern style of detailed description. One can only conjecture what would have been the difference in our knowledge of Australian Diptera if this brilliant young man had continued to work on them to a ripe old age. Unfortunately he apparently fell into bad company and ‘went to the dogs’. After 1890 he produced nothing comparable with his first papers and died in 1896 at the early age of 32. 20 of the 29 names listed by Skuse are recognised as valid species today. He did much collecting himself but also acknowledges specimens from J. and T. L. Bancroft, Henry Tryon, G. Masters, A. G. Hamilton, W. J. Stephens and De Meyrick. He recorded observations on the habits of some species. He mentions Aedes notoscriptus breeding in waterbutts and garden tanks and says of Culex fatigans “The dreary hum of this evil genius of the sleeping chamber is generally considered more troublesome than its operation of phlebotomy”.

On the experimental side during this period, T. L. Bancroft took on his father’s mantle and continued the work on Filaria bancrofti. In 1899 he traced its complete development in Culex fatigans and suggested that it was transmitted to man through the proboscis of the mosquito at the time of biting. He also experimented with other species and extensive laboratory rearings of mosquitoes must have been involved in this work. I gave you a more detailed talk on T. L. Bancroft’s mosquito studies some years ago. (Dec. 1945 Minutes).
Another mosquito student in Queensland was W. R. Colledge, manager of a pharmacy, who in 1899 read a paper to Roy. Soc. Qld on the life history of the common mosquito, dealing mostly with *Culex fatigans*. This included a description of the corolla on the egg, which he believed “apparently not hitherto remarked by observers”. Whether he was in fact the first to describe it, I have not discovered. In 1900 he read another paper on the life history and habits of *Anopheles annulipes* in which, as “epaulettes”, he described the palmate hairs on the larva and suggested that they enable it to float at the surface and are not “natatory hairs” as described by a recent author (perhaps Giles). Colledge was a skilled microscopist and his papers are remarkable for their excellent photographic illustrations.

During this period worldwide research on mosquitoes was greatly stimulated by two discoveries. In 1898, Ross in India proved that *Anopheles* mosquitoes were the vectors of malaria and in 1900 Reed, Carrol, Lazaer and Agramonte showed that *Aedes aegypti* could transmit yellow fever.

From 1901-1910 no original taxonomic work on mosquitoes was done in Australia, but F. V. Theobald described 18 species and G. M. Giles one from Australia, while 23 of our species were described from elsewhere, 11 of them by Theobald. In connection with the investigations into the cause of malaria which were conducted by the Colonial Office and the Royal Society, large collections of mosquitoes were sent from all over the world to the British Museum and other institutions and Theobald was appointed to prepare a Monograph of the Culicidae of the World, which appeared in 5 volumes between 1901 and 1910. Theobald might have been hampered as regards Australian species, for the Macleay Museum authorities were unwilling to risk sending him Skuse’s specimens. T. L. Bancroft came to the rescue and between 1899 and 1901 sent about 600 specimens, mainly from Queensland but some from New South Wales and Victoria. C. French also sent some from Victoria and others were received from the South Australian Museum. This was the beginning of a very fruitful association between Australian mosquito workers and mosquito specialists at the British Museum. Theobald’s stupendous work represented a great advance bringing very scattered information together, and in spite of its scope, his descriptions were detailed. His classification, which was based largely on scale structure, soon proved unsatisfactory, but this does not detract from the general merit of his work.

In Australia, M. R. Colledge in 1903 read a paper on the Scotch Grey, *Aedes (Mucidus) alternans*, describing all stages from the egg and giving notes on its habits, including the delayed hatching of a batch of eggs, many of which hatched 10 months after they were laid. Colledge’s last mosquito paper, in 1911, was on *Megarhinus speciosus*, again he described all stages and also, in some detail, the modified mouthparts, suggesting they were adapted for taking up nectar and fruit juices. He observed the predacious habits of the larvae and may have been the first to have the idea of using *Megarhinus* for mosquito control, for he says “No attempt has ever been made in any country to use them for this purpose, so that Queensland might have the honour of leading the van in the contest”. Actually, Hawaii led the van in 1929.

T. L. Bancroft during this period continued his experimental work with mosquitoes, first on the dog heart-worm *Dirofilaria immitis*, demonstrating conclusively that the larvae escaped from the proboscis of *C. fatigans* by rupturing the membrane at the base of the labella. He also obtained development of a microfilaria of a jew lizard in *C. fatigans*. Then he turned his attention to dengue and in 1906 adduced strong evidence that *A. aegypti*, was the vector, though proof was lacking, as his work was in an area where the disease was prevalent. His collecting activities may be gauged by the fact that, up till 1940 a large proportion of the specimens in all the major collections of Australian mosquitoes had been collected by him.
including the types of 25 species. In 1908 Bancroft published “A list of the Mosquitoes of Queensland” in which he listed 32 species and mentioned there were possibly another 20 to be described. The descriptions in this paper are taken from Theobald, but he gives his own concise observations on habits and life histories. Of these 32, he had obtained eggs and larvae of 17, eggs of another 3, and 4 he had bred from mixed batches of larvae. At that time, unfortunately, little attention was paid to larvae from a taxonomic point of view and Bancroft’s larval material was apparently not preserved. Most of the eggs that he had are still undescribed. One can only wonder just how much T. L. Bancroft would have accomplished if he had had a full time research job instead of being a busy general practitioner.

The period 1911-1920 is marked by the establishment of the Australian Institute of Tropical Medicine in Townsville, which with its successor, the School of Public Health and Tropical Medicine in Sydney, has ever since played a prominent part in mosquito research. F. H. Taylor was appointed entomologist there in 1911, and during the period 1911-1920 described 20 Australian mosquitoes (2 others were described, one by F. W. Edwards and one by Strickland). Taylor also published many new distribution records in the reports of the Institute and with Dr Breinl investigated a malaria epidemic at Cairns. Also at the Institute, Fielding did laboratory studies on the bionomics of *Aedes aegypti*. During this period, Dr J. W. Ferguson was publishing reports on New South Wales mosquitoes in the State Health Department Reports and G. F. Hill, as Government Entomologist to the Northern Territory, reported on mosquitoes there. Ferguson, Hill, Bancroft and Dr J. B. Cleland were notable collectors at this time, though Cleland had collected as early as 1906. On the experimental side, Cleland, Bradley and McDonald proved beyond doubt that *A. aegypti* was the vector of dengue in Australia and reviewed the medical importance of other common species. Cleland, Dodd and McEachran also unsuccessfully attempted to transmit the nodule worm *Onchocerca gibsoni* in calves by mosquitoes.

1921-1930. During this period Taylor described 6 new Australian species and I. M. Mackerras one. This does not give a measure of Mackerras’s taxonomic work however, as he reviewed the species of *Anopheles* and of *Aedes* (subgenus *Ochlerotatus*) and in the latter gave our first zoogeographical study of a group of Australian mosquitoes. The outstanding name in taxonomy during this period is, however, F. W. Edwards, who described 21 new species from Australia and another of our species from elsewhere. Edwards had succeeded Theobald as Culicidologist at the British Museum and his first task was to bring some order into the chaos of mosquito classification. Then he set about reviewing the mosquitoes of different areas and in 1924 published “A synopsis of the Adult mosquitoes of the Australian Region” which remains today an essential tool to the taxonomist and the most useful general paper we have on Australian mosquitoes. In it he lists 92 species from Australia. Attention now began to be directed to the use of larval characters for identification. Hill, Cooling and Mackerras all described larvae, and also pupae of some species. Hill’s valuable field work on mosquitoes has been rather overshadowed by his later work on termites.

As an adjunct to the Hookworm Campaign which was conducted at this period, extensive mosquito surveys were undertaken, principally by Miss M. J. Walker and Dr R. Hamlyn-Harris in Queensland and by L. E. Cooling in N. T. and W. A. Cooling was later attached to the institute in Townsville and produced handbooks for the identification of common mosquitoes. He is another of our workers who might have achieved much if he had not died young (in 1924, aged 31, perhaps from a mosquito-borne disease, as his death has been attributed to X disease, now believed to have been Murray Valley Encephalitis). M. J. Walker did further work on development of *Filaria bancrofti* in mosquitoes. Dr Hamlyn-Harris later became City
Entomologist in Brisbane and published several papers on the biology of mosquitoes and investigated the possibilities of using natural enemies for control.

During the period 1931-1940 there was a comparative lull in mosquito research here. D. J. Lee described one new species from Australia and 4 of our species were described from New Guinea by Dutch workers. I. M. Mackerras reviewed the two Australian species of Aedomyia, and E. N. Marks redescribed Anopheles atratipes larva. In 1936 I. M. and M. J. Mackerras experimented unsuccessfully with several species of mosquitoes as possible carriers of ephemeral fever or 3-day sickness of cattle. Also in 1936, A. R. Woodhill began his experimental studies on Australian mosquitoes with physiological studies of Aedes concolor and Culex fatigans and demonstrated that concolor could be colonised. Of the greatest importance to mosquito systematics was the publication in 1932 of Edward's volume on the Culicidae in Wystman's Genera Insectrum. The classification of the family set forth by Edwards in this work has been followed almost in its entirety by all subsequent workers.

1941-1950. During this period 17 new species were described from Australia by Taylor, Lee, Woodhill and Marks, and 4 of our species were described from New Guinea. When the Second World War spread to the Pacific, malaria became a problem of prime importance and there was a tremendous burst of research, much of it on mosquitoes. Dr Roberts in his Presidential in 1947 and Dr Mackerras and Mr Atherton on other occasions have given accounts of the work of the army entomologists and their associates so I will deal briefly with it. The main feature was the great advance made in our knowledge of Australian Anophelines. The taxonomic side was dealt with by D. J. Lee and A. R. Woodhill in several papers on new species, new records and synonymy and then in monograph “The Anopheline Mosquitoes of the Australasian Region”. Dr C. M. Heydon in 1942 proved Anopheles farauti responsible for an epidemic of malaria in Cairns and A. amictus hilli also a vector. In 1943 the L.H.Q. Malaria Research Unit was established at Cairns. The work of the entomologists attached to it included F. H. S. Roberts’ proof that, in laboratory conditions A. annulipes was as efficient a malaria vector as A. farauti and his study of the distribution and seasonal prevalence of North Queensland Anophelines in which he related the habits of A. farauti to factors which probably limit its spread south of Ingham. Roberts and P. J. O’Sullivan also discovered much about the habits and resting places of the commoner Anophelines and M. J. Mackerras and Roberts showed that most Australian Anophelines could be experimentally infected with malaria. Most of the malaria transmission experiments were done with the New Guinea species, A. punctulatus and a noteworthy achievement was the establishment of a laboratory colony of this species at Cairns. On the control side, R. N. McCulloch and D. F. Waterhouse tested repellents in the field against Aedes vigilax in New South Wales and I. M. Mackerras, F. N. Ratcliffe, D. Gilmour and M. W. Mules have reported experiments on aerial spraying with DDT in which preliminary experiments were made in A. vigilax at Cairns. Numerous malaria control units were sent into the field and these received their initial training in Brisbane from F. A. Perkins assisted by J. L. Wassell.

Apart from Anophelines, the army entomologists collected many specimens of Culicines and much information on their life history and behaviour. In 1941 Woodhill and Pasfield had produced an illustrated key to larvae of some commoner species and in 1944 D. J. Lee produced for the Army an Atlas of Mosquito larvae of the Region which brought together in summary all that was known on life histories up to that date and included many new figures. This provided a stimulus to the discovery of new life histories. The most important of Lee’s taxonomic papers on Culicines in this period was his comprehensive revision of the Genus Tripteroides in the region. As well as other descriptive papers, he published a summary of mosquito records. So many valuable collections were by members of the services that it is perhaps invidious to single out a few for mention here. These who collected either the types, or the first known specimens

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of new Australian species included I. M. Mackerras, J. L. Wassell, O. W. Powell, D. H. Colless and R. H. Wharton. Wharton reviewed the genus *Harpagomyia* in the region, recording it from Australia for the first time – the first specimens were collected by Wassell at Cairns.

On the Civilian side, in 1943 the Queensland Government established a National Mosquito Control Committee, one of whose functions was to institute a research programme dealing with all aspects of the mosquito problem in Queensland. Funds were made available for research to be carried out in the Entomology Department of the University of Queensland by a graduate and I received the appointment. The committee decided that the research should be concerned primarily with taxonomic, biological and ecological studies since these form the basis of species sanitation. Several taxonomic papers on species of *Aedes* were published. Surveys were undertaken from time to time at the request of the State Health Department and included an Anopheline survey at Lucinda Point which showed that *A. farauti* was widespread in the Ingham district. Mosquitoes were identified from many sources, including over 5000 samples of larvae collected by the Brisbane City Council during its Anopheline survey of the Greater Brisbane Area, which continued from June 1946 to June 1948 and provided interesting data on seasonal distribution. Some of the early fieldwork was done in conjunction with the Malaria Control Schools being run in the same department. Gradually much distribution data has been accumulated and an extensive collection built up. Of particular value for taxonomic work are adult specimens with correlated larval and pupal skins and there are today about 1400 of these in the collection.

In Sydney during this period Woodhill continued his experiments on physiological reactions of various mosquitoes and made the first experiments on oviposition responses of Australian mosquitoes. Some of his later work is best discussed under the next period. I. M. Thomas in Adelaide studied the responses of *C. fatigans* larvae to moving shadows. After the war R. H. Black did a malaria and Anopheline survey in N. W. Australia. In 1944 L. B. Bull and M. W. Mules showed experimentally that 4 species of Australian mosquitoes were capable of acting as vectors of myxomatosis of rabbits.

This period marked the death of F. H. Taylor (in 1945) who had for long been the principal mosquito taxonomist in Australia and D. J. Lee later succeeded him at the S.P.H. and T. M. In his later years, whatever the reasons and ill health may have been one, Taylor had been uncooperative with other Australian mosquito taxonomists and I might recount my first meeting with him in 1944. Knowing his reputation and as rather a raw recruit, I went to see him in some trepidation armed with, I hoped, influential letters of introduction. He received me civilly and the conversation went thus, “We have found your check list of Australian mosquitoes very useful, Mr Taylor”. “Have you? There are a lot of mistakes in it”. “I have not noticed many, Mr Taylor”. “Well then, you don’t know your literature properly”. Which of course was quite true but very damping.

We come now to what I regard as the present - the period 1951-55. During this period there have been further strong spurs to mosquito research from two arthropod-borne virus infections – Murray Valley Encephalitis and Myxomatisos and I shall deal with work on them first.

**Murray Valley Encephalitis or MVE**. In February 1951, several severe cases of encephalitis were reported from the Murray Valley. A particularly urgent and important reason for identifying the virus responsible was to exonerate myxomatosis as the outbreak coincided with the first big epizootic of myxo. among the rabbits of the area and public outcry suggested that myxomatosis was responsible for both. The investigations that followed were undertaken by the Walter & Eliza Hall Inst. of Melbourne and organised by Dr S. G. Anderson.
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Virus was isolated from the brain of a fatal case and shown to be related to Japanese B and St. Louis encephalitis viruses both of which are known to be mosquito-borne. The epidemic had lasted from January to mid March and there were 41 diagnosed cases of whom 17 died and others were mentally or physically affected. Serological examinations during the ensuing months showed that for every one of these cases 500-1000 people in the same area had been infected and other subclinical infections had occurred in western New South Wales, Queensland from Rockhampton to Cairns, Mornington Island and Bulolo in New Guinea. Around Mildura 25% of the population had been infected, as well as more than 50% of the horses, dogs, foxes and possums. Sheep, cattle and pigs gave no reaction. 60% of domestic fowls kept near lagoons had been infected but only 12% a mile or more away from them. Among wild birds 40% of water and 18% of land birds had been infected. All the evidence suggested a common freely mobile and highly efficient insect vector and the distribution pattern associated with river systems and the relationships of the virus pointed strongly to mosquitoes.

About 550 mosquitoes collected by D. J. Lee and W. J. Stevenson in May 1951 were tested for virus but none was isolated. In other parts of the world related encephalitides persist from season to season in animal hosts or mosquitoes. In the summer following the epidemic a concerted effort was made to discover the vector of MVE in the Mildura area. Dr W. C. Reeves of the University of California, who had wide experience of both field and laboratory research on mosquito-borne encephalitides in California, was invited to conduct the field operations. Miss N. E. Kent was appointed his full time field assistant and various others assisted including Dr M. J. Mackerras, myself and Dr D. M. McLean (whose laboratory work will be mentioned later). The field work at Mildura, which lasted from December 1951 to February 1952, involved collection of adult mosquitoes on a scale never before attempted in Australia. This was facilitated by the techniques introduced by Dr Reeves, which he had perfected in his Californian studies. In all, over 47,000 female mosquitoes were collected and identified and of these almost 16,000 representing 10 species were tested but no MVE virus was isolated. Myxomatosis virus was isolated from some of the Anopheles annulipes collected. The results from the mosquitoes were endorsed by the results of serological tests of man and domestic and wild birds, which were also negative for MVE in 1952.

On the positive side, a lot of information was obtained on the habits of 16 species collected from a variety of resting places as well as from animal bait. Sufficient larval collecting was done to indicate the sources of the mosquitoes and the problems of controlling them posed by the irrigation system. By far the commonest species in the adult collections were Culex annulirostris and Anopheles annulipes with the Culex fatigans complex and Mansonia linealis next – these 4 together comprised about 90% of the catch.

In April 1952, the Queensland Institute for Medical Research undertook similar large scale field collections of adult mosquitoes at Townsville where both man and horses had shown antibodies to MVE virus the previous year. Dr I. M. Mackerras led the team, which included Dr M. J. Mackerras, Mr R. Domrow and myself. About 50,000 adult mosquitoes were collected, of which 35,000 representing 16 species were tested, again without MVE virus being isolated. Another field investigation at Townsville was undertaken by QIMR last Nov. in conjunction with serological studies of migrating birds and flying foxes by workers from the Commonwealth Serum Laboratories. Dr M. J. Mackerras led the team which included Dr B. McMillan, Mr Domrow and myself. Mr A. K. O’Gower of S. P. H. and T. M. Sydney, also took part, studying the sources of blood in engorged mosquitoes. Tests on these collections are not completed, but so far no MVE virus has been isolated. Conditions were very different on this occasion, being at the end of the dry season, and only about 5000 adults were collected. Again
much useful information has been obtained on the habits of adult mosquitoes and one of the most interesting results was the collection in 1952 of Anopheles farauti showing that, though exceedingly rare, its range does extend to Townsville.

The other aspect of investigation of mosquito vectors of MVE is laboratory studies. These were undertaken by Dr D. M. McLean. He obtained evidence that the virus undergoes a cycle of multiplication in the mosquito, and found that 5 species of Culex and 6 of Aedes retained MVE virus 10 days after feeding on a suspension of it. C. annulirostris and A. vigilax could transmit it from chicken to chicken. An important finding was that the virus does not develop in Anopheles annulipes, which therefore cannot be regarded as a vector. C. annulirostris and C. fatigans are, from their habits, the chief suspects as transmitters of the virus to man. In transmission from bird to bird, other species are certainly involved as well. The study of bloodsources of mosquitoes by S. P. H. and T. M. is contributing to an assessment of possible vectors.

MVE is almost certainly identical with X disease of which there were outbreaks in 1917, 1918 and 1925 and a study of meteorological records has led to the theory that the disease may be endemic in birds in N. Qld. or perhaps New Guinea and in years when there is an excessive late spring rainfall in the Murray and more particularly in the Darling catchment area, with resulting large populations of waterbirds and mosquitoes, it may spread to the Murray Valley. Sir Macfarlane Burnett suggests that, if it remains a rare disease, control even if possible, would not be practicable, and we shall have to adopt the realistic attitude that it is just one of the inescapable risks of Australian life like bushfires and motor cars.

MYXOMATOSIS. The history of the introduction of myxomatosis into Australia as a biological control of rabbits has been told by Ratcliffe, Meyers, Fennessy and Calaby. F. Fenner, M. F. Day and G. M. Woodruffe, in lab. experiments with Aedes aegypti showed that myxoma virus does not have to pass through a cycle in the mosquito. Mosquitoes could not transfer virus taken up in blood, but to pass on the infection had to contaminate the proboscis while probing through a skin lesion. They might remain infective for up to 3 weeks. Pins stuck in the same lesion could also be used to transfer virus.

After the war the rabbit problem was acute. In 1950 CSIRO Wildlife Survey Section liberated virus in 5 areas of the Murray Valley, but infections appeared to have died out by the beginning of December when there was a sudden flareup of the disease in widely scattered areas and this was followed by a widespread epizootic which was believed to be a reflection of the movements of infected insects, almost certainly mosquitoes. Some outbreaks were separated by more than 50 miles. Plotting of outbreaks showed the disease was closely associated with the occurrence of water and the 1950-51 epizootic was dominated by the Murray-Darling system (also involved in MVE). The disease dispersed over an area nearly 1000 miles from South to North and 1100 miles from East to West.

It became obvious that the successful maintenance and spread of the disease was bound up with the presence of its vectors. The first thing was to identify and incriminate the most important actual vectors. I have dealt here only with the mosquitoes, but it should be borne in mind that other insects are known to be involved. e.g. Simuliids. Investigations were initiated which included correlation of disease outbreaks with seasonal abundance of a species, exposure of healthy rabbits to the bite of wild mosquitoes or Simuliids in the hope they would pick up infection, testing pooled catches of individual species for presence of myxoma virus, and ecological and behaviour studies of the blood sucking Diptera of certain localities. It was shown that in the first epizootic on the Murray Culex annulirostris was the principal vector and
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in the following summer *Anopheles annulipes* was proved to be perhaps the most important vector of all. *Culex pipiens australicus* also probably helps with transmission at times.

During the last 3-4 years the Wild Life Section, under F. N. Ratcliffe has maintained about 6 field workers on myxomatosis, who have given much attention to insect vectors. They have made extensive collections of mosquitoes particularly in Vic., Tas., S. A. and W. A. and their material has provided the answer to several taxonomic puzzles as well as including a number of new species and several new life histories, and greatly increasing our knowledge of distribution and ecology. Most of the new species belong to *Aedes (Ochlerotatus)* which often have brief seasons of occurrence after rains or floods, and it is only workers regularly in the field who are likely to collect them. Collections in W. A. have been mainly by J. H. Calaby and D. L. McIntosh, and one of their new species (first collected by Dr A. J. Turner – there is a specimen in Qld. Museum) shows a strong resemblance to a S. African species. In S. A., E. W. Lines found a very distinctive new *Ochlerotatus* breeding in flooded rabbit burrows, and there is a suggestion that a burrow breeding fauna might have developed originally in association with deep wombat burrows which are believed to penetrate to the water table in parts of South Australia. E. Waterhouse found *Aedes mallowi* in dry inland areas, and also collected a species of the rare subgenus *Chaetocruionyx*. In Victoria D. L. McIntosh, and G. W. Douglas (then working on myxomatosis for Victorian Lands Dept.) found a new *Aedes (Finlaya)* of the kochi group, essentially a tropical group breeding in plant axils. Douglas also rediscovered *Aedomyia venustipes* Skuse. In Tasmania, Ratcliffe rediscovered *Aedes nigritorax* (Macquart).

The main work has been focussed on *Anopheles annulipes*. K. Myers first showed that *A. annulipes* harbours in rabbit warrens and B. V. Fennessy obtained evidence that it was a species of surprising longevity in nature and with great range of movement. Currently Myers is making quantitative studies of insects feeding on rabbits in the Albury area, G. W. Douglas (now with CSIRO) is working in the Mallee area of Western Victoria and A. Dyce in coastal N. S. W. These investigations are expected to reveal the daily rhythm of activity of the mosquito in relation to weather, its natural above ground food preferences, its longevity and normal range of movement under coastal and inland conditions and factors governing its burrow harbouring habits, as well as giving a more accurate assessment of its efficiency as a vector, which apparently differs from place to place.

S. P. H. and T. M., Sydney has cooperated in the myxomatosis work by studying the blood sources of mosquitoes and other diptera and D. J. Lee, K. J. Clinton and A. K. O’Gower have recently reported results of many of these studies, involving 15 species of mosquitoes. (Incidentally, lest it be thought that these and wartime studies on Anopheline blood meals were breaking new ground, T. L. Bancroft in 1908 reported that he had taken *Uranotaenia pygmaea* gorged with avian blood.) They show that rabbits form a major source of *A. annulipes* blood meals and cattle are also favoured by it and have suggested that the population level of *A. annulipes* may have been considerably less before the introduction of these hosts. This work is continuing in other areas, including Townsville. O’Gower is also studying the rates of digestion of bloodmeals in different species and the physical factors determining oviposition responses. Current ecological studies of myxomatosis transmission in a coastal valley of N. S. W. are the combined effort of D. J. Lee, and A. K. O’Gower of S. P. H. and T. M. with A. Dyce of CSIRO and are particularly directed to adult behaviour. The epidemiological picture of the disease is quite different here from inland areas. The *Aedes albopictus* complex of mosquitoes is involved, and a study is being made of ecological differences between species of the complex.
At S. P. H. and T. M., D. J. Lee is engaged in taxonomic studies of the *Aedes alboannulatus* group and *Aedes (Chaetocnemia)* and A. K. O’Gower on the *Culex* species with banded proboscis. O’Gower has also completed a summary of all the records of mosquitoes from N. T. and N. W. Australia scattered through many reports. Lee and O’Gower are studying the bionomics of *A. vigilax* in relation to tidal influence. In addition S. P. H. and T. M. has initiated pilot control projects in Northern Territory and in N. S. W.

In Victoria 4 new species have been described in papers by N. V. Dobrotworsky, in one case in association with F. H. Drummond. These papers have been noteworthy in showing that instead of just *Culex fatigans*, we have 4 species of the *Culex pipiens* group in Australia. These were recognised by Drummond during the war and we had recognised 2 forms among larvae in Qld., but most of the subsequent work was done by Dobrotworsky, who as Georgina Sweet Fellow in Economic Entomology is engaged on full time mosquito research in the Zoology Department, University of Melbourne. One species, *C. globocoxitus*, is apparently confined to S. E. Australia, the second, *C. p. molestus* is suspected of being a wartime introduction and now occurs in Vic. and N. Tasmania, the third is the widespread introduced *C. fatigans*, and the fourth, its native counterpart with more rural habits, *C. p. australicus* a bird biting species. These papers include descriptions of all stages and extensive laboratory studies of mating behaviour, biting habits and breeding cycles of the various species, the results of crossing them, and observations on autogeny (ability to lay fertile eggs without a blood meal). Subsequently Dobrotworsky has reviewed the genus *Theobaldia* in Victoria. Again he gives observations on both laboratory and field behaviour, temperature requirements, and so forth. His studies are concerned primarily with Victorian mosquitoes, but cover a wider field where specimens are available. At present he is working on the subgenus *Neoculex* and on *Anopheles stigmaticus*. In Victoria also, N. E. Kent has published the results of a mosquito survey in the Melbourne area.

In W. A., besides the CSIRO workers, Dr E. P. Hodgkin of Univ. Zoology Dept. and Mr E. B. Britten, a Health Inspector of State Health Dept., have undertaken several mosquito surveys in the north west and obtained interesting new records. *Aedes normanensis* and *Aedes pseudonormanensis* extend from Qld. across to that area and the latter is at times a plague mosquito. Dr Hodgkin obtained a new species of *Aedes (Finlaya)* which he sent me for description. He is working on descriptions of larvae of several species.

In Qld. the work of the Mosquito Control Committee has continued. The principal field investigations in addition to collaboration with Hall Institute and QIMR on MVE surveys, have been mosquito surveys in the Torres Strait islands in 1952 and 1953 in conjunction with Malaria surveys which have been reported on by M. J. Mackerras and D. E. Sanders. The results of the mosquito surveys are at present only in departmental reports but a number of interesting new records and new species were obtained. *A. farauti* was prevalent in all malarious areas. Considerable collecting has been done in North Queensland from Townsville to C. York and west as far as Richmond and Normanton. A species previously considered rare, *Aedes culiciformis* was found to be a pest on Torres Strait islands, and in collaboration with Mr J. L. Wassell the breeding places of it were discovered at Coen. It has been the aim to obtain as much information as possible on distribution, and on habits of species in the field. As a result of the many larval and adult collections it is now becoming possible in many cases to build up a picture of the characteristic habitat of a species. The collection of 3 undescribed *Aedes (Ochlerotatus)* at Richmond indicated how much remained to be discovered of the fauna of W. Qld. Taxonomic work is in progress on the species of *Aedes (Aedes)*, and *Aedes (Finlaya)*, and on *Aedes (Ochlerotatus)* of which large collections have been received for study from CSIRO. Wild Life Section.
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Quite different from the general biological studies described, have been the experiments of Dr A. R. Woodhill in Sydney. He and S. Smith White have given Australia a prominent place in genetical studies of mosquitoes. The work has concerned the *Aedes scutellaris* group of which *A. scutellaris scutellaris* occurs in N. G. and Torres Straits and *A. scutellaris katherinensis* in N. T. and probably Coen district of C. York Pen.. Woodhill showed that the cross male *katherinensis* x female *scutellaris* produced fertile hybrids, and therefore named *katherinensis* as a subspecies. His further investigations involved also *A. pseudoscutellaris* and *A. polynesiensis* from Fiji, and the former is a distinct species but suggested that *polynesiensis* is probably a subspecies of *pseudoscutellaris*. Recently Smith White and Woodhill on the basis of results with these species have provided an explanation of the puzzling results obtained by other workers in crossing races of the *Culex pipiens* complex. This work is held up at present because further species of the *scutellaris* complex have so far been unobtainable. Woodhill in conjunction with Backhouse has also experimented with these species and hybrids as vectors of filariasis.

This brings us up to date. I know I have left out the names of many who have made valuable collections but I should like to mention two outstanding collectors of the last 10 years who have not themselves published on mosquitoes. One is Mr J. L. Wassell, to whom we owe very many of our most interesting specimens in the collection here, and the other Dr Bruce McMillan, who has collaborated in much the same way with D. J. Lee.

To summarise the present taxonomic situation there are 152 described species of mosquitoes known from Australia, and about another 40 in various collections that are still to be described. Of the 152 described species, larvae of 99 have been described, 42 prior to Lee (1944), 15 by Lee and 32 since then; 31 are known but not yet described, and 22 are still unknown. Of the 40 undescribed species larvae of 14 are unknown. The major deficiencies are in *Aedes (Ochlerotatus)* for 17 of which larvae are still unknown, and *Aedes (Chaetocruomyia)* in which the life history of none of the 7 species has been discovered. Pupae of only a small proportion of the total have been described and eggs of about a dozen species. However, it does seem that we now have a pretty good idea of our mosquito fauna though there are several difficult groups that will need much careful study to elucidate.

The next basic research that should be undertaken is, I think, to attempt to colonise many of our species. Until that is done much other research cannot begin. Colonies will be necessary for genetical studies, for which there are unlimited possibilities. The chromosomes of mosquitoes are amenable to study, and those of certain larval tissues are comparable with the salivary tissue chromosomes of *Drosophila*. One can think of many groups of closely related mosquitoes that would repay study in this way. There is scope too for many crossing experiments where related forms show clear cut morphological differences.

One species to which field experiments and physiological studies should be devoted is *Aedes vigilax*. I always feel it is one of the major criticisms of the work of the Mosquito Control Committee that we have not paid more attention to *vigilax*. Flight range studies with marked specimens require costly and elaborate organisation but no doubt will some day be attempted. We do not know, either, whether the adults of *vigilax* that plague us return to their breeding grounds, or whether the population is maintained by those that do not travel far afield.

In Africa and S. America extensive studies have been made of the vertical distribution and biting cycle of forest mosquitoes. We are handicapped by a lack of native labour in such investigations, but an attempt on a small scale with volunteers should be possible and yield interesting results. Incidentally this would not be breaking entirely new ground, as Stokes during the voyage of the Beagle in 1837-43 reported that by climbing thirty foot from the
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ground into the higher portions of a tree, a night’s repose, or at least a night undisturbed by the attacks of mosquitoes might be obtained. Mattingly has made some very interesting studies of distribution of certain African species in relation to rainfall and vegetation, and our knowledge of some Australian species is probably now almost sufficient for this to be attempted here.

In relation to disease, apart from the discovery of the vectors of MVE and perhaps ephemeral fever, it would be interesting to know the potentialities of *Aedes tremula* which in Townsville at least is almost as much a domestic pest as *Aedes aegypti*. It is a species which might be easy to colonise. *Aedes (Aedes)* spp. are also pests in places and might be worthy of study as disease vectors.

One would like to know whether there is any differential feeding amongst larvae of species breeding together, e.g. those occurring in tree holes. An interesting physiological study might be made on a species *Aedes (Aedes)* which has large tracheae almost completely occupying its anal papillae. These must surely be used for more than osmotic regulation. Unfortunately this species is very rare and I have not been able to find the larvae since I realised they had these unusual papillae. The common *Aedes notoscriptus* sometimes has larvae clothed with multi-branched stellate hairs, instead of the usual comparatively simple hairs, offering scope for physiological and perhaps genetical studies.

These are just a few of the many problems that await solution and are enough to show that there is scope for all types of investigations, from student projects to large scale field studies.

I think Australia can feel justifiably proud of her record to date in Mosquito Research, but there is no room for complacency she must keep on. This Society also might feel proud, as many of its past and present members have been mentioned in tonight’s account. If there is any moral to be drawn from my story, it is the amount that can be achieved by happy collaboration between individual workers and between institutions, for this I think is one of the outstanding features of research on Australian mosquitoes.

Before I close I should like to acknowledge some of the sources of my information – I have drawn on papers by K. McKeown, A. Musgrave, and I. M. Mackerras for much of the early part of my story, and for accounts of current investigations I am indebted to most of the people concerned but in particular to F. N. Ratcliffe and D. J. Lee who generously told me what their institutions are doing. Finally I want to make a personal acknowledgment to the people whom I regard as laying the foundations of my own work on mosquitoes. Firstly to Dr Hamlyn-Harris and Mr Perkins who when I was an Honours student gave me a very strong bias to mosquitoes, secondly and again to Mr Perkins who has held a steady and encouraging hand on the reins of the Mosquito Control Committee’s research programme. Thirdly to Mr J. L. Wassell who gave me my training in field collecting. Fourthly to Mr D. J. Lee and Col. W. V. King, with whom I had the good fortune to work for some weeks in 1944 and 1945, and who as practising mosquito taxonomists, provided my background to the subject.
APPENDIX D

EXTRACTS FROM ARTICLES AND TALKS ON MOSQUITOES BY E. N. MARKS

Contribution to Symposium held by Wildlife Preservation Society – 5th January, 1966

I hope you will agree that I am rather courageous to speak in favour of conservation when even the most ardent conservationists go into our National Parks and slaughter the animals that are my special interest – mosquitoes.

So many people, entering a National Park and reading the notice that all birds and animals are protected, take the word “animals” to mean “mammals”. Similarly many people when they speak of “wildlife” think only of vertebrates, perhaps only of mammals and birds.

This brings me to the first two points I want to make tonight.

Firstly, one of the really important things that all of us, whatever our age or occupation, can do in the cause of nature conservation, is to remember always that, in the terms of conservation, the words “animals” and “wildlife” include all members of the Animal Kingdom, invertebrate as well as vertebrate. Equally important (and a real challenge to us because it may be difficult) is for us to persuade our fellow Australians to think of “animals” and “wildlife” in this way.

My second point is that we conservationists should always be perfectly clear to ourselves, and make it equally clear to others, what we mean by the terms we use and what precisely is our objective…..

Aspects of Mosquito Ecology in Eastern Australia

Contribution to ANZAAS Symposium on Australian Arthropod-borne Encephalitis – 21st January, 1975

We usually think of mosquitoes in terms of the way they intrude into man’s life, but for a real understanding of their role as vectors of human disease we must also look at the way man intrudes into the mosquito’s life.

Mosquitoes have four stages in their life cycle – adult, egg, larva and pupa. Each species has one or more stages specially adapted to carry it over adverse conditions.

Adult mosquitoes are very vulnerable to desiccation and need cool humid shelter from the heat of the day. Hence most of their activity occurs between sunset and sunrise, though some species bite mainly in daylight hours. They may travel several miles from their breeding places, either in a series of short flights along sheltered routes such as watercourses, or, when populations are large, in mass migrations that may be wind assisted.

Both males and females feed on nectar, but in order to produce viable eggs the female mosquito needs certain vitamins which can be provided by a meal of vertebrate blood. Two to four days after the bloodmeal she lays a batch of about 100-200 eggs, and she may lay several further batches, each preceded by a bloodmeal.
If she imbibes MVE-infected blood, after about six days she can transmit virus when biting, and remains infective for the rest of her life – possibly three or four weeks.

The female mosquito when she deposits her eggs chooses the breeding place where the larval and pupal stages will be passed. Both larva and pupa are aquatic and need protection from predators which are mainly insects and fish. Larvae develop more quickly in warmer temperatures, which no doubt influence their food supply of microorganisms. Pupae do not feed but swim actively and need sheltered sites free of wave action for the adults to emerge without risk of drowning.

About 250 species of mosquitoes are known from Australia. We’ll discuss only potential vectors of MVE virus to man – i.e. mosquitoes which bite both birds and large mammals. The most likely vectors have additional attributes which place them in two groups.

(i) the mosquitoes may not occur in great numbers but they share a restricted habitat with both birds and man. Proximity influences the probability of virus transmission.

(ii) the mosquitoes occur in enormous numbers over a very extensive habitat which they share with birds, and into which man intrudes, or from which they spill over into man’s habitats. Sheer weight of numbers influences the likelihood of infected bites. …

Mosquitoes and Man – International Conference of Australian Institute of Health Surveyors
August 1974

…… Australian mosquitoes have had less than 200 years to adapt to man affected habitats……

…… Practically everyone is aware of some of the effects mosquitoes have on man but, except for health surveyors and entomologists, all too few people realise the effects man can have on mosquitoes. I want to discuss this two-way interaction, especially as it is happening in Australia because we have here a unique opportunity to watch and record how relationships of mosquitoes with man evolve.

Mosquitoes have been around a lot longer than man. The present-day genera *Anopheles*, *Mansonia*, *Aedes* and *Culex* were flourishing in the Oligocene about 30 million years ago, at the time that the ape-man stock was just beginning to diverge from monkeys.

If we consider the basic needs of a mosquito, man directly or indirectly can provide additional breeding places (extended in area and time), shelter for adult mosquitoes, and concentrated aggregations of blood sources, i.e. of himself and his domestic livestock……

…… No species of mosquito feeds exclusively on man but several have developed a very close association with him and have accompanied him around the world. Three of these have become established in Australia, *Culex fatigans* (perhaps with the first fleet), *Aedes aegypti* (probably with mid nineteenth century settlement of the tropics and the sub tropics) and *Culex molestus* (during World War Two)……

15 The original paper dated 1975 contained the following footnote: The National Health and Medical Research Council in 1974 recommended that the disease known as Murray Valley encephalitis (abbreviated to MVE) should be renamed “Australian arboencephalitis”. This new name has not yet received international approval, and the older name is used in this paper.
Mosquitoes and Memories

…… These three species are believed to have originated in lands around the Mediterranean. In all three the adults shelter in large numbers in buildings and can mate in a small space. If we look at the history of man we can see how they might have developed their close association with him……

…… Let us now look at our native Australian mosquitoes. It is fairly safe to assume that all our 240-odd species, except perhaps some found only on Cape York Peninsula, were here when the aborigines arrived. In the last 25,000 years and before, Australian mosquitoes have experienced considerable climatic changes – periods of cooler temperature, much heavier rainfall and strong winds, and periods of aridity when the deserts were more extensive and the rainforests much less than now. The species that were able to adapt best to changing conditions are likely to be those that are now widespread.

The blood sources available to mosquitoes before man arrived were mainly marsupials, birds, reptiles and frogs. Some species feed exclusively on reptiles and frogs, but the most adaptable and widespread have a wide host range.

The last of the giant marsupials – wombat-like beasts the size of a bullock and giant kangaroos – died out about 10,000 years ago, but with an abundance of other blood sources available, their disappearance can have had little effect on the mosquitoes.

For the same reason the presence of the aborigines can have made little difference to the mosquitoes – but not vice versa. Froggatt (1905) reported that in northwest Australia “One of the first things I noticed in the scrub near Kings Sound were large circular shallow pits dug out in the sand, which I afterwards found out were ‘mosquito camps’ constructed by the natives to protect themselves from their bites. When hollowed out, these pits were roofed over with tea-tree bark, leaves and sand, leaving an opening on the side through which they could crawl, and the last man to enter closed it up with a bunch of grass. Here they lay all night like a family of wombats, in an atmosphere one could almost cut with a knife before morning.”

So it is that a two-way mosquito-man relationship has been evolving here for less than 200 years. As yet no native species shows a preference for feeding on man. After our historical review we might feel complacent that a close association will take thousands of years to develop, but the selection pressures now are on a vastly different scale, especially from habitat alteration, and from total numbers and relative abundance of vertebrate species. For example, Lee et al (1954) found that the major blood sources for Anopheles annulipes were cattle and rabbits, animals introduced by white man, and suggested that the population of this species may now be considerably greater than 150 years ago……

…… It can be said at once that the introduced species do not appear to compete successfully (if at all) with the native species in unaltered natural habitats. Diseases restricted to man-mosquito-man cycle (malaria, dengue and filariasis) are no longer present although the vectors are here. Current concern is with zoonoses, i.e. diseases naturally occurring in birds or mammals, but sometimes transmitted to man, and especially with the diseases caused by Murray Valley Encephalitis (MVE) and Ross River (RRV) viruses……

Nature Note – November 1976

Camp Mountain Commentary - An Avid Anopheline

When a mosquito bites it inserts a fascicle of 6 closely apposed stylets into or through a subcutaneous capillary. These are paired mandibles and maxillae, which are cutting organs,
and two tubes, the hypopharynx through which saliva (often containing an anticoagulant) is injected, and the labrum which forms the food channel. Blood passes from the labrum through the buccal cavity, pharynx, oesophagus, stomach and hind gut. A proventriculus at the junction of oesophagus and stomach prevents regurgitation. The muscular pharynx forms a powerful suction pump that causes blood to rush up the labrum and through to the stomach which rapidly becomes distended, filling and distending the abdomen. It is a well known phenomenon (though one seldom discussed in textbooks) that some species of mosquitoes take excessive blood meals and pass drops of blood from the rectum while feeding. *Anopheles* are particularly prone to do this.

Almost all anophelines “stand on their head” to bite, with mouthparts, thorax and abdomen in line at an angle to the surface of the host. While sitting indoors reading about 10 p.m. on 14.11.76, I felt a light touch as an *Anopheles bancroftii* female settled on my forearm. Its bite was painless (as seems to be the case with most *Anopheles* that I have encountered) and I did not disturb it.

Unfed, its body was at an angle of about 70 degrees, a characteristic of this species (sometimes called the "pile-driver") which stands more nearly erect than other Australian anophelines. Other naked-eye clues to its identity were its overall dark appearance and apparently stout black palps (in reality clothed with long scales), and the absence of a large pale patch at the wing apex (which identifies another dark species, *Anopheles atratipes*). As it began to feed, its abdomen expanded until a drop of blood appeared at the tip. When the drop reached about 1 mm diameter, the mosquito’s abdomen was weighed down to an angle of about 30 degrees to the surface. When the drop fell, the still fully distended abdomen jerked back to about 45 degrees. Feeding continued and in all 3 drops about 1 mm in diameter fell onto my skin forming a patch of blood 3 to 4 mm across. A fourth drop, still attached, had reached about half this size when the mosquito withdrew its stylets and flew off.

Several points arise. One would like to have accurate measurements of angles, diameters, weights and times, which were not practicable in the circumstances. As *Anopheles* bites are painless, they may pass unnoticed and may account for unexplained spots of blood on the skin (which, be it noted, are centred under the tip of the abdomen not over the site of penetration of the host). Estimates of blood loss due to mosquito bites are usually based on comparison of weights of unfed and engorged mosquitoes, but this specimen removed probably about four times its stomach capacity from the host. A comparable mosquito, interrupted in feeding and resuming almost immediately on a second host, would pass blood from the first host on to the second’s skin, possibly providing conditions for direct transmission of a blood-borne pathogen that did not have an obligatory cycle in the mosquito’s body.

**Natural Colony of *Aedes notoscriptus* at Camp Mountain – March 1976**

**Lecture - The Natural History of Mosquitoes – 1978**

**Also Reported – Council of QIMR Annual Report – June 1977**

*Aedes notoscriptus* is a widespread and common species whose natural breeding places are treeholes and rockpools. It is a medium-sized mosquito with a neat well-groomed appearance – black with a pattern of white lines and bands. It has become progressively better adapted to domestic situations. ….

…… Early in 1976 I was given an old white enamel bath-tub to water my horses when they were shut in a one acre paddock near my house at Samford. It was placed in a fairly shaded
Mosquitoes and Memories

spot, at the edge of sclerophyll forest, under swamp mahogany (*Tristania suaveolens*) and iron bark trees. Rain, leaves and sticks soon collected in it, and *Aedes notoscriptus* larvae were frequently seen. In 1977 more regular observations started. Eggs were laid above water level, sometimes in masses about three square centimetres in area in which they were placed higgledy piggledy on top of others. Larvae were not seen on 20th March but were present on 27th, presumably from eggs hatching when rain raised the water level. After that the water level sometimes rose above the egg masses but apparently no hatch took place and no larvae were seen up until June. There is a gap then in my notes. On 27th November a very large emergence of adults took place, and all larval instars and pupae were present. Hatching, emergence and laying continued. On 2nd April 1978 I estimated twelve larvae per square inch of water surface.

On 30th April oviposition was observed from sunset until almost dark.

Two females laid on top of a large egg mass 3 to 5 cm above the water level. They did not stop in one place but moved about putting eggs here and there. Three or four other females were at the lower edge of the egg mass about 1 cm above water level and apparently were laying along the edge of the mass. The hind legs were held in the air while laying but these females reached down every now and then with a hind leg to touch the water, as if gauging the distance from the waterline. Were the females attracted to lay on an egg mass by the dark uneven surface, or some attractant in the other eggs? No females appeared to be laying on the white wall of the bath. On 18th June, in air temperature of 18 degrees C, a female was seen ovipositing half an hour before sunset. The larval population remained high until mid August.

After that breeding continued in much the same pattern but my observations were more casual. However since last summer there have been no egg masses and no larvae. Perhaps the overhead foliage has altered to make the white bath unattractive for laying, or perhaps too many rotting eucalyptus leaves made the water unattractive. However I suspect the explanation may lie in a defective fence which allows young cattle to enter the enclosure. An exploratory rough tongue run round the bath might have stimulated a taste for mosquito eggs. There is about 30 metres of open ground with short grass between the bath and my house. Even when breeding was most intense in the bath, few adult *notoscriptus* came into the house, nor were they breeding in the rainwater tanks. Now they are back in the tanks and entering the house......
APPENDIX E

PUBLICATIONS ON MOSQUITOES


Mosquitoes and Memories


Appendix E


Mosquitoes and Memories


Appendix E


Mosquitoes and Memories


95. Marks, E. N. 1983. Mosquitoes (Culicidae) and other biting flies from Hinchinbrook Island - II. Qd. Nat. 24: 66-68.


Mosquitoes and Memories

Other Subjects


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Mosquitoes and Memories


## Mosquitoes and Memories

### Mosquito Species New to Science Described by E. N. Marks

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</tr>
<tr>
<td>34. Aedes (Ochlerotatus) linesi Marks, 1964</td>
<td>South Australia</td>
</tr>
<tr>
<td>35. Aedes (Ochlerotatus) phaeasius Marks, 1964</td>
<td>Northern Territory</td>
</tr>
<tr>
<td>36. Aedes (Ochlerotatus) sapiens Marks, 1964</td>
<td>New South Wales</td>
</tr>
<tr>
<td>37. Culiseta arenivaga Marks, 1968</td>
<td>Queensland</td>
</tr>
<tr>
<td>38. Aedes stenorum (Macleaya) Marks, 1977</td>
<td>Queensland</td>
</tr>
</tbody>
</table>

- Indicates that E. N. Marks collected the holotype
Species New to Science Discovered by E. N. Marks but Described by Others

Patricia took the opportunity to collect miscellaneous specimens during fieldtrips, particularly in remote areas. These specimens were then passed on to appropriate researchers. Her collecting resulted in the following discoveries but this is not an exhaustive list.


● Indicates that E. N. Marks collected the holotype

NEW RECORD FOR AUSTRALIA

APPENDIX F

GENEALOGICAL CHARTS

The following genealogical charts show information from Patricia’s great-grandparents to the level of her generation for the Marks, Stodart and Drury families.

They have been compiled from information supplied to me by Patricia and other family members.

Although they are not complete they are accurate as far as I have been able to ascertain from my research. They are intended to show the relationships of family members mentioned in the text.

K. C. C.
Marks Family

Alexander Hammett Marks (1818-1896) m 1841 Emily Smyth (?-1874)


Elizabeth Gray Dods (nee Stodart) (1851-1908)

1. Alexander (Alec) Hammett Marks (1880-1954) m 1907 Annie Georgina Rhodes (1874-1941)
   1. Charles Ferdinand Marks (1909-1979) m 1936 Julia (Judy) Therese Marie Coogan (1903-1999)
      1. Bridget Jane Annette (Jane) Marks (1936-) m 1965 Lloyd Standish Hassell 5 issue
      2. Judith Blanche Loddie Marks (1940-) n/m
      3. Elizabeth Marie Edris Marks (1943-) m 1967 John Bentley Bishop
   2. Isabella Annette (Anne) Marks (1910-1992) n/m
   3. Daughter (stillborn 1913)
      1. David Alexander Tonge (1948-) m 1978 Suzanne Maule 1 issue
      2. Margaret Louise Tonge (1951-) m 1975 Charles Jeremy Ward 3 issue
      3. Samuel Andrew George Tonge (1953-) m 1981 Jessica Fleur Drynan 1 issue
      4. Stephen John Tonge (1957-) m 1992 Linda Perchard 2 issue
   5. Edward Audley (Patsy) Marks (1917-1919)

2. Edward (Ted) Oswald Marks (1882-1971) m 1914 Ernestine (Nesta) Roberta Barbara Drury (1881-1964)

   Elizabeth Nesta (Patricia) Marks (1918-2002) n/m

   3. Charles (Carl) Hubert Marks (1885-1951) n/m

   4. Edris Marie Blanche Marks (1891-1977) n/m

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Drury Family

Rev. William James Joseph Drury (1791-1878) m 1816 1. Anna Frances Taylor (?-1827) — 6 issue — m 1828 2. Anne Nicholas (1806-1878)

1. Frederick Edward Drury (1830-1830)
2. Caroline Jane Drury (1831-1843)
3. Edward Robert Drury (1832-1896) m 1869
   1. Edward Herbert Merivale Drury (1870-1946) m 1909 Eva Nielsen (1887-?)
   2. Arthur Henry Grahame Drury (1872-1935) n/m
   3. Lilian May Drury (1873-1939) m Harold Saltmarshe
   4. William Byron Drury (1875-1917) n/m
   5. Noel Harnage Drury (1877-1923) m 1907 1. Nina Temple Clerk (?-1907) m 2. Doris Louisa Cardew Simpson (1889-1943)
   6. Evelyn Octavie Drury (1879-1961) n/m
   7. Ernestine Roberta Barbara Drury (1881-1964) m 1914 Edward Oswald Marks (1882-1971)

John Grahame (1818-1852) m 1842 Barbara Shirreff (1817-1897)

1. Isabella Smellie Grahame (1843-1919)
2. Barbara Jane Grahame (1846-1907)
3. Elizabeth Shirreff Grahame (1848-1922)

1. Walter Merivale Drury (1910-1972) m Betty Maas — 2 issue
   1. Evelyn Grahame Saltmarshe (1902-1974) m Charles Montague Clavill Bere (1897-1968)
   2. Yvonne Saltmarshe (1905-1961) n/m
2. Barbara Grahame Drury m Arthur Donald Moore
3. Diana Grosvenor Drury (1921-) m 1. John Henry Propsting — 5 issue m 2. Humphrey Killen

Elizabeth Nesta (Patricia) Marks (1918-2002) n/m

   m 1940 2. Leila Arentz Langberg (1911-1993) — 2 issue
   m 2. Marie Clair Cary (nee Banney)
   3. Richard Alexander Clarke (1915-1977) m Glennie Gibson (1918-)

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ABBREVIATIONS

AC – Companion of the Order of Australia in the General Division
ACF – Australian Conservation Foundation
ADB – Australian Dictionary of Biography
AMA – Australian Medical Association
AMCA – American Mosquito Control Association
ANZAAS – Australian and New Zealand Association for the Advancement of Science
AO – Officer of the Order of Australia in the General Division
ATHRA – Australian Trail Horse Riders Association
Aust. Ent. Soc. – Australian Entomological Society
BM – British Museum (Natural History)
BMA – British Medical Association
CAMD – Conference of Australian Museum Directors
CREB – Cairns Regional Electricity Board
CSIRO – Commonwealth Scientific Industrial Research Organization
Ent. Soc. of Q. – Entomological Society of Queensland
GBRC – Great Barrier Reef Committee
MCC – Mosquito Control Committee
MSc – Master of Science
MVE – Murray Valley Encephalitis
NPA – National Parks Association
OBE – Officer of the Order of the British Empire
PhD – Doctor of Philosophy
PNG – Papua New Guinea
PRSC – Pine Rivers Shire Council
QIMR – Queensland Institute of Medical Research
QNC – Queensland Naturalists’ Club
QPS – Queensland Philosophical Society
RNA – Royal National Association
SPHTM – School of Public Health and Tropical Medicine
U of Q – University of Queensland